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Academicians and scientists use conferences and seminars as platforms to exchange their knowledge and abreast up-to-date on the latest developments in technologies. Deliberations in conferences particularly international conferences provide a great opportunity to know the developments across the world.

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New Delhi

Editor

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20th July 2023

A REVIEW ON IMPACT OF BUSINESS ANALYTICS ON HUMAN RESOURCES MANAGEMENT

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ABSTRACT

The main aim of this paper is to have an idea about how business analytics create impact on human resources management. This paper done on the bases of several published articles on the topic impact of business analytics on human resources management. Our review of these articles addresses the following conceptual context (1) Human resources management (2) Business analytics (3) Steps For Implementing HR Analytics In An Organization (4) Impact of business analytics on HR (5) Future opportunities of Business analytics on HR. We conclude that Business analytics is a high-tech system that combines efforts to execute a variety of marketing, financial, human resource, production, and operations management duties. It also keeps records, sorts data, analyses it, and creates reports for managerial decision-making. HR professionals can acquire and evaluate data with the aid of business analytics to make better decisions. HR can effectively forecast the future of the workforce by using sophisticated statistical analytics. HR encompasses the entire workforce and focuses on the human side of the organization, keeping track of information about current employees, salaries, expenses, new hires, retirement statistics, and much more. As a result, business analytics on HR will be extremely important to all businesses, play a significant part in all elements of the growth of the organization, and aid in decision-making and strategy planning in order to achieve the firm's objective.

Keywords : Business analytics, Human resources, Data Analyzing, Decision making

INTRODUCTION

The goal of human resource management is to use all available tools, techniques, practices, strategies, methodologies, and measures to assess how well employers and employees collaborate to meet organizational objectives. As the human resources department contributes to successful organizational performances by establishing a link between HR actions and financial outcomes, human resources play a crucial role. Only the human resources function of any organization lagged behind owing to reliance on metrics and scorecards of data that can be quantified, despite the fact that every function of any organization plays a significant role as their results can be easily examined. When it comes to the pandemic, HR requires business analytics the most. According to a contributor, HR data is essential for making strategic business decisions that result in positive company outcomes and plays a significant role, particularly during the pandemic time. According to the Wall Street Journal, human resources automation is used by about 40% of businesses. However, a lot of HR departments fail to effectively

utilize the wealth of data they possess. Professionals in human resources could be unsure of what data has to be collected, measured, and analyzed. They can also lack the analytical skills necessary to enable data-driven decision-making. The most crucial asset and one of the best investments for any firm to provide it a permanent competitive advantage is human capital. HR strategy's financial impact is not routinely measured. There has been a dearth of analytical insights about where investments are made, what form those investments take, their impact, and the best ways to move resources and procedures, as well as a lack of awareness and visibility of how human capital is handled in many firms.

REVIEW OF LITERATURE

According to Alessandro Margherita, the rise of a global workforce and the growing importance of business analytics as a strategic organizational competency have a considerable impact on the management of human resources today. While the previous ten years have seen a significant amount of work on human resources analytics, a systematic identification and classification

of critical subjects has not yet been done. A conceptual contribution that aims to provide a thorough explanation of concepts and research areas linked to HR analytics is particularly welcome in a paper on human resources analytics.

According to Shilpi Narula, this paper offers insights on employing analytics in the HR sector. The report highlights a number of analytics' forms and applications. This paper has covered descriptive, prescriptive, and optimizing analytics. Additionally, this study aims to present the actual results of studies on the use of analytics and its applicability in the HR sector. This document lists various analytics-related techniques. According to HR Analytics: Its Use, Techniques, and Impact, there is a connection between HR analytics and both individual and organisational performance.

According to Frank Acito and Vijay Khatri, business analytics is a revolution that cannot be missed. Business analytics is really about getting the most out of data. Data has recently been dubbed "the new oil" rather than the "sludge of the information era." While data can be used to generate new products and services, find market niches, and spot fresh opportunities, it is also infamously unstructured and difficult to extract value from. We first propose a structural framework for obtaining value from business analytics in this Guest Editors' Perspective. Aligning strategy, desired behaviours, and business performance management with analytical activities and capabilities is necessary to derive value from data. The next section of Business Analytics: Why Now and What Next introduces three special pieces that go into great detail about how business analytics is used to manage supply chains, accounting, and healthcare.

The goal of this article, according to Manuela Nocker and Vania Sena, is to examine the prospects talent analytics presents to HR professionals. Over the past ten years, approaches for the analysis of vast amounts of data have become significantly more accessible, and firms have begun to employ talent analytics to manage their personnel. In addition to highlighting the distinctions between talent analytics and other branches of business analytics, this article explores the advantages and disadvantages of using talent analytics inside an organization. Several case studies on how talent analytics may enhance organizational decision-making will be covered. We will highlight significant pathways from the case studies by which

the talent analytics implementation can enhance HR performance and ultimately the performance of the entire organization. This study outlines the costs (in terms of data governance and ethics) that the broad use of talent analytics can produce while also emphasizing the opportunities that talent analytics offers enterprises. Last but not least, it emphasizes how crucial trust is for supporting the effective implementation of talent analytics initiatives in Big data and human resources management: Talent analytics emergence

CONCEPTUAL CONTEXT

Human Resources Management

The process of hiring employees, educating them, paying, setting policies controlling and creating retention plans is called as human resource management. In the past 20 years, there has been substantial update in the subject of HR management, increasing its significance in today's organizations. It involved managing payments, sending birthday cards to the employees on their birthdays, planning business trips, and to assure that works are completed on time.

Business Analytics

A business analyst validates business needs and recognizes and resolves business problems. They act as a middleman between the stakeholders and the IT team. Through data analysis, business analysts assist companies in improving their procedures, goods, services, and software. To close the gap and boost production, these adaptable professionals operate in both the corporate and information technology sectors. Business analysts act as an intermediary between IT team and top-level management by identifying the issues that are faced by the company, finding solution for the problems and giving proper solution and suggestion as a report with the help of data visualization tools. Business executives and users are engaged in communication with corporate analysts to understand better regarding how data changes the methods, products, software, facilities and electronics might develop productivity and create value. They have to talk about these ideas while contrasting them with what is financially, practically, and operationally possible. Depending on your position, you could use data sets to enhance products, tools, programmes, services, or procedures.

HR Analytics Implementation Process in an Organization

For HR Analytics to be successfully implemented in a business, a structured strategy is necessary. Implementing such a process involves significant direct and indirect costs, making it even more crucial for firms to have well-organized processes in place for doing so. The major steps involved for implementing such a process are as followed

Step 1: Identifying the organization's main areas or concerns

It deals with determining the company's most pressing issues or areas. The most crucial function in deciding the same will be played by medium and upper level executives. Any analysis will be centered on validating an executive's suspicion rather than completely analyzing and solving the problem if the critical issue the company faces is not resolved in the context of the bigger business.

Step 2: Constructing a Conceptual Model to Direct the Analysis

The second process involves creating a model to show how organizational processes in the chosen domains move. It is necessary to determine the pertinent data that must be recorded at each step of this process. It's also important to comprehend how the interpretation of the results may be constrained by missing data.

Step 3: Collect and handle pertinent data

Significant data that can be examined is captured. Organizations frequently begin gathering data that is not necessary or sanitizing data that could be crucial. Therefore, it is necessary to gather pertinent data that can offer useful information, and various databases that include data that is similar must be integrated. The data must be processed after it is collected so that it may be evaluated.

Step 4: Use analytical methods and tools

Entails using various analytical tools and approaches to the pertinent data collected to provide useful knowledge that will benefit the organization. This should deal with the problem in a way that is useful and pertinent to the company. There are numerous analytical and statistical tools accessible, and each one has advantages and disadvantages of its own. In light of the cost to the organization, complexity, and volume of data to be

examined, as well as the influence it will have on the organization, the tool needs to be carefully picked.

Step 5: presenting a valuable solution to the stakeholders using the data that has been examined

The processed data must be presented in a way that the various process stakeholders can understand. The findings must be consistent with the management practices and organizational culture. To link the findings of the analyses with the stakeholders' business expertise, the various stakeholders should be actively involved in the discussions. The stakeholders' contributions will shed light on the outcomes and show how to proceed with transformative measures.

Step 6: Designing and implementation of the Action Plan

In order to ensure that the desired result is realized, this phase divides the action plan into a series of steps that should be passed out. According to achieve the desired results, the proposed solution must be transformed into a set of sustainable actions that are routinely monitored. At each stage, these tasks must be successfully implemented using the instruments and procedures that are necessary. It's important to be clear about the various stakeholders' roles in carrying out the action plan.

Impact of Business analytics on HR

Business analytics on HR are supporting organizations of every level and including all areas in today's data-driven world in making choices on hiring, management, and talent. HR metrics are commonly used by the organizations to hire employees, satisfy their needs and compensation. This is advantageous because it enables businesses to gather and evaluate data that can both boost revenues through more precise client targeting and save expenses through enhanced business procedures.

In response, businesses are forming people analytics teams, swiftly upgrading antiquated software, and combing few HR analytics teams into an individual strategic role. These days, businesses use labour data to forecast their financial performance. Though every HR problems cannot be able concerned by the HR analyst, they could provide experienced HR staffs for a proper analysing of how organizations work and supporting them in designing strategy that effectively invest in skill while observing a variety of workplace initiatives, including recruiting, development, engagement, productivity, accountability, and retention. This is according to a top workplace intelligence expert.

Future opportunities of Business analytics on HR

The next big thing in HR is business analytics. Many organizations or companies are actively hiring business analysts, finance analysts, HR analysts, data analysts, and marketing analysts. Among these, one of the most useful applications of HR analytics is modelling potential changes in the company's future talent hiring practices. It plays a significant role in all specializations, including marketing, human resources management, finance, etc. The hiring, retention, and engagement of personnel can have an influence, as the HR staff can determine. HR analytics can be used in the workplace in two different ways. According to startup focus, teams may more effectively allocate talent pool resources such as cost per hire, revenue, and expense per employee. The policies and decisions that may have an impact on business culture can be recommended by HR professionals with knowledge of the situation. As a result, business analytics on HR will be extremely important to all businesses, play a significant part in all elements of the growth of the organization, and aid in decision-making and strategy planning in order to achieve the firm's objective.

CONCLUSION

Business analytics is concern about implementation of effective decisions, this is not the type of decision system that was traditionally done, which mostly depended on intuition, endure and feelings, but rather the kind that depends on data, evidence, and computer, mathematical, and statistical sciences. This chapter gave a general overview of human decision-making and discussed how business analytics may improve it to produce more precise and useful results. Implementing HR analytics can benefit any firm because it is a crucial component of data management. However, as the aforementioned has demonstrated, managing, analyzing, and interpreting data isn't always simple, therefore businesses must approach HR analytics gradually. The awareness that the influence the data can have on organizational decision-making, rather than the magnitude of the measured data, is the key to successful HR analytics. HR analytics should be viewed as something that has the potential to add value across the entire organization, not just in the HR department.

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AUTOMATIC IRRIGATION SYSTEM USING BALL VALVE

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ABSTRACT

India is mostly a farming nation. The majority of Indian households place the highest importance on their work in agriculture. Agriculture has a significant impact on the growth of the country. Irrigation is the process of watering plants to promote growth. The deficiency of water in agriculture in India has made for optimal use of water. By using the Internet of Things (IoT), the wastage of water can be minimized. IoT is an emerging technique that paved the way for automating water irrigation. IoT-based irrigation in the agriculture field helps in the optimal use of water. An automatic irrigation system using Node MCU is a system that allows for the automated watering of plants. Node MCU, an open-source firmware based on the ESP8266 Wi-Fi chip, controls irrigation equipment. The Blynk app is a powerful tool for remotely controlling and monitoring Internet of Things (IoT) devices from a mobile device. It offers an easy-to-use user interface for designing personalized control interfaces with widgets like buttons, sliders, and graphs. The user monitor and control IoT devices from anywhere. The farmer can be able to control the irrigation by using the IoT and by the Blynk app. If the system is switched on, the motor is about to pump the water to a part of the field for a particular period and after the particular period the motor is about to water the another part of the field and then the motor automatically switches off. The proposed system has been designed to overcome the unnecessary water flow into agricultural lands. Also reduces the manpower to monitor the watering process and also reduces the cost of wages. Overall, the automatic irrigation system can significantly benefit farmers in improving their crop yield and reducing water usage, contributing to sustainable agricultural practices.

Keywords: IoT, Node MCU, Blynk App, Wi-Fi

INTRODUCTION

Irrigation plays a critical role in modern agriculture, and it is essential to ensure that crops receive adequate water to grow and produce high yields. However, traditional irrigation methods, such as flood irrigation and manual watering, are inefficient and can lead to water wastage and reduced crop yield. Moreover, water scarcity and the increasing cost of water have made it imperative for farmers to adopt more sustainable irrigation practices. Automatic irrigation systems have emerged as a viable solution to address these challenges.

To effectively irrigate the agricultural area, smart irrigation systems may be deployed. Smart irrigation system's main goal is to increase crop yield and

quality while consuming less water. In the rapidly developing digital world, wireless sensor networks support advanced technologies. All parts of farming and agricultural operations will be automated via the Internet of Things (IoT) to increase productivity and competitiveness[6][12].

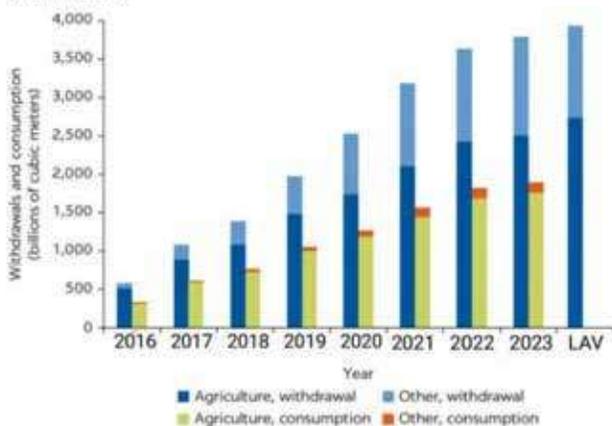
IoT is changing the agriculture domain and empowering farmers to fight with the huge difficulties they face. Agriculture must overcome expanding water deficiencies, and restricted availability of lands, while meeting the expanding consumption needs of the world population. New innovative IoT applications are addressing these issues and increasing the quality, quantity, sustainability, and cost-effectiveness of agricultural production. The Internet of Things (IoT)

is a technology where a mobile device can be used to monitor the function of a device. The Internet of Things (IoT) is concerned with linking communicating devices that are placed in various places that could be far from one another.

Water is an essential component of agricultural productivity and is important for food security. 20 percent of all farmed area is used for irrigation agriculture, which generates 40 percent of all food produced globally. The productivity of irrigated agriculture is often at least twice that of rainwater agriculture per unit of land, allowing for the greater variety of crops and output efficiency.

Demand of water resources is expected to grow as a result of population expansion, urbanisation, and climate change, with an emphasis on agriculture. By 2050, the world's population is projected to reach over 10 billion, and whether they live in cities or in rural areas, they will all require food and fibre to meet their fundamental needs. By 2050, it is predicted that agricultural production will need to increase by roughly 70% due to these factors, as well as the rise in calorie and complex consumption of food that comes along with economic development in the developing nations.

Global Trends in Agricultural and Total Water Withdrawals and Consumption



Source: Schierling and Tréguer 2016a, based on FAO 2016a; Shiklomanov and Rodda 2003. Note: LAV = latest available value.

Fig. 1. Water Forecasting of Agriculture
CONVENTIONAL METHODS

Furrow irrigation is one of the earliest types of irrigation where water is absorbed and transported through the soil surface. This irrigation technique is less expensive than sprinkler or trickle irrigation. As a result, there

is a higher concentration on increasing this irrigation method's efficiency[1][2]. It is extremely challenging, time-consuming, and tedious to manually water the entire field because agricultural land is typically very huge. The entire space is divided into rows or sections through which the water flows[3]. A single individual cannot determine whether the water has reached the end of the row. As a result, individuals are engaged to perform this monitoring task[9]. Someone must stand there and continuously examine or monitor if the soil is properly hydrated. So, the farmers pay those doing this extra labour between 1800 and 2400 per month.



Fig. 2. Furrow Irrigation

Surge irrigation is a technique in which water is periodically delivered through a series of on-and-off procedures. This has been demonstrated to yield excellent outcomes in the fields[13]. Surge irrigation has successfully reduced the process's need for water by 22%. The irrigation's effectiveness has increased by 29%. However, manual irrigation won't produce better outcomes because it takes a lot of time and necessitates frequent soil moisture checks by the farmer. Therefore, it would be best to automate this surge watering.



Fig. 3. Drip Irrigation

The existing system proposes a technique of automate the water pump in the field by giving a phone call. The call gives a trigger to the motor and switches on it and pumps the water to the field. In that case continuous monitoring of the water flow is needed and it increases the man power and wages also. It also affects the personal work of the person[11][14].



Fig. 4. Sprinkler Irrigation

PROPOSED METHOD

The proposed system will be useful to irrigate the water in the fields automatically. The main aim is to reduce the manpower needed for irrigation and also reduce water wastage. The entire system is controlled and operated by the Node MCU. The Node MCU is the Wi-Fi-enabled microcontroller unit, where the entire system is connected via Wi-Fi[5]. The Node MCU controls the valves, the motor, and the relays based on the input and commands given by the user[4][8]. The user can able to give the commands to the Node MCU via the Blynk App[6].

The Blynk App is connected mutually with the Node MCU by the use of the internet. The duration of the running time of the motor is fixed in the Blynk App. The motor is switched on by the command given by the user in the Blynk App. Then the running time and closing time of the motor will also be fixed in the Blynk App. The entire system is in the need of the internet primarily. By implementing the system in the real world, we can able to reduce manpower and water wastage and also ensure the health of the crops. By using this technique crop production also increased.

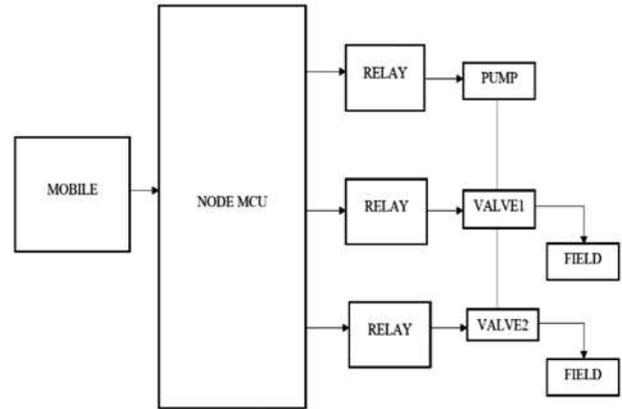


Fig. 5. Block Diagram

EXPERIMENTAL ANALYSIS

The primary component of the automatic irrigation system is the Node MCU. The Node MCU gives the command to the relay, the water pump, and the solenoid valves based on the input given by the user. The Node MCU is connected to the internet for controlling these devices. The Relay is used to switch on and off the water pump and solenoid valves. The water pump is used to irrigate the water in the fields. The solenoid valves are used to open and closure the valves and to change the direction of the water flow in the field. The Node MCU is controlled by the user by using the Blynk App. The Blynk App is a mobile application that paves the way to the way to the user to control the system. The Internet plays an important role in the automatic irrigation system.

Table. 1. Components with Parameter Ratings

S.No	Components	Parameter Ratings	Quantity
1	Node MCU	ESP8266 (3.3V to 3.6V)	1
2	Solenoid Valve	12V	2
3	Water pump	12V	1
4	Relay	12V	3
5	Blynk App	-	-
6	Voltage Regulators	5V	1

The ESP8266-12E Wi-Fi System-On-Chip serves as the foundation for NodeMCU. It is open-source and built on firmware that uses Lua. Since Arduino does not support wireless operation, it is ideal for Internet of Things projects, particularly other Wireless connectivity applications. This chip and the Arduino are both prototyping boards featuring microcontrollers that may be programmed using the Arduino IDE. The ESP8266 is more updated and younger than Arduino, and therefore the ESP has stronger specifications than Arduino. Here the Node MCU is used to connect internet and control the pump to pump the water to the field[15].

A solenoid valve is an electrically controlled valve. A solenoid, an electric coil with a moveable ferromagnetic core (plunger) in its centre, is a component of the valve. In the rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The plunger is pulled upward by the magnetic field, causing the orifice to be opened. In order to open and close solenoid valves, this fundamental idea is used. To stop, start, dose, distribute, or mix the flow of gas or liquid in a pipe, solenoid valves are utilised. Here the solenoid valve is used to open and closure of the valve and then we can manage the water is pumped to which the field for a particular duration.

A 12V water pump is a direct-current electric water pump, motor that is powered by a 12V power source. It uses centrifugal force that generated by high speed rotated impeller to booster, transfer, lift or circulate liquids like water, oil, coolant for sprayers, car, fountain, shower, garden etc. Here the water pump is used to pump the water to the field.

Relay is a switch that can be activated electrically. A magnetic field produced by current passing through the relay's coil draws a lever and modifies the switch contacts. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay. For a 12V relay, the coil normally passes 30mA of current, but for relays made to work with lower voltages, this current can reach 100mA. A transistor is typically employed to increase the small IC current to the larger value needed for the relay coil because the majority of ICs (chips) cannot supply this current. Here we use relay to switch up the motor and the solenoid valves which is used to irrigate the water to the field[10].

For use with the Internet of Things, Blynk was created. It can store data, visualise it, display sensor data, remotely control hardware, and perform many other fascinating things.

The platform consists of three main parts:

Blynk App - Utilising a variety of our provided widgets, the Blynk App enables you to design stunning user interfaces for your projects.

Blynk Server - All communications between the smartphone and hardware are handled by the Blynk Server. You can host your private Blynk server locally or utilise our Blynk Cloud. It can even be started on a Raspberry Pi, is open-source, and has no trouble supporting thousands of devices.

Blynk Libraries - The server can be contacted and all incoming and outgoing commands are processed by Blynk Libraries, which are available for all common hardware platforms.

Here the Blynk app is used to control the motor and the valve to irrigate the water to field over the internet[7].

A class of frequently used ICs involves voltage regulators. The components needed for the reference source, comparator amplifier, control device, and overload safeguarding are all integrated with a single IC in regulator IC units. A fixed positive voltage, a fixed negative voltage, or an adjustable set voltage can all be regulated by IC devices. A fixed three-terminal voltage regulator has an unregulated dc input voltage, it is applied to one input terminal, a regulated dc output voltage from a third terminal, with the second terminal connected to ground.

RESULTS AND DISCUSSION

The designed system will irrigate the water to the selective fields for a particular duration of time. We can able to control the motor and the valves with the internet and able to switch on and off the valves to the respective fields with the use of Blynk app. Through this method we can set the time for irrigation for each field. We can connect the motor and the valves using the help of T-joint. We can set the timer for each field, after the time of irrigation the valves are closed and the motor is switched off.

The below figure shows the control of the valves in the Blynk app.

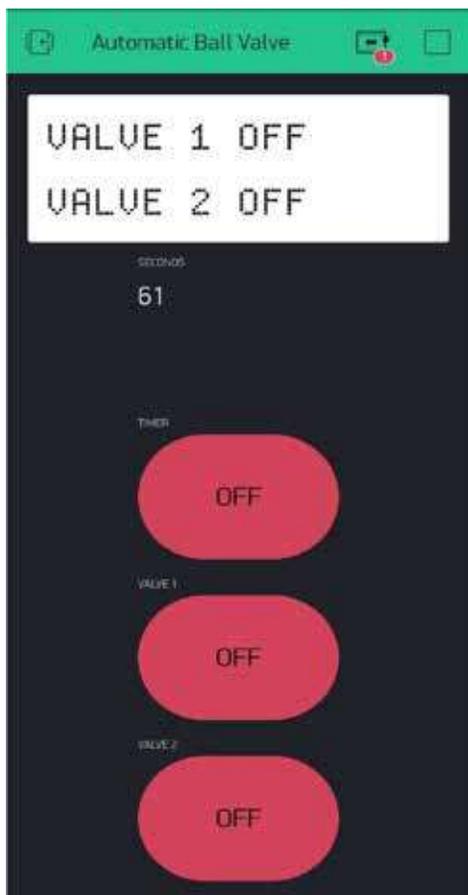


Fig. 6. Blynk App Control

By using this app, we can able to control the valve 1 and valve 2 for a particular duration of time and after that time both the valves are automatically closed and the motor is switched off.

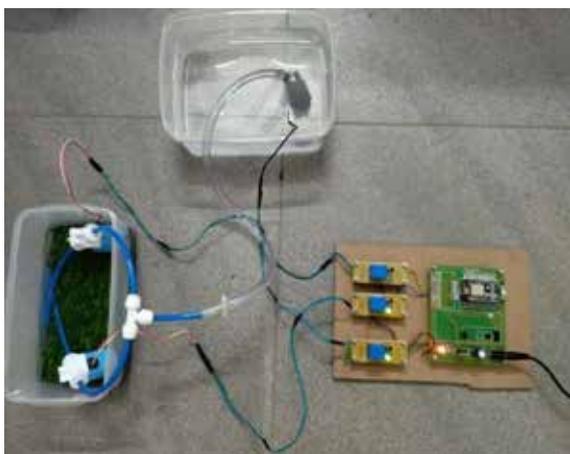


Fig. 7. Working Model

CONCLUSION

By using this method, we can automate the irrigation of the water. The wastage of water by over irrigating can be reduced by this method. By automating the irrigation, we can reduce the manpower of monitoring and also reducing the wages also. The plants also stay healthy by getting the freshwater by using the method. An automatic irrigation system offers a sustainable and cost-effective solution for maintaining healthy plant growth and maximizing crop yield. The proposed system has been designed to overcome the unnecessary water flow into agricultural lands. Also reduces the manpower to monitor the watering process and also reduces the cost of wages. Overall, the automatic irrigation system can significantly benefit farmers in improving their crop yield and reducing water usage, contributing to sustainable agricultural practices.

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AUTOMOBILE MAINTENANCE AND MODIFICATION

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ABSTRACT

Automobile maintenance and modification play crucial roles in ensuring the optimal performance, safety, and personalization of vehicles. Owners of vehicles can avoid unforeseen car problems by maintaining their vehicles regularly. This abstract provides an overview of the key aspects involved in automobile maintenance and modification, highlighting their significance in extending the lifespan of vehicles and enhancing their functionality. Owners of vehicles frequently inquire about service at workshops. Vehicle technicians examine crucial parts of the vehicle and fix problems to make sure they are in good condition and won't break down suddenly. The researchers have identified a need to modernize how auto repair shops work. Customers and car garages will both profit from the system's installation. Furthermore, the abstract explores the different categories of modifications commonly pursued by vehicle owners. This includes performance modifications aimed at boosting horsepower, torque, or handling capabilities, as well as visual modifications focused on enhancing the vehicle's appearance and uniqueness. It also touches upon interior modifications, such as audio system upgrades or custom upholstery, which enhance comfort and entertainment value.

INTRODUCTION

An innovative project focused on vehicle service management. In today's fast-paced world, efficient and effective management of vehicle maintenance and service operations is essential for ensuring the smooth functioning of transportation, logistics, and fleet management industries. Our project aims to address these needs by developing a comprehensive vehicle service management system that streamlines and optimizes the entire process. The primary objective of our project is to create a robust digital platform that revolutionizes the way vehicle services are managed. By harnessing the power of technology, we aim to provide a centralized hub for vehicle owners, service providers, and administrators to effectively track, schedule, and maintain vehicles. Vehicle owners will benefit from our platform's intuitive scheduling feature. They can conveniently book service appointments, select preferred service providers, and receive automated reminders to

ensure timely maintenance. This feature streamlines the appointment management process, reducing the likelihood of missed or delayed services. Our project includes establishing a network of authorized service providers, ranging from mechanics and garages to specialized repair shops. These service providers will be integrated into our platform, allowing vehicle owners to easily locate and select the most suitable provider based on their specific needs. The network will be regularly updated and expanded to ensure a wide range of options for vehicle owners. To enhance transparency and communication, our system will provide real-time updates and notifications to both vehicle owners and service providers. When the car is handed over for repair, the problem of confidence is crucial. Customers are frequently taken advantage of under the name of service. A serious issue is the replacement of original parts with outdated ones. Additionally, it might be challenging for clients to confirm that the service providers are doing the tasks for which they are paying.

Service providers take advantage of this circumstance and overcharge customers. The practice of “periodic vehicle maintenance,” which mandates that the vehicle have periodic servicing and maintenance, is widely used. A vehicle’s service life is typically determined by either a predetermined time frame or the mileage travelled. Generally speaking, it is advised to get the car serviced every six months or 10,000 KM. However, the problem with “periodic vehicle maintenance” is that it’s difficult to determine which parts need to be repaired or replaced, which might lead to repairs or replacements of parts that are still in good shape. Predictive vehicle maintenance proves useful in this situation. This data is obtained from numerous built-in or customized sensors in the car that are used to keep track of the condition of various components. To analyse and make decisions, this data is relayed via the internet, and the chance of failure in the future is then predicted. When a consumer uses this approach to choose when to service their automobile and which part to fix, it saves them a lot of time and money since it gives them transparency. A certain system could occasionally require maintenance or repair before the next scheduled due date.

The solution effectively manages this problem since the user instantly receives a warning on their mobile application. Since it is a website, the client may access it without downloading any apps to their phone. The user doesn’t need a laptop to open the website because it is also mobile-accessible. Vehicle owners may opt for modifications to improve acceleration, handling, or braking performance, or to achieve a unique and personalized look. However, it is essential to approach modifications with careful consideration. Researching the compatibility of parts, understanding local regulations and safety standards, and seeking expert advice can help ensure that modifications are done responsibly and without compromising the vehicle’s integrity or safety. Automobile maintenance and modification are crucial elements of vehicle ownership. Maintenance helps keep vehicles in optimal condition, ensuring reliability, safety, and efficiency. It also protects the vehicle’s value and longevity. On the other hand, modification allows owners to personalize their vehicles and enhance performance. However, responsible decision-making, adherence to regulations, and seeking professional guidance are essential to ensure modifications are done safely and effectively.

EXISTING SYSTEM AND PROPOSED SYSTEM

Existing System

The authorized service or repair shops play a significant role in the existing system. Vehicle owners can take their cars to these repair workshop for routine maintenance tasks, inspections, and repairs. Service workshop employ certified technicians who are trained to perform various maintenance procedures and handle common repairs. Vehicle manufacturers provide maintenance schedules and guidelines that outline recommended maintenance tasks and intervals. These guidelines serve as a reference for vehicle owners to understand when specific maintenance procedures, such as oil changes or filter replacements, should be performed. Existing systems rely on a network of parts suppliers and distributors that provide replacement components for maintenance and repair. in the current system, we can overcome that in the application we are going to develop and implement. This offers a framework for automobile maintenance and modification, it may have limitations such as limited accessibility to service workshop, high costs associated with authorized repairs, challenges in sourcing quality parts, and a lack of guidance for modification enthusiasts.

Proposed System

The Automobile maintenance and modification is website to provide car owners the ease of service more efficiently. This project also keeps details of the previous customer details and their service details. It can be handled by the user. For requesting the service, the user can do it from the website. This document is intended to minimize human works and provide automobile service from their home. The proposed system is very easy to operate. Speed and accuracy are the main advantages of the proposed systems. There is no redundancy of data. The data is stored in database and it can be easily received and used at any time. The proposed system will easily handle all the data and the work done by the existing systems. The proposed systems eliminate the drawbacks of the existing system to a great extent and it provides tight security to data implementing this system, vehicle owners and enthusiasts can benefit from improved accessibility to information, simplified parts procurement, expert guidance, responsible modification practices, vehicle performance and enhanced overall maintenance and modification experiences.

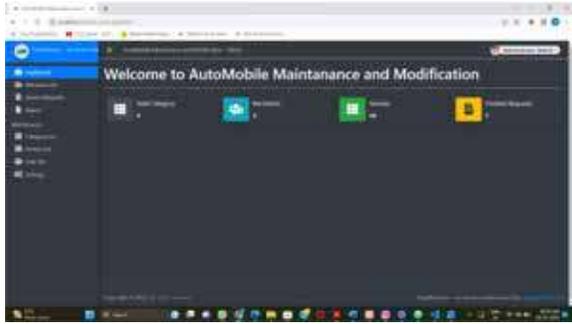


Fig 5: Admin Dashboard

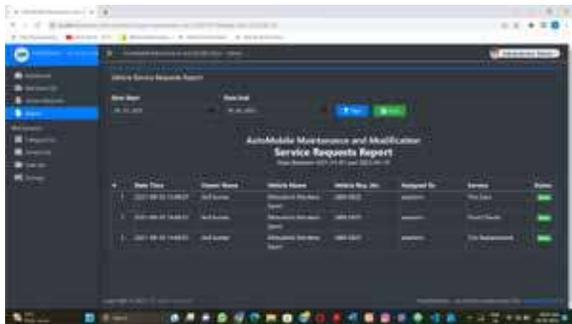


Fig 6: Service Request Report

CONCLUSION AND FUTURE WORKS

Effective Future adjustments may be made with ease because of how the package was created. The project's development has led to the following inferences. Efficiency is increased by automating the entire system. When compared to the current system, it offers a user-friendly graphical interface that is superior. Depending on their permissions, it grants the user proper access. Everyday lives revolve around our cars, which require routine maintenance to function well. Even though this technology raises the cost of servicing, it stops service facility from charging more and informs the client of all the modifications made to the vehicle. Overall, the consumer saves time and money with this method. The way we live and work has been dramatically changed by technologies like IoT and RPA. It has simplified our lives. This technique lessens client effort while simultaneously improving the efficiency of our automobile. And different performance-enhancing techniques. Effective Future adjustments may be made with ease because of how the package was created. The efficiency is increased by automating the entire system. When compared to the current system, it offers a user-friendly graphical interface that is superior. Depending on their permissions, it grants the permitted user the

proper access. The communication lag is reduced. Our everyday lives revolve around our automobile, which require routine maintenance to function well. My team and I have been working hard to provide a website that is better than the current one in terms of information on the different activities. However, we discovered that the job might be carried out more effectively. The company, product id, product name, and the number of quantities available are the only information that is often provided when we seek information on a certain product. After receiving the information, we may reach the product firm's website by simply clicking on the name of the product. The option for searching is the next improvement we can make. From this website, we may easily search for a certain product firm.

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BIG 5 PERSONALITY TRAITS AND MACHINE LEARNING – A COMBINED APPROACH FOR CLASSIFYING MALICIOUS INSIDERS

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ABSTRACT

An insider threat is an act by an authorized employee that affects the integrity of the organization. In most cases, it affects data privacy and leads to data leakage. There are various approaches including machine learning and deep learning approaches that could identify the threats and classify the malicious insiders. Most models use the details such as the log details such as the browsing history, usage pattern of devices, active time, etc as the parameters for identifying malicious insiders. In some works, psychological parameters are also combined with these factors. This work only considers the Big-5 personality trait's score for classifying the users using machine learning. The values are obtained from the CERT insider threat dataset. The performance of the four machine learning models is considered. The models are Logistic Regression, K-Nearest Neighbor, Decision Tree Classification, and Random Forest Classification. It can be observed from the results that the random forest classifier outperforms the other models with an accuracy of 98%. Further extending the work the importance of the features is identified with the permutation importance. A comparison is made to identify whether the top feature retrieved with it matches the features that reflects the various security scenario effects.

Keywords: Machine Learning, Personality Traits, Insider Threat, Malicious Insiders, Permutation importance

INTRODUCTION

Insiders are the one who are authorized to access the resources of the organization. The resources include the data, systems, networks, etc in the organization. When such people use their privileges to do activities that harm the organization in one way or another, insider threats become manifest, and those who are behind them are called malicious insiders. The main concern about the malicious insiders is their capability of disclosing the data to outsiders [1]. Though organizations concentrate on other threats, such as malignant threats, malicious threats cannot be ignored [2], in particular insider threats, as they are made by people who have inside knowledge about the organization [3]. According to IBM's Cost of Data Breach Report 2022[5], average cost of a data breach with malicious insiders is 4.18 million US dollars, and the time taken to identify it is around 284 days.

It affects the integrity and confidentiality of the organization from the viewpoint of different stakeholders. Insider threats have grabbed attention after incidents like the leak of Barclays bank data [4]. The impact of the inside threat on the organization is as follows.

- It would lead to the loss or theft of data.
- The financial loss that would occur in handling and rectifying the process
- The legal consequences that the organization should face
- Loss of integrity of the organization
- Loss of reputation.

The various parameters that are considered for identifying malicious users are mostly retrieved from their usage behavior. This work answers the question, "Can personality traits be used for detecting malicious

insiders?”. Personality traits are those that reflect the characteristics of people [6]. The commonly accepted personality traits are openness, conscientiousness, extraversion, agreeableness, and neuroticism, or “OCEAN” as defined in [7]. To the best of the study, no machine learning models are directly applied to the values of the personality traits for classifying the malicious insiders.

The research questions that have to be answered are:

- Can personality traits be used to classify malicious insiders from normal ones?
- Which personality trait contributes more to the classification of malicious insiders?
- Does the important feature that plays a key role in classifying malicious insiders reflect real psychological behavior with respect to security concerns?

The contributions of the work are as follows:

- Apply machine learning models for classifying the users as either malicious or non-malicious based on the big 5 personality traits.
- Find the best performing model.
- Apply permutation importance to identify the best contributing feature in classification.
- Check whether the important feature identified reflects real psychological behavior?

This paper is organized as follows, the next section gives the related work; the third section explains the background on the personality traits, permutation importance, dataset, pre-processing techniques applied, and the machine learning models experimented with. The fourth section gives the results and discussion, and the last section gives the conclusion.

RELATED WORK

Identifying insider threats has been in use for a long time. Machine learning and deep learning models are used for finding insider threats. [8] Uses a multilayer machine learning approach for detecting insider threats. [9] Considers it as a problem of anomaly detection and employs a one-class support vector machine for finding malicious insiders. [10] Proposed a deep learning model based on Long Short Term Memory for insider threat detection. The temporal pattern of the activities of the

users is used for creating the dataset. The parameters or user behaviors used for identifying malicious insiders differ in different studies. [11] Used the details of the documents accessed by the users. [12] Uses the search key terms used by the users to find malicious insiders using the one-class support vector machine. [13] Uses the violations in the user’s behavior from the roles assigned to them. Even the texts that are used officially are considered as a parameter for detecting malicious users, as in [14].

Apart from the factors that are specified above, there are also studies that consider psychological factors for identifying malicious users. [15] is one of the earlier works that uses psychological factors to identify insider threats. A few other works combine psychological traits with other parameters, such as their behavioral interpretation [16]. Behavior as well as motivational factors are considered in [17] for identifying malicious insiders. [18] Identified the relationship between personality traits and insider threats. [19] Combines psychological traits with browsing behavior to avoid insider threats. [20] Uses the Big Five psychological traits as well as the Dark Triad personality traits for feature extraction and a one-class support vector machine for classification.

There are only a few works that use psychological traits in combination with other features for the classification of malicious insiders with machine learning algorithms. This work uses the big 5 personality traits (OCEAN) traits for identifying insider threats.

BACKGROUND

Personality Traits

Openness in general refers to an individual’s wish to involve themselves in new experiences. Conscientiousness is the one that describes the reliability, and trustworthiness of individuals. Extroverts are individuals whose positivity increases when the interactions they have with others increase. Agreeableness depicts the merging capability of a person. The next trait is neuroticism, the individual who has a low score in this trait is found to be confident, and those who have a high score are the opposite. [21] Have summarized the security scenario effects that are discussed in detail in [22] and [23]. It has been reproduced here for reference in Figure 1.

It can be observed from the figure that extraversion is the

trait that makes people more vulnerable. Implementing machine learning classification and identifying the most important feature from the available features with the help of permutation importance will reveal whether those techniques identify the right feature.

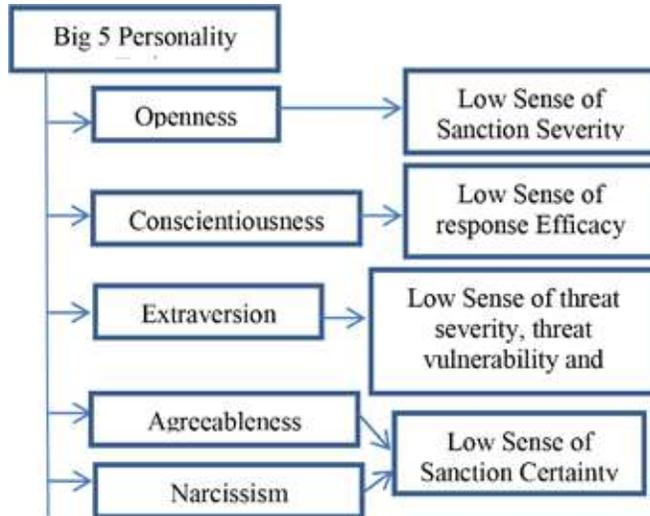


Fig. 1. Big 5 Personality Traits and security scenario effect Permutation Importance

The steps for calculating permutation importance are as follows:

- Train a model on the given dataset.
- Calculate the performance of the model on the validation set.
- Select a feature and randomly shuffle the value.
- Calculate the performance of the model with the permuted data.
- Find the difference between the original performance value and the performance value obtained with shuffled data.
- Repeat the steps from three to five for every feature in the considered dataset.
- Sort the features in an order with the top position occupied by the feature with the largest difference.

This permutation importance is used for finding the most important features.

Dataset

The dataset employed in the work is the CERT Insider Threat dataset, which is discussed in detail in [24]. The complete dataset is not employed. It includes various

log details such as login, website accessed, etc. but only the psychological traits in it are considered. It contains the values of the individual employees for the five psychological traits. The number of employees is 1272. The problem considered here is the binary classification problem. The dependent variable here is the label, which has a value of 1 for the employees who are threats and a value of 0 for those who are not. The original dataset contains values from 0 to 3, with the values from 1 to 3 representing the different levels of threats. It has been converted to a binary value for this work. The independent variables are personalities.

Pre-processing

The pre-processing steps are

- Splitting the dataset into the training set and test set
- standardizing the values

The train test split ratio used in the work is 80:20. 80% of the data is used for training and 20% of the data is used for testing. The standardization is done with the help of the standard scalar. Standardization of the data is performed before feeding the data to any machine learning model to ensure that the mean value is 0 and the value of the unit variance is 1.

Standard scalar is performed with the following Eq.(1).

$$z=(x-m)/s \quad (1)$$

Where X is the value to which the standardization should be applied. m is the mean and s represents the standard deviation.

Machine learning models

The machine learning models employed are

- Logistic Regression
- K-Nearest Neighbor
- Decision Tree Classification
- Random Forest Classification

1) Logistic Regression

The logistic regression model used here is the binomial logistic regression which can handle data that has a dependent variable with a binary class, 0 or 1. The logistic function produces probabilistic values for individual data elements that fit into a specific class. Unlike the regression model, Logistic regression fits the curve for classifying the data. The equation for logistic

regression derived from the equation of the straight line is given in Eq.(2).

$$\text{Log}(y/1-y) = b_0 + b_1x_1 + b_2x_2 + \dots + b_nx_n \quad (2)$$

The value obtained is converted to the probabilistic value with the help of the sigmoid function given in Eq.(3).

$$f(x) = 1/1 + e^{-(x)} \quad (3)$$

2) K-Nearest neighbor

K-nearest neighbor starts by choosing a number with the help of Euclidean distance, k –nearest neighbors are formed. The new data is assigned to one of the k-nearest neighbors based on the maximum number of neighbors. Euclidean distance is calculated with the Eq.(4)

$$D(x,y) = \sum_{i=1}^n (y_i - x_i)^2 \quad (4)$$

Where x_i and y_i are the data points.

3) Decision tree classification

A tree is created, considering the complete dataset as the root node. With the help of the attribute selection measure, an attribute is selected for splitting the dataset to form the decision nodes. The process is repeated from each decision node by selecting the suitable attributes until the leaf node is reached, which specifies there are no further attributes to process. Classifying the new observation with the help of the decision tree is made by comparing the element with the root node, followed by the decision nodes until the leaf node is reached.

4) Random forest classifier

Random forest classifier is a group of decision trees, each of which is generated by randomly selecting the observations and features from the dataset. Each is trained with a subset of the training data. The subset of features used for it is randomly chosen. Classifying a new observation is done by all the decision trees, and the common prediction is the result.

The results obtained are discussed in the next section.

RESULTS AND DISCUSSIONS

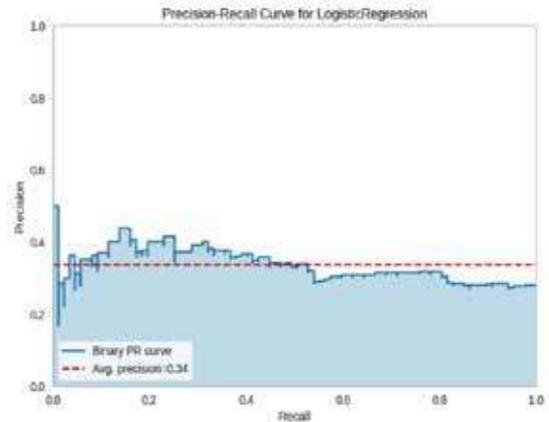
The results obtained with the various machine learning models are given below. The performance parameters are measured using the scikitlibrary[25].

$$\text{Precision} = \text{True Positive} / \text{True Positive} + \text{False Positive} \quad (5)$$

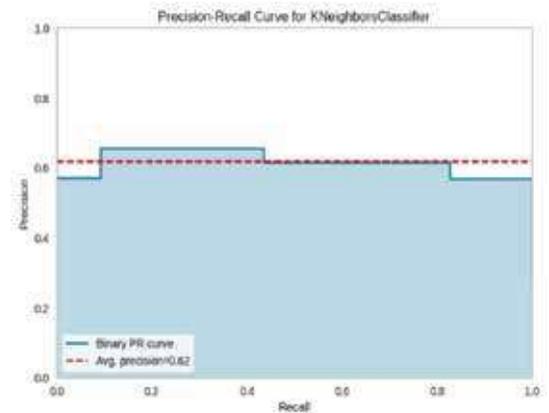
$$\text{Recall} = \text{True Positive} / \text{True Positive} + \text{False Negative} \quad (6)$$

$$\text{Accuracy} = (\text{TP} + \text{TN}) / (\text{TP} + \text{FP} + \text{TN} + \text{FN}) \quad (7)$$

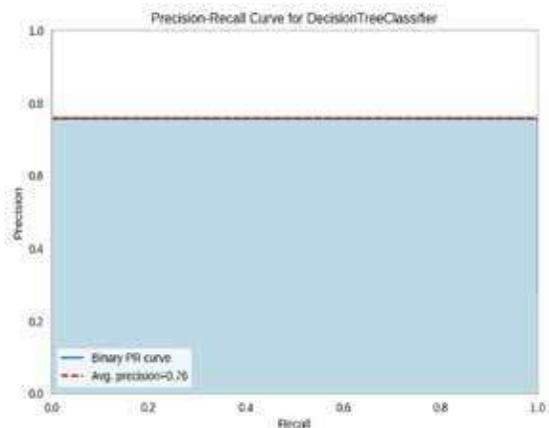
The precision-recall curves of all the models are given in the Figure 2.



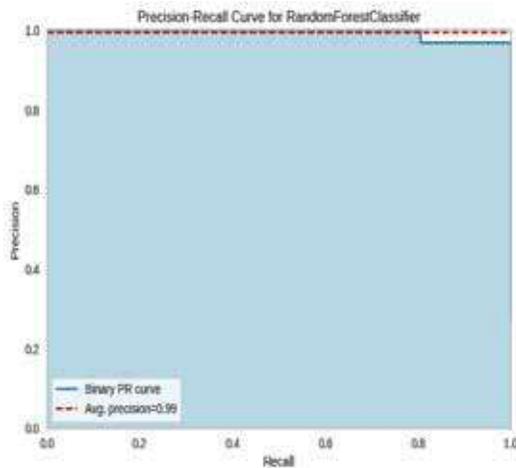
(a) Logistic Regression



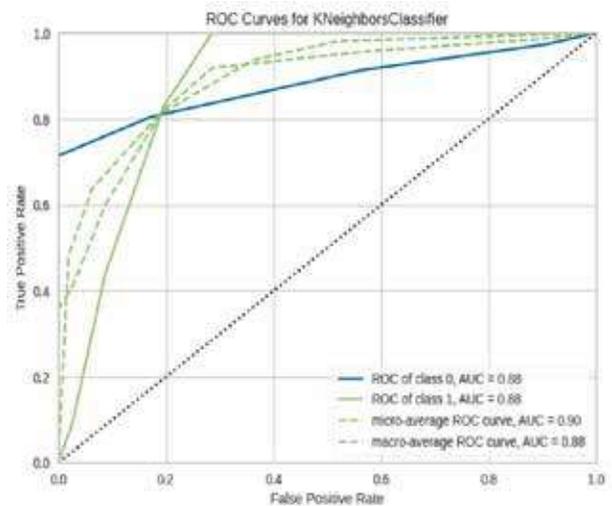
(b) KNN



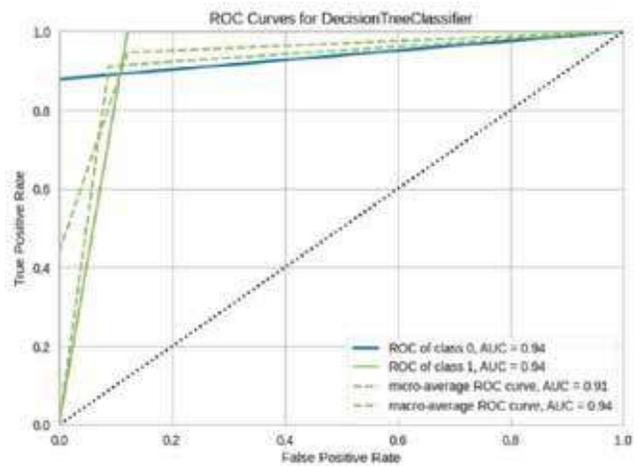
(c) Decision Tree



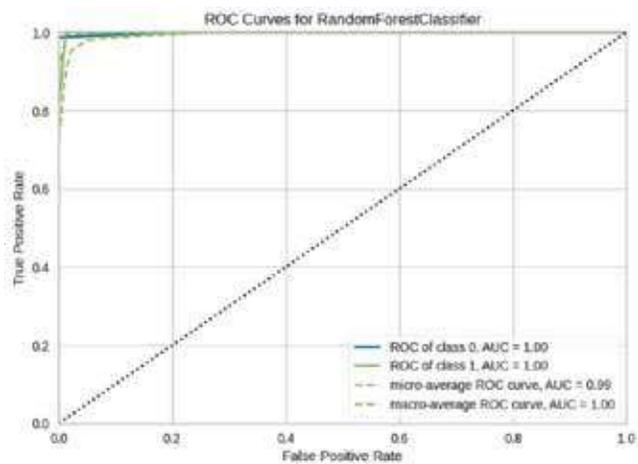
(d) Random Forest



(b)KNN



(c) Decision Tree

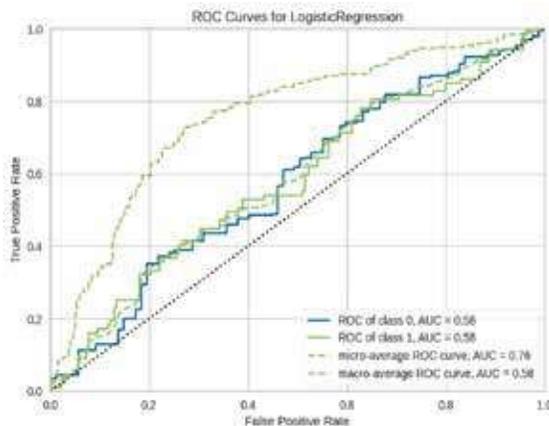


(d)Random Forest

Fig. 2 Precision-Recall curves for all Models

It can be inferred from the figure 2 that the performance of the random forest classifier is considerably higher than the other three machine learning models with an average precision of 0.99. logistic regression records the lowest average precision value of 0.34 .the average precision values of the K-Nearest neighbour and the decision tree classifier is 0.62 and 0.76 respectively. Precision would be more appropriate measure than the accuracy in applications like insider threat identification.

The ROC curves of all the four models are given in the figure 3. The AUC of both the class 0 and the class 1 obtained with the logistic regression model is 0.58. in case of the K-nearest neighbour model it is 0.88 for both the classes. For decision tree it is 0.94 and for the random forest classifier the AUC value is 1 for both the classes. It is evident from the results that random forest classifier outperforms all other models.



(a) Logistic Regression

Fig. 3. ROC curve of all the Models

The comparison of the accuracy obtained with the individual models is given in the Figure 4.

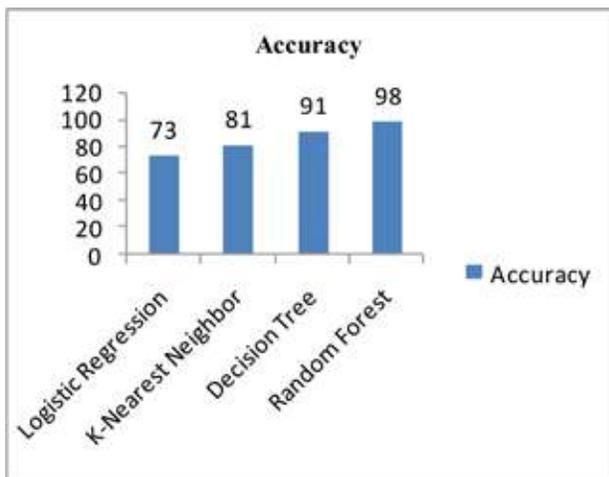


Fig. 4 Comparison of the Accuracy of the models.

It has been observed from the results that random forest classifier performs well than the other models. Hence it is used for finding the importance of the features. The feature importance weight for individual features obtained with the permutation importance is given in the Table 1.

Table 1 Permutation Importance of the Features

Weight	Feature
0.1597 ± 0.0208	E
0.1264 ± 0.0237	A
0.1258 ± 0.0248	C
0.1226 ± 0.0255	O
0.1138 ± 0.0336	N

From the permutation importance it is evident that extraversion contributes more to the classification. This matches with the observations made from the figure 1. Though from the experimentation it is clear that applying machine learning classification only to the personality trait produces good results, the dataset is found to have greater value of extraversion in both the classes.

CONCLUSION

Various factors are considered in various works for identifying anomalous insiders. Though personality traits are considered one among them along with other factors in a few works, this work considers only them. Different machine learning models are trained and tested with the Big-5 personality traits for

classifying anomalous insiders. The data is obtained from the CERT insider threat dataset. Among the four classifiers, the random forest classifier performs well, with an accuracy of 98%. It is evident from the results that considering only the scores of the employee in the psychological traits would be helpful for identifying malicious insiders. In addition to the classification process, permutation importance is employed for identifying the top contributing feature in classification and check whether it is similar to the feature that shows behaviors pertaining to the security scenario effect as observed from various studies.

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COMPARATIVE ANTAGONISTIC ASSAY OF *TRICHODERMA HARZIANUM* AND *TRICHODERMA VIRIDE* AGAINST *COLLETOTRICHUM FALCATUM* CAUSING RED ROT IN *SACCHARUM OFFICINARUM*

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ABSTRACT

Red rot of sugarcane is a fungal disease causes great reduction in the profitable cultivation of sugarcane. Present study is to control the red rot pathogen *Colletotrichum falcatum* by biocontrol agent *Trichoderma*. It is an asexual soil born fungi has antagonistic activity against red rot pathogen. Antagonistic activity was tested among *Trichoderma* spp. showed variation in their ability to resist the pathogen. Observed clear zone indicates the antagonistic effect of *Trichoderma*. Efficacy was tested under greenhouse condition shows the growth difference from each other, 80% survival of crops observed after co-inoculation with *Trichoderma*.

Keywords : Red rot, Sugarcane, *Colletotrichum falcatum*, *Trichoderma*

INTRODUCTION

Red rot, sometimes known as sugarcane cancer, is a fungal disease that has a significant impact on the quality and quantity of sugarcane which is a valuable cash crop grown in tropical and subtropical regions around the world (Chhaya et al., 2015). It is a monocotyledon plant that belongs to the Andropogoneae tribe of the Poaceae grass family (Agnihotri et al., 1979). Because of its economic benefits and availability, *Saccharum* has seen an increase in demand (Krishnamma et al., 2007). Infected internode tissues develop a rot with a distinctive red colour that is often intermingled with patches of normal colour, referred to as white spots (Kumar et al., 2013). Because cane is propagated through setts, which do not allow significant absorption of fungicides due to its fibrous node, it is difficult to handle this disease with fungicides. Planting diseased cane setts is another

major source of disease recurrence in fields (Reddy et al., 2017).

Microorganisms found in the rhizosphere are appropriate for use as biocontrol agents. *Trichoderma* spp. is an antagonistic microbe that is often utilised as a biocontrol agent. It's an asexual soil fungus that's also a well-known mycoparasite for a variety of soil-borne plant diseases (Sharma et al., 2015). There are talc-based commercial *Trichoderma* formulations on the market, as well as formulations based on organic carriers like neem cake, cow dung, tea waste, and coffee husk (Srivastava et al., 2014). The study was conducted to determine the efficacy of *Trichoderma harzianum* and *Trichoderma viride* against the pathogen *Colletotrichum falcatum*, with the goal of increasing commercial variety production and yield.

MATERIALS AND METHODS

Antagonist and Pathogen

The antagonistic investigation included two soil-borne antagonists, *Trichoderma harzianum* and *Trichoderma viride* cultures, as well as native isolates of pathogen *Colletotrichum falcatum* 671 culture from the Sugarcane Breeding Institute in Coimbatore.

Efficacy Testing In-Vitro

Antagonistic activity of *Trichoderma* spp. against *Colletotrichum falcatum* in vitro

Trichoderma spp., such as *Trichoderma harzianum* and *Trichoderma viride*, were used as fungal antagonists in the study. Dennis and Webster (1971) used the Dual plate culture approach to investigate the antagonistic impact against the virus. Without any antagonist, an adequate control was also maintained (Sharma et al., 2015). To test *Trichoderma*'s antagonistic action, a 9mm diameter pathogen mycelia disc was inserted at one end of a Petri dish over oat meal agar (OMA) medium, then after two days, a 9mm diameter test antagonist disc was placed on the other side, and Petri plates were incubated at 28 ± 1 degree Celsius for observation. After measuring the inhibition zone between the colonies after four days, the radial growth of antagonist and pathogen was observed for each treatment period up to seven days (Lal et al., 2016).

Bioassay on Sugarcane Leaves

Young leaf samples from the third position of the CoC671 variety were fully opened and used. For inoculation, the upper surface of the leaves is injured with a sterile pin, and the leaflets are placed in a plastic box coated with damp cotton to maintain a humid environment (Singh et al., 2008). The leaves were then infected with the pathogen *Colletotrichum falcatum* and the fungus *Trichoderma*, with *Colletotrichum falcatum* (1105) and *Trichoderma* (1106) co-inoculation. After 48 hours, the boxes were incubated at 22 degree Celsius in a controlled chamber to see how the symptoms developed (Vishwanathan et al., 2010).

Efficacy Test In-Vivo

Testing Under Green House Conditions

Trichoderma strains were investigated for their efficiency against soil-borne red rot inoculum in this investigation. The antagonistic strains were introduced

as talc formulations by sett treatment, and the experiment included two antagonistic stains and an appropriate control with or without pathogen inoculum (Talpatra et al., 2017). Individual talc formulations of *Trichoderma* strains were applied to single budded setts of the cultivar CoC 671. *Trichoderma* talc formulation was made by combining a blended grown up *Trichoderma* culture in 250 ml molasses yeast medium with 500 mg talc powder and five grams of carboxy methyl cellulose (CMC) in a 1:2 ratio (Chandrashekar et al., 2014). Sett treatment was given by mixing the talc product with water to make a paste, then swabbing the setts in the mixture and incubating overnight before planting (Viswanathan et al., 2010).

RESULT AND DISCUSSION

Antagonistic activity of *Trichoderma* spp. against *Colletotrichum falcatum* in vitro

The % of suppression of growth and sporulation of *Colletotrichum falcatum* was used to identify potent *Trichoderma* spp. *Trichoderma viride* and *Trichoderma harzianum* produce the best results or are highly successful in vitro in 6 to 9 days, although *Trichoderma viride* produces mediocre suppression. Differential antagonistic activity of several *Trichoderma* spp. isolates against *Colletotrichum falcatum* has been previously documented. Three duplicates of each treatment were kept, and following the incubation time, the radial growth of *Colletotrichum falcatum* in the control and treatment plates was measured. The percent of inhibition was calculated using the formula (Cherkuppally et al., 2016).

$$L = \frac{(C-T)}{C} \times 100 \quad (1)$$

Where,

L = Percentage of inhibition of radial growth of pathogen (%)
C = Radial growth of the pathogen (mm) in control

T = Radial growth of the pathogen (mm) in treatment with antagonistic fungi

In comparison to the control, the antifungal activity of *Trichoderma harzianum* and *Trichoderma viride* against *Colletotrichum falcatum* demonstrated a considerable reduction in radial growth following treatment. *Trichoderma harzianum* had the highest level of inhibition (approximately 78%), with a definite zone of inhibition visible after 6 days, while *Trichoderma viride*

had a lower level of inhibition (about 56%). In dual culture, the test pathogen's growth and colonization characteristics revealed that *Trichoderma harzianum* and *Trichoderma viride* have distinct levels of ability to limit the growth of the red rot pathogen *Colletotrichum falcatum*. *T. harzianum* had a zone of inhibition of around 2.2mm.

Table 1. Bio-efficacy of *Trichoderma* spp. against plant pathogen

Biocontrol agents	Radial growth of pathogen (mm)	Radial growth of <i>Trichoderma</i> (mm)	Inhibition %
<i>Trichoderma harzianum</i>	20	60	78
<i>Trichoderma viride</i>	40	47	56
Control	91	-	-

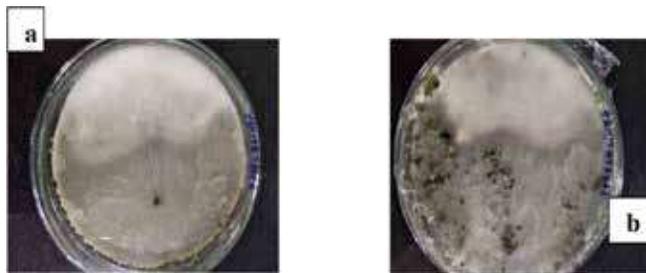


Figure 1: (a & b) *Colletotrichum falcatum* with *Trichoderma harzianum*



Figure 2: (a) *Colletotrichum falcatum* and (b) *Trichoderma viride* with *Colletotrichum falcatum*

Effect of *Trichoderma* on disease development during host pathogen interaction

Trichoderma spp. has an antagonistic effect on the red rot pathogen and the symptoms of red rot disease on sugarcane leaves, according to leaf bioassay experiments. The examination of observed alterations on young leaves of the COC671 sugarcane variety

indicated effective spp. among *Trichoderma harzianum* and *Trichoderma viride*. There are no symptoms on antagonistic-treated leaves or control leaves that have not been inoculated. Leaves treated with red rot pathogen portrayed development in disease, whereas decline on disease development observed on the leaves inoculated with both antagonistic and pathogen.

The results of microscopic examination show that the pathogen was able to colonise the leaf surface with hyphal colonies. After the third day of inoculation, visible alterations were seen, with yellow patches appearing on the host skin at the pathogen inoculation site. In comparison to *T. viride*, *T. harzianum* has a more effective defence mechanism. The finding demonstrates that *Trichoderma* has the ability to prevent *C. falcatum* conidial germination.

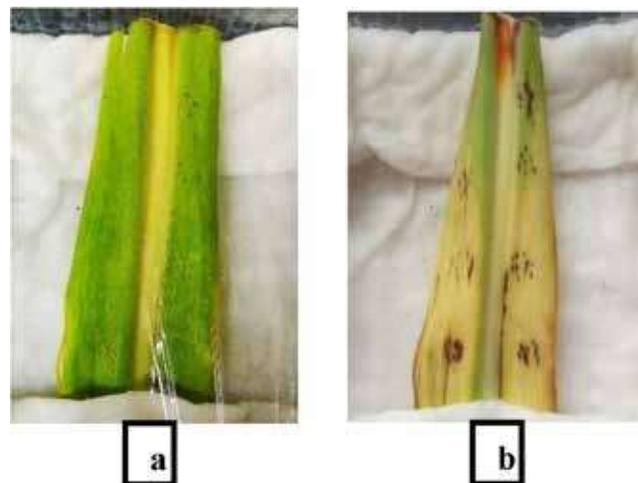


Figure 3: Sugarcane leaves infected with *C. f* pathogen after 2 days (a), after 5 days (b)

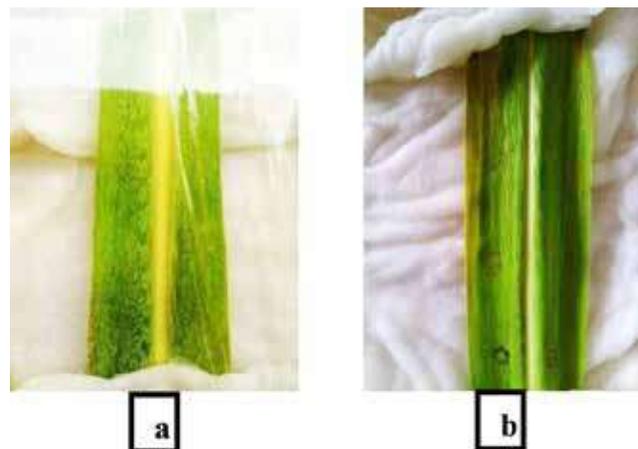


Figure 4: Sugarcane leaves infected with *Trichoderma viride* after 2 days (a), after 3 days (b)



Figure 5: Sugarcane leaves infected with *Trichoderma harzianum* after 2 days(a), after 3 days (b)



Figure 6: Sugarcane leaves infected only with *Trichoderma harzianum* after 2 days

Under Greenhouse Condition

Trichoderma spp. treated sugarcane stalks showed 100% recovery from red rot. On the 13th day after planting, the setts co-inoculated with *Trichoderma* spp. and the *C. f* pathogen germinated. Untreated stalks were unable to germinate. *T. harzianum* outperforms *T. viride* in terms of survival, with roughly 75% of *T. harzianum* surviving. On the 40th day, *T. viride* treated stalks developed illness symptoms and survived around 60% of the time.

Table 2: Efficacy of *Trichoderma* on red rot under Greenhouse Condition

Strains	No. of days for survival %		
	15 days	25 days	40 days
<i>Trichoderma harzianum</i>	2cm	15.5cm	47 cm
<i>Trichoderma viride</i>	1cm	15 cm	42 cm
Co-inoculated control	1cm	8cm	38 cm
Inoculated Control	0	0	0

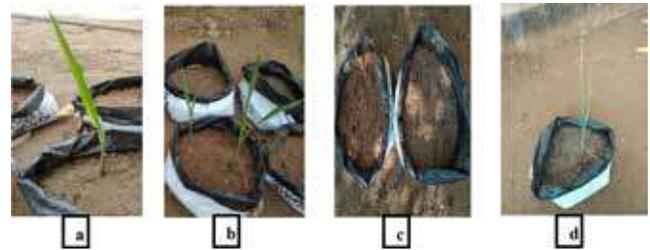


Fig 7: Management of red rot pathogen under greenhouse condition Single bud sets of CoC671 treated with *Trichoderma viride* (a), *Trichoderma harzianum* (b), with *C. f* pathogen (c), Co-inoculation with *Trichoderma* and *C. f* pathogen (d)

CONCLUSION

The results of this study reveal the influence of *Trichoderma* spp. antagonistic action on red rot. The ability of *Trichoderma viride* and *Trichoderma harzianum* can be determined by the difference in inhibitory zone levels. *T. harzianum* outperforms *T. viride* in terms of controlling disease on the host leaf surface, creating an inhibition zone, and controlling the pathogen on infected setts using the greenhouse method. As a result, the study concluded that the antagonistic *Trichoderma* spp. can inhibit the red rot pathogen *Colletotrichum falcatum*. In the agricultural sector, the sett treatment procedure is highly effective in sugarcane cultivation.

ACKNOWLEDGEMENTS

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DECLARATION

The authors declare no conflict of interest.

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DEEP LEARNING APPROACH IN SEPARATION OF BIODEGRADABLE AND NON-BIODEGRADABLE WASTE USING FASTER R-CNN

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ABSTRACT

Solid waste management plays a crucial role in the Smart City and Clean India mission by effectively separating waste into recyclable and energy-generating categories. Manual waste separation is risky and time-consuming, so an automated system is proposed in this paper. When waste is thrown into a dustbin, an image is captured and compared with a dataset using the Faster R-CNN algorithm. The dataset includes various objects such as food, plants, fruits, plastics, metals, batteries, paper, and cardboard, each labeled accordingly. OpenCV and TensorFlow are used to analyze the captured image and determine whether the object is biodegradable or non-biodegradable, drawing a boundary box around it. This research extends to the future by considering the conversion of separated biodegradable waste into energy through biomethanation plants. The goal is to reduce landfill waste to less than 5%, which would significantly benefit the overall ecosystem and environment by preventing pollution. Coimbatore's proximity to the Western Ghats, an important hotspot, highlights the significance of solid waste management in preserving the environment and receiving the southwest monsoon. Implementing automated waste categorization systems and promoting sustainable waste management practices are crucial for achieving the objectives of the Smart City and Clean India mission, leading to a cleaner and greener environment.

Keywords : Faster R-CNN, OpenCV, TensorFlow, Biomethanation, Biodegradable, Non-Biodegradable

INTRODUCTION

Importance of Solid Waste Management

Solid waste management is of paramount importance in India due to several reasons. Firstly, India has a rapidly growing population and urbanization rate, leading to increased generation of waste. Effective waste management is crucial to prevent environmental pollution, health hazards, and the spread of diseases. Secondly, improper solid waste management has adverse effects on the environment. Open dumping and burning of waste contribute to air, water, and soil pollution. It also leads to the emission of greenhouse gases, exacerbating climate change. Furthermore, solid waste management plays a crucial role in conserving natural resources. Recycling and proper disposal of waste can help reduce the demand for raw materials,

promote resource efficiency, and contribute to sustainable development.[1]

Additionally, solid waste management has social and economic implications. It provides employment opportunities in waste collection, segregation, recycling, and waste-to-energy projects. Effective waste management also enhances the quality of life by creating clean and healthy living environments. Given these reasons, the Indian government has recognized the importance of solid waste management and has implemented various initiatives and policies to address the issue. These include the Swachh Bharat Abhiyan (Clean India Mission), waste segregation at source, promoting recycling and composting, and establishing waste treatment and disposal facilities.[2]

Usage of Biodegradable and non-Biodegradable Waste Separation

Biodegradable Waste

Composting: Biodegradable waste such as food scraps, yard trimmings, and plant matter can be composted. Composting is a natural process where organic waste decomposes, producing nutrient-rich compost that can be used as fertilizer for plants and gardens.

Anaerobic digestion: Biodegradable waste can be processed through anaerobic digestion, which involves the breakdown of organic materials in the absence of oxygen. This process produces biogas, a renewable energy source, and digestate, which can be used as fertilizer. [3]

Biomethanation: Biodegradable waste can also be used for biomethanation, a process that converts organic waste into methane gas. The methane gas can be used as a source of energy for cooking, heating, or electricity generation.

Non-biodegradable Waste

Recycling: Non-biodegradable waste such as plastics, glass, metal, and paper can be recycled. Recycling involves collecting, sorting, and processing waste materials into new products. Recycling conserves resources, reduces landfill waste, and decreases the need for raw materials.

Waste-to-energy: Non-biodegradable waste can be used as a fuel source in waste-to-energy plants. Through processes like incineration or gasification, non-recyclable waste is converted into heat or electricity. This reduces the reliance on fossil fuels and provides an alternative energy source. [4]

Upcycling: Non-biodegradable waste can also be upcycled or repurposed into new products with higher value or functionality. For example, plastic bottles can be transformed into textiles or construction materials, creating a market for waste materials.

By utilizing both biodegradable and non-biodegradable waste through these methods, we can reduce the burden on landfills, conserve resources, and promote a circular economy.

The construction of a Biomethanation Plant by the Tamil Nadu government in Bharathi Park, Coimbatore, is a commendable initiative to generate energy from

biodegradable waste. This automatic waste separation implementation helps to send biodegradable waste in huge to the plant which helps in generating the electricity for public usage. [5]



Fig.1 Biomethanation Plant at Coimbatore

Deep Learning in Waste Prediction

The use of deep learning, specifically the Faster R-CNN (Region-based Convolutional Neural Network) algorithm, in waste categorization serves the purpose of accurately predicting the type of waste based on captured images. By attaching a camera to the dustbin, images of the objects thrown into it can be captured. These images are then compared with the MS COCO dataset, which contains a wide range of objects and their corresponding labels. The deep learning model trained on the dataset can classify the waste into two mediums:

Medium 1 - Waste for recycling, including materials like plastic, metal, and glass.

Medium 2 - Waste suitable for producing energy through Waste-to-Energy (WtE) projects.

The integration of a camera with a Raspberry Pi allows for real-time image capture and comparison, enabling efficient waste categorization. The dataset used for training the model includes images of biodegradable and non-biodegradable waste items of various sizes and shapes. This diverse dataset helps improve the accuracy and speed of waste classification. By leveraging deep learning and Faster R-CNN, the proposed system aims to provide an effective and automated solution for waste management, enabling proper waste segregation and facilitating recycling and energy generation processes.

IDENTIFY, RESEARCH AND COLLECT DATA

Faster R-CNN in Waste Material Prediction

Faster R-CNN (Region-based Convolutional Neural Network) is a popular algorithm for object detection

in computer vision. It is an extension of the R-CNN framework that improves both accuracy and speed. The Faster R-CNN algorithm consists of two main components: a region proposal network (RPN) and a network for object detection.

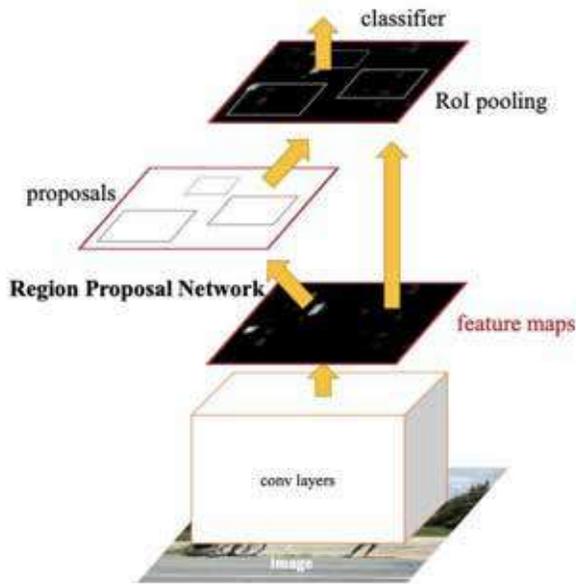


Fig.2 Faster R-CNN Architecture

Region Proposal Network (RPN): The RPN generates region proposals, which are potential bounding box proposals for objects in an image. It accomplishes this by sliding a small network over the convolutional feature map and predicting waste material category (Biodegradable or non-Biodegradable) scores and bounding box offsets for different anchor boxes. These region proposals are then refined in the subsequent stages.

Object Detection Network: The object detection network takes the proposed regions from the RPN and performs classification and bounding box regression. It uses features extracted from the convolutional feature map and applies fully connected layers to classify the object classes and refine the bounding box coordinates.

The key advantages of Faster R-CNN are its end-to-end training and shared convolutional features. The network can be trained in a single stage, optimizing both the RPN and the object detection network simultaneously. Additionally, the convolutional features are shared between the RPN and the object detection network, making the algorithm more efficient. Faster R-CNN achieves impressive performance in terms of accuracy

and speed in waste material detection tasks.[6]

Data Set for Waste Material Prediction

A dataset for predicting biodegradable and non-biodegradable waste, various waste material images are collected and label images representing different types of waste items. The following process are executed to generate a data set for waste material prediction.

Data Collection: Collected a diverse range of waste items that represent both biodegradable and non-biodegradable materials. This can include food scraps, paper, cardboard, plastics, metals, glass, batteries, etc. Ensure that the dataset covers various shapes, sizes, and textures of waste items.

Image Labeling: After collecting the images, labeling of each image in the dataset are executed to indicate whether it represents biodegradable or non-biodegradable waste. This can be done by drawing bounding boxes around the waste items in the images and assigning the appropriate class label to each bounding box.

Dataset Split: Split the dataset into training, validation, and testing sets. The training set is used to train the predictive model, the validation set is used to tune the model's hyperparameters, and the testing set is used to evaluate the model's performance.

Data Augmentation (Optional): Consider applying data augmentation techniques to increase the diversity and robustness of the dataset. This can involve techniques such as rotation, scaling, flipping, or adding noise to the images.

Preprocessing: Perform any necessary preprocessing steps on the images, such as resizing them to a consistent resolution or normalizing pixel values.

Model Training: Use the labeled dataset to train a deep learning model for predicting whether a waste item is biodegradable or non-biodegradable. A latest object detection model Faster R-CNN is applied to fine-tune them to get specific waste material detection dataset.

Evaluation: Evaluation of trained model's performance is applied on the testing set using appropriate metrics such as accuracy, precision, recall, or F1 score. Adjust the model and hyperparameters if necessary to improve performance in waste material prediction.

Iterative Improvement: Interaction on the training process by analyzing and addressing any issues or

errors encountered during waste material evaluation. This may involve collecting additional waste material data, refining annotations, or fine-tuning the model architecture.

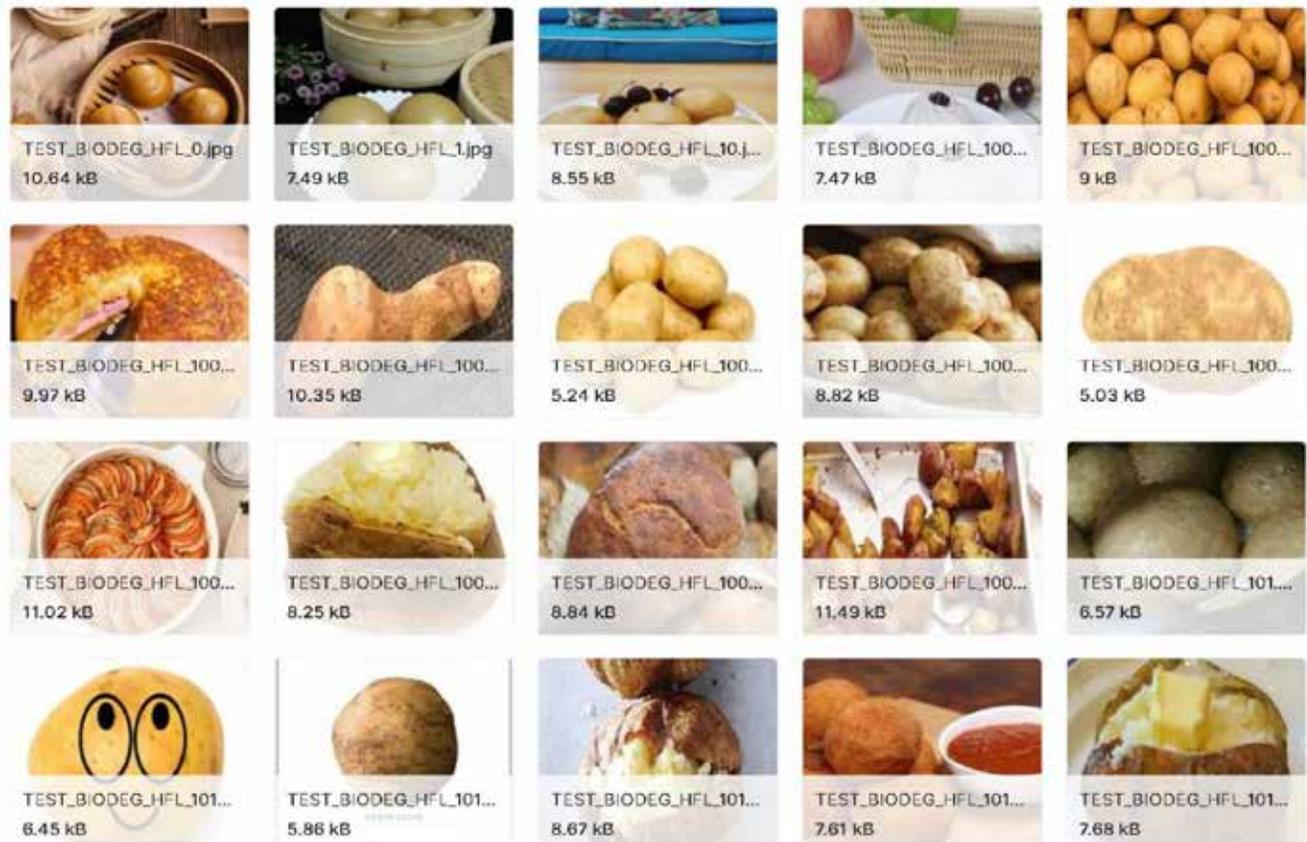


Fig.3 Biodegradable Label Images



Fig. 4 Non – Biodegradable Label Images

METHODOLOGY

The Faster R-CNN algorithm can help in finding

biodegradable and non-biodegradable waste by performing object detection and classification on waste product images.

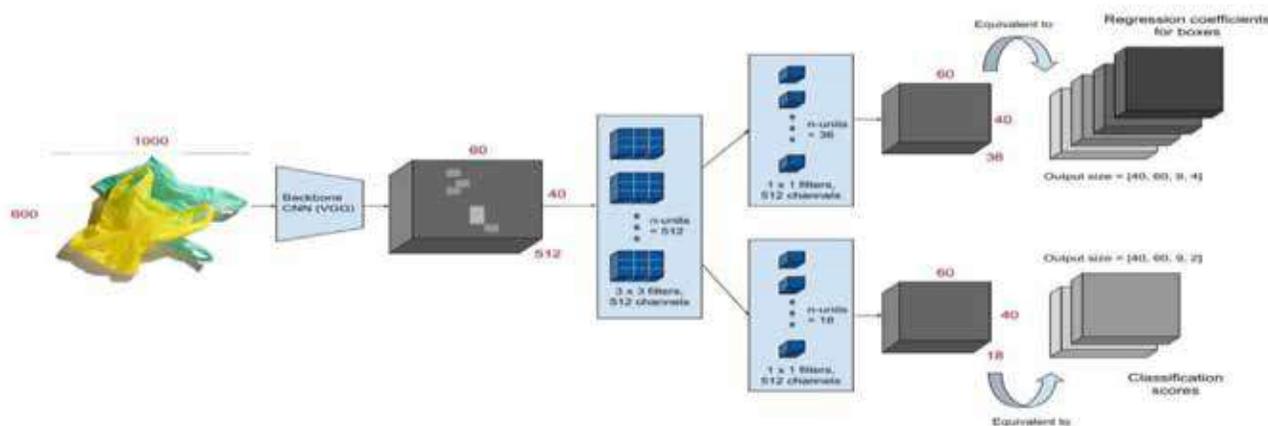


Fig. 5 Faster R-CNN Algorithm Work Flow

In Faster R-CNN (Region-based Convolutional Neural Network) algorithm, the region proposals are not generated within the network itself. Instead, an external algorithm called Selective Search is typically used to generate region proposals. [7]

Generating Region Proposal

1. **Input Image:** The R-CNN algorithm takes an input image as its input.
2. **Selective Search:** The Selective Search algorithm is applied to the input image. Selective Search is a bottom-up hierarchical segmentation algorithm that groups pixels together based on various image features such as color, texture, and intensity. This generates a set of potential object regions or proposals.
3. **Region Proposal Generation:** The Selective Search algorithm produces a set of region proposals, each represented by a bounding box. These proposals are generated based on the segmentation results and are likely to contain objects of interest.
4. **Region of Interest (RoI) Extraction:** The generated region proposals are extracted from the input image based on their bounding box coordinates.
5. **Feature Extraction:** The extracted region proposals are passed through a pre-trained convolutional neural network (CNN), such as AlexNet or VGGNet. The CNN extracts features from each region proposal, transforming them into fixed-length feature vectors.

6. **Object Classification and Localization:** The feature vectors from the region proposals are fed into additional fully connected layers that perform object classification and bounding box regression. These layers classify the objects present in the proposals and refine the bounding box coordinates.

7. **Non-Maximum Suppression (NMS):** After classification and regression, a non-maximum suppression step is applied to filter out redundant and overlapping region proposals. Only the most confident proposals are kept, discarding others that overlap significantly. [10]

By using Selective Search as the external algorithm to generate region proposals, Faster R-CNN can focus on fine-tuning the pre-trained CNN for object classification and bounding box regression. This allows for accurate object detection and localization in the proposed regions.

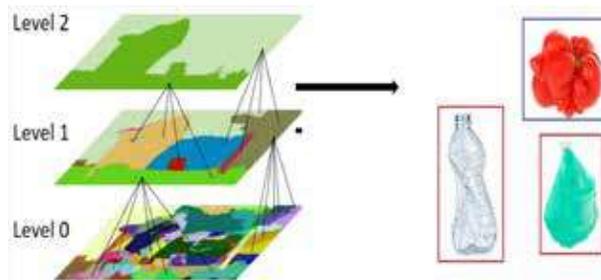


Fig. 6 Oversegmented Image based on Similarity

Output of the selective search in region proposal

Region	x	y	w	h	level
r_1	21	35	10	12	0
r_2	...	...	...		0
r_3	...				0
...		...			0
...			...		0
r_n				...	0
r_{n+1}	52	16	220	390	1
...	...				1
r_m		...			2

Here the x and y values are predicted waste material top left most coordinate values. The w and h values are the width and height of the object region. [8]

Extracting CNN Features

The AlexNet can be used for image classification but for waste material detection, the AlexNet should be Fine Tuned to get better biodegradable or non-biodegradable waste prediction accuracy.

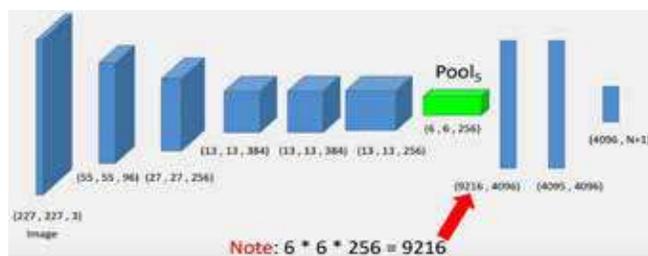


Fig.7 Fine Tune AlexNet for Waste Object Detection

To fine-tune AlexNet for waste object detection, it should follow the following steps.

Preparing the Dataset: Collect or create a labeled dataset specifically for object detection. Annotate the dataset with bounding boxes around the objects of interest, along with corresponding class labels.

Splitting the Dataset: Divide the dataset into training and validation sets. The training set will be used for fine-tuning the network, while the validation set will be used for evaluating the performance during training.

Network Architecture: Modify the last layer(s) of the AlexNet model to match the number of classes in your object detection task. The original AlexNet model ends with a fully connected layer for ImageNet's 1000 classes. Replace this layer with a new fully connected layer that matches the number of classes in your dataset.

Transfer Learning: Initialize the modified AlexNet

model with pre-trained weights from training on ImageNet. This transfer of knowledge from ImageNet helps in leveraging the learned features for your object detection task.

Fine-Tuning: Freeze the initial layers of the AlexNet model (usually up to a certain depth) to preserve the general features learned from ImageNet. Only the later layers, including the modified fully connected layers, should be trainable. This allows the network to adapt to the specifics of your object detection dataset.

Loss Function: Select an appropriate loss function for object detection, such as the combination of classification loss (e.g., softmax or sigmoid) and bounding box regression loss (e.g., smooth L1 loss or IOU loss). This loss function will guide the fine-tuning process.

Training: Train the modified AlexNet model on your object detection dataset. Use the training set to optimize the network's parameters by minimizing the chosen loss function. Adjust the learning rate and other hyperparameters as needed.

Evaluation: Periodically evaluate the performance of the fine-tuned model on the validation set. Monitor metrics such as classification accuracy, mean average precision (mAP), and bounding box overlap to assess the model's progress.

Post-processing: After training, apply non-maximum suppression (NMS) to remove duplicate or overlapping detections and keep only the most confident ones.

Inference: Use the fine-tuned AlexNet model for object detection on new, unseen images. The model will predict the bounding boxes and class labels of waste objects present in the images.

Classify Region Proposals

When working with object detection and region proposals, the Intersection over Union (IoU) is commonly used to classify the proposals based on their overlap with ground truth objects.

Using IoU to classify region proposals

Obtain Ground Truth: Have annotated ground truth bounding boxes for the objects of interest in your dataset.

Generate Region Proposals: Use a region proposal algorithm, such as Selective Search or an algorithm

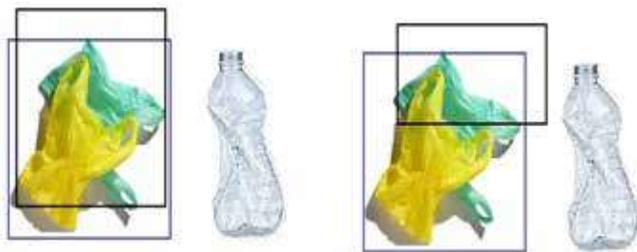
integrated into a detection framework like Faster R-CNN, to generate region proposals for the input image.

Calculate IoU: Calculate the IoU between each region proposal and the corresponding ground truth bounding boxes. IoU is computed as the ratio of the intersection area between the proposal and the ground truth to the union area of the two regions.

Thresholding: Set a threshold value for the IoU. If the IoU between a region proposal and any ground truth bounding box exceeds this threshold, classify the region proposal as a positive example (containing an object). Otherwise, classify it as a negative example (background).

Class Labels: Assign class labels accordingly to the classified region proposals. For positive examples, assign the corresponding object class label. For negative examples, assign the background class label. [9]

The IoU (Intersection Over Union) determines the accuracy level of prediction. If the IoU value reaches above 0.5, it will be stated as positive. The below 0.5 IoU values are stated as negative and therefore the prediction will start again from initial step.



IoU=0.7 : Positive – non-biodegradable IoU=0.3 : Negative – non-biodegradable

Fig. 8 Regional Proposal Boundary Boxes

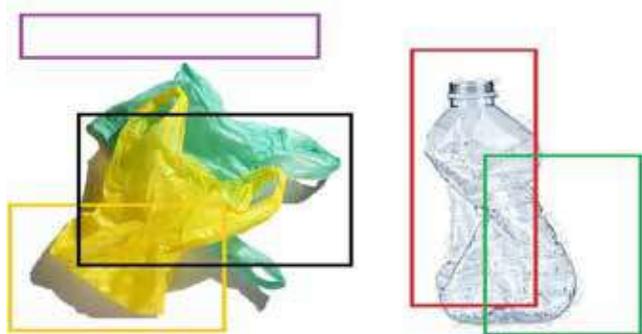


Fig. 9 Region Proposal Boundary Boxes

Dataset Accuracy Class Prediction

Region	x1	y1	x2	y2	IOU	class (neuron)
Red	300	20	70	290	0.8	bottle (1)
Green	375	180	60	70	0.3	negative (3)
Black	...	...	...	...	0.7	cover (2)
orange	...	...	...	...	0.4	negative (3)
purple	...	...	...	...	0.0	negative (3)

RESULT

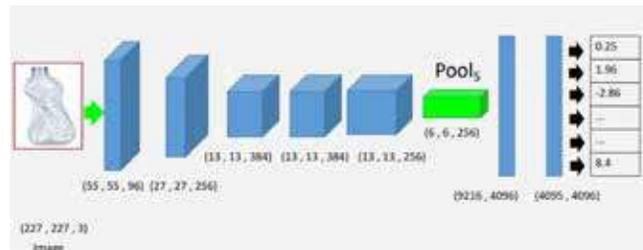


Fig. 10 Boundary Box Regression Accuracy Detection

Dataset for Training Cover Material

Region	feature_0	feature_1	...	feature_4095	IOU	class
Bounding box	0.8	-3.62	...	1.86	1.0	1 (positive)
Green	0.3	0 (negative)
Black	0.7	0 (negative)
orange	0.4	0 (negative)
purple	0.0	0 (negative)

Dataset for Training Bottle Material

Region	feature_0	feature_1	...	feature_4095	IOU	class
Bounding box	-1.56	8.12	...	3.77	1.0	1 (positive)
Green	...	...	...	...	0.3	0 (negative)
purple	...	...	...	...	0.0	0 (negative)
Red	0.25	1.96	...	8.4	0.8	0 (negative)

CONCLUSION

The construction of a Biomethanation Plant in Bharathi Park, Coimbatore by the Tamil Nadu government is commendable as it helps generate 150-170 units of electricity per day from biodegradable waste. However, one of the main challenges faced by the plant is the improper collection of biodegradable waste. Our research work aims to address this issue by serving as a primary source for collecting biodegradable and recyclable waste in a proper manner. By implementing an effective waste collection system, the collected waste can be efficiently utilized to generate energy for the betterment of society. This project will not only contribute to the generation of clean energy but also help mitigate the negative impacts of dumping solid waste in landfills, thus preserving the overall ecosystem and promoting a sustainable environment.

By implementing this project in real-time, it can have a significant positive impact on waste management and energy production in the region.

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DESIGN AND IMPLEMENTATION OF A SMART DAY/NIGHT BATTERY CHARGER BASED ON A SOLAR PANEL USING IOT

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ABSTRACT

In current days there's a high demand for energy and energy reduce-off in each place. This paper offers an answer for increasing energy and making it smart. The maximum generally used method for producing power in renewable energy is the sun. Even though solar energy is to be had all through the day its isolation varies from day to night with modifications in climatic conditions. And we also can operate via mobile applications. Usually, a solar panel can rate and shop energy in the sunlight hours. This paper tells that solar panels can also charge at night time instances automatically and be monitored using software. We can also check the actual reputation of solar panels in IoT applications. IR sensor that emits light in the 700 nm to 1 mm range of infrared light. It creates extra impact in producing energy constancy. Every so often there might be a mist, rainfall, or other climatic situations which also impact the solar panels. Even though we've furnished an answer for the climatic version. The electricity generated at the midnight also can use for our desires. That is one of the methods for generating or getting energy in a renewable manner that will now not affect nature.

Keywords : PV cells, IR sensors, LDR, and IoT applications, Generate power

INTRODUCTION

At this moment, the international appears to be increasing in population. In India populace unexpectedly expanded with the aid of 1.04% in 2018. In India, the contemporary populace is 1,388,456,735 as of Monday, February 15, 2021. It shows the growth in population each yr. The population increases and our human beings' desires also increase. So growing in populace also will increase our desires like electricity, food, refuge, etc. For producing power or growing energy the renewable technique is solar energy.

Sun electricity is a generation that is used to transform daylight into electric energy. Commonly when sunlight

reaches earth the floor it produces 4ultravioletnt rays, 43% seen mild, and 53% infrared rays sun panel in general converts visible mild to electric energy and makes use of 1/2 of infrared rays. A solar panel is built using photovoltaic cells and organized in a configuration of 32,36, forty-eight,60, seventy-two, 90 seventy-two lar panel with 32 cells usually can produce 14.72 volts output (each mobile can produce approximately 0.4voltslt of energy). Photovoltaics is abbreviated as (PV). PV is the s system of changing light (photons) to energy (voltage), which is referred to as the photovoltaic effect. This manner become first overworked in 1954 via scientists at Bell Laboratories.

Solar cells have been quickly getting used to power space satellites and smaller objects inclusive of calculators and watches. These days, electricity from solar cells has come to be a value computed in many regions and photovoltaic systems are being deployed on big scales to help energize the electrical grid. Once the sunlight hits on the solar panel that power is converted into electrical energy to DC present day, which flows to an inverter. The inverter converts the energy from DC to AC. Then the AC cutting-edge is used for appliances. The primary objective of this paper is to music the climatic condition, whether or not it's far daylight hours or nighttime time and it is monitored through an IoT application.

The task is split into phases, first, in hardware, the LDR captures the mild source and gives the input. Whether or not the weather is day or night time. If it's daytime the body routinely gets opened using a DC motor and the solar panel is charged through sunlight. If it's miles night time the frame receives closed automatically and the IR sensor gets ON and emits infrared rays. Infrared(IR) rays fall at the solar panel and are charged then the modern or voltage produced via the solar panel is connected through the battery. We also can manipulate the body via a mobile utility and additionally reveal which era and date the body opened and closed. So, it cannot be laid low with some other climatic circumstance. The hardware connection is easier and shorted. Further by using changing the controller, we also can reveal the status of a voltage going on via sun panels in IoT programs.

IOT AND SENSOR APPLICATIONS

IoT is not anything that offers embedded structures like sensors, software, and different era that interconnects and exchange statistics over the net. It makes human paintings less complicated. It is utilized in healthcare monitoring, automation, and so forth.

Right here the sensors play a main function in getting enter and connects to IoT. First comes LDR that's a mild-dependent resistor this is used to come across the presence of light. LDR is ordinarily used in photographic mild meters and extensively utilized in programs where it is vital to hit upon mild ranges. IR sensor which emits infrared rays. It's far used T.V remotes and other circuits.

LITERATURE SURVEY

A clever road lights device the usage of solar power

This paper gives an in design-depth of a smart street-lights system, where some DC lights are powered by PV resources. A battery is introduced to save the excess electricity of the sun solar, which could later be retrieved at night time, or each time the sunlight is being obstructed by way of clouds or other types of shading. A charge controller is used to manage gadget functioning and protect the battery from overcharging. This system is increased that includes a movement-sensing circuit, and a dirt-cleaning circuit. The general result is a clever and efficient street lighting system, which may be carried out as a standalone off-grid device or linked to the rest of the grid as part of a bigger system.

Improvement of Dual-Axis sun tracking-tracking Arduino with Lab VIEW

This paper targets the method music the solar and gainsthe most efficiency using Arduino and LabVIEW for real-time monitoring. The venture is split into two degrees, first in hardware improvement, four-mild La DR is used for capturing maximum light supply. The PV panel is then moved using DC motors at their maximum mild source location detection. The success of the device has been tested and compared with static solar panels. This paper tells how to layout a low-value sun-trackingssystem.

IOT Enabled solar energy monitoring device

In order to acquire more energy and to show the dust that has accumulated on the solar panels, this paper presents a technique and solution. First, all of the panels and sensors are directly connected to the controller which video display units of the panels and masses. By way of the use of IoT technology the records acquired from the panels and home equipment are despatched to the cloud through the net for future use as nicely the far-flung user can monitor the parameters of the connected systems. The person can view the precise status of voltage, present-day, temperature, and sunlight through the usage of a graphical user interface GUI.

CHALLENGES

In this technique, the meter readings are taken using a multimeter, via changing the controller we can also get the reading through an IoT application. Hardware is compact, has less region and potential requirement,

is eco-friendly, high efficient, has less energy loss, producing power in all situations. The implementation of clever solar panels primarily based the day/night battery charging is used with the generation of Embedded C. So, the principal goal of this paper is to offer a solar energy technology even at night time the use of IR sensor and to make it clever it may be monitored and managed thru IoT software.

PROPOSED SYSTEM

In the proposed device, the input electricity supply is given to the microcontroller Esp8266 board through a 12v DC adapter. Then the output from the NODEMCU is given to the relay that is used as a transfer and operates the DC motor. In this system, a mild established Resistor(LDR) varies the resistance by relying on the mild fall. During the day time intensity of mild falls is increased with a few resistance values. Then the resistance charge is transformed right into a voltage signal.

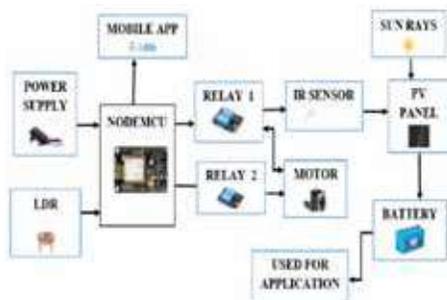


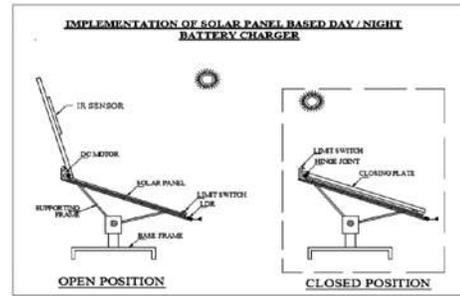
Fig. 1. Proposed System Block Diagram

Then the voltage sign is given to the analog to digital converter. Which converts the input sign of LDR the analogvalue to a digital value.

Then converted digital sign is given to NODEMCU ESP8266. Here, the microcontroller Unit is an open-supply software and hardware improvement environment. Which gets digital alerts.



This sign is numerous in line with the sunlight.



The microcontroller presents code strolling and standing at the serial screen. The output of the microcontroller is given to relay 1 and relay 2. Then the output of the relay is given to the motor. The motor is attached to the frame for opening-last loss. The motor tends to rotate in a forward route. If in the course of the daylight time the body robotically receives opened using a DC motor, and the solar panel is charged via the daylight light. DC energy is generated and saved in a battery. This DC motor connected to the body also can function and display IoT through IoT applications.

At some stage in the nighttime, the resistance value will increase and the value is examined then night-time and is visible on the serial reveal. The circuit receives set and turns on the motor circuitry which tends to rotate in reversed direction. Then the frame receives closed mechanically and the IR sensor gets ON and emits an infrared ray. This ray falls on the solar panel and energy is generated and saved in the battery. Infrared(IR) rays fall on the n solar panel and charge than the current or voltage produced through the solar panel has connected to the battery.

RESULT AND DISCUSSION

First the daylight, the solar panels l charged via the daylight. The output getting from sunlight is stated using a multimeter.

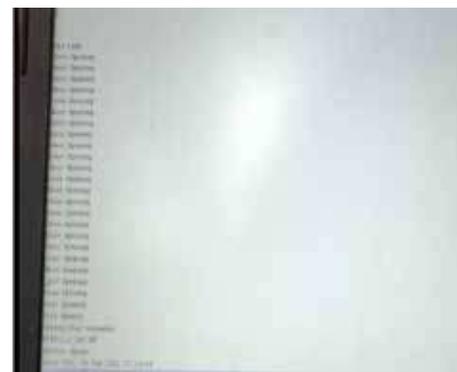


Fig - 2. Daytime Output

The proper aspect photograph indicates the program execution during the daylight hours. At midnight, the solar panel is closed and charged thru an IR sensor. It may be also managed through cell applications.

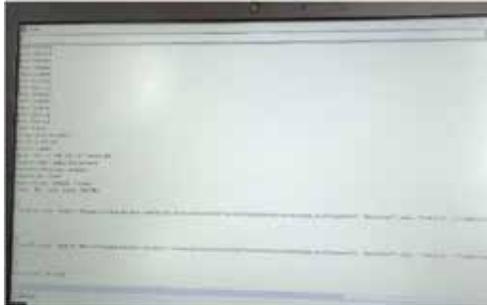


Fig - 3. Night-time Output

Right here the right aspect picture suggests this system execution at night time.

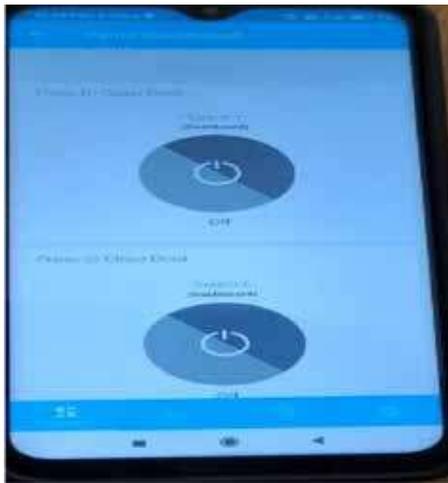


Fig - 4. Daytime Output

Relying upon the panel size and its capacity charging can have completed rapidly or slowly. Right here we're using a 9V 12watts 0.34amps solar panel. The calculation is accomplished under the table for 2 specific length panels. For both day and night time times.

Panel size	Day time	Night time	Before charging	After charging
23.5*20	4v	1.2v	3.5v	4.7v
47*40	8V	2.4	3.5	5.9v

CONCLUSION

This paper concluded that offering a trade source for producing power is achieved in many ways but using a solar panel and solar radiation to enhance the energy processing in both day and night time is proven right here. At night time energy generation is made through the usage of an IR sensor. Its miles are used for appliances. More powerful and one of the strategies of generating electric-powered energy. This system additionally offers programs in which the frame can manipulate by using IoT. Similarly, developments may be greater and alternates may be implemented.

FUTURE DEVELOPMENTS

The assessment of the system may be further particular by using changing the microcontroller we can also monitor the precise status of voltage that is produced by using the IR sensor all through each day and night time times. Then any other manner of generating electricity consumes high depth along with moonlight sensors, pyroelectric sensors, and so forth. May be executed.

DESIGN AND DEVELOPMENT OF FOOD DELIVERY BOX

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ABSTRACT

Swiggy and Zomato applications are being used to deliver food to homes. Before the corona epidemic, young people in the 18 to 24 age range were most often the ones who delivered meals since they found it convenient to use mobile applications and their changing lives favoured speed and advancement. The temperature of the items may change during delivery due to the time spent in transit, which is not what customers want. They are thermally insulated in delivery bags to stop heat loss, but this insulation won't hold out for very long. The delivery box's design is based on the Peltier effect, which states that when a thermoelectric module is given current, the heat transfer between the substrate causes one side of the substrate to cool and the other to heat. The heat and cool of the peltier plate that will be maintained moderately to prevent them from overheating and high cooling. Mini fans will be used to spread the heat and cool inside the box. We can maintain them using the sensor connected to the IC chips which cut off the current supplied to peltier plate and can save the power for longer period. A rechargeable battery is attached in the box which is used as power source. The main intention is to use the peltier module is to modify the surrounding temperature and to deliver food in its fresh state.

Keywords: Delivery box, Peltier effect, Heat transfer

INTRODUCTION

Globally, the refrigeration and air conditioning sectors require a sizable quantity of electrical energy in order to maintain the proper temperature for food and medication. As a result, study on studies related to refrigeration is required in the literature. The vapour compression refrigeration cycle is the most popular. Refrigeration cycles are often employed for this, despite the fact that many research have concentrated on peltier devices [1]. As thermodynamic devices used as energy converters, thermocouples connected in series to peltier thermoelectric devices are considered. Thermoelectric (TE) modules, which is used to convert the heat energy directly into the electrical energy, have received support for research and development. TE devices are semiconductors that may produce a temperature gradient when powered by electricity or generate a voltage when subjected to a temperature gradient, utilising the Seebeck or Peltier effects, respectively [2]. Direct power generation (TE and piezoelectric), plant or district or water heating, absorption cooling, indirect power generation desalination or a clean water and other low-grade waste heat recovery techniques are some of the current and applicable ones. TE module

provides an inexpensive electricity and is a green energy technology without a usage of the moving components and the generation of the waste that is harmful to the environment. However, a number of variables, such as material choice and operational strategy, affect how well TE modules perform [3]. Especially when an element voltage is supplied, this component, which is constructed of two distinct semiconductors, may have a cooling effect. The cold and hot sides of the peltier are connected by two heat exchangers to enhance heat transfer for the experimental setting. To increase system efficiency and guarantee effective heat transfer, fans can be used to support the exchangers that are currently being used [4–6]. Using portable mini-refrigerators, the efficiency of the Peltier element is being studied. In one investigation, a peltier device and its blowers on the cold and hot sides was mounted in the refrigerated coffer [7]. Clean renewable energy sources like solar electricity may be coupled to energy systems. Raising the COP efficiency was the aim of the solar-powered Peltier refrigerator. Peltier cooling modules are another idea for electronic device cooling. A thermoelectric model was made [8] to predict how effectively a thermoelectric module will cool. The experimental examination comparing the thermoelectric peltier's

cooling and heating capabilities using TEC1 12715. Within the first 60 seconds, it was found that the cooling mode's normalised COP values were 233% lower than the heating mode's [9]. On the basis of semiconductors, TEC1 12706 is utilised in fresh food storage containers [10].

WORKING

Electrical energy can be converted into a temperature using thermoelectric devices. Before the invention of semiconductor materials, the application of the cooling and heating effect is used minimal [2]. A thermoelectric device is composed of N and P-type semiconductor pellets that are electrically arranged and are thermally equal. Bismuth Telluride, the most widely used semiconductor material, has a distinct electron density (BiSb). Generally, thermoelectric semiconductor materials used in thermoelectric coolers are bismuth Telluride alloys. There are other thermoelectric materials available depending on the purpose, including Lead Telluride (PbTe), Bismuth Antimony (BiSb) and Silicon Telluride (SiGe) alloys [11]. As current travels from an N-type semiconductor to a P-type semiconductor, and electrons (e) go from P-type semiconductor materials to N-type semiconductor materials, TEC operates by the electrons hopping from low energy levels (P type) to higher energy levels (N type). The p type and n type semiconductor dice are connected by copper tabs for the advancement of power. When the voltage is applied at the two ends of two semiconductors, current flow causes a temperature gradient to occur over the junctions. The Peltier plate warms up on one side while cooling off on the other [12]. This setup is equal, in terms of efficiency, to electrons moving directly from one TE material to the other. TE pairs are used to create traditional TE cooling/heating modules, which are then organised into arrays and repeated roughly 100 times. Within the module, one side cools and one side heats up when current flows. The hot and cold sides likewise switch positions as the current does. The idea of geometry is the same for power producers. A heat sink is linked to both the top and bottom in this instance [13].

METHODOLOGY

The heating and cooling effectiveness of the delivery box is determined by its design. The dimensions of the box that we created were 20 inches long, 14 inches wide, and 15 inches tall. Our heating area measures 14 inches in length and breadth, while the cooling section

is 12 inches long and 4 inches wide. Using tin sheets and arc welding, we created a box for delivering meals. The cooling part has EPS thermocol that has been sliced and connected. The length and height of a mica sheet are each 14 inches. Due to the fact that heat will pass to the cooling side, it is screwed into the delivery box. So the heatsink slited according to the size of the peltier plate. Due to heat transmission to the cooling side, they are firmly fastened to the mica sheet. Using heatsink compound, we mounted the heatsinks to the peltier plate. On the heat side, a heatsink with a thickness of 0.3 inches is employed. Thick heatsink makes the process of eliminating heat simpler. RV fans are employed for cooling and distributing heat. These RV fans aid with heat dissipation, and we added two more micro fans on the hot side to help with heat removal from the box. To keep the heat in, aluminium foil is fastened to each side of the box. The circuit is created with a programmer IC, and the PICkit2 is used to programme it. This microchip is used to automatically shut off the gadget when it becomes too hot or too cold. This circuit helps in indicating the temperature inside the box in the digital display. Three switches are connected to the circuit. First switch will be used to turn on and off, second switch is used to turn on the peltier palte and minifans and third is used to switch the circuit to direct current for recharge and to battery. Halogen bulb is connected to the battery to prevent battery from voltage fluctuation. For the power source, 220V SMPS power supply and 12V 24Ah rechargeable battery is used.

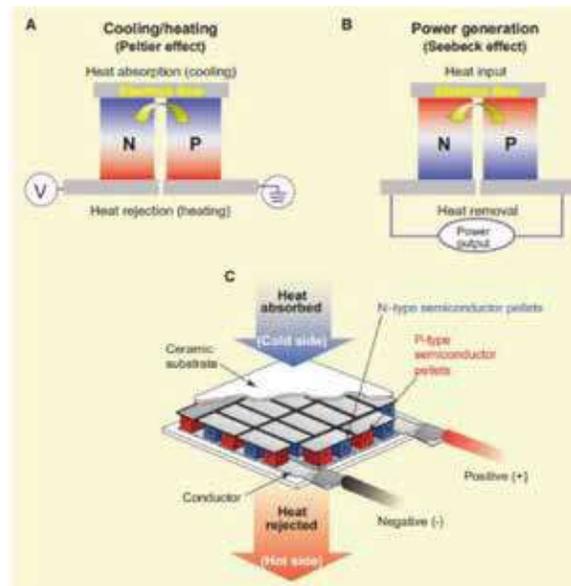


Fig 1. Working of Peltier plate

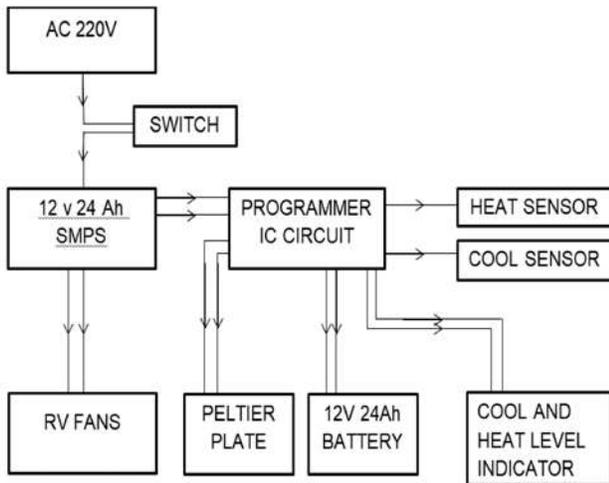


Fig. 2. Experimental model

RESULT

To ensure they are in functioning order, they are initially tested with direct current. The circuit's power source is examined extensively. Wires that must not touch one another are thoroughly inspected. The circuit receives 12 volts of electricity. The power switch is switched on after connecting to the battery. The switch in the bottom corner has been modified to operate on batteries. Following extensive testing, the heating section's temperature is 44 degrees Celsius, while the cooling section's temperature is 24 degrees Celsius. After operating for 6 minutes, cooling is observed. Within three minutes, you may feel the heat. Due to the aluminium foil wrapped around the sides, the food is able to retain heat. The temperature within the box in the cooling area was kept at 25 degrees Celsius during the hour-long examination. The temperature of the meal is slightly altered. The temperature of the meal is measured to be 45.7 degrees Celsius, and its chilliness is measured to be 24.6 degrees Celsius. The temperature is recorded after an hour of keeping them in the box.

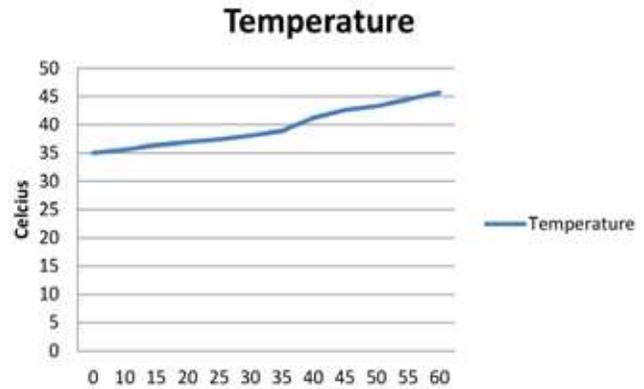


Fig. 3. Heating level in delivery box

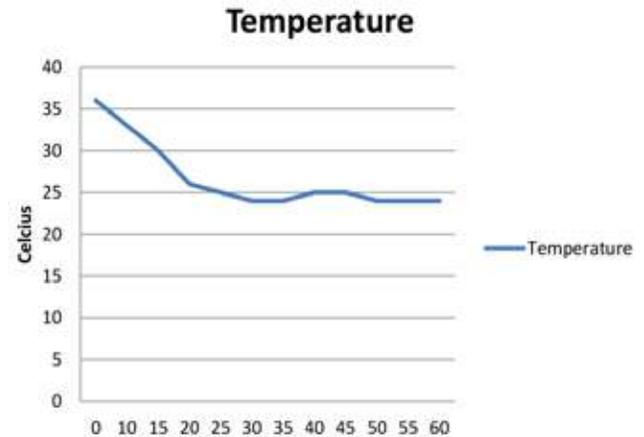


Fig. 4. Cooling level in delivery box

CONCLUSION

They are small in weight which will need low power. They are compact and simple for maintenance. It has more durability. For local applications such as thermoelectric refrigeration, fridge, power plants, DC machines, printed circuit boards and thermoelectric air conditioning, among others, thermoelectric cooling (TEC), as opposed to compression systems, is one of the best cooling techniques. Thermoelectric cooler is fully gas-free, portable, and does not require any kind of compressors or cooling gases of any kind. It may be energized by the direct electric sources like as solar cell either with batteries. When employing TEC, both heating and cooling temperatures vary abruptly within 10 minutes. We can top out the peltier plate's needed charge using rechargeable batteries. This delivery box is small and battery-operated and can be mounted on any vehicle. The temperature of the food products is maintained in this case via TEC. Until they are given to the consumer, they can be kept.

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DEVICES SUPPORTING THE DEVELOPMENT OF ROBOTIC AND ARTIFICIAL INTELLIGENCE APPLICATIONS

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ABSTRACT

Beginning with the Turing test and progressing through the logic theory machine, expert systems, and autonomous vehicles, robotics and AI have seen three generations of development. Today, in the third generation, AI and robots are used together in many areas of society, such as commerce, industry, science, and the classroom. Making useful robots and AI programs is fraught with challenges. There is an immediate need to create a new networking paradigm that is proactive, self-aware, self-adaptive, and predictive. Network operators may access vast amounts of data, notably related to the network and its users. Systematically utilizing big data not only makes the system smarter and more capable, but it also allows for more economical and productive operation and optimization. The future generation of wireless networks they imagine is data-driven and makes use of sophisticated data analytics, ML, and AI. We cover the data sources and key factors influencing the uptake of data analytics, as well as the part machine learning and AI play in making the system self-aware, adaptable, proactive, and prescriptive. Data analytics is considered in connection to several different approaches to network design and optimization. The problems and advantages of using the next generation of communication systems will incorporate artificial intelligence, machine learning, and big data analytics are covered in the conclusion of this research.

Keywords: Self-driving, Robotics, Self-aware, Wireless

INTRODUCTION

Research and development in robotics and artificial intelligence (AI) began in the 1950s. At that time, development and research in these two fields were being conducted separately and independently [1]. The “Turing test,” which Alan Turing first introduced as the “Imitation Game”, this first generation of artificial intelligence began in 1950. Turing presented a framework for artificial intelligence in his paper and the Turing test, which measures that intelligence [2]. However, McCarthy, who first popularised the phrase “Artificial Intelligence,” is frequently attributed with the treatment of the study of artificial intelligence as a 1956 Dartmouth meeting. The logic theory machine at this moment developed by Allen Newell, Cliff Shaw,

and Herbert Simon was recognised as one of the first AI programmes [3]. Due to the meeting itself as well as the ongoing rise in computing capacity, AI gained appeal after this conference. With the use of servos, actuators, and automated control systems, robotics development was mostly done in the field of mechanical engineering while AI in computing continued to advance. When it came to applications, robotics was more in the production phase than AI. Due to issues including inadequate computer power despite constant improvements, slow and insufficient data storage, and the consequent decline in financing, interest in AI started to decline in the half of this generation.

Technology based on artificial intelligence (AI) is becoming more commonplace. Clinical decision-

making in the healthcare business has much to gain from the application of artificial intelligence (AI), since it has the potential to streamline hard or time-consuming tasks. [3], including prognosis, analysis, treatment, and monitoring. All of these developments have the potential to completely transform the healthcare system. The immense potential of AI in healthcare has sparked significant ethical and legal issues. For instance, medical professionals may be hesitant to implement cutting-edge AI models due to the fact that these systems operate as opaque “black boxes” whose decisions and suggestions are sometimes incomprehensible or inexplicable to everyone, not just computer scientists. Errors, such as those brought on by algorithmic bias, can be hard to attribute to AI systems, though. Unless substantial effort is made and all parties are prepared, it is challenging for these systems to acquire the trust of healthcare professionals and patients and be applied in clinical practise [6].

The system must be intelligent, self-aware, self-adaptive, able to handle system services efficiently, also capable of managing and running networks on its own. Regular reactive maintenance is not any more effective. Big data analytics allows for the proactive and pre-emptive maintenance of network components. The network can help or direct the operational and service unit with decision-making options, action consequences, etc. due to the volume of data, the speed at which data is received, and the variety and kind of data foundations. Artificial intelligence (AI) as well as machine learning (ML) can assist find previously undiscovered characteristics of wireless networks, spot correlations and anomalies that we are unable to detect visually, and offer creative solutions to improve network deployments and operations.

REASERACH REVIEW

The concept of the TENG, which uses mechanical energy to generate electricity, was initially presented by Zhong Lin Wang. TENGs take advantage of high voltage output performance, varied operating modes, broad material availability, wearable/implantable compatibility, a simple manufacturing method, and inexpensive cost thanks to the coupling effect of contact electrification and electrostatic induction. Since TENGs are so effective in collecting biomechanical energy from humans as well as blue energy and natural wind energy, they are increasingly being used in this capacity.

TENGs may be created from a wide variety of flexible and elastic materials such as fabric, silicone rubber, thin plastic film, and others, which allows for rapid production and a comfortable fit. Although TENGs are equivalent to a piezoelectric-based sensor that also provides self-powered sensing, they distinguish themselves as an improved alternative by offering simpler designs and customizations than piezoelectric sensors. Touchpad interfaces, auditory interfaces, manipulator controllers, etc., can all benefit from TENGs because of their four simple operating modes: contact-separation mode, lateral-sliding mode, single-electrode mode, and freestanding triboelectric-layer mode. Since TENGs can run on their own power, it is much easier to implement them in a variety of low-power wearable human-machine interfaces (HMIs) such electronic skin (e-skin), smart gloves, wearable wristbands, and smart socks. The utilization of advanced data analytics for broader applications such as home security, IoT control, virtual reality game control/rehabilitation, and personal identification highlights the immense potential of triboelectric sensors in the HMI industry.

Artificial intelligence, or AI, is the capacity for learning and cognition within a computer program. Artificial intelligence may be defined as any situation in which a computer program performs a task that we would normally attribute to a human being. The advantages of AI will be discussed first.

COVERAGE AND CAPACITY OPTIMISATION OF FUTURE CELLULAR WIRELESS NETWORKS BASED ON DATA

The traditional network-centric design doesn't account for all the intricacies that might effect service quality. In order to remove assumptions during fault isolation and reduce mean time to repair, mobile operators need systems that provide analytical capabilities by integrating all subscriber and network-related data into a unified corporate geolocation platform. Network operators can profit from big data analytics since they have access to vast amounts of data. Using data from several sources, including subscriber information and network statistics, the big data analytics engine/agent may help build and improve the network.

When there is a physical obstruction or impediment between two objects communication nodes, Fig.

1(a) envisages adaptive/dynamic rerouting of traffic. Based on TP and other data like resource availability, a dynamic rerouting path is possible chosen. When the primary serving BS is bandwidth restricted, congested, or otherwise unavailable, a cell helper with holographic beamforming can more easily service a distant user beyond the aiding BS's extensive coverage area, as shown in the dynamically adjacent Fig. 1(b). Based on the data it receives, the holographic beamforming antenna may construct a high-directivity beam toward the far-off user by employing TP and REM [7]. Figure 1(c) shows how a 3D geolocator tool and configurations for long-range, high-capacity links and electronic speed beam-switching can be used to improve dynamically steering coverages to where they are needed, while Figure 1(d) shows how this can be done to provide access while in motion.

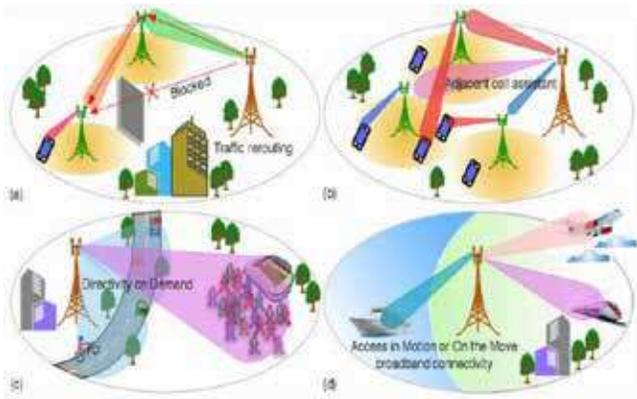


Fig. 1. Techniques from ML, AI, and data analytics can be applied in analogue

In addition to the aforementioned management and optimisation scenarios, properly and effectively maintaining components of the network, backhaul checking. Some of the most painful and bothersome problems the network operators are frequently tasked with include managing and orchestrating fronthaul, intelligent network slicing, maximising energy efficiency, and keeping an eye on critical network health indicators. Big data analytics can be used to perform network element predictive maintenance. Through sensors, the predictive maintenance continuously examines the network elements' operating status. The possible threats can be recognised using big data analytics. Therefore, potential issues are discovered early. This enables the network operator's operation and maintenance staff to develop proactive predictive maintenance planning.

IV RESULTS AND DISCUSSION

Through simulated studies, the effectiveness of the CNN algorithm is assessed, including the network's throughput at various v values. The performance of the network as a result of the detected mammalian motion and the v values. The curves for the network's effective throughput at different v values in the two scenarios are shown in Figure. When several animals are present, the sensor node switches to shared mode. In the exclusive mode, requests for parallel transmission from nodes will be put off if no mammals are identified. Even in the worst-case situation where mammals are negatively harmed, the network's effective throughput can still reach 85% of that throughput without the presence of animals ($v = v_1$). Comparing the CNN algorithm's network's effective throughput to that of the traditional SFAMA protocol and the underwater MAC protocol, the effective throughput can be enhanced by 30% to 50% at various speeds (v values).

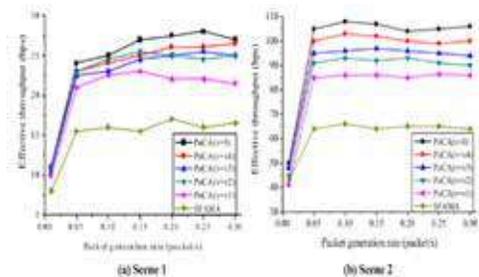


Fig. 2. Network effective throughput comparison at various v values

In order to enable more simultaneous transmission, the CNN algorithm effectively increases the multiplexing space's capacity. End-to-end delay is a crucial metric for assessing the performance of the network. Through simulation tests, it is assessed under various speed conditions in this research. It has been discovered that the end-to-end time delay is increased by the presence of underwater mammals. The mammal moves slower when the direction is the same, which results in a larger time delay. Because of the mammal's poor movement pace, the effect on the network lasts for a very long time, delaying the delivery of numerous data packets and increasing end-to-end delay.

Each time the parts were examined, they were rotated in a new direction or exposed to various lighting conditions. When an unidentified object was placed underneath the camera, it was not at all recognised. The

stored model had to make up at least 80% of the match conditions. The user received feedback from the vision sensor software for each component that was scanned, including the component's orientation, orientation, and position.

Based on the distance between the camera and the electro pneumatic valves, as well as the conveyor belt's speed, it was determined how long it takes a component to approach a valve. The band was fully operational and able to separate all the components after a few minor calculations and modifications to the PLC's programming.

employees in repair shops, municipal solid-waste employees, and sometimes even scavengers at illegal disposal sites are some of the people who engage in ad hoc, non-industrial e-waste separation. Legal or not, e-waste recycling is typically performed in a disorganized atmosphere by small enterprises utilizing antiquated equipment. Most of the remaining electronic trash is collected by municipalities along with regular garbage. This practice poses dangers to the health of those working in the neighborhood as well as the general public and the environment.

Although the general regulation did not provide a precise explanation of the practical details (even the categories of electrical and electronic equipment and E-waste were not defined clearly), if the legislation is put into effect, it can result in significant improvements in the management of E-waste and a reduction in the problems with the environment and public health that are related to it.

CONCLUSIONS

The third-generation AI and robotics applications face numerous difficult issues. In this opinion piece, we discussed the advancement of ideas and technologies related to artificial intelligence (AI) and robotics, in particular the contemporary settings for developing AI and robotics that are built on a variety of technologies from IBM, Intel, and Nvidia. We discussed the development of integrated robotics and AI systems using AWS RoboMaker and ASU VIPLE. Technology for coverage preservation is only available in the static deployment framework. Sensor nodes built on the theoretical foundation of AFS and taking into account the movement of the undersea environment achieve complete coverage of target events. The blindness of

conventional random search algorithms is solved by artificial FSOA, which also exhibits a greater coverage capability and has faster convergence and more stable performance. A model for the next-generation wireless network that is data-driven that uses machine learning, artificial intelligence, and advanced data analytics for effective operation, control, and optimisation. We outline the primary forces behind the uptake of big data analytics and talk about the crucial roles that machine learning, artificial intelligence, considering the role that they play in data analytics for future wireless networks. With regard to data analytics, we propose a number of network design and optimisation strategies. Finally, we go over the advantages and difficulties network operators face when implementing in the next-generation wireless networks, big data analytics, artificial intelligence, and machine learning.

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DEVELOPMENT OF GLUTEN FREE MULTI MILLET ICE CREAM CONE

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ABSTRACT

It is very much important to ensure the health benefits of the foods consumed. Now a days consumers are very much concerned about the products they eat daily. Dairy Industry is a important sector in Food industry. Ice Cream- cones are one among the dairy industry and most loved by the younger generation, which is made up of high gluten content. Gluten content may cause celiac disease. Celiac is a disease that affects the small intestine. Gluten is the content filled in Maida, and Ice cream cones are made of refined wheat only as a major ingredient. As refined wheat has rich gluten it also creates problems in digestive tract. Our main aim is to develop Ice Cream cones without refined wheat flour. In this study refined wheat is replaced by Finger millet flour, Kodo millet flour, Little millet flour, Barnyard millet flour and the other minor ingredients. Millets are gluten free flour and have more health benefits. The goal was to develop a gluten multi millet Ice cream cone with health benefits.

Keywords : Ice cream cones, Gluten, Millets

INTRODUCTION

A key component in the creation of the encouragement of interest in cold desserts is the ice cream cone [1]. It is a dried-out, funnel-shaped level waffle that allows frozen yoghurt to be kept close by and consumed. Before frozen custards were invented, frozen yoghurt was served in cups and platters. The two varieties of ice cream cones include wafers in other shapes and moved sugar cones [2]. Level waffles are folded into cone-shaped structures while still hot and flexible to create sugar cones, also known as moved frozen custards [3]. However, the basic amino acids and nutritional fibre on low degreecones, also known as moved frozen custards, are made by folding level waffles into cone-shaped structures while hot still and malleable. Sophisticated wheat flour is a crucial component for this item [4]. Although the idea behind roasting these pipe-shaped ice cream cones may be simple, the hardware setup required for reliable production is confusing. Cereal products have emerged from grains other than wheat as a result of an increase in the number of people who have been diagnosed with celiac disease and a general demand for new, delicious, and energising dietary options [5]. It is said that despite an increase in celiac disease cases, there is no global preparedness for the

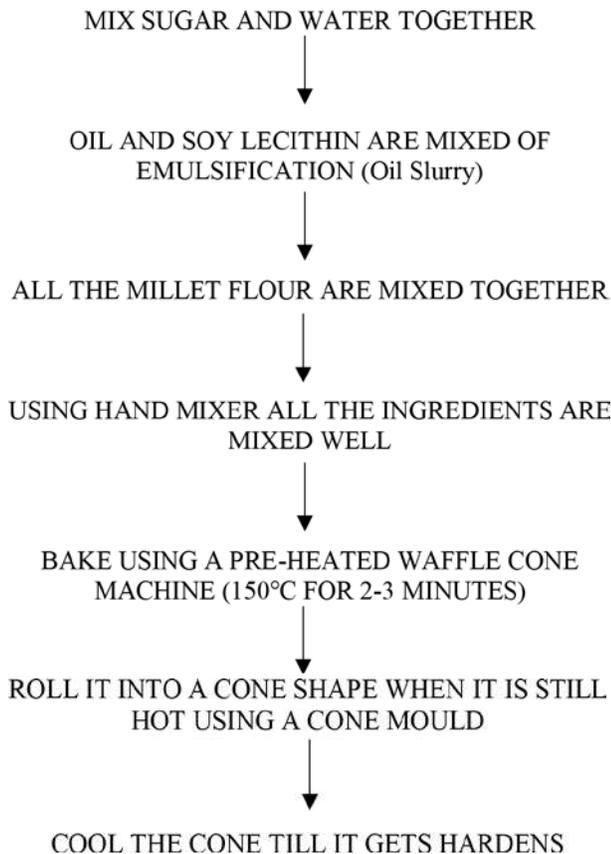
disease's impending pandemic. The present gathering of reliable and affordable non-gluten food sources is a pressing concern [6, 7]. People rely on massive grain harvests like rice and maize, which account for the majority of the calories consumed worldwide. It serves as a significant component of various conventional food sources and beverages including bread and porridge as well as a significant supply of carbohydrates, proteins, and extra significant phytonutrients [8, 9].

Many ancient crops that are rich in micronutrients, such as amaranth, buckwheat, millets, and so forth, have traditionally served as staple meals in many societies. In addition to fagopyritols, these grains are enhanced by polyphenols, flavonoids, nutritional fibre, amino acids, lignans, minerals, nutrients, and cancer-prevention agents [10, 11]. Food sources made of composite flour are a good source of micronutrients with dietary filaments [12]. Their higher nutritional fibre content is also linked to restorative health benefits, such as improved stomach health, gastrointestinal changes, blood sugar regulation, and lowered cholesterol [13]. The role of a staple food has traditionally been supplied by a few old harvests rich in micronutrients, such as amaranth, buckwheat, millets, and so forth [14]. This review focuses on the history, consumption, and health

advantages of finger millet, one of India's oldest millets. Of all grains and millets, finger millet contains the highest concentration of calcium and potassium. Recent research indicates that urban Indians consume less millets. The processing of finger millet can take several different forms. Additionally developing from finger millet are soups and baked goods. Numerous health advantages of finger millet have been discovered in investigations on animals. Essential elements including vitamins and minerals are absent from rice flour [15].

METHODS

Development of Ice Cream Cones



Sensory evaluation

Sensory evaluation was performed with the help of 9-point Hedonic scale. There are 5 panelists (3 men and 2 women) in the age group of 20 to 24. The parameters are appearance, taste, crispness, flavor and over all acceptability.

Table 1. 9- Point Hedonic Scale

9 Point Hedonic Scale	Rating Scale
9	Like Extremely

8	Like Very Much
7	Like Moderately
6	Like Slightly
5	Neither Like or Dislike
4	Dislike Slightly
3	Dislike Moderately
2	Dislike Very Much
1	Dislike Extremely

Moisture analysis

The product was weighted in the sample plate. Then using of digital moisture analyzer and the amount of moisture removed is displayed in the display. It was expressed in percentage

Ash content

Ash content in the food sample can be analysed with the help of muffle furnace at high temperature as 560°C for 1 hour. 2 gms of sample is weighted in crucible and kept in a muffle furnace. After 1 hour, the sample becomes ash and the weight of the ash is measured.

Cost analysis

The financial results of new products are typically used to determine their success, so it is necessary to have a variety of financial data in order to conduct this analysis. For example, they must know the potential financial returns from a new product, as well as the amount of funding required to develop, produce, and market it.. For the multi millet ice cream cone, the design is based on raw materials, utilities, contingency expense, building cost and personnel.

RESULTS

Baking of Ice Cream Cones

All the measured dry ingredients are mixed. Water and Sugar are mixed separately. Oil slurry is prepared with the mixture of oil and lecithin. Now the wet and dry ingredients are mixed using a hand mixer. Check the consistency of the batter (Pouring consistency). Pre Heat the Waffle cone machine for 10 minutes @ 150°C. Pour the batter into the waffle machine. Bake it for 2-3 minutes in 150°C. Roll the waffle into a cone shape using the cone mould before it retains the room temperature. Rest the cone till it gets hardens. Table 2 gives the Composition table for the Development of Multi Millet Ice cream cone.



Fig 1: Developed Multi Millet Ice cream cone

Sensory Evaluation

Table 3 briefs the average of the all the Trails and Table 4 explains the results of sensory evaluation of Trail 8

Moisture Analysis

Moisture content for the product developed was analyzed with the help of the digital moisture analyzer. The value obtained by moisture analyzer was tabulated in Table 5.

Table 5. Moisture content of Millet Ice cream cone

Product	Weight of the sample (gms)	Temperature (°C)	Time (sec)	Moisture content (%)
Millet Ice cream cone	5	120	270	4.30

Ash Content

Using muffle furnace, ash was obtained at high temperature at 560°C for 10 minutes

Table 6. Ash content of millet ice cream cone

Product	Temperature°C	Time (min)	Ash content
Millet Ice cream cone	560	5	1.79mg/100g

Table 2. Composition table for the Development of Multi Millet Ice cream cone

Ingredients	Trail 1	Trail 2	Trail 3	Trail 4	Trail 5	Trail 6	Trail 7	Trail 8
Finger Millet (%)	12.5	14.45	15.18	12.9	9.25	9.87	10.24	13.5
Little Millet (%)	5	7.16	8.59	10.19	7.31	6.90	8.19	11.5
Kodo Millet (%)	7.5	7.32	9.6	7.6	7.34	6.90	4.09	7.96
Barnyard Millet (%)	5	7.22	7.59	4.91	7.32	6.90	4.09	10.33
Sugar (%)	27.5	27.71	28.67	29.7	26.32	21.65	26.63	16.63
Water (%)	42.5	36.14	30.37	34.7	41.46	33.5	34.83	36.80
Soya lecithin (%)	-	-	-	-	-	3.54	3.27	0.86
Vegetable oil (%)	-	-	-	-	-	10.74	8.19	2.42

Table 3. Average of all the Trails

	TRAIL 1	TRAIL 2	TRAIL 3	TRAIL 4	TRAIL 5	TRAIL 6	TRAIL 7	TRAIL 8
PANELIST 1	6	6	7	7	6	7.5	7	8.2
PANELIST 2	6	6	6.8	7	6	7	7	8
PANELIST 3	6.7	6.9	7	7.5	7	7	6.6	8
PANELIST 4	5	6	6.5	7	6	7	7	7.8
PANELIST 5	6.7	6	7	7	7.5	7	6	8

Table 4. Results of Sensory evaluation of Trail 8

Panelist	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Average
Appearance	8	7	8	9	9	8.2
Taste	9	7	9	7	8	8
Texture	7	8	8	8	9	8
Hardness	8	8	8	8	7	7.8
Over all acceptability	8	8	8	8	8	8

Cost analysis

Table 7. Cost analysis of developed Millet Cone

S. No	Expenses/ kg	Cost of Production (Rs.)
1	Personnel (A)	1
2	Raw Material	
	a) Flour	10
	b) Oil	0.5
	c) Sugar	0.5
	d) Lecithin	0.10
	e) Other materials	0.90
	TOTAL(B)	12
3	Utilities	
	a) Power	0.25
	b) Water	0.25
	c) Fuel	0.25
	TOTAL(C)	0.75
4	Contingency Expense	
	a) Transport	2
	b) Packaging Material	0.25
	TOTAL (D)	2.25
5	Depreciation of Building (E)	1.25
6	Total Cost (A+B+C+D+E)	33.25
7	Average Yield Loss Cost	6
8	Net profit Ratio	2:5
9	Cost of Developed product for 10 cones	60
10	Valid cost of Production per 10 cones	120

CONCLUSION

The Demand consumption of millets is going up

year by year due to its health benefits. So this study is to developed a Gluten free Multi Millet Ice cream cone. Totally 8 trails were conducted. Each Trail was estimated by its over all acceptability. The selected trail was further analyzed for Sensory analysis, Moisture, Ash and Cost analysis. Finally, a Gluten free Multi millet Ice cream cone was developed.

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ENVIRONMENT FRIENDLY AUTOMATIC ELECTRIC BROODER SYSTEM FOR POULTRY FARMS BASED ON DESIGN THINKING APPROACH

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ABSTRACT

An Automatic Electric Brooder is a tool used in Indian agriculture that enables resource management in a poultry farm. A sizeable percentage of the population in India heavily rely on primary industries for income. For many households, a poultry farm or the poultry industry serve as the main source of income. There is high protein content in chicken, so it is preferred by people all over the world. The major requirement of meat or non – vegetarian food supplied from the poultry farm. It could be necessary to increase the manufacturing of Automatic Electric Brooder machines in order to develop this sector in rural India. In the current scenario, the poultry farms require man power. Automatic Electric Brooding technique can be adopted by the agricultural industries as well as both large and small poultry farms. The temperature of the space may be maintained consistently by using automatic brooder equipment. In the proposed work the Livestock Farm's air can also be maintained at a comfortable temperature with this automated brooder equipment. This gadget is inexpensive and easy to use. The temperature sensors display both the internal and external temperature of farms. The exhaust fan can be activated if the farm's internal temperature rise and goes above the typical temperature that should be provided to the chicks or if the farm's temperature rise externally. The exhaust fans linked within the farm will remove any extra heat if it exists. Additionally, a Web interface is developed to track and shows parameters through Wi-Fi module connection. To display the temperature readings from the farm, an IoT web application called ThingSpeak is employed. It displays the current temperature and allows to view temperature readings obtained at predetermined intervals. Farmers can be informed via temperature graphs as the farm's internal temperature rises quickly. For the first and second days after birth, the newly hatched chicks brought to farms need a temperature of 100 degrees Fahrenheit; for the third day, it is 98 degrees Fahrenheit, etc. The Real Time Clock (RTC) helps to enable the temperature automatically by programming according to the required heat mentioned for brooding purposes. It can easily maintain the specified temperatures without the farmers having to do any effort. The details of these temperatures are viewed without internet with the help of LoRa. A physical, exclusive radio communication method is LoRa. It is based on chirp spread spectrum technology-derived spread spectrum modulation techniques. There will be a lack of network coverage in the majority of villages and rural areas, so LoRa is quite helpful in those kinds of circumstances.

KEYWORDS: Automatic electric brooder system, Poultry farming, Temperature control, Temperature monitoring, Chick growth, Efficiency, Smart farming, IoT devices, Productivity

INTRODUCTION

Poultry products, such as meat and eggs, are renowned for the exceptional nutrient density, containing vital elements essential for a balanced human diet. These food sources are particularly valued for abundance of high-quality proteins and minerals, making a sought-

after dietary component. Poultry farming is the most crucial aspects of Indian agricultural economy because of the rising demand for poultry products. According to the most recent annual data, India is the world's third-largest producer of eggs and the fifth-largest producer of chicken meat. The market for layers is expected to

expand by 6 to 7% annually, while the market for broilers will grow by 8 to 10 % annually. The development of layer chickens is the primary emphasis of initiative. A particular breed of hen that lays eggs is called a layer chicken. A single layer chicken will often lay up to 300 eggs each year, which is almost one egg every day. The growth of the chicks in resting stage is developed with the help of artificial brooder [1].

The growth of muscle building by the humans is developed by consuming 30g of protein from chicken at each meal. In addition to being high in protein, chicken is also a good source of calcium and phosphorus, two elements that help maintain healthy bones. It also contains selenium, which is believed to lower the chance of developing arthritis. A heart-healthy, low-fat, low-cholesterol diet, such as the DASH diet, can feature chicken as the star of the plate since it provides vitamins and minerals are underutilized. The chicks in poultry farm is safer while compared to the free range chicks because some birds like eagles will hunt the chicks while free roaming [3].

Therefore, certain parameters like temperature, air quality, humidity, ventilation and illumination need to be frequently monitored in order to ensure a healthy chicken growth [6]. Due to the absence of temperature that should have been provided to the chicks during the early stages, approximately 1/4 of those brought to the farms are dead [2]. So, farmers lose the money which have spent on chicks. The temperature sensor, exhaust fans, Internet of Things (IoT) and LoRa is used to automate the process of monitoring the aforementioned elements and poultry cultivation in order to create healthy chickens or quails that generate high-quality eggs to increase production in India [5]. Numerous small-scale businesses, as well as farmers, can benefit from this strategy by making significant profits while making minimal investments.

The above bar graph (Fig 2.1) represents the consumption of poultry meat in India from 2018 to 2022(in 1000 MT). The requirement of poultry farms is increased because of the higher consumption rate in India. The ranking of poultry products in India is rapidly increasing frequently. India stands third in poultry egg production and sixth in poultry meat production according to last survey on 2022.

The Pie chart (fig 2.2) represents the poultry inventory of Indian states in the year of 2019. It seems that Tamil

Nadu ranks first in the poultry inventory. The poultry farms are increased in large amount in Tamil Nadu.

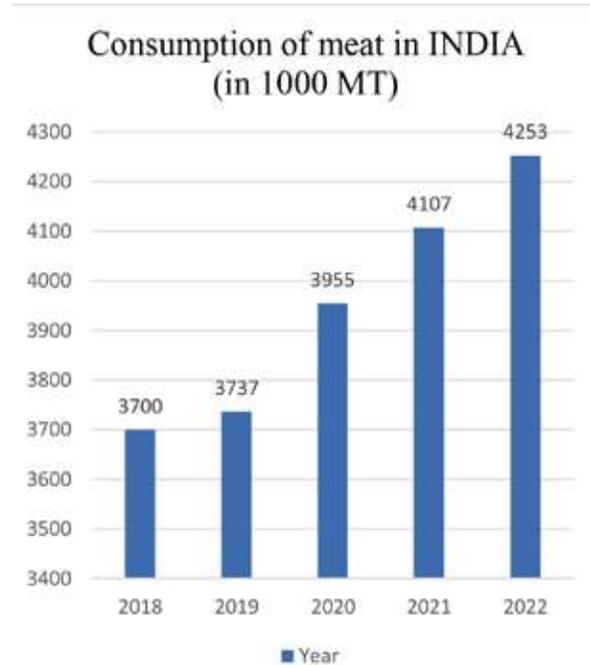


Fig. 1. Consumption volume of poultry meat in INDIA from 2018 to 2022 (1000 MT)

Indian states with highest poultry inventory in 2019 (in millions)

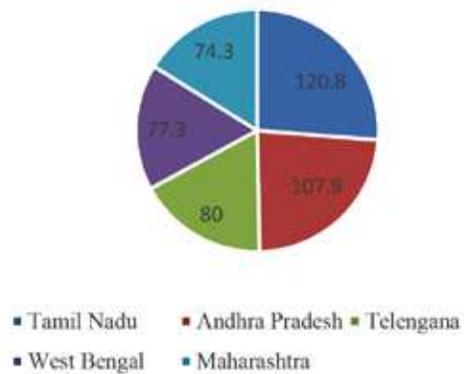


Fig. 2. Indian states with the highest poultry inventory in 2019

From the first day of the chick's arrival in the farm, several temperature readings are maintained. Initially the temperature is 100 degrees for day 1 and 2, and so on. These changes in the temperatures are controlled by RTC (Real Time Clock) and programmed in the

Arduino. If the temperature exceeds the programmed value, the exhaust fan comes into play and reduces the excess heat inside the farm.

Table 1. Brooding temperature details for Quails

Brooding temperature details for quails	
Day	Temperature in Fahrenheit
1	100
2	100
3	98
4	96
5	95
6	95
7	95
8	95
9	93
10	90

CONVENTIONAL METHOD

Gas tubes is using to connect cylinders and burners. Two burners can be utilized with a single cylinder. The amount of gas that flows through the knob is controlled by a regulator. The burner is ignited by a lighter. The sound of the gas flowing helps to convey the intensity of the flame. The forthcoming brooding days and numerous environmental changes are manually monitored [7].

In India, the majority of poultry farms are manually supervised and managed. The critical variables that must be monitored and managed include temperature, humidity, air quality, illumination, ventilation and food feeding [13]. This method needs a significant amount of labor and constant monitoring of the farm's required temperature.

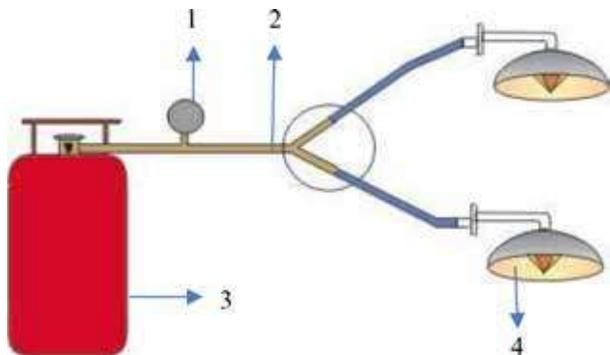


Fig. 3. Gas Brooder

1. Regulator, 2. Gas tube, 3. LPG Cylinder, 4. Gas Burner

Fig 3 represents the Gas Brooder and its components. In gas brooder the constant temperature is not accurately maintained and there are changes in the temperature. These changes also result in significant initial chicken mortality and chicks with slower growth rates, lower weights and weaker immune systems [8].

Therefore, the money spent on chicks is a waste and the over leakage of gas leads to death of the chicks [14].

MATERIALS AND METHOD

The system contains a crucial part called the Temperature sensor. An Arduino UNO is the primary development board in use. This development board is connected to the sensors and the relay. The Wi-Fi based IoT ESP 01 is the Wi-Fi controller utilized in this system. The temperature module on the Arduino UNO is used to collect the thermal parameters. ThingSpeak IoT web application served as the database that can be utilized. The alarm can be sent to any user device, such as a smart phone, laptop, or any other devices through IoT connected Thing Talk web application, after the data is processed in the application layer through application program and then through the Access Point. A built-in LCD is also included for displaying the parameters. Real-time clock aids in adjusting the temperature according on how many days the chicks must be raised. By employing LoRa, which can be viewed across great distances, these details can be viewed offline [10].

EXPERIMENTAL ANALYSIS

The primary component for the automatic electric brooder is an electric burner, made with tubular shape that gives an output of 2Kw/hr. Firstly an electric brooder should be installed in the poultry farm, which include embedded system [12]. The DS18B20 temperature sensor is used to calculate the temperature coming from the brooder. In order to maintain the inner temperature of the farm, the outer temperature is also calculated. In the LED digital display, these temperatures are displayed. DC exhaust fans are used to remove the heat once it exceeds the par temperature. The ThingSpeak IoT platform displays the temperature readings. Along with the temperature gauge meter, a temperature rises and fall graph is displayed. Real Time Clock maintains the temperature needed for the chicks in accordance with the temperature chart.

The farmers can use LoRa to view these temperatures offline.

Table 2. Components with parameter ratings

S. No	Components	Parameter ratings	Quantity
1.	Arduino	UNO R3 (6 – 20 volts)	1
2.	Temperature sensor	DS18B20 (-67 F to +257 F)	2
3.	Relay	5 V DC	2
4.	Exhaust Fans	6000 rpm	2
5.	Wi-Fi Module	ESP8266	1
6.	LCD display	4.7 V to 5.3 V	1
7.	RTC (Real time clock)	2.3 V to 5.5 V	1
8.	LoRa	15 kms	1
9.	Electric Brooder	2Kw/hr	1

Arduino is an electronic device that is built on simple hardware and software. A motor can be started, an LED can be turned on, and something may be published online by using an Arduino board to receive inputs like light on a sensor, a finger on a button, or a tweet. By providing a set of instructions to the board's microprocessor, a message indicating what to do can be conveyed to the board. The Arduino Software (IDE) and programming language is utilized to accomplish this. Over the years, countless of projects, ranging from simple household items to intricate scientific instruments, have used Arduino as brain. At the Ivrea Interaction Design Institute, Arduino was created as a simple tool for quick prototyping geared towards students without a background in electronics or programming.

Dallas Semiconductor Corp. produces the 1-Wire interface temperature sensor known as the DS18B20. Only one digital pin is necessary for two-way communication with a microcontroller using the innovative 1-Wire Interface. There are typically two shape factors for the sensor. A transistor that comes in a TO-92 packaging resembles one in every way. Another that has a waterproof probe design may be more practical, it need to measure anything that is far away, submerged, or underground. The DS18B20 connects with Arduino using a 1-Wire bus, which by definition only needs one data line (and ground) to function. It is accurate to 0.5°C over the range of -10°C to +85°C and has an operational temperature range of -55°C to +125°C [11].

A relay is a switch that is activated and deactivated by another electrical circuit. In its original configuration, an electromagnet drives the switch to open or close one or more sets of contacts. In 1835, Joseph Henry created it. Relays can be viewed broadly as a type of electrical amplifier since it can control output circuits with higher power than the input circuit. An electromagnet is modified into a straightforward electromagnetic relay, like the one removed from an automobile in the first image.

Usually intake fans, exhaust fans lower the temperature inside the case by pulling in the relatively cool air from the surrounding room. Exhaust fans are often located on the back and sides of the case, sending hot air that has been warmed by the components back into the space. Exhaust fans purge the air of unwelcome odors, dampness, smoke, and other contaminants. Exhaust fans are made to remove humid air from rooms in addition to extracting offensive odors. Mold growth and moisture problems can be avoided by removing damp air from a space before it condenses.

The ESP8266 wi-fi module is a relatively affordable and user-friendly tool for connecting the creations to the internet. The module may function as a station (connect to Wi-Fi) and an access point (create hotspots), allowing it to simply retrieve data and post it to the internet, making the Internet of Things as simple as feasible. The project could access any information that is available on the internet because it can also fetch data from the internet via APIs, making it smarter. This module's ability to be programmed using the Arduino IDE, which makes it much more user-friendly is another intriguing feature.

One of the most advanced display technologies is LCD and LED. It will be the simplest and most dependable output device to utilize after figuring out how to interface it! Additionally, not every project based on a microcontroller can use a debugger. Therefore, output testing can be done using LCD monitors. Two RAMs, known as DDRAM and CGRAM, are found in LCD panels.

A real time clock or RTC is a digital clock and its main purpose is to continue keeping correct time even when a power source is removed or a device is switched to low power mode. RTC's are comprised of a controller, oscillator, and an embedded quartz crystal resonator. An RTC is designed to offer accurate time and date

that may be applied to a variety of situations. RTC is a type of integrated chip (IC)-based electrical device that comes in a number of packaging configurations. A lithium battery inside of it provides electricity.

A wireless modulation method called LoRa was developed using Chirp Spread Spectrum (CSS) technology. It uses chirp pulses to encrypt information on radio waves, much like dolphins and bats do. LoRa modulated transmission may be received across a wide range of distances and is resistant to disruptions. The Internet of Things' primary wireless platform is LoRa. (IoT).

RESULTS AND DISCUSSIONS

The Automatic electric brooding system uses a real-time clock (RTC) to set a limit for the maximum temperature in the farm. When the temperature sensor detects that the temperature has exceeded this limit, the exhaust fan is activated to bring the temperature back down to within the desired range. If the temperature does not decrease within a certain time, the output voltage of the electric brooder is reduced to further help bring the temperature down.

One additional feature of the system is that it shares the temperature readings through an IoT device, which can be accessed by farmers on mobile phones. This allows to monitor the temperature of the farm remotely, which can be especially useful in rural areas where there may be limited access to internet or network connections. To address this, the system uses LoRa WAN technology, which allows for offline viewing of the temperature readings.

This system seems to be a valuable tool for poultry farmers, as it reduces the need for manual monitoring of the farm and helps maintain a consistent temperature for the animals.

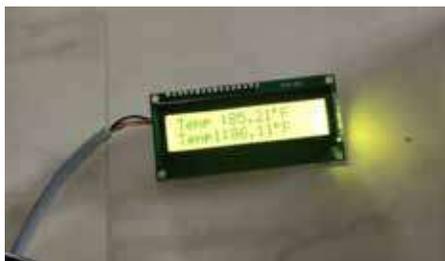


Fig. 4. LCD display

The output (Fig 4) shows the temperatures measured by the temperature sensors.

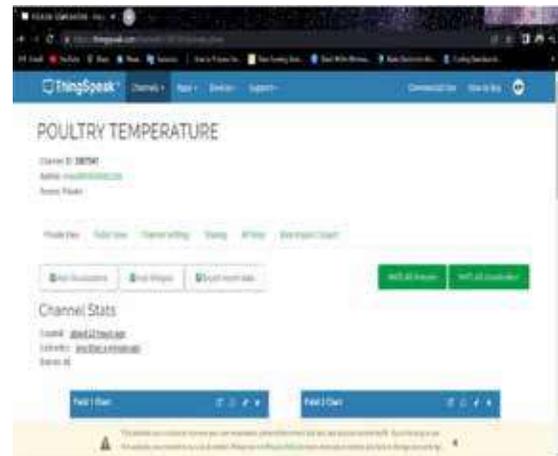


Fig. 5. ThingSpeak IoT platform

ThingSpeak IoT platform is used to view the temperatures measured through online.

Parameters in ThingSpeak Platform

- i. Channels
- ii. Apps
- iii. Devices
- iv. Support

Channels panel is the display panel that shows the temperature readings from the farm. It has several options that allows the farmers to view the statistics of the temperature. There is public view, private view, Channel settings, sharing, API keys, Data import/export in the options panel. Private view enables the information for a particular server/private server. Public view is used for viewing the information through a public server. Private view is the best view for a private farm.



Fig. 6. ThingSpeak IoT temperature graphs

Fig 6 shows the output temperatures in graphs and temperature meters.



Fig. 7. Electric Brooder



Fig. 8. Automatic Electric Brooding System

1. Exhaust fans
2. LCD display
3. Arduino UNO R3
4. Power supply
5. Relay
6. Wi-Fi module
7. Temperature sensor
8. LoRa

CONCLUSION

The automatic electric brooder system can help improve chick growth rates and overall health, leading to better-quality meat and higher profits for farmers [9]. Additionally, it can help reduce the risk of disease and other health issues among the chicks. The system is customizable, allowing farmers to adjust the temperature and other settings according to the specific needs of the chicks. This flexibility can help farmers achieve better results and improve overall efficiency. The system is easy to install and operate, with user-friendly controls that make it accessible to farmers of all skill levels. This can help reduce the learning curve and ensure that the system is used effectively.

The automatic electric brooder system can be integrated with other smart farming technologies, such as temperature sensors and IoT devices, to provide real-time data and alerts. This can help farmers make informed decisions and take quick action in response to any issues. The system is environmentally friendly, as it uses electricity instead of fossil fuels or other non-renewable resources [4]. This can help reduce carbon emissions and promote sustainability in poultry farming. The automatic electric brooder system is a valuable tool for modern poultry farming, providing farmers with an efficient, safe, and customizable solution for raising healthy and productive chicks.

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FORMULATION AND DEVELOPMENT OF ICE APPLE (*BORASSUS FLABELLIFER*) FLAVORED ICE CREAM UTILIZING COCONUT MILK

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ABSTRACT

The aim of the study is about formulation of lactose free ice cream infusing with ice apple flavour. As in India 60% of people are suffering from lactose intolerance (milk intolerance). As nondairy products are preferable alternative for lactose intolerance, coconut milk is an efficient alternative for cow milk. Nondairy ice creams are very popular for its taste and dietary value. Ice apple is an underutilized product which has high nutritional properties. So, value addition of ice apple is the best way for extending shelf life and availability of the product. Stevia is a plant-based sweetener used in ice cream as it gives sweetness & smooth texture. Ice cream was prepared with two formulations namely 1) using coconut milk & 2) using coconut cream. High acceptance was obtained for Ice apple ice cream using coconut cream. The final product is found to have 75.69% moisture, 8.12% fat, 14.04% carbohydrate, 0.16% crude fibre, 1.83% protein and 0.32% total ash. Microbial load was found to be <10 CFU/g of yeast and mould, 25 CFU/g TPC and E. coli was absent. Inclusion of ice apple resulted in improvement of textural quality. This study was found to increase the value addition & commercialization of ice apple ice cream among consumers with improved nutritional benefits.

Keywords : Coconut cream, Coconut milk, Ice apple, Ice cream, Lactose free, Stevia

INTRODUCTION

Ice cream is a food widely consumed around the world [19]. Ice cream is a beloved and delectable frozen delicacy that is often produced using dairy products such milk, cream, and sugar, though in more recent years, plant-based milk alternatives have started to be utilized. Particularly vegetarians, raw vegans, lactose intolerant individuals, and people who usually desire a healthy lifestyle choose this dietary ice cream. The fact that plant-based milk is cholesterol-free and contains unsaturated fats, vitamins, minerals, and antioxidants makes it a functional food and nutraceutical [14]. Between 57% and 65% of people around the world are lactose intolerant. It is brought on by a decline in activity of the intestinal enzyme lactase-phlorizin hydrolase, which breaks down lactose. Cases are distributed quite unevenly around the globe. In America, it is roughly

50%, in Asia, 70%, and virtually entirely in Africa [7]. Coconut milk, a plant-based milk that is both easily digestible and full of nutrients, is therefore seen as a viable option [10]. The most popular byproduct of coconut flesh (endosperm), coconut milk is a delicious, milky-white, oil-protein-water emulsion that is made by pressing grated coconut meat through a muslin cloth. About 17% of milk is made up of fat, 90-92% of which are saturated fats [8]. It enhances weight loss, lowering cholesterol and it is well known in the health care community as an alternative to dairy milk [12]. Coconut cream has a high proportion of lauric acid which is a saturated fat. Lauric acid boosts blood cholesterol that is also found in breast milk as well as sebaceous gland secretions [1]. *Borassus flabellifer* is nature's gift to mankind. It is a plant that serves various ecological, medicinal, economical and sociological benefits to society [13]. In India, Sri Lanka, Malaysia,

the Philippines, Indonesia, and many regions of East Africa, the palmyra palm tree grows naturally. It can be found throughout India in Kerala, Andhra Pradesh, Orissa, Bengal, Bihar, and along the entire west coast. It is particularly noticeable in the south Indian state of Tamil Nadu, where it was named the state tree in 1978. The fragile fruit of the palmyra tree contains a soft, jelly-like endosperm known as “Ice Apple,” which is both seasonal and exceedingly perishable. Ice apples, however, can be kept and processed to provide value-added goods [20]. palmyra processed product has more nutritional quality, nutraceutical characters [15]. The phytochemicals like alkaloids, flavonoids, steroids, saponins, etc. compounds present in Palmyra palm are well known for cardio tonic properties, antimicrobial properties, antioxidants, anti-inflammatory etc.,[6].

Table 1. Proximate composition of Ice apple [17]

Physiochemical parameters	Values
TSS (°Brix)	8.50
pH	6.44
Tritable Acidity (%)	0.06
Total Sugars (%)	8.83
Reducing Sugars (%)	5.11
Non-Reducing Sugars (%)	3.72
Browning (%)	0.01

The processing of tender fruit endosperm into value added products with sufficient shelf life is most important to utilize the product further. As in normal conditions ice apples will have a very short shelf life of 2-3 days. Palmyra palms are suitable for popularization through value addition which helps and improve food security. Ice apple having the potential to overcome the problem of malnutrition in developing countries like India [17]. The development of new food products brings numerous advantages, including improved quality and increased variety for consumers [3]. Among the variety of ingredients of ice cream, sweeteners are more important factors on consumer’s acceptance mainly due to their influential effect on freezing point, viscosity and maintaining good texture Cream [2]. Stevia leaf powder is a natural sweetener which has the potential to substitute sugar in ice cream production. Stevia leaf powder characteristics thus provide a sweet taste, while also safer for diabetic consumers, consumers with dental caries and obesity The utilization of stevia leaf powder as sugar substitution gave highly significant effects on

ice cream viscosity, overrun, melting rate, sugar content, total calories and antioxidant activity [16].

MATERIALS AND METHODOLOGY

Tender ice apple, Matured Coconut (without fibrous husk) were procured from local market of Coimbatore. Stevia (eco-heal) 100g purchased from super market, Coimbatore, Tamil Nadu.

Preparation of Ice Apple Pulp

Tender ice apples were procured from local market, Coimbatore. Fresh ice apples were collected, washed and white skinny layer was peeled by manually and sorted. The sorted ice apples were blended in addition of some amount of coconut milk to obtain a smooth pulp and the pulp was stored at 4°C for further process.

Preparation of Coconut Milk

The matured coconuts (without fibrous husk) were cracked manually, and the shell is removed. then coconuts were cut into pieces. the brown skin is removed to avoid unpleasant taste. The coconut pieces were washed using deionized water because the coconut is rich in minerals, especially calcium and magnesium.

Table 2. Raw coconut milk nutritional information [18]

Nutrient portion / 100g	Values
Energy (kcal)	230
Total Fat (g/100g)	23.8
Moisture (g/100g)	67.6
Total sugars (g/100g)	3.3
Dietary Fibre (g/100g)	2.2
Protein (g/100g)	2.90
Sucrose (g/100g)	2.3
Ash (g/100g)	0.7
Total Carbohydrate (g/100g)	5.5
Calcium (mg/100g)	16.0
Vitamin C (mg/100g)	2.8

The coconut pieces were loaded into blender, and it was blended smoothly. Then the mixture was filtered using cotton / muslin cloth, then squeezed to extract coconut milk collected in a bowl. the extracted coconut milk is pasteurized 62.8°C for 30-60 mins by heating. cooled and stored at 4°C [18].

Preparation of Condensed Coconut Milk

First coconut milk was taken and heated at 75°C. Next, stevia (7% of total amount of milk taken) is added with continuous stirring. After that the mixture is evaporated, concentration reduced to 2 times the original coconut milk and cooled to room temperature.

Preparation of Coconut Cream

The mature coconuts shell (without fibrous husk) was cracked and opened manually. The coconut water is separated. The endosperm was scrapped and cut into small fragments. Fragmented pieces were washed with clean water to remove foreign materials and dirt. Cleaned pieces were blended using mixer. Blended coconut was pressed /filtered using cotton cloth to obtain cream. Prepared cream was stored in refrigerator at 4°C for further processing [1].

Ice Cream Preparation

Ice cream mix is a liquid mix containing all the ingredients of ice cream except the air [5]. Ice cream mix is formulated into two types, namely 1. using coconut milk 2. using coconut cream as given in table 3.0. All the ingredients were mixed homogenously, and the mix was pasteurized at 72°C for 15mins. It is followed by homogenization using homogenizer DLAB D-500 at 500 rpm for 10mins. Next, aging is done at 4°C 1 hour, freezing carried out at -18°C and stored in HDPE container.

Table 3. Coconut milk and coconut cream-based ice cream formulations

Composition	S 1	S 2	S 3	S 4	S 5	S 6
Coconut milk (%)	-	-	-	63	48	23
Coconut cream (%)	42	32	15.2	-	-	-
Coconut condensed milk (%)	21	16	7.6	-	-	-
Ice apple pulp (%)	35	50	75	35	50	75
Stevia (%)	2	2	2	2	2	2

Quality Analysis of Ice Cream

pH was measured using a digital pH meter. Titratable acidity was estimated using titration against standard NaOH solution in the presence of phenolphthalein indicator. Fat content of ice cream mix was estimated using Rose Gotlieb method. Proximate composition was estimated using AOAC standard method. Percent

of over run of the ice was calculated as per the following equation [5].

$$\text{Overrun}(\%) = \frac{((\text{weight of mix per unit volume} - \text{weight of delicacy per unit volume}))}{(\text{weight of delicacy per unit volume} * 100)}$$

RESULTS AND DISCUSSION

Physico-Chemical Quality Analysis of Ice Apple Ice Cream

Table 4 shows the result of physico-chemical quality evaluation of the ice cream. The lower fat content of ice cream indicates the low calorie of the ice cream.

Table 4. Physico-chemical quality analysis on ice cream (S1)

Parameters	Results
pH	6.10
Moisture (%)	75.69
Total Ash (%)	0.36
Crude Protein (%)	1.83
Crude fat (%)	8.12
Carbohydrate (%)	14.04

Coconut milk-based ice apple ice cream had 75.69% moisture, 0.36 total ash or minerals, 1.83% crude protein, 8.12% fat and 14.04% carbohydrate.

Quality Analysis of Ice Cream

Ice cream mix is the liquid mix containing all the ingredients of ice cream except the air (before freezing). Here, sugar would be in true solution, fat is in emulsion state while protein is in dispersion. As the coconut fat globule size is much higher in comparison to dairy milk fat, the mix was homogenized at 500 RPM, so as to make the fat globules smaller and uniform. Mix quality has crucial role in the quality of ice cream [5].

Over Run

Overrun is related to the amount of air incorporated into the ice cream during the production which has affects the texture and physical properties of ice cream. Many factors such as proteins, fat, emulsifier and stabilizer are crucial in air incorporation and stabilization of air cells. Usually, non-dairy based ice creams or frozen desserts have lesser overrun [5]. The overrun of ice apple ice cream was estimated 32%, the lower overrun is due to low fat of the ice cream.

Crude Fat %

Milk fat (including non-dairy sources) provides desirable flavor and helps to provide a good melting property as well as decrease the size of ice crystals. Moreover, fat also affects textural attributes such as viscosity, tenderness, elasticity, emulsification and ice crystallization, and other desirable attributes such as richness and smoothness [5]. the ice apple ice cream made with coconut milk has low fat 8.12% which results in formation of ice crystals and lower the overrun.

Crude Protein %

The protein content of the ice cream was 1.83%, protein is lower which affected the overrun of the ice cream. It shows that to improve the non-dairy ice cream some protein sources should be added.

Moisture %

The moisture content of the ice cream was 75.69% which is due excess water content in the ice apple. High moisture content results in a low total solid include protein, fat and other solids.

Total Ash%

Ash content of the ice cream formulated was 0.36%, this indicates the mineral content of the ice cream made from coconut cream. Addition of strawberry pulp, fig paste, ginger shreds and juice, grape and mulberry pekmez in ice cream increased the ash content [11].

Sensory Analysis

Mean value of the scores obtained from sensory attributes such as intensity of coldness, firmness, viscosity, degree of smoothness, liquefying rate, body & texture, total acceptance [4].

Table 5. Sensory analysis of ice cream made from coconut cream (Mean±SE)

Formulations	S1	S2	S3
Intensity of coldness	8±0.7	6±0.00	6±0.52
Firmness	7.7±0.9	6.2±0.36	6.5±0.24
Viscosity	7.5±0.5	6.1±0.22	6.2±0.25
Degree of smoothness	8±0.4	7.6±0.1	7.3±0.29
Liquefying rate	7.1±0.9	6.3±0.4	6±0.12
Body & texture	8.1±0.5	6.5±0.6	7.1±0.36
Total acceptance	8.1±0.6	6.2±0.3	6.9±0.22

Table 6. Sensory analysis of ice cream made from coconut milk (Mean±SE)

Formulations	S4	S5	S6
Intensity of coldness	7±0.6	6.2±0.09	6.1±0.25
Firmness	6.2±0.4	6.4±0.07	6±0.42
Viscosity	6.4±0.2	6.5±0.58	5.5±0.52
Degree of smoothness	6.5±0.4	6.9±0.03	6±0.31
Liquefying rate	6.3±0.3	7.1±0.14	6.1±0.55
Body & texture	7.2±0.7	6±0.5	5.6±0.65
Total acceptance	6.8±0.9	6.2±0.2	5.9±0.31

Overall acceptability of sample 1 (Table V) made with 35% ice apple pulp, 2% of stevia as a sweetener, 42% of coconut cream, 21% of condensed coconut milk. Because ice apple has soft jelly like texture, minimum amount of ice apple pulp makes the ice cream softer and prevent from formation of jelly consistency and maximum amount of coconut cream increase the smoothness of the ice cream.

CONCLUSION

This investigation was carried out to study the effect of incorporating ice apple with the coconut milk-based ice cream. The formulations were made to know the composition of ice apple added to the coconut milk to obtain a consumer satisfied ice cream. The total solids and fat of the ice cream was reduced in addition of ice apple pulp. The fat can be replaced by addition some protein sources. The positive attributes were coconut cream gives good appearance and better flavor. This study provided a lead for utilization of ice apple and developing an exclusive ice apple incorporated non-dairy ice cream.

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FACTORS INFLUENCING CONSUMER BEHAVIOR

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ABSTRACT

In the last years, consumer behaviour and their decision-making process has advanced and has become an important topic in the marketing society. this paper presents an extensive review on the influencing factors on consumers behavior and their buying decision-making process in marketing. The marketing starts and finish with the consumer hence, consumer purchasing decision taking shows how well the organizations' marketing strategy suits marketing demand. Consumer behavior includes the psychological procedures which consumers experience in understanding their requirements. Discovering patterns to rectify these requirements, taking buying decisions for example, whether to purchase goods and services and if so, which types of brands and where, interpret tips, making plans, and executing these plans for example, with engaging in comparison shopping or real buying of products, Totally, modern and professional marketing staffs try to know consumers and their responses, therefore, analyses the essential traits of their behavior.

Keywords: Consumer behavior, Perception, Culture, Purchasing, Family, Personality, Social

INTRODUCTION

The relationship between consumer behaviour and marketing strategy is stressed because it is essential for organisations to have managers who are aware of consumer behaviour in order for their marketing strategies to be successful (Kotler and Caslione, 2009). Understanding the behaviour that consumers exhibit is especially important during a recession. based on the shopper base According on the marketing team's analysis of consumer behaviour, consumers might be classified as users, payers, or buyers. Even for industry specialists, studies have shown that predicting consumer behaviour can be challenging (Armstrong & Scott, 1991). customer purchase decisions demonstrate how well an organization's marketing strategy meets market demand because marketing begins and ends with the customer. The psychological processes that customers go through to understand their needs are included in consumer behaviour. identifying trends to address these needs, taking purchasing decisions as an example whether to buy goods and services, if so, which brands and where, understand advice, make plans, and carry out these plans, such as through comparison shopping or by actually purchasing the things. Fully contemporary and

professional.

TYPES OF CONSUMER BEHAVIOR

The five steps of the decision-making process should be experienced by consumers anytime they want to make a purchase, according to the study of consumer behaviour. The table 1 in the model summarises this and shows that there are five processes that consumers go through and experience while making a purchase. However, customers frequently eliminate or reverse parts of these processes while making routine purchasing decisions. Understanding a need is the first step in the purchasing process. The buyers recognise a problem or need at this stage or respond to a marketing stimulus. The second phase is information research or determining how much information consumers need, if any, in order to make a decision. Information can come from a variety of sources, including consumers' internal resources like memory and experience and external sources like social media, friends, relatives, and family who can give them the relevant information. A buying choice is likely to be reached quickly if the requirement is substantial and the product and service that satisfy the requirement are readily accessible. If not, the process of looking for information begins. Information can be obtained

from a variety of sources, including personal sources (friends and family), commercial sources (advertising, packaging, and stores), and public sources (magazines, newspapers, radio, the Internet, and television). Each of these informational resources will vary depending on the product and the user in terms of usefulness and impact (Furajji, et al., 2012). If the marketing team has greater control over the information that is provided to customers and the patterns that information exhibits, no value is produced (Kivetz et al., 2000). The purchasers are expected to select their preferred brands and goods from the available options throughout the assessment process. Whether or not consumers “involve” themselves with products is a key component of the assessment’s degree. The level of a customer’s involvement determines why they are urged to research a particular brand or product while largely avoiding others.

There is a comparison of several behaviour categories in Table (2). Consumers employ routine reaction behaviour for goods and services they routinely acquire. These affordable goods and services demand little effort to make decisions and little information to seek for, including (Buying milk, eggs, bread, and socks.) Customers who choose to buy the aforementioned goods and services take very little time to make their decisions and rarely consult reviews or ask their friends for advice before making routine purchases. But when faced with ethical products and services, customers may become involved, which leads to a longer search for information (Carrigan et al., 2001; Zander et al., 2011).

Usually not major purchases, they fall towards the lower end of the price spectrum. Customers may choose a certain brand when buying such products, but they are sociable with various brands within the product family and view more than one as being pleasant. Little level of participation products are typically bought on a fairly regular basis. Little decision making is created by combining a big purchase with a little one. Even though they are trying to choose a brand, customers who engage in this type of purchasing behaviour typically know the kind of goods they want. Clothing purchases are a good example of how constrained decision-making works.

FACTORS INFLUENCING CONSUMER BEHAVIOR

These elements, such as cultural aspects, conception factors, civil components, and psychological

components, have an impact on consumer behaviour. These elements are acknowledged by marketers as being necessary for identifying consumers and being able to decide what kind of consumers to target. As a result, these elements are used to divide the market into segments and identify consumer groups (Hasslinger et al., 2007).

1. Cultural factors - Culture, cultural subgroups, and social classes are recognised as the three categories of consumer behaviour that are most significantly influenced by cultural influences.

A-Culture - Culture is regarded as the primary factor influencing individual needs and desires. Consumer behaviour is largely influenced by distinct groups’ values and beliefs, which are apparent to them as early as puberty and which influence their behaviour and decision-making. These elements are so intriguing to marketing staff and important indicators of definite customer behaviour and taste.

B - Cultural subgroup - are tiny organisations with a distinct affiliation of people that transmit values and beliefs about things like origins, worldviews, and geographical regions. Recognised cultural subgroups can be used as an important and fruitful market segment that can be promoted.

C - Social classes - Social classes are made up of a variety of parts that bring together different types of associates. Several factors, including income, the length of an animal’s life, the accumulation of knowledge, and property, as well as civil classes, are seen as making up a class system.

2 - Civil factors- social components are divided into three various categories, such as reference groups, household and civil roles and status.

A - Culture is regarded as the primary factor influencing individual needs and desires. Consumer behaviour is largely influenced by distinct groups’ values and beliefs, which are apparent to them as early as puberty and which influence their behaviour and decision-making. These elements are so intriguing to marketing staff and important indicators of definite customer behaviour and taste.

B -Household- on the purchasing behavior of consumers household affiliates have high extent of impact. The level of engagement and domination by the household affiliates are different, till what extend and in which

pattern. Hence, it is significant for the marketing personnel to recognize what role is showed via whom in the household, and approaching the promotion toward the principal affecting part of the household affiliate

3 - Personal factors - these components have approximately more impact on the consumer behaviors that are described in the following such as:

A-Age and process of lifeform phase- consumers during their life they experience various phases as they spend life periods. These various phases also display various shifts which the consumers may go through while arriving at a new phase. Hence marketers determine their market goals in proviso of various phases in order to improve suitable marketing scheme (Kotler, et al, 2007).

B-occupation-consumers' occupation has a great extent of influence on the purchasing behavior of the consumers the jobs aim to have influence on the products, purchased via the buyers. this causes to the chance of improving various kinds of products, which fits keens recognized to be above average within an occupation

C-Economic situation- the consumers products choice will be affected by the consumers 'wealth. Some consumers may be sensitive on the in issue of price of products and services or not rely upon on the amount of earnings. amount of retaining, amount rate of interest, and also the products and services solely (Hasslinger, et al, 2007).

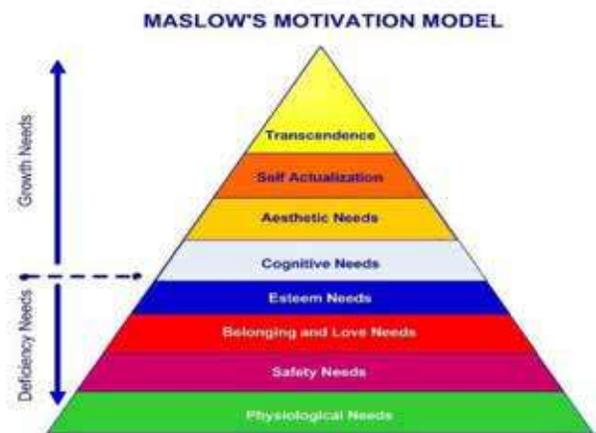
D-lifestyle- it is known as the way of consumers living, which identified by the activities, interests, or point of view consumers have, it also describes how the consumers communicate with the world (Hasslinger, et al, 2007).

F-personality- this is essentially described by the term certainty, control over others, genialness, independence, protectiveness, versatility, aggression. These concerning minds components are the consequence of an individual's surrounding. Persons'

4 - Psychological factors- the psychological factors are divided into four following concepts such as (motivation, perception, learning, learning, beliefs and attitudes).

A-Motivation-this concept refers to an individual requirement that must be fulfilled. These requirements

are in various types such as (biological requirements like appetite for food, thirstiness and displeasure). As well as there are other requirements like, concerning the mind requirements like need for acknowledgement, venerate and needs for belongingness. Needs do not get fulfilled until they extend to some point of intensity and then turn into motives for the buyer to fulfil establishment. Freud argued that human beings do not really and fully know about their motivations. On the other side according to Maslow's theory human beings requirements are arranged from the most urgent to the least urgent needs and known as the Maslow's hierarchy of requirement that begins from the physiological needs, safety needs, social needs, esteem needs and self-realization needs, when one need gets fulfilled the individual moves to next step to fulfil the needs.



B-Conception- this concept means that pattern in which human beings interpret their environment differently. Conception is a procedure in which a person chooses, arranges and interprets information. For interpreting information there are three various processes in which make a determination how individuals interpret their information, such as selective consideration, selective distortion, and also selective retention

C - Beliefs and attitudes- these factors can be acquired by the human beings through learning and practicing. They can influence the purchasing behavior by creating an image from the brands and products in the consumers' heads. A belief can be described as an explanatory thought about objects and is based on the actual knowledge, point of view and faiths, believes can be created by human beings' emotions. Attitude can be defined as the human beings' evaluations, feelings, tendencies against somethings, and also, the

determinations of human beings about somethings such as like and dislikes.

RESULTS AND DISCUSSIONS

Marketing begins with the consumer and finish with the consumer. Satisfaction of consumer gets the significant goal of a business enterprise. The essential to ensure consumer fulfilment lies in recognizing of the consumer, his likes and dislikes, his expectations and encouragement, in short understanding of consumer behavior. Consumer behavior caters a clear essential for recognition and knowing consumer requirements. the study of consumer behavior is crucial for managing consumption of goods and by that sustaining economic. Consumer behavior is an extensively studied area. It allows the organizations to know how consumers decide about acquiring products and services. Marketing managers are always eager to understand more about the consumer behavior; hence they are able to prepare better communication and advertising campaigns about their products and services. Many people make purchasing decision daily but they don't realize the components that derive them to this settlement. Commonly the components influencing consumers purchasing behavior involve, concerning mental components, civil components, cultural components and personal components. Consumer behavior doesn't stay identical or consistent in every condition it changes from time to time.

There are different components that affects consumer behavior. As the change comes in these components, consumer behavior also changes such as Demographic Factors, social factors and cultural factors. Consumer purchasing decision process involves five stages in which, actual buying (for decisions that are complicated) is the only stage on the process. Not all decision-making process causes to a purchase and also, not all consumer decision always involves these stages, and determined by the extent of complexity such as problem recognition, information search, evaluation of alternative, purchase decision and post.

CONCLUSION

Consumer behavior refers to a process in which consumers select, buy and utilize of products and

services to meet consumers needs and desires. Different processes are conducted in the consumers purchasing behavior. Firstly, the consumers attempt of discovering which products they want to consume, then they select merely those products that warrant greater efficacy. After products are being selected, the buyers create a measurement of the accessible finance that they are capable to allocate. finally, the consumers analyze the dominant prices of products and forms the decision about the products they should consume. During the interval, there are different factors that influence on the purchases of Consumer likes civil components, cultural components, personal components and psychological components and also When purchasing any products consumers experience these process that consist of five stages at first Stage consumers aware of a problem or known as (problem recognition), at second Stage consumers search for information that is known as (information search) at third Stage consumers evaluate different alternatives and known as (evaluation of alternatives) at fourth Stage consumers make purchasing decision that is known as (purchase decision) and in the end stage or fifth Stage is known as post purchase behavior.

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GAS LEAKAGE DETECTION IN REFRIGERATOR SYSTEM USING IOT

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ABSTRACT

Gas leakage is a critical issue that poses significant risks to human life, infrastructure, and the environment. The rapid development of gas detection technologies has led to the design and implementation of various gas leakage detection systems. In this project we are going to identify the freon gas leakage detection in the refrigerator system. This abstract explores the advancements in gas leakage detection systems, focusing on a novel approach that combines multiple sensing techniques for enhanced accuracy and reliability. The proposed gas leakage detection system utilizes a multi-sensor fusion technique to achieve efficient and real-time monitoring. It integrates diverse gas sensors, to detect a wide range of gases commonly found in domestic, commercial, and industrial settings. The fusion of these sensors enables the system to overcome individual sensor limitations and improve overall detection performance. To ensure precise and reliable gas detection, the system incorporates advanced signal processing algorithms. These algorithms analyze the sensor data to identify gas presence, concentration levels, and potential leak sources. There are various techniques, are used to train the system and enhance its ability to distinguish between different gases and minimize false alarms. Furthermore, the gas leakage detection system includes a centralized control unit that receives real-time data from multiple sensors distributed throughout the monitored area. The control unit utilizes wireless communication protocols to establish seamless connectivity with the sensors, enabling quick response and remote monitoring capabilities. The system also employs a user-friendly and give alerts to users, ensuring effective gas leak management.

Keywords: Gas leakage, Detection technologies, Freon gas, Concentration level, Gas sensor, Connectivity

INTRODUCTION

The discovery of freon gas spillage in coolers is significant for guaranteeing the protected and productive activity of these apparatuses. Freon, or refrigerant, breaks can prompt decreased cooling execution, expanded energy utilization, and natural mischief. This theoretical presents an outline of the techniques normally utilized to recognize freon gas spillage in fridges. The discovery cycle includes a progression of steps, including visual investigation, tuning in for murmuring sounds, checking for scent, and using spill identification arrangements or electronic hole locators. Visual investigation involves analyzing the fridge for indications of spillage, for example, oil stains, staining, or ice gathering close to refrigerant lines and parts. Tuning in for murmuring sounds recognizes releases that produce perceptible signs. The feeling of smell assumes a part in spill discovery, as refrigerants are frequently blended in with odorants like mercaptan. Recognizing a

surprising synthetic or spoiled egg scent can demonstrate the presence of a refrigerant break. Spill discovery arrangements or air pocket arrangements can be applied to potential spillage regions, and the development of air pockets at spill locales affirms the presence of a break. Furthermore, electronic hole locators give a proficient and exact method for recognizing freon gas spills. Nonetheless, it is critical to focus on wellbeing during this interaction, as freon inward breath can be destructive. Sufficient security precautionary measures, for example, wearing defensive gloves and wellbeing goggles, should be followed. On the off 3 chance that the spillage is significant or on the other hand assuming that there are worries about private security, counseling an expert refrigeration technician is encouraged. All in all, distinguishing freon gas spillage in fridges is an essential support task. By following the illustrated advances and going to important security lengths, people can distinguish and address spills instantly, guaranteeing the ideal presentation and wellbeing of

their refrigeration apparatuses while limiting ecological effect.

LITERATURE SURVEY

“Leak Detection and Diagnosis in Refrigeration and Air-Conditioning Systems” (2019) Authors: Oroz, Matthew P., et al. Published in: Applied Thermal Engineering This paper provides an overview of different leakage detection methods used in refrigeration and air-conditioning systems. It discusses the principles behind visual inspection, electronic leak detectors, and other techniques. The authors also explore the challenges associated with leak detection and offer recommendations for improved practices. “Refrigerant Leak Detection Technologies for HVAC&R Systems” (2020) Authors: Braun, James E., et al. Published in: ASHRAE Journal This article focuses on various refrigerant leak detection technologies employed in heating, ventilation, air conditioning, and refrigeration (HVAC&R) systems. It covers methods such as infrared imaging, ultrasonic detection, and electronic leak detectors. The authors discuss the advantages, limitations, and best practices for each technology. “Investigation of Refrigerant Leakage Detection Techniques in Air-Conditioning Systems” (2017) Authors: Kalamkar, Vilas R., et al. Published in: Energy Procedia This study evaluates different refrigerant leakage detection techniques, including visual inspection, bubble testing, and electronic leak detectors, in air-conditioning systems. The 6 authors present experimental results and discuss the sensitivity, reliability, and practicality of each method. “Freon Leak Detection in Refrigeration Systems Using Electronic Nose” (2018) Authors: Nannipieri, E., et al. Published in: IEEE Sensors Journal This research paper explores the use of an electronic nose as a tool for detecting freon gas leaks in refrigeration systems. The authors describe the setup and experimental results of using an electronic nose device to identify specific gas signatures associated with freon leaks, offering a potential alternative to traditional detection methods. “Leakage Detection and Location in Refrigeration Systems” (2018) Authors: Ma, Long long et al. Published in: International Journal of Refrigeration This article presents a comprehensive review of leakage detection and location techniques used in refrigeration systems. It discusses various methods, including tracer gas detection, pressure decay, acoustic methods, and vibration analysis. The authors highlight the advantages, limitations, and practical considerations of each approach.

6. Title: “Freon Leak Detection in Refrigeration Systems Using Ultrasonic Technology” (2016) Authors: Almasri, Ahmed, et al. Published in: Procedia Engineering This paper investigates the application of ultrasonic technology for freon leak detection in refrigeration systems. The authors describe the experimental setup and methodology for detecting freon leaks using ultrasonic sensors. They discuss the accuracy and reliability of this method and its potential for real-time monitoring.

PROPOSED METHOD

If Arduino Uno and Wi-fi Module are used for freon gas leakage detection in refrigerator system, the proposed method may include the following steps:

1. Gas sensor: The Gas sensor send the signal of gas leakage detection to the Arduino uno.
2. Arduino Uno: The Arduino uno receives the signal of gas leakage detection from the buzzer and it sends the serial signal to the Wi-Fi module (ESP8266). 14
3. Wi-Fi module: The wi-fi module receives the signal from the Arduino uno board and a send a message through the app.
4. Buzzer: The buzzer will send the alarm to the user by a beep sound.

SOFTWARE REQUIRED

BLYNK APP

The Internet of Things was the focus of Blynk’s design. It can store data, show sensor data, remotely operate devices, visualize data, and perform a variety of other fascinating tasks. The platform primarily consists of three parts:

Blynk App- enables the development of stunning user interfaces for projects utilizing a variety of widgets.

The Blynk Server- is responsible for taking care of all correspondence between the cell phone and equipment. It is open-source, has the ability to run on a Raspberry Pi, and is promptly versatile to a large number of gadgets.

Blynk Libraries- which are accessible for all normal equipment stages. Consider a situation where each time presses a Button in the Blynk application, a message is shipped off the Blynk Cloud and afterward some way or another advances 28 toward your equipment. Everything occurs in a squint of an eye and works the

same way going the alternate way. The Blynk app is shown in Figure 1.

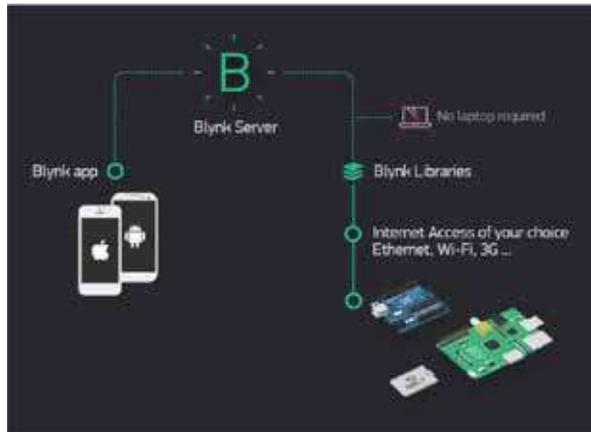


Fig 1: The Blynk app

SIMULATION FOR GAS LEAKAGE DETECTION IN REFRIGERATOR SYSTEM

The simulation for gas leakage detection in the refrigerator system is shown in Figure 2.

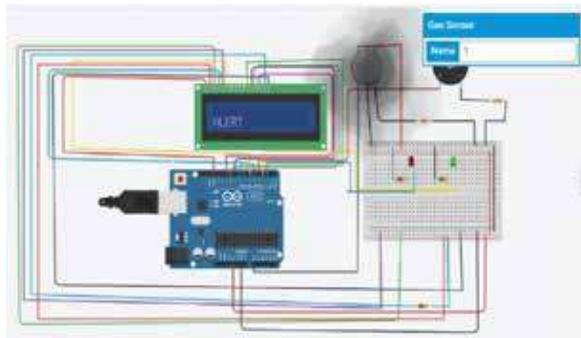


Fig 2: Simulation Circuit

In this simulation, first connect the circuit. 2. Then if we simulate it, initially it does not produce any alarm sound and it displays “SAFE” in the LCD display. 3. After it detects the gas, the buzzer sound will happen and the LCD display will display “ALERT”

BLOCK DIAGRAM

The proposed system is controlled by Arduino Uno. This system consists of a gas sensor, wi-fi module, LCD display, and buzzer. The central Arduino uno microcontroller processes the signal from the gas sensor and sends back a response, which is displayed on the LCD screen and it transmits the signal through a wi-fi module. The buzzer connected to Arduino can also

intimate the user about leakage detection by alarming sound.

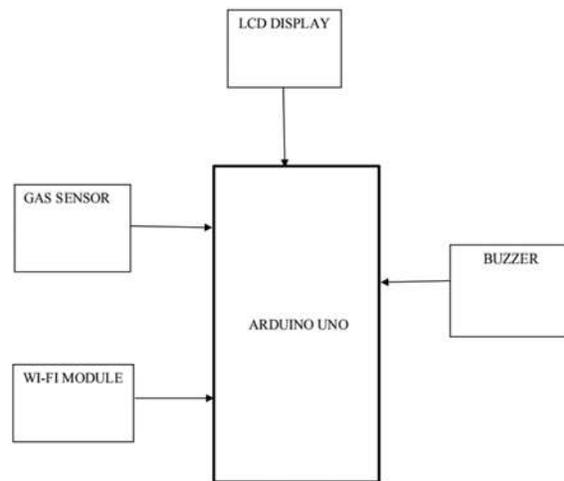


Fig 3: Block Diagram

RESULTS AND DISCUSSION

The gas leakage detection in the refrigerator System project is expected to result in user satisfaction, increased efficiency of leakage identification, cost savings, improved communication, and scalability. By providing real-time information about the leakage of gas, users will experience reduced carelessness and increased alertness, leading to higher satisfaction levels. The use of Wi-Fi signals ensures reliable communication, even in areas with poor cell phone reception or other communication issues. Additionally, the system can be easily scaled up to all refrigerator systems because of its cost-effectiveness. Overall, the Bus Stop Notification System has the potential to significantly enhance the experience of identifying gas leakage easily. The wi-fi module sends a message to the user which is helpful for the identification of gas leakage.

CONCLUSION

The Refrigerator gas leakage detection System is a promising project that has the potential to significantly improve the experience of users to enhance the efficiency and effectiveness of the systems. By providing real-time information about the leakage detection system we can improve the accuracy of the system. The use of Wi-Fi signals ensures reliable communication, even in areas with poor cell phone reception or other communication issues, and the system can be easily scaled up to additional sensors and integrated with existing leakage

of gas in the system. Overall, the refrigerator leakage detection system is a simple, reliable, and cost-effective solution to improve public safety.

FUTURE SCOPE

The refrigerator leakage detection System has a promising future scope for further development and implementation. Some of the possible future scopes for this project are: 1. Integration with mobile apps: The system can be integrated with mobile apps to provide real-time information to users, further enhancing the user experience. 2. Integration with GPS technology: The system can be integrated with GPS technology to provide more accurate and precise leakage information, further reducing inaccuracy in leakage detection. 3. Data Analytics and Predictive Maintenance: By analyzing previous data on freon gas leaks, it may be feasible to spot trends and anticipate prospective leaks before they happen. This is known as predictive maintenance. This proactive approach can lessen the influence on the environment and assist avert damage. 4. Non-invasive technique: Future developments might result in the creation of non-invasive or minimally invasive freon gas detecting techniques. This might use methods that don't require direct physical touch or intrusive procedures, such as infrared imaging, laser-based spectroscopy, or other distant sensing technologies. 5. Alternative Refrigerants: Using alternative refrigerants, which have less of an impact on the environment than freon gases, may become more common in the future. This change would need the creation of fresh detection techniques designed exclusively for these substitute refrigerant.

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IMPACT OF EMOTIONAL INTELLIGENCE OF STUDENTS ON THEIR ACADEMIC SUCCESS

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ABSTRACT

Emotional intelligence influences individual's life quality and hence their success in official as well as personal life. With this belief this study aims to focus on the measurement of emotional intelligence level which is constantly taken for a toss by all age groups, based on so many external as well as internal factors of life. Various studies on Emotional intelligence reveal, that more number of researches is focusing on analyzing the emotional intelligence components of students. This research especially throws light on the impact of their strength and weaknesses on their emotional intelligence which decided their success. The study outcomes revealed the fact that emotional intelligence, as well as IQ, is largely influenced by their strength and weakness factors. In other words, success cannot be explained only through IQ, besides, emotional intelligence through their strengths and weaknesses influence their academic success and also the choice and development of their career plans.

INTRODUCTION

Emotional Intelligence (EI) or sometimes Emotional Quotient (EQ) is a more modern concept and was only developed in the mid-1990s. Emotional Intelligence is a measure of an individual's abilities to recognize and manage their emotions, and the emotions of other people, both individually and in groups. When it comes to happiness and success in life, emotional intelligence matters just as much as intellectual ability. Emotional intelligence helps one to build stronger relationships, succeed at work, and achieve your career and personal goals. It also helps individuals to achieve the life quality that will make them successful by guiding the actions of individuals. It's interesting to note that how the concept of emotional intelligence has evolved over the years, from its inception as something called "social intelligence" all the way back in the 1930's, to "emotional strength" in the mid-20th century, to its present terminology, "emotional intelligence." But whatever we call it, emotional intelligence is, in layman's terms, one's ability to:

- Recognize and understand the emotions and reactions

- Manage, control, and adapt the emotions, mood, reactions, and responses
- Harness emotions to motivate oneself to take appropriate action, commit, follow-through, and work toward the achievement of the goals
- Discern the feelings of others, understand their emotions, and utilize that understanding to relate to others more effectively
- Build relationships, relate to others in social situations, lead, negotiate conflict, and work as part of a team.

When emotional intelligence first appeared to the mass in 1995, it served as the missing link in a peculiar finding of people with average IQs outperform those with the highest IQs. Emotional intelligence is that "something" in each of us that is intangible. Emotional intelligence involves the ability to carry out the emotions accurately and the ability to use those emotions and emotional knowledge to improve thought. It affects how we manage our behaviour, navigate social complexities, and make personal decisions that achieve positive results. With all these combinations it takes us towards our goals and brings success.

LITERATURE REVIEW

This literature review explores mainly about the impact of emotional intelligence on academic achievement, and student attitudes, behaviours, and interactions. While, impact of emotional intelligence in developing skills is the subject area of this particular research project, the scope of this literature review is expanded to include research that examines the academic success and emotional intelligence level during their graduation.

B.P. Singh, P.hD, (2015) in his study discussed about the interest shown by parents in understanding cognitive domain of their children.. Student show this as fear, pleasure, anger, anxiety under the different situations. With the passage of time his perception becomes much more organized, detailed and specific. In the present study cognitive behaviour i.e. academic achievement is studied with emotional intelligence and self-concept. The autor has concluded that there is a positive correlation between academic achievement and self-concept along with emotional intelligence. Male students have high self-concept and emotional intelligence than female students. Male students have more exposure of outer world;

Pavithra Raj and V. Chandramohan, P.hD, (2015) studied Emotional Intelligence (EI) and they said EI is considered as a successful predictor of academic achievement. Researchers have claimed that EI predicts success in schools/colleges/universities. EI in its five domains such as Self-recognition, Self-regulation, Self-motivation, Empathy and Handling relations was positively associated with academic achievement. Over all EI score showed that 23% of the

students were emotionally intelligent and excellent on academic achievement. Students, who were high on EI, were academically excellent. EI played a major role in promoting academic achievement among college students. Also, the study has brought out the fact that the emotional wellbeing could be emphasized on academic achievement.

RESEARCH METHODOLOGY

Based on the study requirement, population chosen was UG students of Arts as well as engineering back ground from the colleges in the rural areas of Coimbatore district. A sample of 122 students was taken for the final study. A questionnaire containing question related to the core research area was circulated to all and their response were taken for analysis using statistical tools. Based on the study objective that the academic performances of students are influenced by their emotional intelligence the following hypothesis is set:

Ho: There is significant relationship between Strength and Weakness and Emotional Intelligence of Students.

Ha: There is no significant relationship between Strength and Weakness and Emotional Intelligence of Students.

ANALYSIS & INTERPRETATION

In this section, an effort is made to find out the prominent factor which helps to find out the strength and weakness of the respondent. In general, there are numerous factors are used to find out the strength and weakness and it may differ from one to another. Hence, to identify the most prominent source of factor to know the personal strength and weakness factor analysis is employed.

Table 1. Factors Which Helps to Know the Strength and Weakness of the Respondents – Factor Analysis

Factors	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Communality (h ²)
Q78	0.038	0.056	-0.201	0.601	-0.162	-0.184	0.466
Q79	0.011	-0.078	0.186	0.671	-0.282	-0.02	0.571
Q80	-0.173	-0.056	-0.051	0.732	0.092	0.021	0.580
Q81	0.442	0.089	0.126	-0.106	0.518	-0.168	0.527
Q82	-0.078	0.468	0.406	-0.467	-0.153	0.059	0.635
Q83	0.106	0.089	0.673	-0.07	0.284	0.12	0.572
Q84	0.229	0.346	0.532	-0.194	-0.055	0.211	0.540
Q85	-0.031	0.631	0.156	-0.196	0.294	0.097	0.558
Q86	0.284	0.117	0.695	0.024	0.115	-0.075	0.597

Q87	0.371	0.502	0.222	-0.049	0.192	-0.099	0.488
Q88	0.25	0.565	0.465	0.09	-0.003	0.045	0.608
Q89	0.322	0.564	-0.128	0.131	0.176	0.236	0.542
Q90	0.466	0.537	0.134	-0.062	0.059	-0.158	0.556
Q91	0.527	0.196	0.307	-0.075	0.232	-0.008	0.470
Q92	0.472	-0.045	0.267	-0.119	0.369	0.103	0.457
Q93	0.156	0.368	0.244	-0.036	0.46	0.007	0.432
Q94	0.152	0.151	0.208	-0.086	0.274	0.629	0.567
Q95	0.069	0.177	0.063	-0.115	0.687	0.215	0.571
Q96	0.105	-0.009	-0.02	-0.082	-0.036	0.822	0.695
Q97	0.675	0.138	0.109	0.086	0.195	0.025	0.533
Q98	0.621	0.276	-0.049	-0.146	-0.189	0.155	0.545
Q99	0.597	0.325	0.093	-0.043	0.143	0.11	0.505
Q100	0.614	-0.068	0.234	0.016	0.001	0.217	0.484
Eigen Values	5.998	1.796	1.354	1.167	1.133	1.05	
% of Variance Explained	13.208	10.392	9.358	7.684	7.413	6.285	
Cumulative % of Variance	13.208	23.6	32.958	40.642	48.055	54.34	

Source: Data collected from questionnaire

Six factors are ascertained by locating Eigen values greater than unity. From the rotated component matrix Table 3.38, it can be seen that “shouting at people”, “insulting others”, “not interested in others problems”, “un-cooperative”, “not understanding people getting emotions” have a component loading of 0.5 and above. Hence, these five variables form first factor.

In factor two, “Experience varied emotions”, “panic easily”, “irritated easily”, “cheating others to get ahead”, “dislike myself”, have a component loading of 0.5 and above. In factor three, “getting angry”, “feeling sad”, “difficult to approach others”, have a component loading of 0.5 and above. In factor four, “Better than others”, “Empathetic”, “thinking highly of myself”, “have a component loading of 0.5 and above. In factor five, “worrying person”, “indifferent to feelings of others”, have a component loading of 0.5 and above. In factor six, “rarely notice my emotions”, “comfortable only with friends”, have a component loading of 0.5 and above. The percentage of variance to know the strength and weakness explained by these sources in all these factors is also presented in the table.

Factor one explains 13.208 of variation in knowing

the strength and weakness. The second and third factor explains 10.392 and 9.358 of variance in knowing the strength and weakness. The fourth, fifth and sixth factor explains 7.684, 7.413 and 6.285 in knowing the strength and weakness. The total cumulative percentage of variance explained by all these factors is 54.34.

FINDINGS AND SUGGESTIONS

Values of communality shows that percentage of variations explained by a variable. Above table reveals that “Insulting others”, “Not interested in others problem”, “Not understanding people getting emotion” and “Un-cooperative” explains the maximum variations in knowing strength and weakness. They account for 53.30 per cent, 54.50 per cent, 48.40 per cent and 50.50 per cent variation respectively in knowing the strength and weakness. “Indifferent to feelings of others – 57.10 per cent”, “Worrying person – 52.70 per cent”, “Comfortable only with friends – 69.50 per cent” and “Rarely notice my emotions – 56.70 per cent” are the factors that account for the least variation in knowing the strength and weakness of the respondent.

Six factors have been identified through the factor analysis. These factors explain 54.34 per cent of

variance in the ability to know the strength and weakness of the respondent. Ranking of variables depicts that “Insulting others”, “Not interested in others problem”, “Not understanding people getting emotion” and “Un-cooperative” explains the maximum variations in knowing the strength and weakness of the respondents. They account for 53.30 per cent, 54.50 per cent, 48.40 per cent and 50.50 per cent variation respectively

In factor analysis to know the strength and weakness of the respondent the ranked variables explains that the respondents are not strong with their emotion and also with others. To change the weakness into strength the most important ability is to control ones own emotions and also ability to find out others emotions and know how to handle with it.

Respondents should have confidence in the positives and know how to change their negatives into productive way. The ability to identify the special and unique qualities will serve well throughout the life to get success. Respondents are lack in self-awareness and usually haven’t any person who could help them identify their skill deficiencies. So it’s an individual respondents job to understand their own strengths and weaknesses to improve their life. Improving Emotional Intelligence will help to improve good relationship with other members and help them to improve the productiveness and efficiency in work. Having understood the negative factors which leads to the weakness of and vice versa the positive factors and their influence on emotional intelligence we can infer that the hypothesis Ho is accepted and hence it is concluded as the emotional intelligence of students have got influence

CONCLUSION

Emotional intelligence of an individual concentrates on the area of cognitive capabilities which covers personality and social skills, which helps in handling interpersonal behavior. People who are successful in

managing their emotional intelligence can very well manage their team and bring success to self as well as their team. Strengths and weaknesses of individuals forms the part of their SWOT and the same directly relates to their emotional intelligence. Hence we can conclude that there is a strong impact of strength and weakness of an individual on their emotional intelligence and hence their academic performance. Focusing on this an individual’s success can be enhanced in academic as well as personal life.

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LANE DETECTION FOR AUTONOMOUS VEHICLES USING MACHINE LEARNING

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ABSTRACT

Lane detection is considered as one of the important components in autonomous driving cars. Lane detection has become a critical and highly researched field in recent times due to advancements in the Intelligent Transport System. It allows vehicles to identify and track lane positions accurately and is used for several aspects of autonomous driving such as routing based on lane markings and high-definition map modelling. The process of lane detection involves employing a forward-facing camera in a vehicle to capture real-time road images or videos, which are then analyzed using an algorithm to detect and monitor lane markings. Lane Detection System (LDS) needs to operate accurately in real life when there may be multiple scenarios like different lighting conditions. Although lane detection is not always simple, especially on complicated highways, there has been significant advancement in this area over the past few years. In this paper, with the help of computer vision technology, a lane detection system has been developed by considering different lighting conditions.

Keywords : Lane Detection, Lane markings, Intelligent Transport System, Computer vision, Lighting conditions

INTRODUCTION

Autonomous driving has received a lot of attention in recent years due to advances in research of technologies related to smart vehicles. Lane Detection is a crucial task when it comes to computer vision, autonomous driving, and Advanced Driver Assistance System (ADAS) [13]. Apart from lane detection, some of the other things which are needed are sensing, processing images, and communications [14]. Some of the parts of autonomous driving can be road detection, lane detection, vehicle detection, and pedestrian detection [14]. Advanced Driver Assistance Systems (ADASs) has feature lane departure warning systems which inform drivers when their vehicles leave their lanes as well as cruise control [16]. Drivers when lose focus while driving are more likely to get into an accident [11]. Detecting lanes in daily life situations presents significant challenges, including obstructions caused by other vehicles, variations in lighting conditions, adverse weather conditions, and the unpredictable width and size of lanes.

ADASs are ideal to integrate with automobiles and aid people in becoming accustomed to automatic driving when combined with various technologies to detect traffic. But the issue is that when it is tested on actual roads, the varied and complex road circumstances, such

as lighting, obstructions to vision, etc., among other factors, make it difficult to effectively discern lanes.

As the usage of autonomous driving is increasing and has gained attention, the techniques used in smart vehicles also need to be improved over the period. One important technique which is used in smart vehicles is lane detection. It detects the lane lines and notifies the system in which lane the car is going and in case of cruise control mode, which is basically autonomous driving, it tells the system if car is going out of lane or not. There have been numerous studies for lane detection where radar sensors and LiDAR have been used [8]. LiDAR sensors can be used as data from LiDAR can be used to improve road detection which are based on images [15]. But the problem is the operational cost and limited performance.

The contribution of this paper is below:

- Video dataset is being generated by using dataset provided by [6]
- Developed an LDS which helps in identifying lanes.

RELATED WORK

Lane detection can be done using different algorithms which use machine learning, deep learning, neural networks, or computer vision. Lane detection is based

on object detection and classification-based methods and image segmentation which is end-to-end [12].

Lane detection, which is vision based contains mainly 3 components which are preprocessing, extraction of features and curve fitting [10].

Author Lucas Tabelini et al. [1] discuss a method called LaneATT. This proposed model can be used for lane detection in real time as it is faster and more accurate. Their algorithm is a single stage lane detection and is an anchor-based model. A light-weight backbone CNN is used which is enabled by a feature pooling method which is anchor-based. The method which is proposed by the authors is an anchor-based single-stage method like SSD or YOLO. Here a feature map a feature map from the input image has been generated by the backbone. Here backbone is used as an alternative for CNN. Then each anchor is projected onto the feature maps. Then this projection will be used to pool the features and then they are concatenated with another set of features created in the attention mechanism. Eventually, with the help of using this feature set which consists of two layers out of which one will be used for classification and the other one for regression which will make the final predictions.

Author Lucas Tabelini et al. [2] discuss to use convolutional neural network to achieve end to end estimation of lane markings. It will take image as an input and that image will be captured via a camera which will be mounted on the vehicle, and it will be a forward-looking camera. The output will be a polynomial which will represent every lane marking in the image and the confidence scores for every lane. This approach is competitive with the existing methods while being faster and there is no need for post processing for lane estimations.

Author Lizhe Liu et al. [3] discuss using a top-down framework which is based on conditional convolution for lane detection. This framework will first detect the lane instances and then it will predict the shape of line for every instance dynamically. They have designed an idea called RIM (Recurrent Instance Module) to overcome the problem of detecting lane lines in case of complex topologies like dense and fork lines. ResNet and FPN are being used by backbone to do multi scale feature extraction. To make more efficient context feature extraction, transformer encoder module is added. The

proposal head is used to detect proposal points which are located at the starting point of line. A conditional shape head is used to predict row wise location, offset map and vertical range for describing shape of every line. RIM is being designed to address case of dense and fork lines.

Author Md. Al-Masrur Khan et al. [4] proposed a model which uses CNN, and they are calling it LLDNet. This model uses an encoder decoder architecture. This architecture is being considered as a lightweight architecture. The Framework of LLDNet is basically divided into 3 parts: feature extraction module, convolutional attention block module and decoder module. The feature extraction module works to extract features and generate low level as well as high level feature maps. Then these generated features are sent to the attention module to get more advanced features. Main task of attention module is to focus primarily on the roads rather than the other objects which are not necessary for lane detections. The task of the decoder is to reconstruct the feature map which is extracted from encoder or feature extraction module and attention module to produce the predicted images.

Author Fang Ding et al. [5] proposed a model which uses Markov random field algorithm to identify lane lines. The main idea is as follows: Firstly, image processing is being used to enhance images, which includes methods like grayscale transformation, image graying and extracting ROI (region of interest). After image processing is done, the images are modelled based on Markov random field and then reasoning is done on the model based on binary graph cut method.

Author Tiago Almeida et al. [7] discuss about combining two deep learning models which are trained to execute different work and their output is merged to create confidence score.

Author Zhiyuan Zhao et al. [9] discuss their model which includes localization stage and lane detection stage. A deep convolution-based lane bounding box is being utilized in this context.

Author Tu Zheng et al. [13] discuss their model RESA which takes advantage of shape of lanes and then captures spatial relationships for pixels which spreads across columns and rows. The model consists of 3 modules: encoder, aggregator, and decoder.

PROPOSED MODEL

In this section, discussion is being held about dataset generation and how the dataset is being used for LDS to detect lanes.

Dataset

Lane detection systems need data of lanes in form of either images or videos. The data can be collected by using a camera which is mounted at the front of the car. This camera will capture a video which can then be divided into frames to generate images. There are some datasets available which are widely used. One such dataset is CULane [6] which is generated by Chinese University of Hong Kong. This dataset contains images for various scenarios such as daytime and nighttime. Using these images, videos are being generated as our model takes videos as input. Videos are generated by taking a series of images and combining them using any online editor and giving some time interval between two images such that it looks exactly like a video. Here various videos are being taken into consideration like daytime where light conditions are great, nighttime where light conditions are very poor and early morning or evening time when light conditions are average.

Proposed LDS

To detect lane lines, computer vision techniques along with machine learning techniques are used. Input is given in the form of a video and output will also be a video.

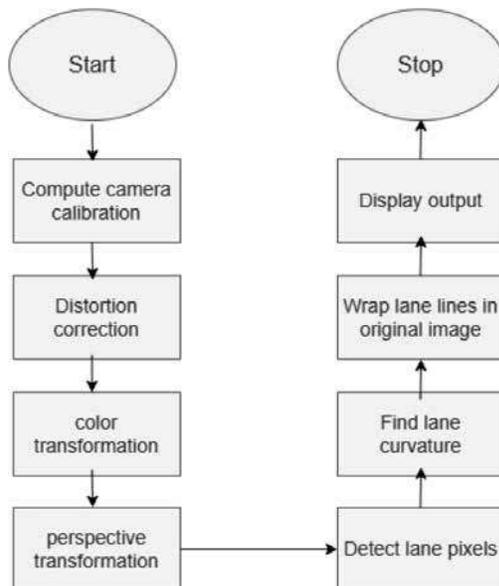


Fig. 1 Proposed architecture of LDS

As depicted in Fig. 1, the proposed algorithm is as follows:

- From a set of chessboard images, distortion coefficients and matrix for camera calibration will be calculated.
- Raw images are made better by applying distortion correction.
- A binary image which is threshold can be generated by using color transformations, gradients.
- Birds eye view can be generated by applying perspective transformations to binary image.
- Detection of pixels of lanes and fit lane boundary.
- Detected lane boundaries are warped to original image.
- Visual display of lane boundaries is given as output.

CNN is being used to train the model and the algorithm is trained in a pipeline as a sequence. Radius of curvature which is used for curve fitting can be calculated using the following equation at any given point x for curve $y = f(x)$:

$$\text{Radius of curvature} = \frac{\left[1 + \left(\frac{dx}{dy}\right)^2\right]^{\frac{3}{2}}}{\left(\frac{d^2y}{dx^2}\right)}$$

RESULTS AND DISCUSSION

Evaluation Metrics

The performance of the proposed LDS is measured using F1 score and precision. Intersection over union is being considered in F1 and it focuses on areas.

Results

Table 1 Performance of LDS

	Daytime	Nighttime	Evening time
F1	87.59	69.10	69.7
Precision	88.41	67.24	69.1

From Table 1 depicted in Fig 2, it can be observed that the accuracy of lane detection for daytime is pretty much nice as compared to other scenarios. When lane detection is done for medium to very low lighting conditions, it is seen that for evening or early morning when lighting is average and nighttime when lighting is very low, the accuracy tends to decrease as compared to daytime.

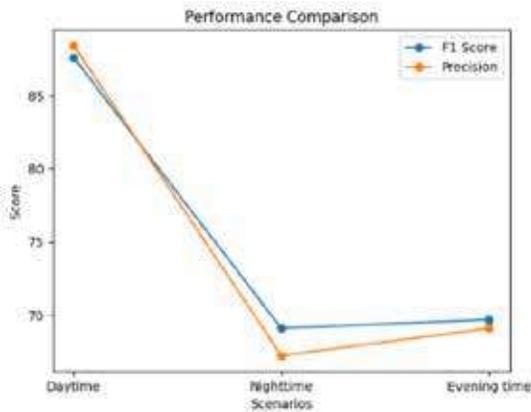


Fig. 2 Graph comparing performance of LDS



Fig. 3 Day time result



Fig. 4 Nighttime result

Fig 3 and Fig 4 depict that the accuracy of lane detection varies according to different scenarios. For daytime the lane is pretty much accurately detected all the time. But for the case of nighttime or early day or evening, when lighting conditions are poor, accuracy is not that good.

CONCLUSION

This paper introduces a Lane Detection System for daytime and nighttime scenarios using CULane dataset. Based on the results obtained, the proposed model performs well in proper lighting conditions as compared to that in poor lighting conditions. Therefore, in future, the focus will be on developing algorithms which will help to improve accuracy for poor lighting conditions.

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ML AND IOT BASED ADAPTIVE TRAFFIC-MANAGEMENT SYSTEM FOR SMART CITIES

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ABSTRACT

Everywhere in our daily lives, the Internet of Things (IoT) is quickly expanding. Buildings, hospitals, transit systems, and other associated public and private surroundings all benefit greatly from advanced information and communication technologies. Autonomous vehicles and smart devices have sensors from an IoT-based ITM system installed in order to identify, acquire, and communicate data. Machine learning (ML) is another way in which the transportation system may be improved. The present transport management methods are plagued by several challenges that cause congestion, delays, and an alarmingly high mortality toll. This article details the methodology behind the development of an ATM that makes use of ML and the Internet of Things. The design of the suggested system centres on the interplay of three elements: cars, infrastructure, and occasions. Multiple scenarios were used in the design process to account for any issue that may arise with the transportation network. The intended ATM system would also use this machine-learning-based clustering method to detect any accidental outliers. The proposed ATM model automatically adjusts the timing of traffic lights in response to changes in traffic flow and predicted movements at nearby intersections. It significantly shortens commutes by gradually letting vehicles go through green lights. The streamlined change also helps reduce traffic congestion. According to the testing findings, the proposed ATM system outperformed the conventional way of traffic management and will become the gold standard for transportation planning in smart cities.

Keywords : Traffic congestion, Machine-learning (ML), Adaptive traffic management (ATM)

INTRODUCTION

IoT devices that are connected are currently expanding rapidly to fulfil the standards needed by many different application domains, including smart homes, smart cities, transportation, agriculture, and healthcare. Large-scale network evolution faces a number of technological issues that are addressed by the standard governance and practical constraints. Connective smart device elements including sensors, actuators, and gateways are part of the technology breakthroughs that enable the provision of creative application services. The majority of application situations necessitate the adoption of a new computing paradigm to emphasise pressing issues including data management, security, and interoperability. The developing IoT frameworks take into account an intelligent platform to manage

various sources of aggregated data. Creative new services integrate several transmission channels to assess the needs of commercial and public facilities. Connectivity, continuity, compliance, cohabitation, and cybersecurity are just some of the enabler technologies that city dwellers are familiar with. Developing an intelligent machine that can infer the presence of logistical processes from a network of physical items is the primary technological challenge of the IoT.

Modern technology is used in smart cities to boost both economic development and quality of life. Four stages are typically used to complete this. These stages entail acquiring real-time data, analysing it to learn more about municipal operations, telling decision-makers what was learned, and then taking action to improve city operations. Urbanisation is a rapidly growing trend.

By 2050, it is predicted to have grown by up to 66%, which translates to more over 2.5 billion people.

The appliances in a smart home are linked to one another to create a network that is managed and controlled from a central location. All of the appliances in a smart house can be controlled by a single home automation system. The homeowner can choose how to control this automation system using a smart device. IoT technology, which connects these many devices and aids in data collection and sharing, is to thank for all of this automation. An effort to automate the entire city, a smart city is an extension of a smart house. By maximising city operations and boosting economic growth, it seeks to improve the quality of life for residents. Along with IoT, several types of hardware and software are used in these smart cities to provide connectivity between the entire city.

These are the main contributions:

Smart IoT application security issues need demonstrable study of state-of-the-art approaches.

Focus on doing in-depth research on how to build a secure IoT system to bridge the gap between security requirements and smart cities and industries.

The planned EATM system employs the layout and intelligent traffic signal to ease gridlock.

We provide a completely deterministic adaptive method for monitoring traffic and regulating congestion at major regional crossroads regardless of the order in which events occur.

One of the main benefits of the proposed EATM structure is that it may interact with any flexible method without needing any changes to the underlying architecture.

Energy consumption will be decreased in four key areas for smart cities, including public lighting, buildings and street billboards, smart homes, and smart parking, by using the proposed technique. The suggested model is statistically evaluated, and the results demonstrate that it contributes to improving smart cities' energy efficiency.

RESEARCH REVIEW

In the authors present a cloud-based, ML-assisted transmission-control system. The images captured at the next traffic light are saved indefinitely in the cloud. The API for cloud images is used to analyse the density and vehicle details. In addition, the event

is moved to the subsequent signal. The current signal is the one that came before it, therefore it will keep an eye on how the subsequent signal is doing and behave accordingly. According to these methods may improve ITM by helping us predict traffic behaviour, handle traffic signals automatically, identify driveways, and recognise nearby objects and cars. Although there are a lot of people working on intelligent transportation systems, making traffic management better is still challenging. The authors of demonstrate how traffic monitoring frameworks may significantly impact smart urban areas. There have been several investigations on IoT-based intelligent traffic-control systems.

In 2017, Cisco pledged roughly \$1 billion towards the creation of smart cities. Smart city applications are well-liked because of digital intelligence and data collection in fields including energy consumption, transportation, education, human health, knowledge exchange, and city growth. Modern private industrial, residential, transportation, and commercial operations need a great deal of resources, and sustainability brings this fact to light, as stated by Deakin and Al. Comparable to sustainable cities and digital cities, smart cities are a relatively new idea. An idealised model in which urban growth may outpace technological progress, "smart cities" rely heavily on information and communication technologies (ICTs) to give themselves an edge in the global economy. The increasing pressure to adopt smart solutions and the subsequent hunt for answers to the accompanying difficulties may have an impact on urbanisation. In addition, it guarantees that ICT advancement would have a beneficial effect on urban growth owing to mutuality. Security and better promoting smart city technologies to consumers are considered in the development of IoT-based smart cities, as is the importance of protecting the privacy and integrity of collected data. As a result, preventing malicious actions in open-IoT settings is a serious challenge for online safety and personal privacy.

PROPOSED SYSTEM

The suggested ATM solution employs the promising technique of an intelligent transport system to deal with the actual, severe problem of traffic management. The proposed ATM model employs the following components to build a state-of-the-art transport management system. Layered design of the suggested ATM model is shown in Figure 1. The application layer is the highest level and it

stores data regarding the vehicle's position, unintended tracking, message passing, and image tracking. Layer 2 is the service layer, and it shows how data is gathered, stored, and pre-processed. While Layer 3 represents the communication layer, the underlying network at Layer 4 represents the sensing layer.



Fig. 1. Layered design of the planned ATM system

The proposed ATM system allows for more precise route selection. The model's accuracy is measured against the precision value of the benchmark's lower limit. Let us, however, suppose that the proposed model yields an adequately precise bottom limit. If that's the case, it's evident that productive avenues exist, whereas inefficient ones have been closed up. However, there aren't enough paths if the lower limit is larger than the desired accuracy rate. Important routes for precise vehicle positioning are also included. The suggested module for the vehicle tracking system is seen in action in Figure 2. In the first step, data is obtained with the help of sensors and cameras. When it comes to ITM, the pre-processing of data acquired by a sensor or camera is crucial. Data missing values are estimated using several methods during pre-processing. After collecting data, the processing technique is used to clean and organise the information, and the training method is used to teach the dataset. The vehicle's location and traffic data are collected.

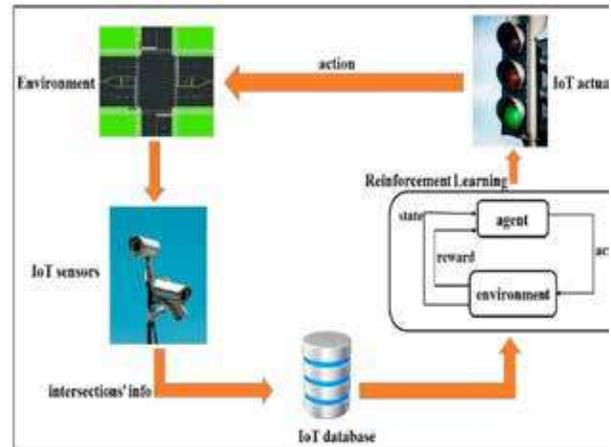


Fig. 2. IoT and ML approach for ATM

In this study, we used ML, a data-driven approach for adaptive traffic signal control in complex urban traffic networks, and we were unable to use centralised RL because our simulation scenario contained four bridges with six interconnected intersections in Shiraz City. As a result, the multi-agent system was employed, which can solve the scalability problem. As a result, additional intersections may be managed. In order to handle the local traffic lights for vehicles travelling in all directions, distributed ML was put in the traffic light system with an agent placed at each intersection. To record the duration of the vehicle queues, IoT sensors were also installed as surveillance cameras on either side. Additionally, the agent collected camera-tracked local traffic data and stored it in a nearby IoT database. Agents also acquired information from neighbours via the Internet of Things by transferring data across network connections. The same database also contained neighbour information.

RESULTS AND DISCUSSION

The MATLAB simulator is like a traffic simulator without the crashes. The next step will include using an EATM technique based on machine learning to locate the accident. Table 1 displays the results of cluster analysis using DBSCAN and ML methods for accident detection. A vehicle is forced to come to a halt at a certain location. Stops are similar to major accidents that occur along a section of highway. Autonomous cars, drivers who double as passengers, and mixed-use vehicles all add complexity to transportation networks. Recognising these scenarios and engaging incoming cars may help prevent collisions. Once every 100 seconds, all simulated vehicles must halt in a road view.

The unbelievably fast halt is achieved by setting the deceleration point at 60 m/s². In this example, we use three distinct automobile types.

Table 1. Results of accident detection using ML and EATM

Time Duration (Sec)	Road Segment (Vehicle)	Normal	Anomaly
70	85	80	1
80	88	82	1
90	92	85	2
100	95	86	3
110	97	88	3

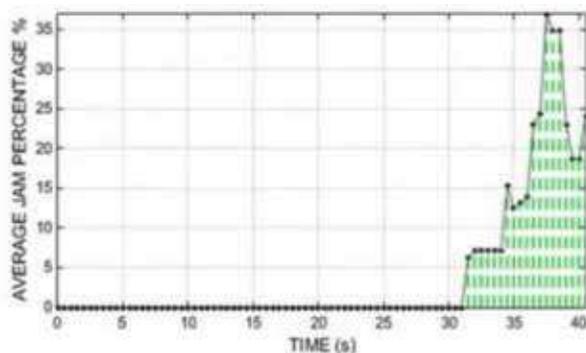


Fig. 3. Traffic jam ratio

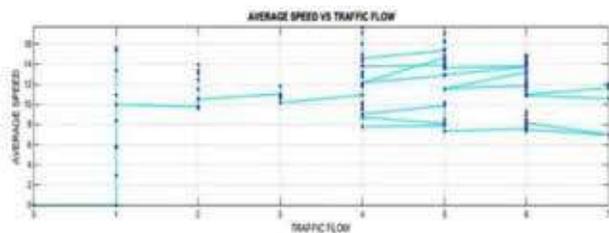


Fig. 4. Average Speed Vs. Traffic Flow Results

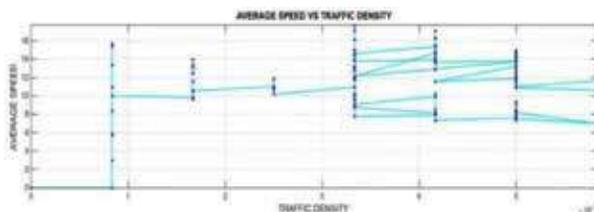


Fig. 5. Average Speed Vs. Traffic Density

RESULTS

The suggested ATM system aids with accurate vehicle tracking. It also helps with annoying traffic congestion by rerouting vehicles when there is congestion in

a particular area. The traffic situation is predicted by the density, flow, and condition of the traffic, and vehicles are rerouted to their destination safely. Due to the present plan's efforts to manage traffic on the roads without adding unnecessary complications, the planned ATM system's expanded service area results in a decrease in vehicle density. Traffic is reduced by diverting vehicles to a secondary route. The proposed ATM system would function substantially better than the existing system. In contrast to previous designs, the suggested ATM is able to interact with real-world traffic circumstances and movement patterns across many nations. It simplifies routine tasks by allowing for downstream monitoring and a consumer environment. With the use of a centralised transportation network, green-green coordination at highway interchanges may be achieved throughout the distribution zone. Red-green traffic signal cycles are optimised by modern traffic management algorithms. The ATM automatically adjusts to the current traffic situation. In order to establish the appropriate signal lengths for the current traffic circumstances, ATM employs a machine learning technique to assess real-time traffic data gleaned through car detection.

CONCLUSION

Vehicle traffic management systems have increasingly used automatic accident detection. By keeping an eye on the scene of an accident, authorities will have an easier time clearing the area so that other vehicles may use it again. We demonstrated that information on vehicle locations and average speeds may be used to assess traffic activity. Drivers in the immediate vicinity of an accident may see it as an additional obstacle. When compared to the current ATM setup, the proposed solution performed far better in tests. Since most individuals now live in a city, our environment has become more urban. Worldwide, the rate of urbanisation is increasing rapidly. In general, urban living, particularly in smart cities, is associated with better social, health, and educational outcomes, as well as higher opportunities for cultural and political engagement, as compared to rural life. There are long-term obstacles to sustainable growth and environmental protection because of urbanisation. A major objective of "smart city" projects is the reduction of overall energy usage. It's possible that the solution lies in adopting cutting-edge energy-saving practises. This study

proposes a strategy for optimising smart city energy consumption by using IoT technologies, 5G networks, and cloud storage. 5G enables instantaneous connection with power-hungry smart appliances, and IoT sensors that are easy on the electrical grid are widely used. Data collected by intelligent IoT gadgets is sent to the cloud and stored there via a 5G connection. The programme keeps an eye on the status of smart devices, and if a problem emerges, the control management team may get the data they need from the cloud via an existing line of communication. Mathematical modelling is used to test the proposed concept, and the results show that it provides a practical solution for a smart city.

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OBJECT REPOSITIONING WITH VR

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ABSTRACT

Pertaining to the applications applying in the fields of Interior Designing, Warehouse Space management and wherever space utilization plays an important role, the 'Object Repositioning with VR' serves to be an effective solution to rearrange the objects, to validate their repositioning and redesign without physical labor. The Unity 3D application aids the user in repositioning various furniture in multiple pre-built virtual environments and creating virtual environments on demand by taking the real-world physical room as a reference by its video. The video of the room primarily contains the ArUco markers placed onto the corners of the considered space-area for visualization and onto the objects which have to be detected and placed inside the environment. Each corner, objects and certain room dependencies (like windows) are associated with the corresponding ArUco tags. These ArUco marker positions determine the walls' lengths that have to be rescaled and used for building a relative sized virtual room. The 3D virtual environment is rendered by rescaling to the real-world of a four-walled room scale and is populated by the models of the objects detected in the same room. After superimposing the models into the dynamically created environment, necessary interactions are added to those objects, like movement and rotation for users to interact with them. The entire interior of the built virtual room can be visualized from the camera attached to the FPC (First Person Controller) Capsule. The FPC controls in UI will provide the user freedom to move inside the rendered environment and reposition the objects around to find suitable and required rearrangement provided the space conditions satisfy. Overall, the entire system design involves creating a novel application that could be used for visualizing the environment and provide a foundation for building a more complicated interior of a room. Further, the paper elaborates on the methodologies used for generation and visualization of the required room filled with necessary furniture models using ArUco tags. It discusses the methods used for connecting various sub-systems under this application and for object instantiation and interaction (movement and rotation of objects) in accordance with the freely moving FPC Capsule's position and orientation in world-axes of the environment. With this, the App can be extended for a wider range of real-world applications.

Keywords: ArUco markers, Interior designing, First person controller, Virtual environment

INTRODUCTION

The visualization of real-world environments via mobile phones can be vastly beneficial to the interior designing. The ability to view the replicant environments in virtue of phone screens can help them analyze the positioning of furniture in the most advantageous manner.

The artwork and science of upgrading a building's indoors to furnish a higher and extra artistically attractive surroundings for these the use of the place is recognised as indoors designing. A character who designs, investigates and supervises such improvement tasks is recognised as an interior designer. The interior designing being an umbrella term includes many sophisticated procedural works, one of the fundamental

elements being interior space planning. An in-depth examination of how a given space will be used is called space planning. Prior to the actual interior designing process, space planning is done to get a blueprint for interior design. While space planning a room, one of the crucial conditions to consider is the structure and architecture of the room. The doors, windows being the main focal points.

Space and volume are the next two vital factors to consider in placing the furniture at apt and required places thereby ensuring the space is not overfilled and certain specifications like maintaining a clear view of the outer world through the window, i.e, no object blocking the view. By taking into account the space

with respect to its volume. Evidently, the room size influences so many decisions like the number and types of furniture that can be accommodated and thus how effectively a room is planned. By properly arranging a room, an interior designer could ensure that the layout, functional needs, and purpose of the space are all met.

Under the space planning, the movement patterns are analyzed wherein the factors like location of doors, furniture placement, and other practical and decorative items are considered to check if there is plenty of room to move around. To visualize this in real-time, the built Unity 3D application can be helpful. Furthermore, to view and analyze the arrangement of various pieces of furniture with different orientations in the room.

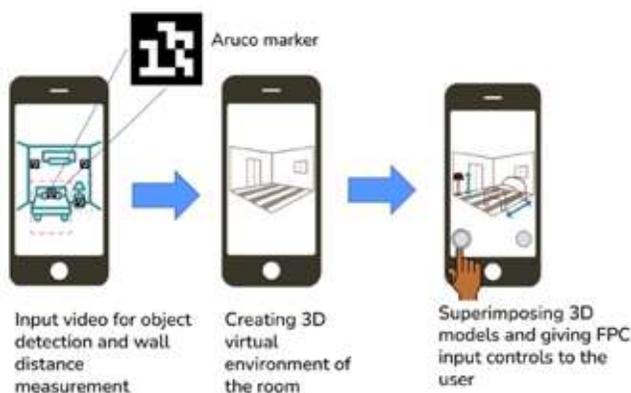


Fig. 1. Overview of the system.

The ‘Object Repositioning with VR’ primarily involves the dynamic creation of a virtual environment taking the realworld physical room as a reference and to impose the 3D models in the virtual environment by Auto Scaling as shown in Fig. 1. Auto Scaling is a method used in creating environments by dynamically adjusting the dimensions of the real-world room to build the environment relatively. The 3D models of the furniture detected in the room are then superimposed with their standard sized dimensions into the environment. The models representing the objects could then be moved around and rotated by the user to see the different arrangements in the room. This aids in planning the furniture with the scale of the room to determine the ideal furniture and accessory placement for the available area.

LITERATURE SURVEY

VR can characterize new fashions of understanding associated with the world of structure and the human physique via the digital twins.[1] AR furnishings

association device consists of two steps: firstly, the device calculates the lengths of the handy area via estimating all the aiding planes in a room. Secondly, By analyzing the depth facts that used to be captured by using the KINECT sensor, the assisting planes can be identified. [2] An utility that permits the consumer to add more than one object to the display screen in real-time and has the potential to pick out an object and manipulate it with the aid of moving, rotating, resizing, and altering its color or texture. In specific for architects and designers, the software must scan 2D maps to create 3D versions, permitting customers to share their work and schedules. [3] The VR software program engines are very beneficial equipment to create VR worlds of any type. This technological know-how has made lifestyles very easy as even the indoor designers and consumers are in a position to see how the result of the room will be so that any modifications can be made in advance. These units are very available and easy to use and can be set up in hours.[4] The ADDIE model is utilized to research’s improvement technique. The scan has two parts. The first phase to acquire the demographic statistics from the respondents, consists of gender, age, and instructional background. The 2nd phase consists of questions related to the utility in most cases to evaluation the respondent’s trip in the usage of the application.[5] Further The CFAD has inspired its indoor sketch college students to use a range of visualization processes to assist their initiatives and homework.[6] Another application uses Mixed Reality where the consumer can rapidly see the gallery wall plan in location the usage of a combined actuality tool, such a Magic Leap One headset, and can interactively alternate the layout whilst working with our tool’s advice engine.[7] The novel integration of speech controls and VR consequences in a notably intuitive journey that prioritizes the innovative procedure over technical proficiency.[8] The actual illumination can additionally be reconstructed from RGBD photos using an estimate of floor normals and albedo. This approach makes the supply of mild estimation which is community impartial of the digital camera pose and calculates a transformation to actual world area vectors after estimation. [9] The BIM mannequin gives several advantages, such as structured and specific object and multi-material naming, which is quintessential for object determination and manipulation inside the recreation engine application. [10] A new interplay

method that can advantage a number 3DUI mission eventualities in immersive VR.[11] Interplay diagram lets in customers to have an trip based totally on real-world metaphors for digital objects and their operations; it additionally offers a sensible journey with herbal interplay in the digital space. [12] Interaction with a 3D digital environment(VE) is limited when customers have solely one free hand to function smartphones using MagicCube. [13] Eyetracking applied sciences have been adopted or built-in into the digital actuality (VR) head-mounted display. Eye-see-through structures unified device determination and utility with eyetracking strategies in VR, which gave customers fast interplay with context menu interfaces in VR. [14] Sonic interplay diagrams can be utilized to get to know environments and gamification contexts in order to enhance a precise performance. The innovative strategy to a creative expression such as musical composition can be utilized additionally to drawing learning environments. [15] It is proven that the use of easy fiducial markers, an attitude of incidence of 30° have to be viewed due to the fact the dimension is greater secure in contrast to 0° attitude of incidence. The consequences bought via the dice in each orientations are comparable with the ones from the single marker at 30° attitude of incidence. [16] The ArUco pose estimate procedure is set in a way that ArUco markers are positioned on recognized locations in space, the place localization takes place. This way, each marker ID has its personal position; thus, it is viable to estimate the pose globally. [17] A technique to notice the marker from the untextured 3D cloud and its key function is its projective invariant look as the 2D ArUco, however structure records are encoded so that it is detectable in the untextured 3D factor cloud. This helps in bridging the 2D and 3D modalities that are quintessential to truth modeling.[18] By fastening the ArUco marker to the object, the object’s mindset may additionally be efficiently tracked. The preliminary end result is rapid and precise, however it is nonetheless prone to obstruction and hand shaking. To tackle these issues, a linear Kalman filter used to be used to expand the ArUco marker’s resilience. [19] The touchdown help machine for fixed-wing UAVs that fly inside visible line of sight is presented. The marker identification and posture estimation used in the navigation technique are primarily based on laptop vision. When used to calculate the float slope, ArUco markers set alongside the runway supply unique records about the UAVs

position. [20] The ArUco markers meet all of the necessities for toughness, dependability, and versatility. In indoors surroundings, they understand everything differently shortly and with little uncertainty. [21] For illustration of the Oriented Bounding Box, the OBB of a goal is described through the HBB enclosing it and the orientation (transformation) parameters are used. In the education process, the floor reality OBB is firstly changed to its surrounding HBB with transformation parameters h and w , which would be faster to be regressed. [22] The adaptive object orientation regression technique makes use of the anchor to educate and regress 5 object area parameters. The regressed parameters are later used to reap the 4 corner’s coordinates of the object vicinity. [23] Hand-crafted points such as part and texture are used in typical 3D object recognition. CNNs can additionally be used to predict object poses straight from photos. [24] By evaluating the depth fee of the near-depth photo to the corresponding depth buffer of the digital scene, occlusion administration is independently carried out for every eye view. The last photograph is then created for show as a composite of the digital scene and true objects. [25] The traditional Canny facet detection approach filters out the vital side records about the object in the AR-oriented 3D object identification process, reducing consciousness accuracy. [26] The container approach is used to put in force actor, transferring object, and scene collision detection in digital actuality settings. Experiments in this work validate the algorithm’s viability, which has some theoretical lookup significance and applicability. [27]

SYSTEM DESIGN

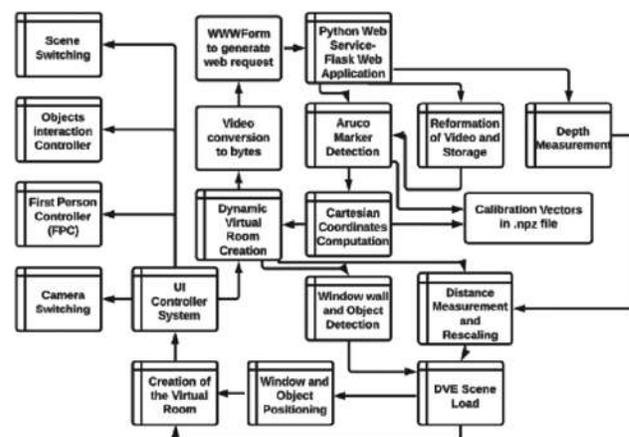


Fig. 2. High Level Design

The entire workflow of the application shown in Fig. 2, initially, the User Interface (UI) of the application has multiple options for FPC movement, interaction, cross-scene switching and multiple viewpoints for seeing the environment from various viewpoints. The option for creating dynamic virtual rooms runs the dynamic room creation scripts, where the selected video from the file system is first converted to the string of bytes and is sent in WWWForm's value field. The hosted python web server then receives the request and reforms the bytes string back to the video format and saves it in the server. The Flask web application runs the python scripts for ArUco markers detection to return back the necessary values, such as the coordinates and distance from the camera (Depth measurement) to the detected ArUco tags. The presence of a few ArUco tags are checked to see if there are any dependencies that have to be added like windows to the walls. The detection of the object is done and its position is determined in the virtual environment.

All these computations are done using the camera's calibration vectors. For each camera of different mobile phones, the calibration vectors are different. There are few input images taken from the mobile's camera of a checkerboard in various angles. The python script for calibration is run upon them and .npz files are created storing various vectors. These vectors are used for running ArUco markers python scripts. The result of the computations are returned back to the device in which the euclidean distance is found and that distance is rescaled to generate the virtual room's boundaries. The Dynamic Virtual Environment (DVE) scene is loaded with the virtual boundaries, objects positioned and walls with dependencies, if any. The loaded scene gets the same UI functionalities (like FPC Controls, icons of multiple objects instantiation, objects interaction etc) as any other scene having a pre-built environment.

PROPOSED METHODOLOGY

Dynamic Environment Generation

The environment to be built is of a four-walled room. The inclination of all the surrounding walls with each other as well as with respect to the floor and ceiling is strictly assumed to be right-angled. The environment built to be relatively dimensioned to the real-world room has to create the walls and rescale position-appropriately. At specific predefined locations, ranging from the plane's center, the walls must be instantiated.

Then, to create a single contained space, these walls are rescaled to specific lengths. By employing ArUco markers to denote their locations, the dependencies of the walls, such as windows and doors, are taken care of.

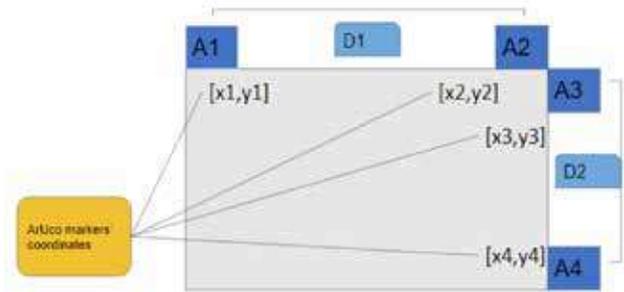


Fig. 3. Placement of ArUco markers

On two neighboring walls, the four ArUco markers are used to measure the length of the walls. The IDs of the markers that must be placed are fixed with respect to the wall and must be put at the outer limits of the area that will be used to perform calculations, and therefore to build the virtual world environment. From Fig. 3 we can infer the placements of the ArUco markers in the environment. The coordinates of the detected markers are used to compute the euclidean distance between them. Since they are kept on the same plane and on the same height from the ground, the distance between them will give us the length of the wall that must be rescaled to generate the virtual boundaries in the environment as shown in Fig. 4.

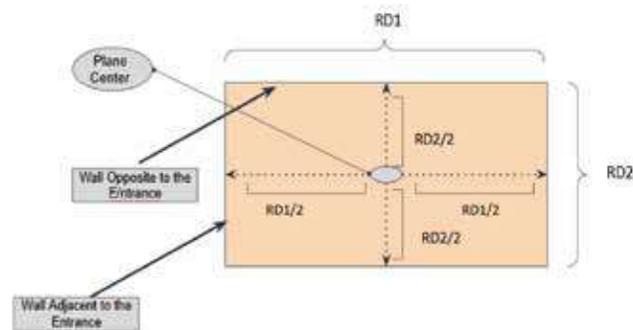


Fig. 4. Placement of ArUco markers

The walls are instantiated at half the distance of rescaled distances ('RD1' and 'RD2' in Fig. 4). The wall opposite to the entrance is created at a distance half of the second rescaled distance (RD2). Likewise, the wall consisting of the door (the entrance wall) is instantiated at the same distance from the center of the plane. The wall adjacent to the entrance is created at a distance half of the first

rescaled distance (RD1). Hence, the wall opposite to this wall is instantiated at the same distance from the center of the plane as shown in Fig. 4.

Mapping Environment and Object Detection Using ArUco Markers

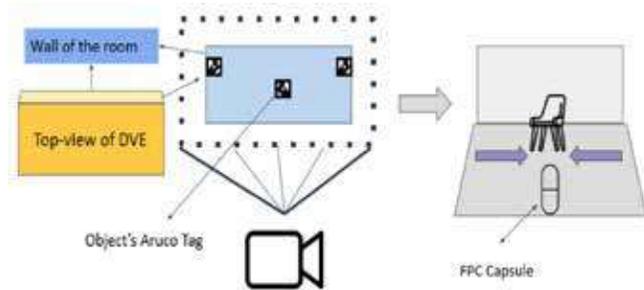


Fig. 5. Object positioning in the front-middle region of the FPC when both the corners' ArUco markers of the walls are detected along with the object's ArUco tag

The objects are associated with their correspondingly mapped ArUco markers. The type and location of the furnishings in the virtual environment are determined by these ArUco markers. Each object will have their own representative ArUco marker's ID. According to where the ArUco marker is set and how the input video is recorded, the 3D models of the furniture are placed appropriately in the environment.

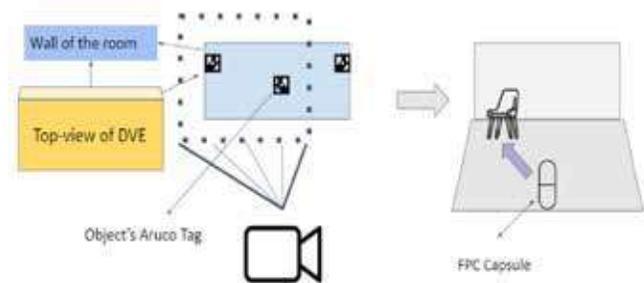


Fig. 6. Object positioning in the front-left of the FPC when only the left-end's

ArUco marker of the wall is detected along with the object's ArUco tag. The ArUco markers on the wall behind are used to assess the object's position in relation to the surrounding area. The object is placed in the middle region of any of the walls if both the edges' ArUco markers are detected along with the object's ArUco tag in the Fig. 5. If any one of the wall's ArUco markers (some corner's marker) are seen along with the object's ArUco tag, the system assumes that the object must be positioned close to that corner in the dynamically built environment as in Fig. 6.

Applied Physics on the Objects for Interaction and Instantiation

1) Interaction with Objects with respect to the FPC's position: The ability of the FPC capsule to move around in all the directions in the environment allows it to see different views of the same object (like front view, back view, sideleft view, side-right view) at different positions considering the fixed static world-space directions. The user through the mobile screen will see the view which is determined based on the position of the FPC in the room. Since the view changes depending on the position, the interaction with the objects should also be changed based on the FPC's position. The alignment between how the user intends to move the objects and how the controls he is using actually move the objects should be accurately the same.

The world-space, taken as a cartesian plane, is divided into four regions. The regions are distinguished by conforming to the FPC's orientation in the virtual world. Region-1 falls within the range $315^\circ - 45^\circ$, Region-2 in the range $45^\circ - 135^\circ$, Region-3 within $135^\circ - 225^\circ$ and Region-4 being in the range $225^\circ - 315^\circ$. In Fig. 7, the FPC is facing the object in the virtual world. In world-space the orientation of the FPC falls in the range $315^\circ - 0^\circ - 45^\circ$. The object instantiated would be perfectly aligned with the world or parent axes ,i.e, with "no" rotation. It indicates that the FPC is viewing the object from the front (the object's front view). Thus, for the controls to behave as anticipated the object's position is manipulated to move right when the controls are moved to the right and left translation of the object by moving the controls to the left. Moving backward and moving the object forward involves similar techniques.

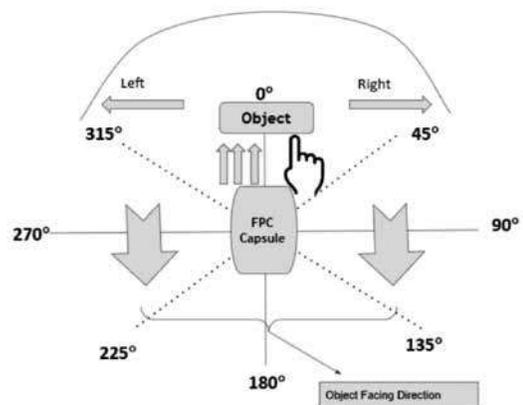


Fig. 7. Movement of the Object when FPC is facing the object in the range $315^\circ - 0^\circ - 45^\circ$

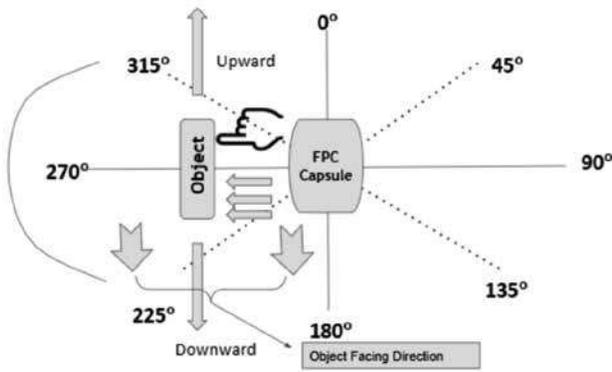


Fig. 8. Movement of the Object when FPC is facing the object in the range 225°- 315°

In Fig. 8, the object instantiated following zero rotation with respect to the parent axes and the FPC's orientation in the virtual world-space is in the range 225°- 315°, technically is left to the object in the world axes. The FPC is notably viewing the object and is seeing the left-side view of the object. The user controls for the FPC should now move the object upward when the controls are moved right and while moving the controls to the left the object should go downward. If he moves back, the object is actually moving to the left in the world axes but with the user's point of view it seems as if the object is really going backward. On using the controls to get the object nearer, the object is moved towards the right in the world-space and is thus getting nearer to the FPC. Thereby giving the observer the impression that the controls are moving in accordance with what he is requiring them to do.

2) *Instantiation of Objects with respect to the FPC's position:* On user demand, the object has to be instantiated in the place wherever the FPC capsule has moved to and is viewing an empty space. The object's instantiation will predominantly depend on the FPC capsule's position and orientation while moving around the environment. Considering the boundary conditions, the object has to be placed in front of the FPC irrespective of its orientation in the world-space. Initially, the "player" or the capsule's local euler angles with respect to the Y-axis is measured. The FPC's position is also determined for the placement of the object. Now, according to the local euler angle or rather the side where the FPC has turned to (the place being looked at through the mobile screen in the virtual environment), the coordinates of the position where the object should be placed is calculated.

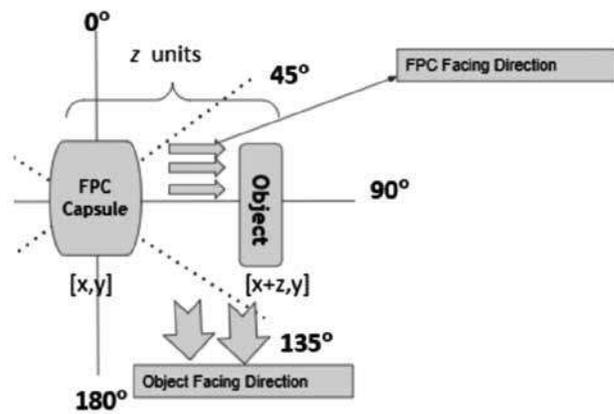


Fig. 9. The instantiation of the object when the FPC is facing in the range 45°- 135°.

In Fig. 9, FPC is facing with an angle in the region 45°- 135°. In the world axes, if the user wishes to instantiate an object in the region the FPC camera is covering ,i.e, the Region-2, which is established by measuring the angle at which the FPC camera is rotated with respect to the Y-axis standing in a particular spot, the coordinates at which an object has to be imported is premeditated taking the current coordinates of the FPC. Judging the alignment of the FPC with the region it is intending to populate, the coordinates is determined by adding the z-units (the safe optimal distance away from FPC, so it doesn't hit the player after getting instantiated) to the x-coordinate and y-coordinate being the same for the scenario in Fig. 9. If the FPC faced towards Region-4 (in the range 225°- 315°), the x-coordinate of the FPC's current position would be subtracted by z-units to determine the coordinates for placing the object, with the y-coordinate remaining constant.

If the FPC is turned with an angle (in the range 135°- 225°) such that it is looking in Region-3, as in the Fig. 10. The object is imported downward to the FPC in world axes but in the region the FPC camera is pointing at. For determining the coordinate, y-coordinate is subtracted with z-units and x-coordinate remains the same. If the FPC faced towards Region-1 (in the range 315°- 0°- 45°), the coordinates for the placement of the object would be calculated by y-coordinate of the FPC current position getting added by z-units and x-coordinate remaining the same.

Dynamic creation of the Virtual Room by connecting Subsystems

The finest and most performant solution was found

to be able to host a python web server that hosts the ArUco markers' python scripts. The unity application sends requests to the server and gets back the response containing necessary parameters to further create the environment in the application.

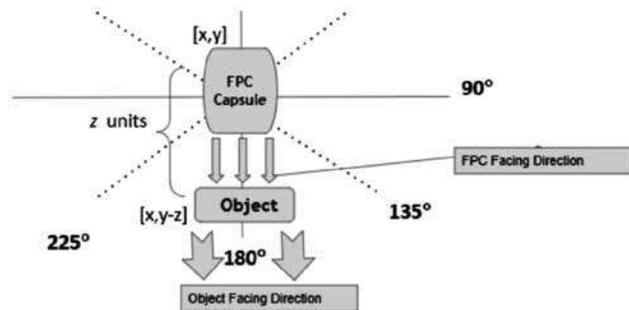


Fig. 10. The instantiation of the object when the FPC is facing in the range 135°- 225°

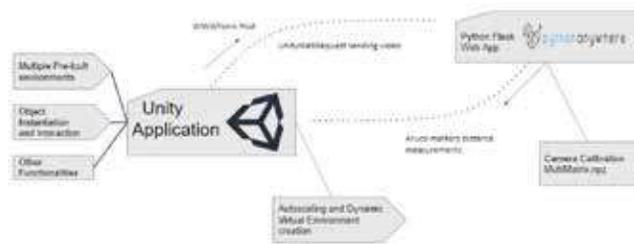


Fig. 11. Connecting Unity C# scripts with the Python web hosting service

Step-1: In Fig. 11, initially, the unity C# script first opens the file system of the OS by using Runtime File Browser utility. The selected input video is then converted to the string of bytes.

Step-2: The WWWForm in unity creates a form and adds this binary data of bytes string as a value to a particular key.

Step-3: The Unity Engine Networking posts the Unity Web request by the form to the server.

Step-4: The server side flask application gets this request and writes the video's bytes string to a video file.

Step-5: The formed video file is then used for ArUco markers detection, coordinate and distance measurement. The OpenCV library is used to calculate all the parameters to be sent back to the device requesting this information.

Step-6: The response is sent back in JSON format to the device. The JSON string is deserialized into a JSON object to extract the necessary information.

Step-7: The object holds the variables' names (identifying which information is held by which parameter key). The access specifier of the variables is changed for it to be recognised by other scenes' scripts (particularly the scene that builds the virtual environment dynamically).

Step-8: The scene building the virtual environment is loaded and the variables needed to build the virtual environment dynamically is read from the previous script's variables.

Step-9: The walls are adjusted, rescaled and imported at a specific distance from the center of the floor plane. Hence, all the four walls with necessary dependencies (like windows) are added and imported.

Step-10: The objects detected in the video are instantiated within the virtual-world space. The 3D models (with their standard sizes) of the furniture are placed inside the virtual room.

Step-11: The FPC (First Person Controller) capsule is placed in the center of the plane and the First Person Controls can be used to move the FPC around to get different views within the environment and object interaction is added to the instantiated objects so they can be moved and rotated as well as be removed out of the environment if not needed. So, it is possible to determine the ideal furniture arrangement.

RESULTS AND DISCUSSION

The built application is tested to check if the environment is built relative to the size of the room and can generate all the objects detected using ArUco markers at appropriate places. The Functionality Testing was performed to cover the following aspects, (i) Multiple Environments and across varied wall lengths. (ii) Objects instantiation and positioning accuracy. (iii) Different lighting conditions. (iv) UI controls covering all icons.

Table 1. Multiple Environments And Across Varied Wall Lengths

Place	Wall-1 Length (in m)	Wall-2 Length (in m)	Creation	Enclosed	Size Relativity
Cafeteria	1.7	2	Y	Y	High
Cafeteria	2.5	2	Y	Y	High
Cafeteria	4	2	Y	Y	Medium
Cafeteria	5.5	4	Y	Y	Medium
Cafeteria	6	4.5	Y	Y	Medium
Cafeteria	6	6	Y	Y	Less
Library	2.5	2	Y	Y	High
Library	3	2.5	Y	Y	Medium
Library	4	3.5	Y	Y	Medium
Bed Room	1.5	2	Y	Y	High
Bed Room	1	1	Y	Y	High
Seminar Hall	4	6	Y	Y	Medium
Seminar Hall	5	6	Y	Y	Medium

From Table 1, it can be inferred that relativity seemed to be good when the considered input area is less. The environment was created most of the time and showed medium relativity to the actual space area. It created an enclosed environment almost all times, implying the rescaling of the walls gave satisfactory results. However, it is creating a relatively-sized environment convincingly for most of the varied length walls. The difference in the walls, like in complicated backgrounds, is causing no such change in detection and creation of the height and on an disinclined wall.

Table 2. Objects Instantiation and Positioning Accuracy

Test Video	Object Positioned	All Required Places Filled	Number of Extra Models
T1	Y	Y	0
T2	Y	Y	0
T3	Y	Y	1
T4	Y	N	2
T5	Y	N	4
T6	Y	Y	0
T7	Y	Y	2
T8	Y	Y	3
T9	Y	N	0
T10	Y	Y	0
T11	Y	Y	1
T12	Y	N	2
T13	Y	N	0
T14	Y	Y	0
T15	Y	Y	2
T16	Y	Y	0
T17	Y	Y	1
T18	N	N	0
T19	Y	Y	1
T20	Y	Y	0
T21	Y	Y	1
T22	N	N	0
T23	Y	Y	0
T24	Y	Y	1
T25	Y	Y	4

To test for object positioning accuracy, the position of the objects instantiated were checked against expected places. In Table 2, under the “Required places filled” field, it was checked if all the required places were filled with the objects expected. However, due to the value updates of the ArUco markers, there can be multiple objects instantiated at multiple positions even if it was intended to be kept only in one position. The number of extra models instantiated were more when the number of objects at the same place were large in number and when the video was recorded incorrectly. The upgradation in the values might happen in case the input video is not captured correctly. In case of ambiguity, it produces the models in all those ambiguous places.

Inferring from Fig. 12, 84% of the users found that the UI was user-friendly and had good usability. The comment received from the rest 16% included the FPC controls were too fast in some scenes, accidental selection of objects due to high Sensitivity. This was

resolved by adjusting the FPC movements speed and thus, by reducing sensitivity.

Table 3. Different Lighting Conditions

Lighting Condition	Corner Aruco Tags Detection Rate (%)	Objects Detection Rate (%)	Number of Tags Undetected
Well-Lit	100%	100%	0
Well-Lit	100%	100%	0
Well-Lit	100%	100%	0
Well-Lit	100%	100%	0
Well-Lit	100%	75%	1
Well-Lit	100%	100%	0
Well-Lit	100%	80%	1
Well-Lit	100%	100%	0
Well-Lit	100%	100%	0
Well-Lit	100%	100%	0
Well-Lit	100%	85.71%	2
Well-Lit	100%	100%	0
Well-Lit	100%	100%	0
Dim-Lit	100%	75%	2
Dim-Lit	50%	100%	2
Dim-Lit	100%	66.67%	1
Dim-Lit	100%	83.34%	1
Dim-Lit	100%	66.67%	1
Dim-Lit	100%	100%	0
Dim-Lit	75%	90.9%	2
Dim-Lit	50%	100%	2
Dim-Lit	100%	88.89%	1
Dim-Lit	100%	87.5%	1
Dim-Lit	75%	80%	2
Dim-Lit	100%	100%	0



Fig. 12. User Study for Testing Performance

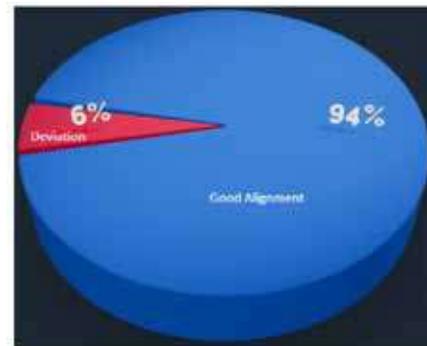


Fig. 13. User Study for Testing Object Controls

In the Fig. 13, it was seen that 6% users while testing found that objects appeared too near to the camera covering most of the mobile screen which made it trickier to move objects away using the space outside the model. This problem could be resolved by changing

the FPC Capsule's orientation. From Table 3, it can be concluded that the results were more accurate when the environment was well-lit. In dim-lit environments few ArUco markers went undetected.

The multiple objects instantiated at nearby places can then be again thought of to be reduced in number but the system just prefers to instantiate in all the ambiguous places in case of any ambiguity due to the reason that the required positions are all filled and in case of extra objects they can be just moved out of the scene by user. Thus, the results are graphed assuming the users record the video correctly and have good internet access to send the video to the web server.

CONCLUSION AND FUTURE WORK

The developed application provides interior designers with a feasible way to visualize the environment. These can be further built upon to build environments having more than four walls. Overall, the application is providing references by instantiating objects in the places required by the user for most of the time. It works best provided the environment is welllit and the device has high bandwidth internet connection. This provides a foundation for further modeling the entire environment with multiple rooms. More complicated Interiors could be designed like a room with five or more walls in realtime. Further, in addition to the position, taking into account the orientation angle attribute of the ArUco Tags to import the walls accordingly.

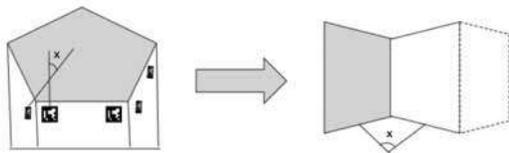


Fig. 14. Dynamic Virtual Environment generation for a five-walled room

In Fig. 14, as can be observed, the angle between the walls in the virtual room is determined using ArUco tags orientation in the room. The angle 'x' between the normals (coming out of the wall) of the adjacent walls in the room along with the position determines the placement of the walls, thus creating the virtual boundaries. This might be expanded upon to create even more complex setups with numerous dependencies.

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ROLE OF ARTIFICIAL INTELLIGENCE IN HUMAN RESOURCE MANAGEMENT

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ABSTRACT

The replication of human intelligence functions by machines, particularly computer systems, is known as artificial intelligence. Expert systems, natural language processing, speech recognition, and machine vision are some examples of specific AI applications. While AI has had a fantastic impact on HR, there is a small drawback that you should be aware of as well. Every time AI is applied in the HR department, the ethical influence on that department must be clarified, addressed, and reviewed again. This section manages a great deal of the employees' private information. The goal of this essay is to explain the changes that artificial intelligence has brought about in the various facets of human resource management. The goal of the paper is to examine both the advantages and disadvantages of using artificial intelligence, as well as how certain businesses are employing it in practical applications. The answer to all the new issues is to develop new and modern skill sets.

Keywords: Artificial Intelligence, HRM, Manager, Organization

INTRODUCTION

Artificial intelligence is a tool that enhances performance in a variety of sectors by combining human intelligence with technology. In the simplest words, artificial intelligence (AI) is a subfield of computer science that focuses on creating intelligent robots and gadgets that may be utilised to carry out tasks that often call for human intellect. Organizations are fast embracing artificial intelligence thanks to technological advancements in order to obtain a competitive edge in the online world. It has altered how different managerial duties are carried out. Artificial intelligence has been incorporated into human resources management for a variety of functional goals. There will be both positive and negative effects on HR Management as time goes on and the application of AI develops, as AI is constantly changing the environment. Management of human resources, which often deals with people and their behaviour inside the firm, is crucial to managing people

in the workplace. An organization's human resources policies are a set of rules for managing its employees. Its primary duties include hiring, selecting, training, and developing people. It also covers disciplinary, safety, compensation, and termination rules. HR is affected by AI in a variety of ways, including hiring, firing, training, and development, performance measurement, task automation, and more. There will be both as AI use progresses over time. Nowadays, due to the employment of artificial intelligence in many areas, HR managers must consider employees' aptitude and skills. New hires frequently find it challenging to understand and become familiar with AI tools. Employees will start to worry about whether they will be able to keep their jobs or not. One of the biggest challenges facing all managers is choosing the correct talent to handle AI.

REVIEW OF LITERATURE

Scott W. O'Connor (2020): In the article titled Artificial Intelligence in Human Resource Management,

the author clearly says that artificial intelligence will continue to positively shape the field of human resources management in the coming years. HR professionals should also be more aware of the challenges that they might face. Thus, to prepare for the future of human resource management, professionals should take the necessary steps to learn about the current trends in the field.

According to Buzko et.al (2016): “Artificial Intelligence in human resource development paper revealed that the application of artificial intelligence in HR facilitates organizations to work effectively and it also provides accurate data”.

Jennifer Johansson and Senja Herranen (2019): In the paper titled “The Application of Artificial Intelligence in Human Resource Management”, it is mentioned that the area of AI in recruitment is new and there are not many organizations that has implemented AI in all parts of the recruitment process. It also mentions that the main benefits of AI are seen as the speeded quality and elimination of routine tasks, while major challenge is seen as the companies’

Albert Christopher (2019): In his article names as “Use of Artificial Intelligence in Human Resource Management, the author says that AI is based on the applications raise employee productivity. It has ability to analyse, predict, diagnose, and become more capable resource while focusing on employee need and outcomes. However, there are challenges like privacy, talent gap, maintenance, integration capabilities or limited proven applications. AI systems must be managed carefully by finding reliable learning data sets, using the right implementation approach, seeking clarity, eliminating bias, and considering unintentional consequences.

Anupam Jauhari (2017): In the paper title how AI and machine learning can affect HR practices today. AI is becoming increasingly relevant and reshaping the way businesses employ and do every activity recruitment is simple for practitioners as machine learning technology will use chatbot to carry out all activities, AI will screen candidates and send the confirmation or rejection email to the candidates.

According to Daceport (2019): “Artificial intelligence helps to minimize the work being done in HR function it is still far away from replacing the HR personnel completely because of persistent need for human intervention while dealing with employees”.

Dinesh G. Harkut and Kashmiri Kasat (March 2019): “Artificial Intelligence - Challenges and Applications” – In this study based on open access – peer reviewed it has concluded that building trust, AI human intervention, Investment, High expectation, Data security are few of the challenges which is faced by the organisations.

Vivek Yawalkar (February 2019): “A Study of Artificial Intelligence and its role in Human

Resource Management” - Volume 6, - The research paper is descriptive in nature. The researcher used secondary data and concluded that a role of AI is larger into various functions carried out in human resource department where by robotics companies can handle recruitment, hiring, analysing the data, collecting the data, reducing workload at workplace and enriching workplace efficiency.

HUMAN RESOURCE MANAGEMENT

HRM is the study of workplace activities involving employees. Trying to match an organization’s needs with its employees’ skills and competencies is a managerial task.

The managerial task of acquiring, motivating, and retaining employees is known as human resources management (HRM). It focuses on the individuals within organisations. Designing management systems for human resource management ensures that human talent is utilized effectively and efficiently to achieve corporate goals.

The HRM department is responsible for hiring, training, compensating, integrating, and maintaining an organization’s workforce in order to support the achievement of the goals of the company. Therefore, planning, organising, directing, and controlling the execution of those operational activities constitutes personnel management.

NATURE OF HRM

HRM is a managerial function that aids in the hiring, vetting, onboarding, and development of employees. The role of people in organisations is something that HRM considers.

1. HRM involves putting management principles and practises into practise. Applying the concepts and functions will help your organisation find, develop, retain, and pay your people.

2. Employee-related decisions must be integrated. Decisions made on various aspects of employees must be consistent with those made with other human resources (HR).

3. An organization's effectiveness is influenced by decisions that are made. When an organisation is effective, clients will receive superior services in the form of high-quality items offered at affordable prices.

4. Non-business organisations like those in the fields of education, health care, recreation, and similar ones can also use HRM functions.

The term "HRM" refers to a collection of policies, procedures, and tasks developed and implemented to enhance both employee and organizational effectiveness.

CURRENT TRENDS AND APPLICATIONS IN ARTIFICIAL INTELLIGENCE

AI technologies are gaining popularity in several sectors such as financial, automobile, healthcare, security, and various application scenarios. The commercialization of AI is accelerated due to business digitalization, globalization and rising improved industry 4.0 chain structures and enhanced need for information efficiency. Several countries are investing in AI and machine learning technologies for increasing productivity and meet the global industrial sector demand.

In autonomous driving, AI and machine learning algorithms can help to address safety and avoid human error through industrial collaborative robots. AI through robots in the autonomous vehicle can provide safe vision to make its way through traffic. It leverages complex neural networks to extract more detailed of the surrounding through cameras and continuously learns through a neural network and evaluate its input data for efficient driving. Several leading players are launching new systems and components for autonomous driving using AI and machine learning.

IMPACT ON VARIOUS HR MANAGEMENT FUNCTIONS

Recruitment

Recruitment In every area, the use of AI for hiring new people is growing quickly. Its endeavour to lessen or perhaps eliminate time-consuming tendencies in manually assessing applicants through their resumes is the primary driver behind its creation. The largest

difficulty for HR managers over the past 10 years has been the time-consuming process of screening potential employees for a position. However, this process has accelerated with the application of AI. Without the use of human intelligence, AI assists in automatically matching candidates with open positions. When hiring is done manually, it takes about 23 hours to narrow down the pool of qualified candidates, but when artificial intelligence is used, stacks of resumes may be read in just one hour. In order to save time and avoid the usage of human intelligence, recruiting software can filter out appropriate talents, experience, educational background, and many other factors. At the same time, recruiting software has the ability to simultaneously send an advertisement to thousands of job seekers.

AI is capable of a wide range of extra tasks, including chatbots, preliminary screening, and employee data collection. Chatbots assist in automatically responding to the enquirer's questions. lowering the usage of human intelligence as a result. Thus, we can conclude that AI significantly speeds up the hiring process.

The use of AI to the hiring process still faces several difficulties. People who are seeking for work have the perception and conviction that having human interaction will make the recruiting process go more smoothly. AI still has some shortcomings and weaknesses, which may cause it to struggle with pattern recognition and inference. A applicant profile could be rejected by AI if it can't read a certain typeface used on the resume. This is an obvious illustration of how every technological innovation has both beneficial and detrimental effects.

AI-based recruitment methods have streamlined the application process while also altering how HR functions when selecting new hires. It screens candidates first, then matches them (i.e., makes the job description and candidate resume fit), and lastly chooses the individual that best fits the requirements in terms of domain, skills, tools, location, education, etc. Other advantages of using an AI-based hiring process include improved hiring quality, time savings, the elimination of bias, and improved candidate assessment.

Training & Development

Almost all businesses, industries, and sectors in today's world are equipped with artificial intelligence in one form or another. AI is also essential to employee development and training. In the past, it was challenging to educate

personnel due to a lack of appropriate machinery, but today's simulation and vestibule training programmes give workers an accurate working environment, better preparing them to handle the practical aspects of their jobs. AI simultaneously assesses the performance, behaviour, productivity, and skills of workers who are undergoing training. The use of AI in training and development aids managers in both candidate selection and the provision of qualified applicants for open positions. It assists in preserving productive

Individuals differ in their capacities for comprehension, learning, and knowledge acquisition. Therefore, tailored learning can be offered by AI to meet the demands of the workforce.

The use of AI in training and development is not without its difficulties. One such disadvantage is that these new trainers won't be able to continue their task manually if the software in use malfunctions or if some unanticipated event takes place. Another significant obstacle is time because there are ongoing improvements and advancements with each new day. There are advancements in every software. Without receiving fresh training, this reduces the employees' long-term productivity. Because it also depends on the learner's mental health and level of weariness during training, evaluating trainee performance with the aid of AI may occasionally be unsatisfactory. Machine learning and AI are being used by the public sector organisation NTPC in India to teach mid-level executives and improve operational effectiveness.

Performance Management

Traditional techniques of performance evaluation are rapidly fading as a result of the adoption and use of AI in many organisations. Traditional methods of performance evaluation can occasionally lead to managerial mistakes. AI evaluation regularly assesses employee performance based on the goals set forth to them and by evaluating their teamwork. The introduction of AI has sped up the rewards and feedback process because it is now constantly monitoring employee performance. Employee data such as absenteeism, work satisfaction, performance statistics, and goals attained are gathered, and performance is projected using AI-driven assessment tools. It has changed how assessments are done by offering a quicker, wiser, and better method than previously. A system no longer operates these days on rewards.

Talent Acquisition

Traditional techniques of performance evaluation are rapidly fading as a result of the adoption and use of AI in many organisations. Traditional methods of performance evaluation can occasionally lead to managerial mistakes. AI evaluation regularly assesses employee performance based on the goals set forth to them and by evaluating their teamwork. The benefits and Human resource tasks are increasingly automated as a result of the extensive use of AI and the absence of routine transactions with third parties in hiring. This enables firms to find or hire the best employees with the least amount of money and time spent. One of the main benefits of hiring people using AI is that it lessens bias because it contains characteristics that allow for objective shortlisting of candidates. Businesses could

To offer recommendations based on current employees' actual competence and to obtain a more thorough understanding before making a final selection, AI devices are frequently employed in computerised resume screening processes. In order to locate the best resumes and align them for interviews, artificial intelligence searches through millions of websites and job descriptions using algorithms. A few MNCs have begun implementing AI in the search for talent across industries. In order to conduct interviews remotely and assist PepsiCo in implementing green HRM, AI software is connecting with candidates. As a result, candidates do not need to travel. A few other businesses, like Hilton, Thread Up, Humana, Five Guys Burgers and Fries, AT & T, and Procter & Gamble, are also utilising AI in the hiring process. Thus, it may be said that AI

Employee training, estimating, ID production, data administration, and correspondence for jobs are all computerised at Tech Mahindra. Top MNCs around the world employ the top AI recruitment platforms Fetcher, Heretical, Eightfold, Plyometrics, my interview, Humanly, Paradox, talk push, and Alloy in their talent acquisition procedures. Some of the AI systems utilised in HR functions are IBM Watson selection, IBM Watson candidates, and IBM Watson career coach. Instead, then using the standard keyword matching search, IBM's recruiting Chabot helps job candidates identify positions that fit their skills. With this cutting-edge advancement, candidates may now upload their resumes and talk with the Chabot for the job's requirements directly. In reality,

the Indian company NTPC employs AI and machine learning in its training programmes. On the first day of your new company, display a picture of the first day on your mobile device that exudes confidence and positivity. Chatbots will be able to provide you with the knowledge you require in the new company if you are genuinely curious.

Compensation and Benefits

One of the most crucial aspects of guaranteeing employee happiness is compensation and benefits, which also leads to increased employee engagement. Artificial intelligence aids in the creation of compensation models and programmes by identifying patterns and forecasting performance. A significant shift in an employee's life is being brought about by the use of AI in compensation and benefits since employees are now receiving fair wages, incentives, and rewards. As algorithms employed in AI systems look at previous and present outcomes of employees in terms of performances, human bias in evaluation is also eliminated. AI is playing a critical part in every HR policy by reducing costs and preserving productive hours.

The potent recommendation engine at Amazon keeps track of how employees use its services as they communicate throughout the company. It makes informed decisions and uses the information. Say, for example, that a worker seeks maternity leave. AI will automatically display both the topic's specifics and related information. This fosters a closer relationship between the employee and the company and improves job satisfaction.

Decision Making

Making decisions is at the centre of human resource management (HRM). Human resource management (HRM), like the other functional divisions of a business, is tasked with making choices that will promote the expansion and profitability of the company. Some of the judgments could be complicated in nature, necessitating a thorough comprehension of the issue, in-depth knowledge of the topic, critical thinking, and an organised approach. Artificial intelligence (AI) and knowledge bases can be used to generate complex database models and stimuli that serve as the basis for decision-making.

NEED OF ARTIFICIAL INTELLIGENCE IN HUMAN RESOURCE SYSTEM

The newly constructed human resource Information system (HRIS) has built-in support for AI applications. The Human-Computer Interaction (HCI) function established by AI increases management effectiveness and aids in streamlining the functional process for gathering, maintaining, and validating data needed by an organisation. Artificial intelligence (AI) is replacing mundane work with a minimum of human input. AI is assisting in many aspects of the hiring process, including scanning resumes, sending automated SMS messages, and reference checking. These devices have been found to be more effective than HR teams at retaining employees and lowering turnover rates. It is evident that AI is successfully handling routine HR tasks, but it is also necessary to check in.

CONCLUSION

The incorporation of AI into HR procedures has shown to improve organisational effectiveness. Although artificial intelligence (AI) lacks emotional and cognitive capacities, it has strong tools for analysing and forecasting human resource management policies.

The greatest concern regarding the development of AI is its potential to eliminate jobs globally, but the reality is that it is moving positions from less capable individuals to those with greater talent. Although the rise of AI is affecting a small fraction of workers, everyone needs to keep up with technological advancements.

AI-based HR policies increase employee output since they put an emphasis on a worker's total job happiness. AI is ultimately a technology that employs algorithms to make judgments depending on the information provided. Future predictions indicate that a certain amount of jobs, including those of drivers, traditional office workers, surgeons, pilots, and many more, will be lost to AI. Younger generations must therefore choose to enrol in AI-related courses like those for software engineers, programmers, information security analysts, cyber security, statisticians, etc. The use of AI is expanding across all industries; therefore, it doesn't matter what line of work you are in; you need to be technically proficient and competent to be competitive. However, there are several difficulties, including.

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THE POWER OF EMPLOYEE RECOGNITION: BUILDING A CULTURE OF APPRECIATION IN THE WORKPLACE

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ABSTRACT

Post Covid era tries to focus more on retaining efficient performers through designing a positive work culture. Any work place which appreciated and rewards its employees for their efforts is considered as the best work culture and preferred by best players. The present paper describes about the significance and impact of employee recognition on organizational culture, employee engagement, and performance. The article delves into the importance of fostering a culture of appreciation within the workplace and provides practical insights and strategies for HR professionals and organizational leaders to implement effective recognition programs. The article begins by highlighting the positive relationship between employee recognition and organizational outcomes such as employee engagement, job satisfaction, and productivity. It emphasizes the role of recognition in creating a positive work environment where employees feel valued, motivated, and committed to the organization's goals. Furthermore, the article delves into various forms of employee recognition, including verbal appreciation, rewards and incentives, career development opportunities, and work-life balance initiatives. It explores the advantages and challenges associated with different types of recognition programs and offers guidelines for designing and implementing effective recognition initiatives.

Keywords: Employee recognition, Work Culture, Appraisal, Work-life balance, Rewards and incentives

INTRODUCTION

In today's competitive business landscape, organizations are increasingly recognizing the critical role that employee recognition plays in building a thriving workplace culture. Gone are the days when a simple pay check was enough to keep employees motivated and engaged. Today, employees seek more than just financial rewards; they yearn for genuine appreciation and recognition for their contributions. As a result, HR professionals are turning their focus to developing robust employee recognition programs that foster a culture of appreciation within the workplace. Employee recognition goes beyond mere praise and acknowledgment; it is a powerful tool that can transform the dynamics of an organization. When employees feel valued and recognized for their hard work, they become more engaged, motivated, and committed to achieving organizational goals. Recognition acts as a catalyst, igniting a sense of purpose and fueling a desire to excel. It reinforces positive behaviours, encourages

continuous improvement, and boosts morale.

Research has consistently shown a strong correlation between employee recognition, job satisfaction, and performance. According to a study conducted by Gallup, organizations with high employee recognition have lower turnover rates and higher productivity. Additionally, a report by the Society for Human Resource Management (SHRM) found that companies with effective recognition programs outperform their peers in key business metrics, including revenue growth and customer satisfaction. To build a culture of appreciation, HR professionals must go beyond sporadic acts of recognition and implement comprehensive programs that are ingrained in the organizational DNA. Such programs encompass a range of strategies, from formal recognition programs tied to performance metrics to informal gestures of appreciation that foster a sense of camaraderie and teamwork.

This article delves into the power of employee recognition and provides practical insights for HR

professionals looking to create a culture of appreciation within their organizations. It explores the impact of recognition on employee engagement and performance, discusses various types of recognition programs, and offers guidance on designing effective initiatives. Furthermore, it addresses the challenges faced in implementing recognition programs and presents real-life case studies of successful organizations that have embraced the power of employee recognition. By understanding and harnessing the power of employee recognition, HR professionals can lay the foundation for a workplace culture that nurtures talent, fuels innovation, and cultivates an environment where employees thrive. Let's explore the transformative potential of employee recognition and embark on a journey toward building a culture of appreciation in the workplace.

REVIEW OF LITERATURE

Employee Recognition and Engagement

Numerous studies have highlighted the positive correlation between employee recognition and engagement. A study by Towers Watson found that companies with high employee recognition had significantly higher levels of employee engagement, resulting in improved performance and lower turnover rates (Towers Watson, 2012). Other research studies, such as those by Harter et al. (2002) and O'Reilly and Pfeffer (2000), have also supported the notion that recognition positively impacts employee engagement.

Types of Employee Recognition Programs

The literature explores various types of recognition programs. Formal recognition programs, such as structured award systems and performance-based incentives, have been widely researched. For example, a study by Lawler et al. (2017) found that formal recognition programs linked to performance metrics had a positive impact on employee motivation and performance. Additionally, informal recognition, such as verbal appreciation and peer-to-peer recognition, has gained recognition as a valuable aspect of recognition culture (Kessler et al., 2010).

Designing Effective Recognition Programs

Literature offers insights into designing effective recognition programs. For instance, a study by Gostick and Elton (2009) suggests that recognition programs aligned with organizational values and goals are more

likely to be successful. Clear criteria and transparent processes for recognition are also essential (Woods et al., 2017). Furthermore, research highlights the importance of customization and personalization in recognition initiatives to ensure they resonate with individual employees (Cohen et al., 2019).

Fostering a Culture of Appreciation

Creating a culture of appreciation requires deliberate efforts. Leadership plays a pivotal role in modeling recognition behaviors (Eisenbeiss et al., 2008). By leading by example and demonstrating appreciation for employee contributions, leaders can create a positive climate that permeates throughout the organization. Peer-to-peer recognition programs have been shown to enhance teamwork, collaboration, and overall organizational culture (Tidd et al., 2017).

Overcoming Challenges in Employee Recognition

Implementing recognition programs can present challenges. Resistance to change, lack of understanding, and skepticism are common barriers. Studies suggest that effective communication and employee involvement in the program design process can help overcome these challenges (Meyer et al., 2019). Measuring the effectiveness of recognition initiatives is another critical aspect, and metrics such as employee satisfaction, retention rates, and productivity can be used (Gennard and Judge, 2005).

Case Studies: Successful Employee Recognition Programs

Several case studies highlight organizations that have implemented successful recognition programs. For example, companies like Google and Adobe have gained recognition for their innovative approaches to employee recognition, such as peer nominations and spot bonuses (Henderson, 2012). These case studies offer practical insights and best practices for HR professionals seeking to implement effective recognition initiatives.

The review of literature emphasizes the significant role that employee recognition plays in fostering a culture of appreciation in the workplace. It underlines the positive impact of recognition on engagement and performance, explores various recognition program types, provides guidance on program design, and addresses challenges in implementation. The inclusion of case studies showcases real-life examples that inspire and offer

practical lessons for organizations aiming to harness the power of employee recognition.

OBJECTIVES OF THE STUDY

1. To examine the relationship between employee recognition and employee engagement: The study seeks to understand the connection between employee recognition initiatives and the level of employee engagement within organizations. It aims to explore how recognition influences employee motivation, commitment, and satisfaction.

2. To identify different types of employee recognition programs: The study aims to explore various forms of employee recognition, including formal and informal programs, monetary and non-monetary rewards, and individual and team-based recognition. It seeks to understand the advantages, challenges, and best practices associated with different types of recognition programs.

3. To provide guidelines for designing effective recognition programs: The study aims to offer practical guidance to HR professionals on designing and implementing effective recognition programs. It aims to identify key considerations, such as aligning recognition programs with organizational values, setting clear criteria and processes for recognition, and ensuring personalization and customization of recognition initiatives.

4. To explore the role of leadership in fostering a culture of appreciation: The study aims to highlight the role of leaders in promoting and modeling a culture of appreciation within the organization. It seeks to identify leadership behaviors and actions that positively influence employee recognition and contribute to creating a supportive and appreciative work environment.

5. To address challenges and measurement of employee recognition programs: The study aims to address common challenges faced in implementing recognition programs, such as resistance to change and skepticism. It also seeks to provide insights into measuring the effectiveness of recognition initiatives and identifying appropriate metrics to evaluate the impact of recognition on employee satisfaction, retention, and productivity.

Overall, the objective of the study is to provide a comprehensive understanding of the power of employee recognition and its significance in building a culture

of appreciation in the workplace. By achieving these objectives, the study aims to equip HR professionals and organizational leaders with the knowledge and tools necessary to effectively implement recognition programs that enhance employee engagement, performance, and overall organizational success.

EMPLOYEE RECOGNITION

Employee recognition refers to the act of acknowledging and appreciating the efforts, achievements, and contributions of employees within an organization. It involves giving credit and expressing gratitude for their hard work, dedication, and positive impact on the organization's success. Employee recognition can take various forms, ranging from simple gestures of appreciation to formal recognition programs. The purpose of employee recognition is to create a positive work environment where employees feel valued, motivated, and engaged. It serves as a powerful tool for reinforcing positive behaviors, fostering a sense of belonging and loyalty, and enhancing employee morale and job satisfaction. By recognizing and appreciating employees' efforts, organizations can create a culture that promotes productivity, teamwork, and continuous improvement.

Employee recognition can be expressed in different ways, including:

1. Verbal and Written Appreciation: Simple acts such as saying "thank you" or sending a personalized note or email to acknowledge an employee's contribution can have a significant impact. Verbal and written recognition can be spontaneous or part of regular feedback and performance discussions.

2. Public Recognition: Recognizing employees in front of their peers, teams, or the entire organization can be a powerful form of recognition. Public acknowledgment can be through team meetings, company-wide announcements, or employee recognition events.

3. Rewards and Incentives: Providing tangible rewards such as bonuses, gift cards, or other monetary incentives is a common form of employee recognition. These rewards can be tied to individual or team performance and serve as motivators to drive desired outcomes.

4. Career Development Opportunities: Recognizing employees' potential and investing in their professional growth and development is a form of recognition.

Offering training programs, mentoring, promotions, or challenging assignments demonstrates that the organization values employees' long-term success.

5. **Work-Life Balance Initiatives:** Supporting employees' well-being and work-life balance is a form of recognition. Offering flexible work arrangements, wellness programs, or time-off benefits shows that the organization cares about employees' overall happiness and satisfaction.

Employee recognition programs and initiatives can be formal or informal, structured or spontaneous, and can vary based on the organization's culture, size, and resources. The key is to ensure that recognition is genuine, timely, and tailored to the individual's contributions and preferences.

APPRECIATION IN THE WORKPLACE

Appreciation in the workplace refers to the act of recognizing and valuing the contributions, skills, and efforts of individuals within the work environment. It involves expressing gratitude, acknowledging achievements, and highlighting the positive impact of employees' work. Appreciation goes beyond merely recognizing the completion of tasks or meeting performance goals. It involves recognizing the qualities, behaviors, and attitudes that contribute to a positive work culture and organizational success. Appreciation can be directed towards individuals or teams and can be initiated by leaders, peers, or even customers and clients.

The importance of appreciation in the workplace cannot be overstated. When employees feel appreciated, valued, and recognized for their contributions, several positive outcomes can occur:

1. **Motivation and Engagement:** Appreciation plays a significant role in motivating employees. When employees feel their efforts are recognized and appreciated, they become more engaged and committed to their work. Appreciation acts as a source of intrinsic motivation, driving individuals to perform at their best and exceed expectations.

2. **Job Satisfaction and Well-being:** Employees who feel appreciated experience higher levels of job satisfaction. When their efforts are acknowledged, they develop a sense of fulfillment and pride in their work. Appreciation contributes to a positive work environment, fostering a

sense of well-being and reducing stress levels.

3. **Improved Relationships and Collaboration:** Appreciation strengthens relationships among team members and between employees and their supervisors. It creates a positive and supportive atmosphere where colleagues celebrate each other's successes and work collaboratively towards shared goals. Appreciation enhances teamwork, communication, and cooperation, leading to improved collaboration and synergy within the organization.

4. **Increased Retention and Loyalty:** Appreciation is a powerful tool for employee retention. When employees feel valued and appreciated, they are more likely to stay with the organization, reducing turnover rates. Recognizing employees' contributions and creating a culture of appreciation fosters loyalty and a sense of belonging, increasing employee commitment and dedication to the organization.

5. **Enhanced Productivity and Performance:** Appreciation positively impacts productivity and performance. Recognized employees are more motivated to perform at their best, resulting in increased productivity and higher-quality work. Appreciation acts as positive reinforcement, reinforcing desired behaviors and encouraging individuals to continuously improve their performance.

Appreciation in the workplace can be expressed through various means, including verbal praise, written notes or emails, public recognition, rewards and incentives, and opportunities for growth and development. It is important for leaders and organizations to foster a culture of appreciation by consistently expressing gratitude and recognizing the efforts of employees.

ADVANTAGES

1. **Enhanced Organizational Culture:** The article provides insights on how employee recognition can shape and improve the overall organizational culture. By fostering a culture of appreciation, organizations can create a positive and supportive work environment where employees feel valued, motivated, and engaged.

2. **Increased Employee Engagement:** The article highlights the positive correlation between employee recognition and engagement. By implementing effective recognition programs, organizations can boost employee morale, commitment, and productivity.

Engaged employees are more likely to go the extra mile, contribute innovative ideas, and actively participate in achieving organizational goals.

3. **Improved Performance and Productivity:** The article explores how employee recognition positively impacts individual and team performance. By acknowledging and rewarding employees' efforts and achievements, organizations can incentivize high performance and drive productivity. Recognition programs that link performance metrics to rewards can motivate employees to strive for excellence.

4. **Talent Attraction and Retention:** The article emphasizes how a culture of appreciation can attract top talent and contribute to employee retention. Organizations that prioritize recognition and appreciation are more likely to create an appealing work environment that attracts skilled individuals. Additionally, employees who feel recognized and valued are less likely to seek opportunities elsewhere, reducing turnover rates.

5. **Positive Employee Morale and Satisfaction:** The article discusses the role of recognition in boosting employee morale and satisfaction. When employees receive recognition for their contributions, they feel a sense of accomplishment and value. This, in turn, enhances job satisfaction and increases overall happiness and well-being among employees.

6. **Enhanced Teamwork and Collaboration:** The article explores the importance of peer-to-peer recognition and its impact on teamwork and collaboration. Recognition programs that encourage employees to appreciate and acknowledge their colleagues' efforts foster a sense of camaraderie and cooperation. This leads to improved teamwork, better communication, and increased synergy within teams.

7. **Practical Implementation Strategies:** The article provides practical strategies and guidelines for HR professionals to design and implement effective recognition programs. It offers insights into program design, criteria setting, leadership involvement, and overcoming implementation challenges. This practical advice equips HR professionals with the tools they need to successfully implement recognition initiatives.

DISADVANTAGES

1. **Lack of Individualized Approach:** The article may provide general guidelines and strategies for

implementing recognition programs, but it may not address the unique needs and dynamics of every organization. Each workplace has its own culture, workforce demographics, and challenges that may require tailored approaches to employee recognition. Relying solely on general recommendations may not fully capture the specific nuances of an organization's context.

2. **Limited Attention to Organizational Constraints:** The article may not extensively address the potential constraints and limitations organizations may face when implementing recognition programs. Factors such as budgetary constraints, organizational structure, or industry-specific regulations can impact the feasibility and effectiveness of recognition initiatives. It is important to consider and navigate these constraints while implementing recognition programs.

3. **Potential for Perceived Inequality or Unfairness:** In recognition programs, there is a risk of employees perceiving inequality or favoritism if the criteria and processes for recognition are not transparent or consistently applied. This can lead to demotivation and resentment among employees who feel their efforts are undervalued or overlooked. Clear communication and fairness in recognition processes are crucial to mitigate such risks.

4. **Overemphasis on Monetary Rewards:** The article may focus primarily on the importance of monetary rewards in recognition programs. While financial incentives can be effective, relying solely on monetary rewards may neglect the value of non-monetary forms of recognition, such as verbal appreciation, flexible work arrangements, or career development opportunities. A holistic approach that incorporates a mix of rewards and non-monetary gestures may be more effective in fostering a culture of appreciation.

5. **Lack of Long-Term Sustainability:** The article may not extensively address the sustainability of recognition programs over time. While initial implementation efforts may yield positive results, maintaining the momentum and ensuring long-term sustainability of recognition initiatives can be challenging. Organizations need to continuously assess and adapt their recognition programs to keep them relevant and effective.

6. **Potential Resistance to Change:** Implementing a culture of appreciation requires a cultural shift within the

organization. However, the article may not extensively address potential resistance to change or the complexities of organizational change management. Resistance from employees or leaders who are resistant to new practices or skeptical about the impact of recognition initiatives can hinder successful implementation.

CONCLUSION

It provides valuable insights into the importance of employee recognition and its impact on organizational success. The article emphasizes that creating a culture of appreciation is crucial for fostering employee engagement, increasing productivity, and driving overall performance. By recognizing and appreciating employees' contributions, organizations can cultivate a positive work environment where employees feel valued, motivated, and committed to their work. This, in turn, leads to higher levels of job satisfaction, improved collaboration, and reduced turnover rates.

The article highlights the various forms of employee recognition, from verbal appreciation to rewards and incentives, career development opportunities, and work-life balance initiatives. It underscores the need for leadership involvement in recognition programs and offers practical guidelines for designing and implementing effective initiatives. While implementing recognition programs may come with challenges, the article emphasizes the importance of customization, clear criteria, and continuous evaluation to ensure their ongoing impact and success. It emphasizes that recognition should go beyond financial rewards and encompass non-monetary gestures and opportunities for growth and development.

At last the present study emphasizes that employee recognition is a strategic imperative for organizations aiming to create a positive work environment, drive employee engagement, and achieve organizational success. By implementing effective recognition programs and practices, organizations can foster a culture that values and appreciates their employees'

contributions, ultimately leading to enhanced employee satisfaction, improved performance, and a thriving organizational culture.

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THERMAL DEATH KINETIC STUDY FOR EFFECTIVE STERILISATION OF MICROORGANISM

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ABSTRACT

Thermal death kinetics study is used to determine the minimum lethal time taken to kill a specific microorganism at specific temperature. The bacterial associated in spoiled vegetables are isolated by growing them in the nutrient media. The microorganism was identified by straining technique. The morphology characteristic was studied under microscope. The microorganism was destroyed in the way of different sterilization methods. Physical parameters for the death of the organism were optimised. The best sterilization temperature is suggested by getting the appropriate temperature and time taken for killing of the microorganism. The kinetic equation was developed using these mathematical models.

Keywords : Sterilization, Kinetics equation, First order kinetics.

INTRODUCTION

The shortest lethal period needed to eradicate a certain bacterium at a specific temperature is established using thermal death kinetics. This is the lowest temperature that, when used for a predetermined amount of time, will eradicate a microbiological population. With far shorter treatment periods than traditional heat treatment, high-pressure high-temperature therapy is effective at inactivating microorganisms by gently preheating, followed by fast volumetric compression heating, and cooling during depressurization.

One of the most popular techniques for eliminating bacteria that cause spoilage and disease is heat treatment. Pasteurization, a mild-heat process, is frequently employed for food products that are negatively impacted by heavy heating. It considers the application of the multiple critical site inactivation model to the kinetics of thermal death of bacteria and provides proof that, in the case of homogeneous bacterial populations, a curve derived from this premise fits experimental data to extremely high kill probabilities.

Sterilization is the elimination, destruction, or inactivation of all types of bacteria. Numerous techniques, such as heat, chemicals, radiation, high pressure, and filtration, can be used to sterilise. Heat

sterilisation is the most traditional, widely used sterilisation technique in the world. Heat has an impact on every substance and living thing on the planet. Heat increases the kinetic energy of atoms and molecules, breaking their connections and impairing their ability to function within a bacterium or other living thing. The categories of radiation (ionizing, non-ionizing), thermal (dry and moist heat), and chemical are used to classify various sterilisation methods.

When a reaction's pace and reactant concentration are inversely correlated, the process is known as a first-order reaction. To put it another way, the reaction rate doubles when the concentration does. One or two reactants can be present in a first-order reaction, as in the case of the decomposition process. A first-order reaction is one that has a reaction rate that is linearly dependent on the concentration of just one component. In other words, a first-order reaction is a chemical reaction in which the rate of the reaction varies as a result of a change in the concentration of only one of the reactants.

MATERIALS

Chemicals used are yeast extract, peptone, sodium chloride, agar, ethanol, dextrose, and distilled water. Equipments like Laminar air flow, Autoclave, Weighing balance, Beaker, Conical flask, Test tube, Bunsen burner, Petri plate, Inoculation loop.

METHODS

A sample suspension was created by dissolving 1g of damaged tomato in 10ml of sterile distilled water for the purpose of decreasing the microbiological population. A single colony was isolated using serial dilution. We took nine test tubes, each with 9ml of sterile water. Numbers were written on the test tubes' labels. Using a micropipette, 1ml of the rotten tomato solution was extracted from the filtrate solution mentioned above, added to the first test tube, and thoroughly mixed. Once more, 1ml of the material was extracted from the first tube and well mixed in the second tube. Up until the ninth test tube, the procedure was continued. For inoculation, the sample's middle three dilutions (5, 6, and 7) were employed. 1 ml of sample from each test tube is inoculated into petri plates containing agar media by the pour plate technique under aseptic conditions. The petri plates are marked as S1, S2, S3 as per the sample.

POTATO DEXTROSE AGAR PREPARATION

Potato were peeled and cut into small pieces then it was cooked in the boiling water. The boiled potato were smashed using mortar and pestle. Using a weighing balance, the ingredients were each separately weighed. Adding distilled water helped the components in a 500ml beaker to dissolve. The cooked potato was then added and well-combined. Then, for 15-20 minutes, autoclave the media at 121°C and 15lb pressure. Pour the media into the P1, P2, and sterilised petri plates. The organism that was cultured in nutrient media was inoculated using the inoculation loop and steaked in the media after the media had solidified. After that, incubate in an incubator for 24 hours at 37°C. Colonies began to form after five days.

SEQUENCING PROCEDURE

Genomic DNA isolation

DNA was recovered from microbial samples using Bogar Bio Bee shops Pvt Ltd.'s EXpure Microbial DNA isolation kit.

PCR Protocol

With the aid of a highly specialized enzyme, the Polymerase Chain Reaction (PCR) uses primers to amplify particular cloned or genomic DNA sequences. In PCR, the enzyme DNA polymerase controls the synthesis

of DNA from deoxynucleotide substrates using a single-stranded DNA template as a substrate. When a correctly constructed oligonucleotide is annealed to a longer template DNA, DNA polymerase adds nucleotides to the 3' end of the molecule. Therefore, DNA polymerase can employ a synthetic oligonucleotide as a primer and extend its 3' end to form a lengthy stretch of double-stranded DNA if it is annealed to a single-stranded template with a complementary region.

Taq DNA polymerase is given in 2X Taq buffer together with 0.4 mM dNTPs in the Taq Master Mix. 0.02% bromophenol blue and 3.2 mM MgCl₂. The MgCl₂ concentrations utilised were 3.2 mM and 0.02%.

To 25 litres of PCR reaction solution (1.5 litres of forward and reverse primers, 5 litres of deionized water, and 12 litres of Taq master mix), 5 litres of separated DNA should be added.

FIRST DETAILS

Name	Tag detail	Base number
ITSAMPLE	5' TCCGTAGGTGA ACCTGCGG 3'	19

Denaturation

The DNA template is 95 degrees Celsius in temperature. By enabling the DNA to split apart and produce single-stranded DNA, this disintegrates the weak hydrogen bonds holding DNA strands in a helix together.

Annealing

The combination receives heat up to 60°C. The corresponding sequence in the template DNA can then be bound by the primers (annealed).

Extension

The temperature is subsequently raised to 72 °C, which is the optimum temperature for DNA polymerase. By adding nucleotides one at a time to the primers while using the target DNA as a template, DNA polymerase extends the primers.

Sequencing protocol

Using universal primers for the below 16s rRNA, single-pass sequencing was carried out on each template. An ethanol precipitation technique was used to separate the fluorescently tagged fragments from the unincorporated terminators. On an Applied Biosystems ABI 3730xl

sequencer, the samples were electrophoreses after being redissolved in distilled water.

RESULT

Selection of the proper growth medium, sample collection and processing, dilution, incubation, colony morphology, streaking, and confirmation of microbial identity are all phases in the isolation of microorganisms from a sample. The microorganism are identified as fungi those they are having the spores and then this has been sub-cultured in PDA media. The pure culture was grown in the PDA media.



ISOLATED ORGANISM

SEQUENCING RESULT

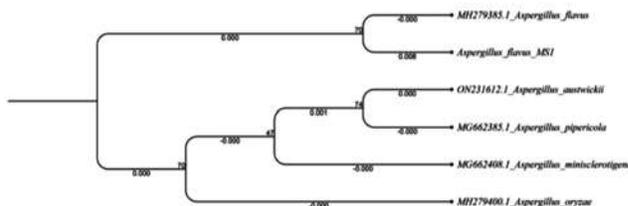
In rotten tomatoes, the fungus *Aspergillus flavus* is frequently discovered. The 18S rRNA sequencing technique is commonly used to determine the species of fungi. The organism can subsequently be identified and its evolutionary relationships with other species can be ascertained by comparing the obtained sequences to databases of known 18S rRNA sequences.

CONTIG ANALYSIS

TTCTTGGTCCATTTAGAGGAAGTAAAAGTC
 GTAACAAGGTTTCCGTAGGTGAACCTGCGG
 AAGGATCATTACCGAGTGTAGGGTTCCTAGC
 GAGCCCAACCTCCCACCCGTGTTTACTGTACC
 TAGTTGCTTCGGCGGGCCCGCCATTCGTGGC
 CGCCGGGGGCTCTCAGCCCCGGGCCCGCGCC
 CGCCGGAGACACCACGAACTCTGTCTGATCT
 AGTGAAGTCTGAGTTGATTGTATCGCAATCAGT
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 ATA ACTAGTGTGAATTGCAGAATTCCGTG
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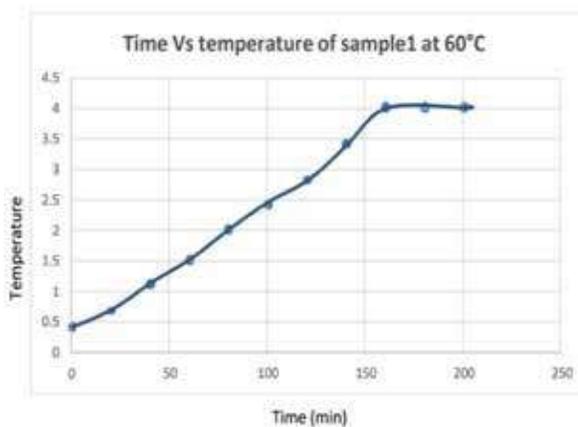
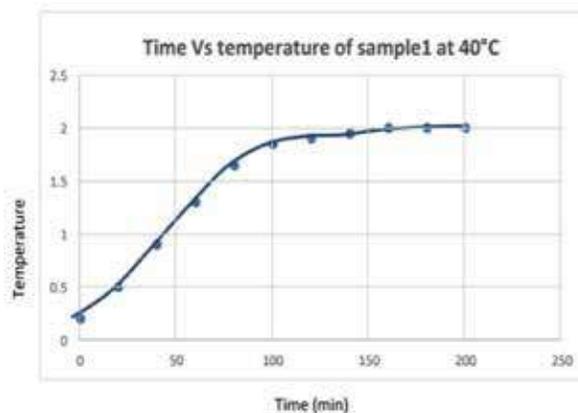
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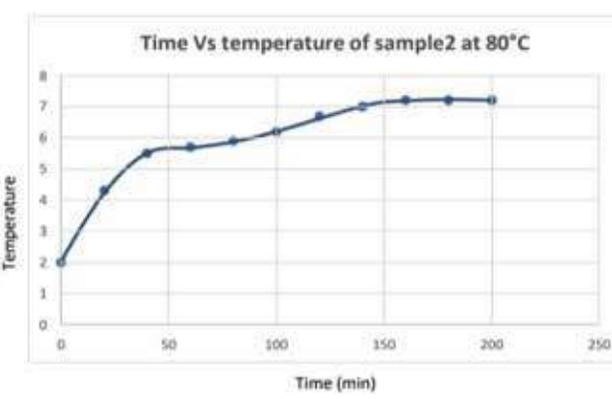
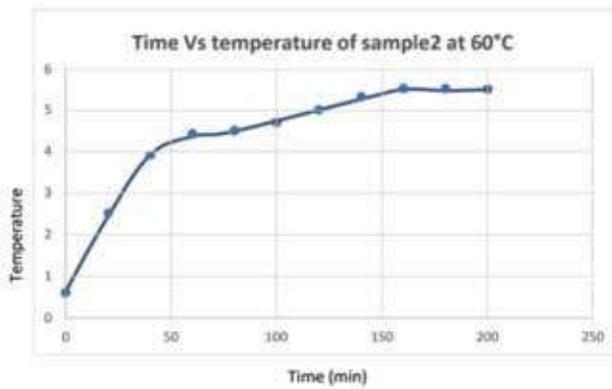
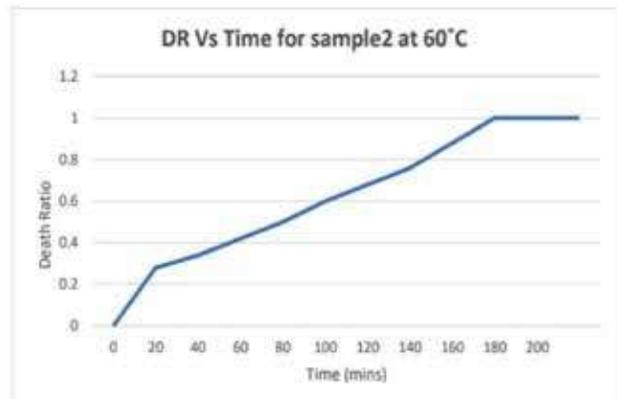
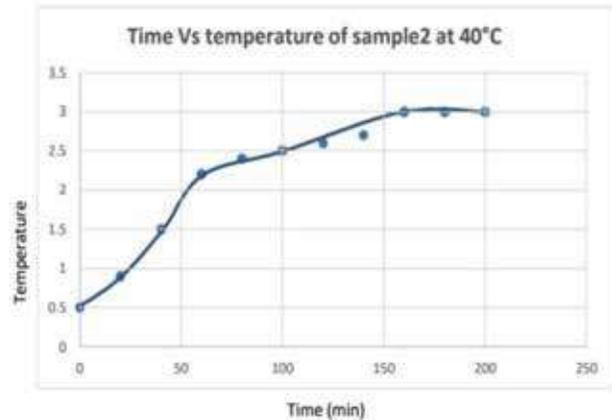
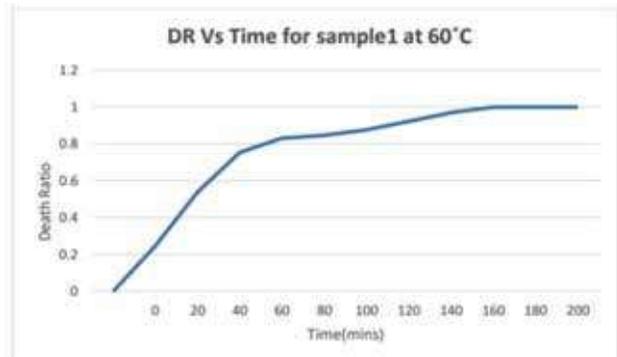
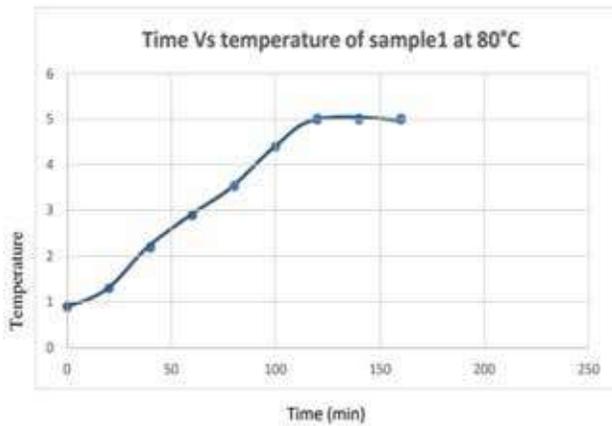
PHYLOGENIC TREE OF ASPERGILLUS FLAVUS



DEATH KINETICS

The experimental data for temperature for all of the materials under examination during death are shown in figures for different temperatures ranging from 0.01 to 8 kg/kg dB. Each diagram shows the death kinetics for each material at three distinct bath temperatures. Higher water temperatures result in a higher death rate when all other process factors are held constant.





CONCLUSION

In the study, native fungal strains were isolated and identified from damaged tomatoes. It took the organism 5 days to fully develop in the culture, after which the species was identified by DNA sequencing. *Aspergillus flavus* has been identified as the fungus in question. The taxonomy of the isolated fungus species is provided by the sequencing outcome. The fungal staining approach was used to observe the species' structural characteristics. The temperature that is appropriate for the microorganism's demise has been described using a first order kinetic model. It was discovered that the temperature had an impact on the fungi's mortality rate. The materials under investigation have a rehydration ratio that falls between 1 and 2. Due to the cellular and structural damage that occurs during death, the death ability appeared to display a hysteresis during sterilisation.

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UTILIZING A FUZZY LOGIC CONTROLLER, A SMALL-SCALE MICROGRID POWERED BY HYBRID WIND AND SOLAR BATTERIES CAN MANAGE ITS ENERGY

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ABSTRACT

This paper describes a power operation system grounded on a fuzzy sense regulator for managing small-scale power inflow and locally distributed generation in a system. Wind and solar power plants are the principal energy sources for a standalone microgrid (MG). A super capacitor (SC), a diesel creator (DG), and a battery storehouse system (BSS) are all part of the reinforcing system. The DC machine is linked to numerous energy sources. To model the MG, the MATLAB/Simulink Sim Power System is employed. Originally developed to address power shortfalls in diesel generators, the supercapacitor was employed as makeup and had a charge and discharge current restriction for BSS. The proposed management scheme's major goal is to keep the system's power balanced. Some of the performance indicators that are accessed are frequency deviation, DC link potential stability, and distortion factor of AC potential. The effectiveness of the intended project was evaluated using simulation. The simulation results validate FLC-based management. Furthermore, the efficacy of the FLC perspective and the robustness approach differs. FLC lowered the daily load by 18.7% when compared to the robust method. The study demonstrates that the FLC's power signal quality outperforms the predefined technique.

Keywords : Efficient energy use, Isolated Microgrid, Fuzzy logic controller, Reusable energy sources, Super Capacitor are all terms used to describe distributed generation

INTRODUCTION

The off-grid microgrid that is the subject of this study is connected to all power sources by a Direct Current link, as shown in diagram 1. Off-grid electric grid are viewed as favouring from the armature since it facilitates the development and improvement of energy from solar and wind sources [1]. The power signal's quality must fall within a acceptable limit. Distortion factor of the potential signal (THDv) is reduced by constant force voltage and Alternative current frequency [2]. In this study, Microgrid has a sizable amount of Photovoltaic power generators and wind power generators. The main energy reserve is accessible energy, which, in the event of unanticipated cargo diversions, maintains the Direct current connection voltage within the specified range. As a backup, a diesel creator (DG) paired with a super capacitor (SC) is used. To better balance high efficiency and cargo distribution, the system should be

appropriately governed. Stage-alone MG power systems frequently use DG as a reliable backup power source since it can offer long-term support [3]. Because of slow dynamic behaviour, it takes a few seconds to reach its output voltage and frequency stability [4]. SC makes up for power during developing DG. It is capable of an instantaneous reply time, can store massive amounts of energy quickly, and provides electrical power in the sense of electricity [5]. The stand-alone Direct Current Microgrid combined with SC based on Diesel creator, Battery Storage System, Photovoltaic Energy

Generator and Wind Energy Generator is the subject of this inquiry. MATLAB software is used to design and control it. More specifically, it's important to ensure voltage management, sharing of power, and efficient use of energy [6]. In order to govern the key variables according to the energy produced by the PVEG and WEG group, together with the battery storage system (BSS)

state of charge (SOC), and SC, an operating system unit is needed. It presented a power operation approach to serving loads with as little power force loss as possible. Under vivid downpours and colourful freight demands, the DC machine is kept within a reasonable range (380-400 V). More specifically, voltage management, power sharing, and energy-efficient operation must be ensured [6]. An operating system unit is required for this purpose to control the primary factors based on the power generated by WEG and PVEG, as well as the BSS state of charge (SoC) and SC. It is challenging to create and put into practise a traditional operating strategy for such a complex system. Both its dynamic ability and stable state faults are poor. The switching losses of power transformers and high fault-forbearance negatively affect and distortion factor of the affair electrical voltage signal. Flexibility and quick responses are required for operation strategy. As a result, in this study, a fuzzy sense regulator (FLC) technique is proposed. In contrast to the traditional and digitally logical sense, which only works discrete numbers of one or zero, FL is a great system that evaluates analogue values of input based on logical factors that take continuous values concerning zero and one [7]. Operating large, complex systems with poorly known behaviour or when a rapid approximation is extremely helpful [8]. Since based on knowledge design principles are able to be immediate realised in systems with undetermined things, the FLC technique may play a vital part. In a variety of environmental factors, the suggested control the formula ensures the ideal system operation. It suggested a more advantages conclusion for carrying out a stage-alone procedure. The suggested manage technique makes sure that all of the power produced by WEG and PVEG is effectively transmitted, reducing reliance on DG and eliminating continuous BSS charging process and discharging process. Reference in [9-23] covered the RES-grounded MG's power operations. In [9], FLC is imposed as the based administrator power operating strategy of mixed DG/PVEG/WEG with BSS. An Microgrid is mostly composed up of PVEG in [11], and SOFC is taken into account. To optimise the energy input between the MG and SC, an optimisation system based on FLC is proposed. The control strategy guarantees stability and fluid dynamic reactivity. The signal THD is used to estimate the affair power, which is adjusted to be within the IEEE-approved range. [12] present a RES and ESS-based FLC-grounded energy operating strategy for residential use on the MG grid. The design aims to

decrease oscillation and manage the grid's power quality. This analysis keeps track of the power delivered and received by the grid using the MG the power conversion process rate and the State of Charge (SOC) of the BSS. A Photovoltaic connected to the grid system and BSS are used to serve a home load utilising an FLC-based management of energy technique described in [13]. To control household energy demand, a load-priority-based approach is adopted. To satisfy the demands of a home DC load, a PVEG with BSS is linked to an FLC system in [14]. The electrical power conditioner is regulated to control the electrical power travel from/to the BSS. The outcomes illustrate FLC's benefits over conventional PID controllers. The PVEG standalone MG system is managed by the FLC [15]. To ensure a stable power supply, FC and BSS are included. The proposed management technique maximises hydrogen production while optimising power generation. Using the energy produced by Fuzzy Controller and PVEG, a water pumping load works in [16] using an FLC-based power management scheme. Systems for mechanical motion and electrochemical storage are employed. The controller ensures that power is produced constantly, and that water will be inexpensively available. [17] manages the electric power transfer of a solitary BSS/PVEG/WEG/ MG using an FLC scheme. The key goal of the plan is to maintain load balancing despite variations in power generation. Results from the simulation are used to verify the approach's capabilities. [18] A FLC system to manage energy for the multi-function mode of the smart MG was developed. The elements that make up residential MG are PVEG, FC, and BSS. Based on current energy consumption and output data as well as projections for the future, the control strategy aims to choose the best process style. Distribution of energy and cost estimates are carried out for each scenario to validate the management strategy. [19] optimises FLC design to regulate electricity flow from various RES. Different storage techniques, including BSS, SC, and storage for hydrogen tanks, were investigated to handle fluctuations in RES generation. In order to lessen the unpredictability and instability of recyclables in the MG system, [20] adopted the FLC management of energy method. The MG simulation model's two main parts are photovoltaic panels and BSS units. The MG operates by adaptable regulation of the in two directions DC/AC switch and BSS section in different configurations along with to the PV system. An innovative BSS management approach that combines PVEG, BSS, & a tiny residential

group was given to MG by [21]. The topic of the research is located in a region with a great potential for solar radiation, but it is constrained by periodic cloud movement. Utilizing FLC, which covers rules based on resident behaviours, SOC of BSS, PVEG, as well as the cost of kWh purchased from the supply provider, the management technique is created. This method was successful in providing power to consumers while avoiding grid disturbance and maintaining BSS SOC at 100%. [22] Two FLCs were in charge of managing the electricity produced by the PVEG, WEG, FC, DG, and BSS. Utilizing simulation software, the MG recyclables is simulated. The findings indicate that FLCs can control intermittency in RES to deliver continuous electricity. [23] With the use of FLC, power flow from various power sources is kept balanced. A few rules are used to decrease BSS use, ensure consistency, and preserve the equilibrium that occur between sources of energy, keeping, and demands. The following improvements and contributions are made to this document: A power handling approach built on the FLC technique is realized for a discrete direct current (DC) MG. The method relies on sharing of load, PID controllers, WEG/PVEG controllers, and synchronizing DC-bus voltages. DG will be utilized as a safeguard if BSS is unsuccessful. When starting with SC, this technique assumes slow DG motion. When the deficiency/excess power exceeds the capacity of the BSS, the SC is also used to discharge/charge the energy. This technique considers the SC fast self-discharge problem. The system takes into account a dump load in order to handle additional power in situations of completely charged BSS and SC. The weak dynamic performance of the deterministic technique was addressed in this work by reducing error in steady-state and energy converter transfer losses. Plus, it mitigates the output voltage signals THDv.

EXISTING SYSTEM

For a discrete direct current (DC) MG, a power management method depending on the FLC methodology is used. The idea is based on matching DC-bus voltages with PID controllers and sharing WEG/PVEG/load. If BSS fails, DG will be used as a backup. This scheme replaces the gradual movement of DG while beginning with SC. When the shortage/excess power exceeds the capacity of the BSS, the SC is used to discharge/charge the energy.

This technique considers the SC fast self-discharge

problem. A dump load is considered in fully charged BSS and SC systems to properly manage excess power.

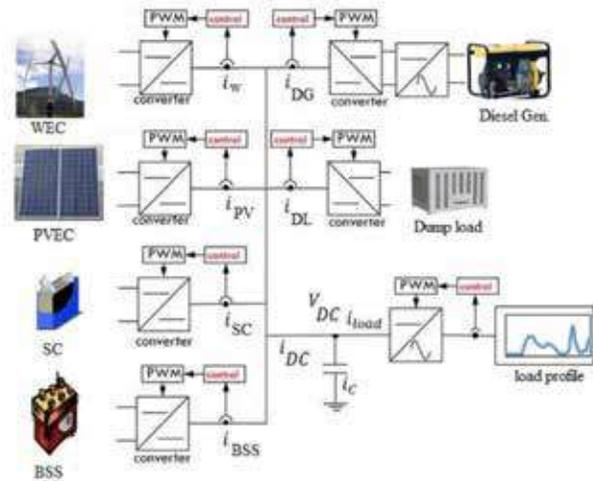


Fig 1. Illustration of the independent power system

Defects

This study improved the low dynamic performance of the conventional technique by reducing error in steady-state and loss of switching in power converters. Furthermore, it brings down the output voltage signal's THDv.

PROPOSED SYSTEM

Managing small-scale power flow and locally distributed generation in a system, this paper proposes a fuzzy logic-based power management methodology. A freestanding microgrid's (MG) main energy sources are renewable energy sources like solar and wind power plants. Three components of the reinforcement system are the supercapacitor (SC), diesel engine (DG), and the battery backup system (BSS). The DC bus is associated with different energy sources. Modelling the MG makes use of the Simulation and MATLAB Sim Power System. Originally introduced due to power shortages in diesel generators, the supercapacitor was used as makeup and had a charge and discharge current limit for makeup for BSS. The major goal of the suggested management plan aims to keep the power of the system in balance.

SYSTEM DESCRIPTION

PVEG System

The photovoltaic (PV) cell model used in this investigation, which is based on the use of one diode with a total of four characteristics, is shown in Figure 2.

Models of the photovoltaic (PV) panels utilized in this investigation can be found in [1-6].

$$I \text{ equals } I_L - I_0[\exp(V+R_s I/V_t)-1] \quad (1)$$

$$V_t \text{ equals } N_s k T / q \quad (2)$$

$$I \text{ equals } I_0 \exp(V_{oc}/N_s V_t) \quad (3)$$

$$I_{sc}(T) \text{ equals } I_{sc} (1+k_i/100(T_{cell} - T_{stc})) \quad (4)$$

$$V_{oc}(T) \text{ equals } V_{oc}+k_v (T_{cell} - T_{stc}) \quad (5)$$

$$T_{cell} \text{ equals } T_{ambient} - ((NOCT-20)/0.8) G \quad (6)$$

k acts as the Boltzmann ratio ($J/^\circ K$), a is the ideal state factor, I become the process current and I_L is the illumination current as well I_0 is the diode affect achromatism current, & K_v seems the voltage measurement temps, expressed in $V/^\circ C$. $A/^\circ C$ denotes for the current-measured temps, k_i for the electron's charge, N_s over the number of series-connected cells in the panel, and R_s for the initial series resistance of the array. T is the temperature of the PV cells at STC ($^\circ K$), Volt (v) is the operation voltage of the array, and V_t is the thermal voltage of the array. The NOCT is the level of temperature below normal conditions of operation, whereas T_{cell} equals the temp of the cell. Photovoltaic Energy Generation monitoring algorithms (P&O) are integrated into the control system topology of the MPPT controller. A total of 1.888 kW of power is generated by the PV system.

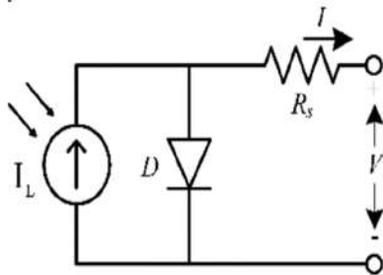


Fig. 2. Circuit model for a single-diode photovoltaic cell

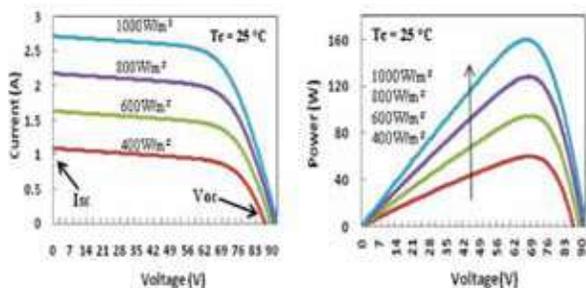


Fig. 3. Variable sun radiation and a cell the temp of 25 °C are aspects of the VI solar array model

System WEG

A model is created for a miniature wind turbine with a vertical axis and three helical blades. The PMSG, or permanent magnet synchronised generator, is part of the wind turbine. The WEG system's mathematical model is displayed in [7-9]. The rotor turbine is powered by wind energy [7].

$$P_t = \frac{1}{2} \rho a C_p A_t V_w^3 \quad (7)$$

The value of the wind energy coefficient is C_p , the density of air is ρa , along with V_w is wind speed in the turbines, A_t is swept area. The power ratio (C_p) curve is shown in Figure 4. The wind energy generated given [8], where the rotational speed of the blades Ω is determined using the PMSG system's engine, can be used to calculate the turbine's torque on the rotating shaft (T_t).

$$d/dt W_r = 1/J (T_e - F W_r - T_t) \quad (8)$$

An electrical generator receives mechanical power in the form of the produced shaft mechanical torque (T_t). The mechanical mechanism of the electrical generator is shown in [9].

$$T_t = P_t / \Omega = \frac{1}{2} \rho a C_p A_t V_w^3 / \Omega \quad (9)$$

Where F is the rotor and cargo's viscous friction, T_e is the electromagnetic torque, J is the rotor and cargo's combined inertia, and the angular velocity is W_r . A sinusoidal electrical model is used to determine T_e in a synchronous reference frame. A schematic representation of the WEG model and its testing is shown in Figure 6.

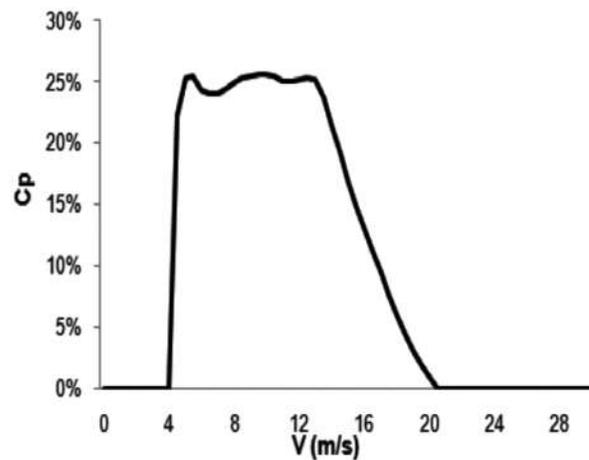


Fig. 4. Energy co-efficient versus varying wind speeds

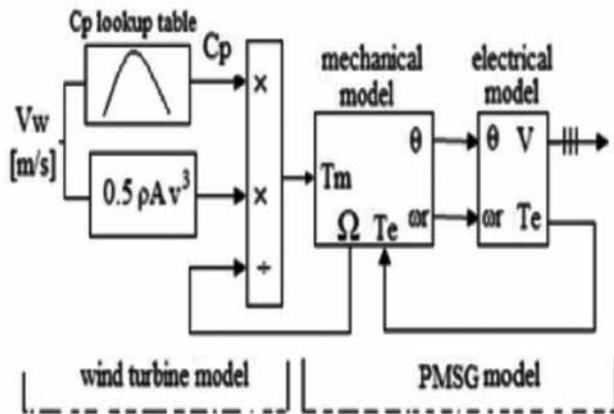


Fig. 5. Diagram of the WEG model's SimulinkSimPowSys simulation

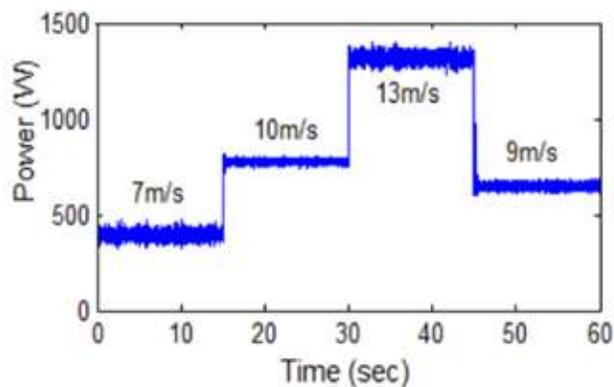


Fig. 6. Diagram of the SimulinkSimPowSys framework verifying the accuracy of WEG model

Diesel Generator

Machine, governor, exciter, and synchronous generator are the initial components of DG. Machine control of speed, a generator with synchronous function, and a regulator of the voltage make up the majority of the DG model. Figure 7 depicts the DG module schematic, while Figure 8 depicts the MATLAB/ Simulink SimPowSys simulation model. The combustion technique and machine design determine the mechanical component, while the generator's synchronous function and regulation of voltage prescribe the electrical component.

The model estimates affair machine power using tabular machine energy data related to rotational speed (rad/s). In order to establish an optimal dynamic system and promote equilibrium, the synchronous generator's excitation voltage is regulated by (AVR) Automatic Voltage Regulator, which also controls the rotor angle and generator output voltage.

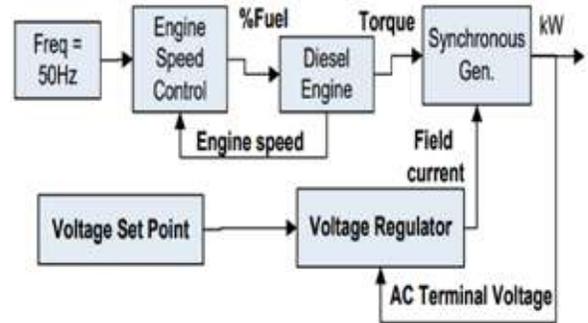


Fig. 7. Diagram of the DG model used for modelling

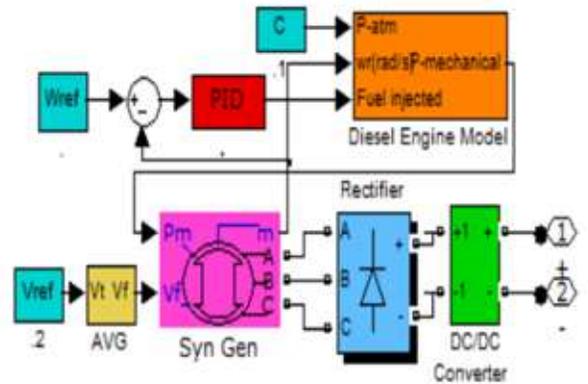


Fig. 8. MATLAB simulation design for DG modelling

Systematic Use of Batteries

This simulation research examines the included Simulation module designs of a lead-acid battery BSS, which is essentially made up of a controlled source of voltage that depends on the power bank's capacity, charge, as well as discharge rates. In Figure 9, the model is shown. The DC machine is connected to the battery by a buck DC/boost/DC motor. A simplified version of the management approach is shown in Figure 10.

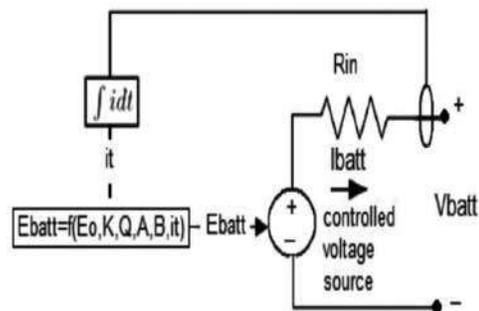


Fig. 9. An analogous lead acid battery electrical circuit is used for modelling and controlling battery storage systems

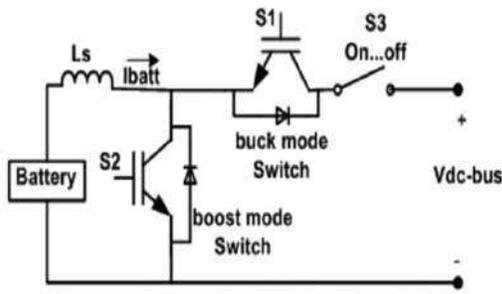


Figure 10. Battery storage system modelling and control: A diagram of the battery and the direct current (DC) bus control system

Super Capacitor (SC)

Figure 11 shows SC as a source of controlled voltage and its internal resistance. Figure 12 shows the supercapacitor final voltage V_{sc} , supercapacitor (I) current i_{sc} , as well as self-discharge (I)current i_{self_dis} performance of the SC model during electrical charging and even self-discharges [15].

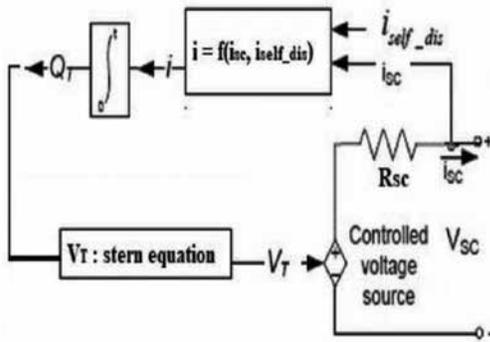


Fig. 11. Modelling & validation of supercapacitor SC: SC equivalent electrical circuit

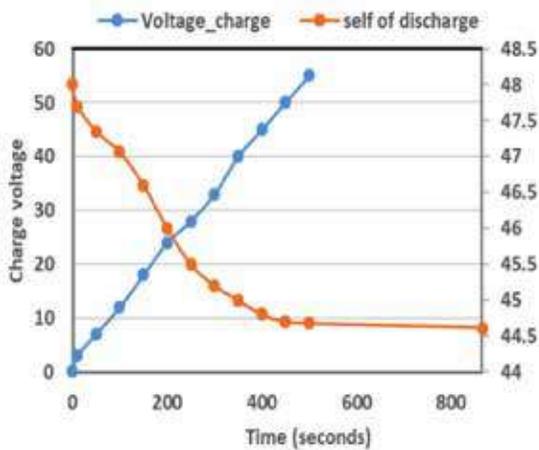


Fig. 12. Supercapacitor SC model creation and verification: it's charging as well as self-discharging performance

Dump Load (DL)

A strong motor and a collection of resistors make up DL. The WEG and PVEG-rated output power will be 28 times lower than the Dump Load-rated power. Dump Load is linked to the DC bus.

Fuzzy Logic Energy Management (FEM)

Figure 13 depicts the components of a fuzzy logic system: rules, fuzzifier, inference, and defuzzifier. Inputs are routed through a rule-based inference block. Figure 14 depicts the primary components of each FLC. Fuzzy inputs & guidelines are sent to the inference block. Human experience provides the basis for rules. The Mamdani type is used in this study to build fuzzy inference.

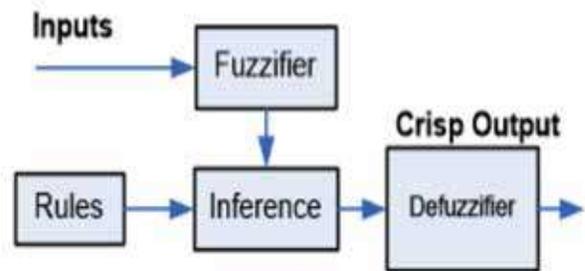


Fig. 13. A fuzzy logic system: (a) FLC's essential elements

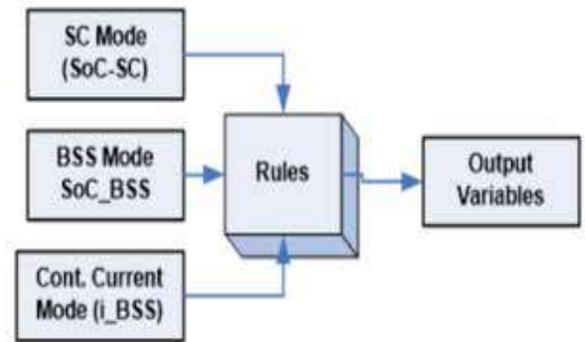


Fig. 14. A Fuzzy logic system: (b) Common FLC model setup

Fuzzification

The three different fuzzy inputs and a single fuzzy output of the FEM are shown in Figure 15. These are the three inputs: i_{BSS} , SoC_{SC} , and SoC_{BSS} . SoC_{BSS} and SoC_{SC} are, VL for veritably low, L for low, M for medium, H for high, and VH for veritably high. HI, I, LI, O, and HO stand for high insufficiency, insufficiency, low insufficiency, overdose, and high overdose, accordingly.

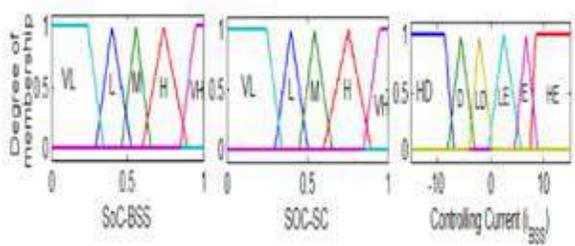


Fig. 15. The inputs SOC-SC, SOC-BSS, and controlling current determine membership

Inference

Both the overpowering and underpowering modes are visible. The following step defines the if-then logic premise. An example of a scenario that could happen in the low overload mode is given below: If the power type is high definition (HD), the SOC_BSS is Very Low, and the SOC_SC is Medium, there is a high probability that the DG will operate.

Defuzzification

Following the application of fuzzification rules, the next step is to define defuzzification. The system of the centre of graveness is applied in this investigation. Figure 16 depicts the FEM system’s affair member functions with sigmoid functions of varying values for each kind.

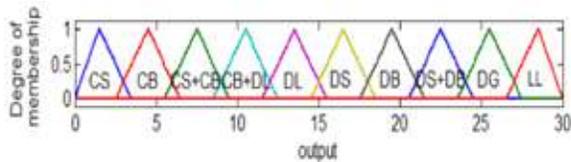


Fig. 16. Membership-based output-variable functions for each component of the sophisticated hybrid energy system

Simulink Model for Power Balancing of Hybrid System

The proposed system displayed in Figure 17 is demonstrated by creating a simulation structure of the MG under review using the MATLAB/simulation software. The proposed PID controller power operation control approach is used to regulate the converters, with the goal of balancing the power influx by keeping the DC-bus within a set respectable range. By using specific performance indicators including frequency division, voltage on the DC bus stability, and THDv, the simulation trials are intended to verify the viability of the suggested energy operating strategy. The efficient distribution of the necessary power to various energy

sources is another sign of a successful energy operation strategy. The simulation results were covered and recorded to do the required analysis, which comprised the power generated by the DG, PVEG and WEG.

The battery backup system and SC systems receive power installation / removal. Two different kinds of SoCs are SoC- SC and SoC- BSS. It should be noted that the BSS system currently in charge of charging the iCBSS and controlling the discharge simulation depends on actual data on rainfall and freight interest in a particular area. The units of solar energy and cargo requirement are 1.0 kw/m² (pu). In m/s and oC, respectively, the speed of the wind & temp is expressed.

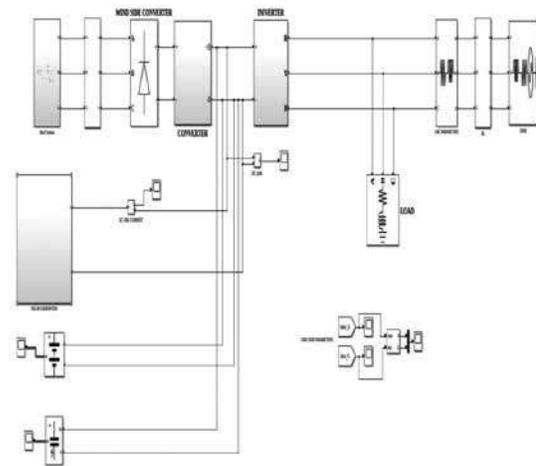


Fig. 17. Using a hybrid wind and solar battery, the proposed fuzzy base small-scale Microgrid is simulated

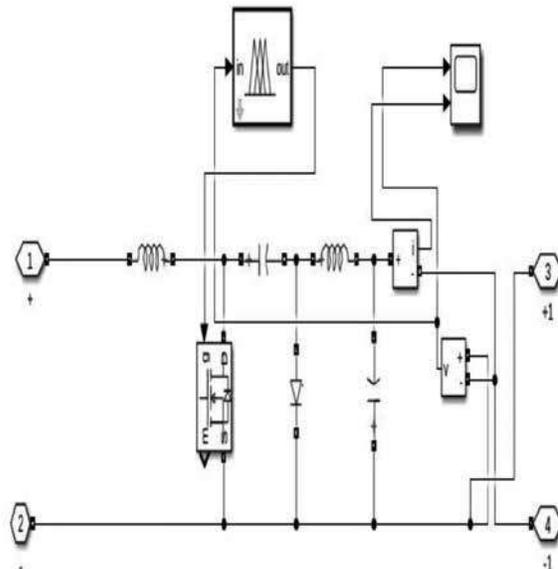


Fig. 18. Simulation model of Fuzzy Logic Controller

The converter is made up of a fuzzy logic controller and a MosFET. Creates a Fuzzy Inference System (FIS) with the parameters supplied. The module evaluates the FIS and generates the related output values for a given set of input data. Fuzzy is employed here to provide a more consistent and accurate value. The maximum output power is obtained by using this output value.

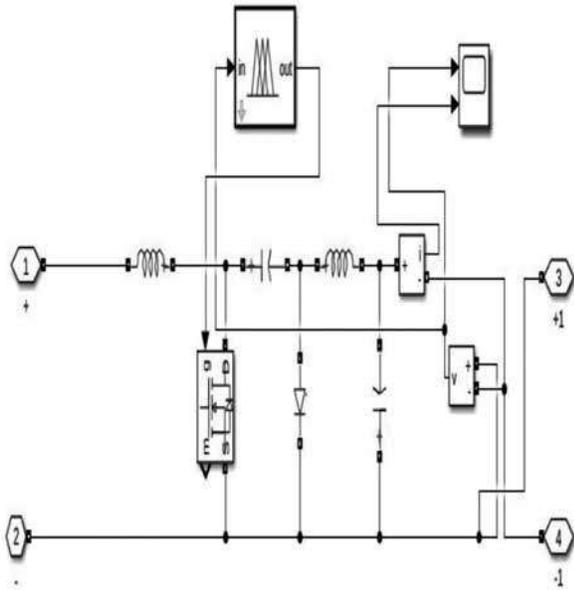


Fig. 19. Simulation model of Inverter

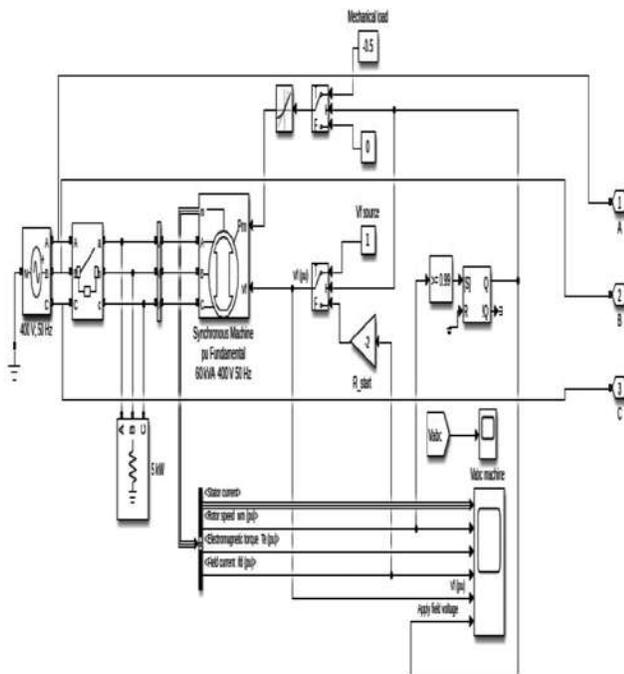


Fig. 20. Wind turbine simulation model



Fig. 21. Model for Simulating Solar Generation

Figure 22 depicts a single PV array from the two preceding PV arrays.



Fig. 22. Simulation model of PV array

Figure 23 depicts the above PV array with 39 solar cells.

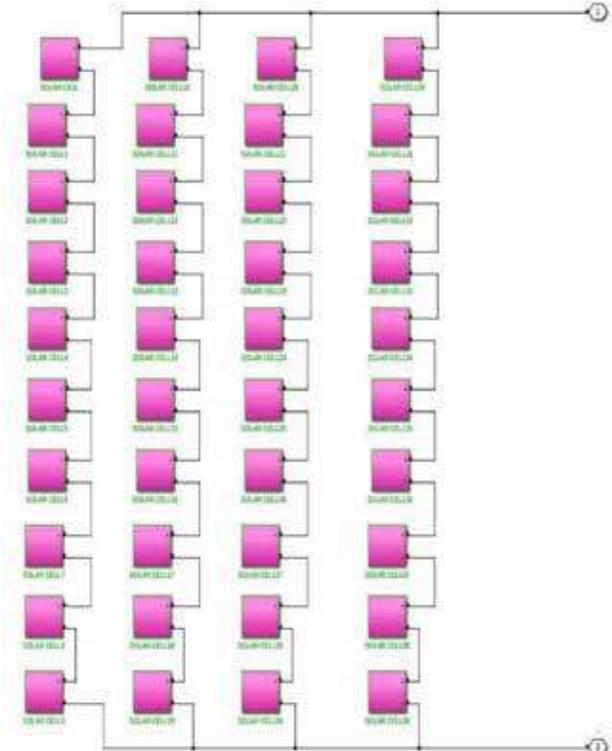


Fig. 23. Simulation model of 39 Solar cells

SIMULATION OUTPUT

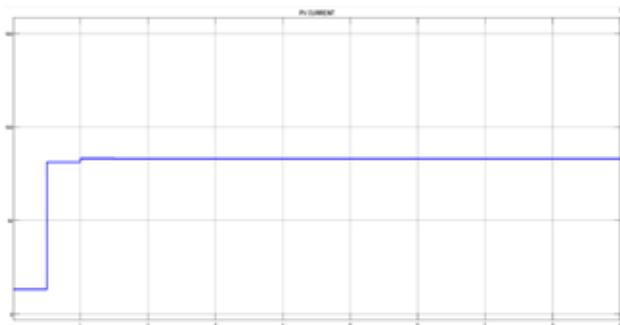


Fig. 24. Simulation output of PV current

The above waveform depicts the PV current generated by solar panels. A solar generator is made up of two PV arrays, each with its own PV array. Finally, the PV array is made up of 39 solar cells. As a result, solar cells can produce PV current. The photovoltaic (PV) current is initially raised from zero to thirteen, as indicated by the figure. This is the solar panel's initial current; following the solar hook-up, it will continue to provide this current for a while before increasing to 80 amps. The solar current has reached this final value. Amperage states that as the voltage rises, the current rises along with it. The current progressively grows and reaches a certain final amount as the voltage produced by the solar panel rises throughout the day. The term for this is PV current.



Fig. 25. The direct current link voltage output from simulation

Fig. 25 displays the Direct Current Link voltage output. There are several different power sources connected to the DC bus. As shown in Figure 17, take the output of the solar generator to create the DC link. The solar voltage ranged from zero to 350v at its beginning. Maximum Power Point Tracking, or MPPT, is what this is. This is the solar panel's maximum voltage, which decreases to zero as night falls. However, it does not go to zero because it still contains some voltage, which causes it to stay at 10, as seen in Figure 25.

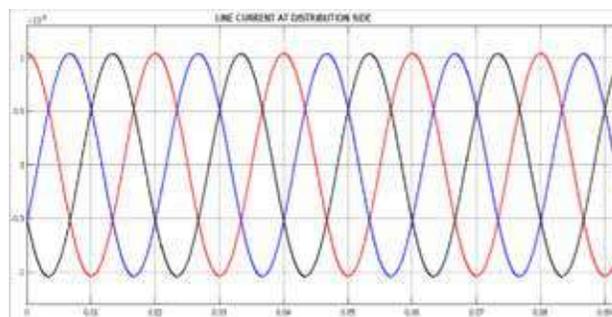


Fig. 26. Simulation output of Line Current at the Distribution Side

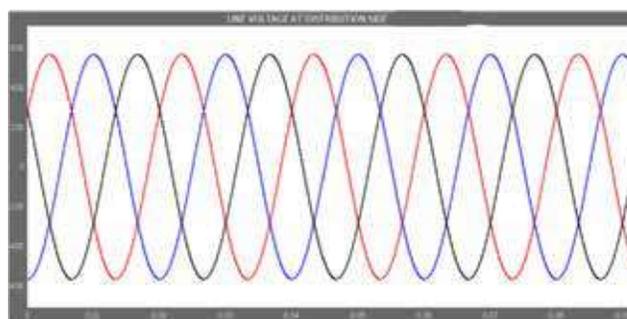


Fig. 27. Simulation output of Line Voltage at the Distribution Side

The battery is stored in the storage system after receiving the voltage and current inputs from the solar and wind sources, and after increasing the inputs because of the fuzzy logic controller as illustrated in Figure 18, the power from the battery is sent to the inverter. After getting the DC voltage and current, it turns them into AC using an inverter, as seen in Figure 17 for V_{abc_G} and I_{abc_G} . So, as shown in figures 27 and 28, we obtain three phase current and voltage. a 3-phase output is used because: We convert the input from DC to AC because our primary goal is to distribute voltage to the home's components. V_{abc_G} is the supply side line voltage, and I_{abc_G} is the supply side line current. Both V_{abc_G} and I_{abc_G} give results.



Fig. 28. Simulation output of Real Power flow

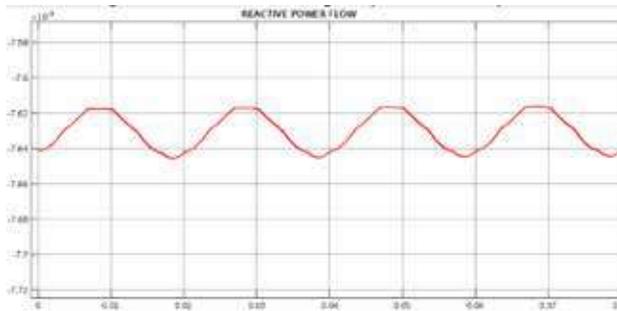


Fig. 29. Simulation output of Reactive Power flow

Following the acquisition of V_{abc_G} and I_{abc_G} , the signal is fed to the power (3ph, instantaneous) shown in Figure 17. Finally, power provides us with both real and reactive power. While reactive power maintains the voltage that needs to be controlled for system reliability, real power actually does useful work.

HARDWARE IMPLEMENTATION

Hardware

In order to handle power overflows in a simple and innovative distributed generating system, this study proposes a power operation approach designed around the Arduino microcontroller. The design is a reliable system with flexible input requirements. These types of systems are capable of processing a wide range of inputs, including confusing, skewed, or inaccurate data. You can reprogramme the feedback detector to your needs if it stops working.

System Block Diagram

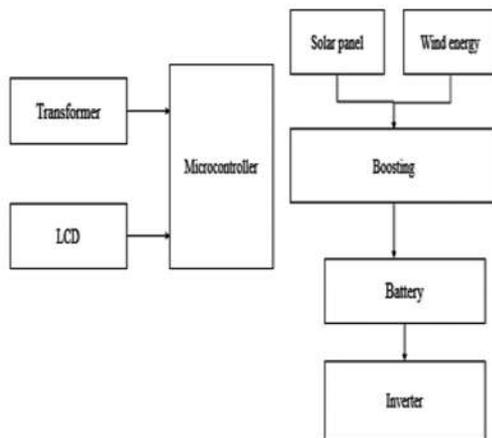


Fig. 30. System Block Diagram

In this instance, we used two forms of energy. These two inputs, a wind turbine and a solar panel, are added to one another if the two inputs are the same. Stability

checker has been introduced if it differs. When the voltage generated by a solar panel is less than the voltage of the wind, for instance, a stability controller is now added, and electricity is then sent to a battery for storage. the battery is connected to their output. We use two 6V batteries connected in series to get 12V output. The booster is connected to the battery output. Because of the 240V bulb, a booster is utilised to augment the battery power and achieve stable output. As a result, the booster output is linked to the inverter after boosting to convert DC to AC. The wattage sensor is used to display the value of the power sources stored in the battery in real-time. Fuzzy logic is used to process boosting. In this case, the Arduino UNO is utilised to identify the error, which is then used as feedback and supplied back into the input. This process is repeated, and the voltage is then increased. Finally, using fuzzy logic, the output maintains some value.

Circuit Connection Diagram

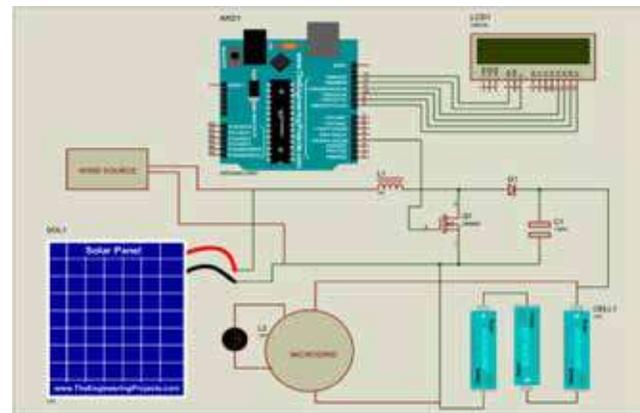


Fig. 31. Circuit Connection diagram

Fuzzy Algorithm

The fuzzy rule algorithm sequentially accumulates numerous fuzzy control rules. This rule, which governs the system to meet the required performance requirements, is constructed using a variety of intelligent system control information. Maximum minute mixing relates to the fuzzy estimation of FLC using the Mamdani approach. Three parts make up FLC's fuzzy inference the entire system: an information base, a collection of data base, and a reasoning method [19]. The input parameters V_{dc} (V_{dc} -error), ΔV_{dc} (V_{dc} -error), 7 language fuzzy groups, an operational fuzzy block structure (fuzzification, fuzzy guide base, and also defuzzification), V_{dc} -error, & V_{dc} -error are all

determined via the FLC approach. The degradation in the defuzzification stage of the fuzziness operation is calculated using the smoothness value from the fuzzy rule basis table. The loss p serves as the input variable for [16]'s computation of the compensating currents ($* c\alpha_i, * c\beta_i$). During the inference process, a number of input parameters are computed and transformed into language variables according to a subset known as the function of membership. An error V_{dc} (V_{dc} -error) along with delta of errors V_{dc} (V_{dc} -error) are the suggested input variables as well as outcome variable loss p . Seven membership functions are used to transform these variables into descriptions of each output and input variable.

Sliding type controller with fuzzy logic (STC)

The sliding platform $S(t)$ can receive systems of control states or signals of error $e(\text{time})$ using a non-linear precise and reliable control approach known as STC. When a sliding platform is reached, control error messages are put nearby.

Technique for managing power

The management approach is to successfully stabilise the power supply of BSS, PVEG, WEG also battery backups also to guarantee that power is delivered to loads under a variety of conditions. By distributing the power between its source and the load at the same time, the voltage on the DC-bus is kept constant. PVEG and WEG power is represented as PPVEG and PWEG, respectively. The power of the load is P_{load} . The main operating modes of the power management technology are excess and deficient power. The system is in the 3rd condition when the generated energy and the load requirement are equal. Since solar radiation, wind speed, and demand for load are constantly changing as well are not taken into account in the analysis, this rarely happens.

Excess power mode

if ($P_{\text{net}} > 0$) the combined output of WEG & PVEG is larger than the combined output of the load. There are two categories for this pattern: typical overshoot and substantial overshoot. The limiting current of charging (k_{ij}) of the BSS is predicted by the control technique. The BSS maximum current in this inquiry is 5A. The mode is referred to as regular overpowering if $k_{ij} > 5$. It is technically not advised to plug in the batteries in the BSS along with a current larger than K_{ij} , hence this

classification is significant.

An illustration of a battery system for storing energy

The conversion of alternating current (AC) to direct current (DC) is accomplished by a battery storage system, which also uses power electronics devices for device management. A battery's job in this context is to convert electrical energy into chemical energy for storage. DC power is used to charge and discharge batteries. The flow of electricity between energy storage devices and batteries is controlled by bidirectional power electronics. There are numerous advantages and disadvantages depending on the type of battery, including price, weight, size, power, and energy efficiency.

HARDWARE OUTPUT

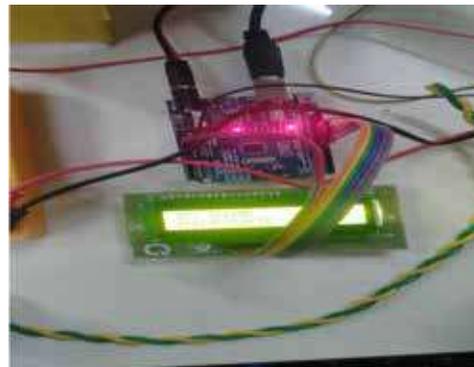


Fig. 32. Hardware Connection of Arduino

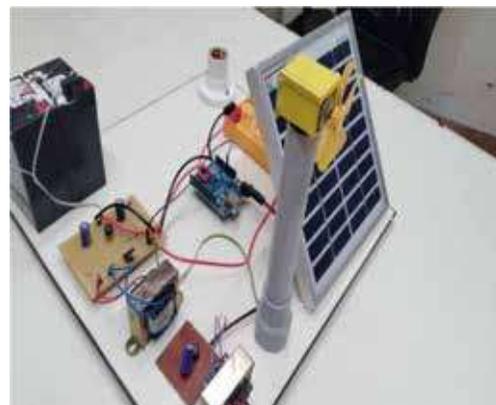


Fig. 33. Overview of Hardware project

TO SUMMARIZE

The outcomes demonstrate that the FLC method can regulate the voltage of the DC bus within limits that are defined. Even with irregular electrical power generation from WEG and PVEG, power balancing is maintained.

The results provide evidence for the efficiency of the suggested energy management method and also lay the groundwork for its implementation in real life. Findings suggest that Diesel Generator is a reliable source of emergency power. Because of its sluggish dynamic behaviour, DG cannot be easily coupled to a DC-bus, while SC effectively overcomes this limitation. The SC charges and discharges the BSS in the event of a significant power surplus or shortfall. To maintain the DC bus steady over an excessive voltage, this system uses a dumping load. The conventional approach, prone to steady-state inaccuracy and low dynamic performance of power converters, was solved in this work. The output voltage message's THDv is additionally subjected.

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3D MAPPING OF INTERIOR ENVIRONMENTS FOR DESIGN VISUALIZATION

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ABSTRACT

This research paper proposes a 3D mapping framework for living spaces that leverages the capabilities of computer graphic toolsets and RGB-D sensors. The framework is designed to scan, digitally represent, and classify physical living spaces in a user-friendly and immersive manner. The proposed solution involves four key steps: scanning of the living spaces, point cloud registration, surface reconstruction, and segmentation, which is either automatic or manual. The scanning phase captures data from our primary source, RGB-D cameras, and fuses them into a single point cloud. Point cloud registration aligns the scans and eliminates inaccuracies, while surface reconstruction uses algorithms such as Poisson's Surface Reconstruction algorithm to generate an accurate 3D mesh representation of the living space. The segmentation step separates the mesh into different objects and surfaces, which are then classified based on their characteristics. The results of the research demonstrate the accuracy with which our concoction of algorithms segment the scanned living space, providing a low-cost and user-friendly solution for capturing and representing physical environments. Obtaining and reconstructing point cloud data from scans is useful for many applications like Building Information Modelling (BIM), Design, Retrofitting. It is especially useful when used in tandem with AR/VR technology. The proposed method provides a comprehensive and accurate representation of living spaces, which can be used for visualization, simulation, analysis, and design purposes. In conclusion, the proposed 3D mapping framework provides a valuable contribution to the field of 3D digital representation of living spaces. Its user friendly design, low cost, and potential for various applications make it an attractive solution for professionals and consumers alike. Future research could focus on further improving the accuracy and efficiency of the tool and exploring new applications for the resulting 3D models.

INTRODUCTION

Interior Scanning

In order to support next-generation navigation, 3D indoor mapping from mobile scanning is a hot research and application issue driven by miniaturization, lightweight of positioning and remote sensing sensors. Scanning Interiors using RGB-D and other such depth sensors help us alleviate the process of retrofitting living spaces. Using high accuracy sensors and robust machine learning algorithms, one can design a framework which captures the dimensions of the room and all entities it encompasses.

The state-of-the-art scanning systems equipped with

multiple sensors produce accurate point clouds of interiors containing billions of points. However, these scanning systems are super costly and not easily portable. Low cost consumer RGB-D Cameras provides an alternative way to solve the core challenge of indoor mapping that is capturing detailed underlying geometry of the building interiors. Although these low-cost sensors capture the geometry of the entities and the dimensions of the room to a certain extent, they tend to product an incomplete dataset. Endeavour to collect a complete scene without data blanks using single RGB-D Camera is not technic sound because of the large amount of human labour and position parameters need to be solved. A lot of the blank data can be solved

using machine learning algorithms. But these machine learning algorithms do not promise cent percent data coverage. Now comes a need to measure the distance between the segmentation done using this concoction of algorithms and segmenting entities manually. In this paper we aim to perform tests on point clouds of different living spaces and output the percentage of data coverage between auto and manual segmentation of entities within them.

Computer Graphic Tool Set

Computer Graphic Tool Set play a major role in a system that does 3D mapping of a living space. While the hardware components take care of actuating and bringing in the point cloud, it the job of the computer graphic software to help the user enter the realm of point cloud customization and programming. Software such as Blender and Cloud Compare lets us to retrofit entities with the living space flawlessly. The user interface is the component of a software system that connects two very complex system: humans and computers. Each of these two systems impose certain requirements on the final product. However, running the software and performing certain actions within its suite utilizes a lot of graphics and takes up a lot of memory. But the pros out-weigh the cons, the computer graphic tool set software provides a robust array of actions which can be performed on the point cloud in order to get the desired output.

Augmented Reality and Virtual Reality

Virtual reality allows you to immerse yourself in a virtual world using a headset with some kind of screen that displays a virtual environment. These headsets also use a technology called head tracking, which allows you to look around by physically moving your head. Augmented reality allows you to see the world around you by overlaying digital images on top of it. This allows us to imagine our environment with changes made to it. Construction companies use AR/VR technology to plan projects from start to finish, streamlining the process and taking the guesswork out of most construction projects, saving time and money while providing clients and architects with a comprehensive experience. can provide valuable design insights. The combination of BIM technology and immersive VR headsets allows architects and designers to better assess spaces before they physically exist, thus better planning their approach to construction.

Proposed System

Figure 1 shows the proposed system of the project. First, we will scan the environment with the help of an RGB-D scanner and store the point cloud generated. The next step is to register the point clouds with the tailor-made room so we get a single complete point cloud to work with. On this we will perform surface reconstruction to convert the point cloud into a 3-dimensional model. From this step we can either perform segmentation to use the point cloud for interior designing or we can convert this model as an NFT using the front end we have made.

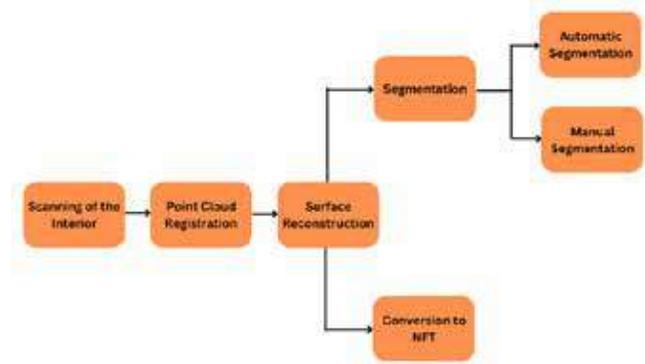


Fig 1. Proposed System of the project

LITERATURE REVIEW

Scanning of Point Cloud Data

Scanning using Kscan3D

Kscan3D is a 3D scanning program that allows you to use a sensor, such as an Xbox 360 Kinect, to scan objects, rooms, or even people and recreate them as computer-based 3D models. There are features such as model editing and automated watertight repairs. [1] After connecting to the sensor, you can scan objects. After the object is scanned, the software compiles the image and range data from the sensors and recreates the object on a computer-generated platform. Steps for obtaining scans include • setup • scanning • Processing.

Denosing Point Cloud Data

In this paper [2], the authors put forward a low dimensional multifaceted model for the image patches to surface patches in the point cloud, and denoise them using similar patches using the prior patches. The manifold dimension computation is approximated and defined in the continuous domain with a patch-based Laplacian regularizer, and they propose a unique patch

distance measure to quantify the similarity between two similar surface patches for graph construction without noise. The methodology put forward is demonstrated to contain graph spectral low-pass filtering interpretation and numerical stability in solving the linear equation system, and tends to be useful to solve with methods like PCG. Experiments demonstrate that the methodology outperforms existing methodologies with better structural detail preservation.

Using RGB -D Scanning

Dense 3D Modelling of Indoor Environments

This study [3] describes how RGB-D cameras collect data and how they are used to generate 3D models of interiors. The RGB-D camera captures the RGB image and per-pixel depth information of the previous object. The image on the left is an RGB image and the image on the right is the depth information of the object per pixel. The core of the aligning of the current frame with the previous frame is the RGB-D ICP algorithm (Iterative Closest Point). This is an algorithm that is designed to take the richness of the output of the RGB-D camera. RGB-D Mapping also includes a Surfel representation, which allows for occlusion reasoning and visualization. In conclusion, the authors were able to get successful results in converting the object in front of them first into a point cloud data from the RGB images and the depth information and then into a 3D model by using the RGB-D ICP algorithm and the Surfel reconstruction algorithm for joining the frames.

Texture Mapping for 3D Reconstruction with RGB-D Sensor

The authors of this study [4] offer a global-to-local correction approach for better texture mapping outcomes. Their approach first adaptively selects an appropriate image for each face of the 3D model, which can effectively remove blurring and ghost effects created by multiple image mixing. A non-rigid global-to-local modification step is used to reduce the effects of seaming between textures. This effectively compensates for texture shifts and geometric errors caused by camera position drift and geometric errors. Their proposed algorithm was evaluated on a series of complex scenes, showing effective performance in generating seamless, high-fidelity textures for 3D models.

3D Modelling of Interiors

3D Modelling of Building Interiors

This paper [5] presents an automatic system for planar 3D modelling of building interiors from point cloud data generated by range scanners. This has been aided by the revelation that most building interiors may be represented as a collection of planes representing ceilings, walls and staircases. Virtual and augmented reality, navigation, and virtual heritage conservation are all examples of applications for three-dimensional (3D) modelling of architectural scenes from point cloud data collected by range scanners. While user-assisted approaches have been demonstrated to be useful, automatic methods for 3D interior modelling have recently attracted a lot of attention. In this context, methods for modelling building interiors using planar primitives are becoming increasingly common. Interior modelling, in contrast to building exteriors, presents two significant obstacles. The first is the issue of complexity, as building interiors can feature several interconnected rooms and corridors. Second, scaling is a challenge due to the inclusion of small-scale objects like walls and staircases in comparison to the scene's scale. The following is a summary of the authors' approach. On a point cloud representing a building interior, a point-wise principal component analysis (PCA) is first done. The next step is to identify and segment regions that represent basic architectural structures using a classification and segmentation procedure. Model-fitting is then used on the segmented regions to detect ceilings, floors, walls, and staircases, and a 3D model is generated by putting the architectural structures together. This approach is unique in that it can detect both larger and smaller structures such as ceilings and floors and also staircases.

3D Mapping of Indoor Environment

In this experiment [6] the authors have used an RGBD camera used in Microsoft Kinect called the Microsoft Kinect V2.0 sensor to scan an environment and construct a 3D map of the same. They have used a method called RANSAC (Random Sample and Consensus). RANSAC is a robust algorithm that estimates the fundamental matrix in presence of the wrong matches and also implements the Iterative Closest Point Algorithm to estimate the outliers and the inliers in the data. RANSAC picks the smallest number of sample points at random and estimates the fundamental matrix for the first sample. It then validates this hypothesis and counts

the number of outliers until the likelihood of discovering a better solution fall below the threshold value. The experiment also implements Joint optimization of ICP and RANSAC. Once the scan is done, the two algorithms are performed.

Converting Point Cloud Data to Models

Unsupervised reconstruction of Building Information Modelling wall objects

In this paper [7], the authors put forward research in the field of Scan-to-Building Information Modelling, and a methodology to overcome challenges that are being faced in this field of high demand. Presently, challenges include complexity of structures, cost, speed, automation. The proposed methodology aims to reconstruct BIM wall objects featuring reconstructing multiple wall axes and simultaneous multiple-story computation. In the proposed methodology, the input to the procedure pipeline is a set of pre-processed point clouds, which are smoothed into mesh net segments for the walls, ceilings and floor. The floor and ceiling segments are used to create Ifc Building Storey objects and Ifc Space placeholders. Wall reconstruction begins with computation of best fit partial geometry. Wall type is chosen and Wall axis is chosen by picking a candidate central point for the wall. These partial walls are topologically adjusted to form a BIM model. The output is an IFC model containing the parametric geometry with relevant metadata. Reconstruction of wall topology is necessary as windows, doors, floors, etc depend upon wall geometry. The proposed methodology works in 3D and uses Total Least Square and RANSAC. The results provide a promising methodology with competitive accuracy to current standards. It is however, not without its limitations. The methodology does not achieve the required accuracy when limited wall observations are available or ambiguous floor/ceiling mesh segments are involved, or when walls which do not meet Ifc Wall Standard Code are encountered

Segmentation and Retrofitting

This paper [8] presents a method for alignment of a LiDAR-generated point cloud of real-world objects in a video scene with the real-world environment captured by a camera, using a frame-by-frame registration method. Aligning the point cloud with the physical environment allows the user to manipulate and modify individual entities in the environment. Hokuyo 2D Lidar sensor

along with 6DOF IMU sensor are used for the generation of the point cloud. The Lidar scanner provides the depth values of points which are converted to 3D coordinates in the scanner coordinate system. The scanner is calibrated from 4 different positions. To align the scanned object, the partial point cloud is imposed over the points of the pre-processed data so they overlap completely. To this end, the iterative closest point (ICP) algorithm is used. ICP uses the partial point cloud and the closest pair of 3D points in the target data set as correspondences, and assumes that each data point has a corresponding match. The environment visualization setup utilises Samsung Oculus Rift DK2 with an integrated camera to visualize the real environment scene. The Polhemus G4 motion tracking sensors provide basic interaction with the virtual environment for functionalities such as manipulation and modification.

IMPLEMENTATION

Scanning of the Interior Environments

The scanning of the interior environments was done using an RGB-D sensor (Xbox 360 Kinect Sensor). The Kinect Sensor (Figure 2) has 3 main components: the RGB camera, the depth sensor and the infrared projector.

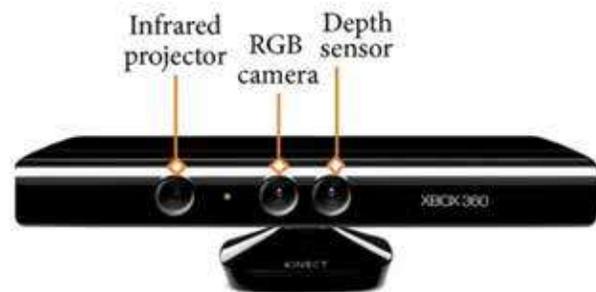


Fig 2. Xbox 360 Kinect Sensor[27]

The RGB camera recognizes the RGB coloured components as shown in Figure 3. It also detects the body and facial characteristics. The camera has 640X480 resolution and an optimal frame rate (30 fps). The depth camera helps us recreate a 3D image of what is in front of the camera. This is done with the help of an infrared projector. It projects dots constantly which is viewed by the camera and then the depth of the image is determined. The depth camera gives a black and white output as it has a monochrome CMOS sensor.

The scanning environment had a basic room layout that

is 4 walls with 2 doors and 3 transparent glass windows. The glass windows needed to be covered as the infrared light was passing through the glass. The range of the Kinect sensor is approximately between 4ft to 10ft. The complete wall cannot be scanned within this distance. In order to proceed with the scanning, partial stand out aspects of each wall were scanned and stored. The standalone features of the walls were then integrated into a tailor-made room which was recreated in blender.

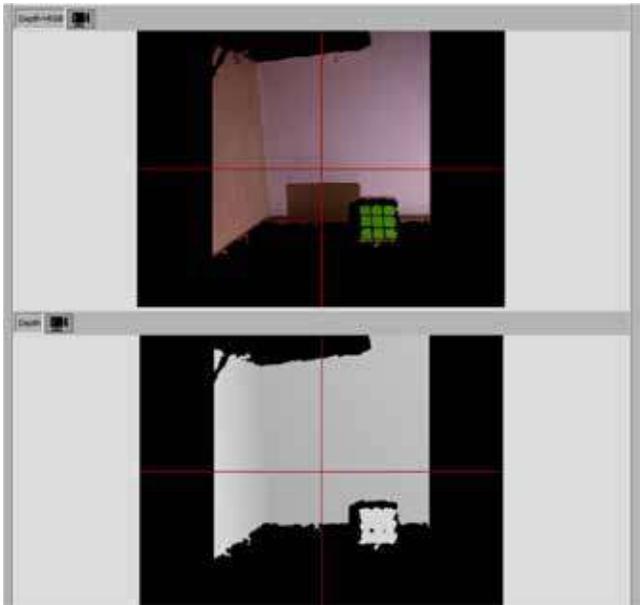


Fig 3. Output of RGB camera(top) and Depth Camera(bottom) of Kinect Sensor.

Registration of the Scanned Point Clouds

Registration of a point cloud involves three main variables: scaling, rotation and translation of the point cloud. The process of aligning two Point clouds by changing these three variables is called Point cloud Registration. A tailor-made room has been created using blender. Using this room, we will perform the registration of the point cloud that we have scanned on CloudCompare.

In Blender, using the addon “Archimesh”, an exact copy of the scanning environment was made. The room was made to scale. The main motive of making the room was to register the scanned point clouds to this room model so as to have a complete room with the stand alone features of the scanning environment. The room design can be seen in Figure 4.

The room was imported into CloudCompare. The room in blender was a 3D model and the requirement

for registration was point cloud data. The room was converted into a point cloud data and then registration of the point cloud can be done. The Figure 5 shows the room layout that has been converted into a point cloud data.

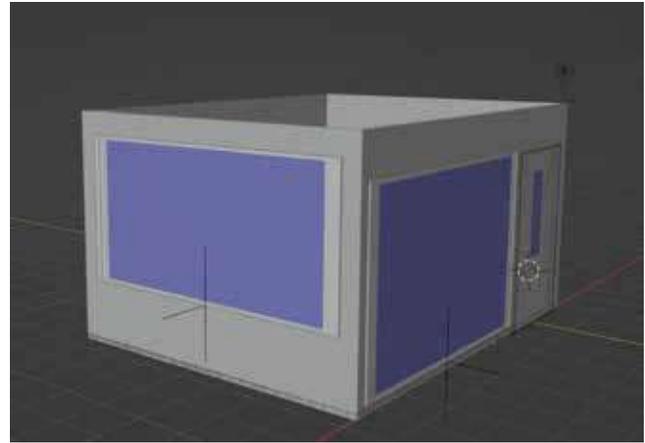


Fig 4. Room Made in Blender

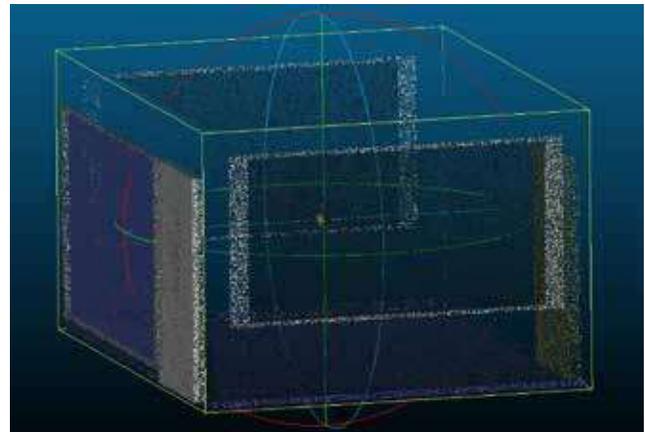


Fig 5. The Room in blender as a Point cloud Data

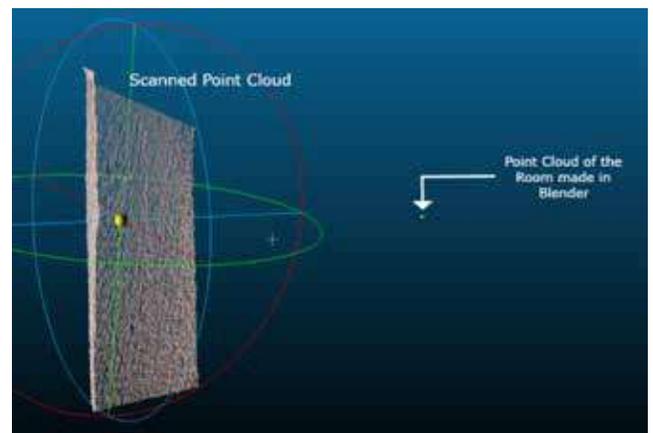


Fig 6. The Scaling difference between the 2 point clouds

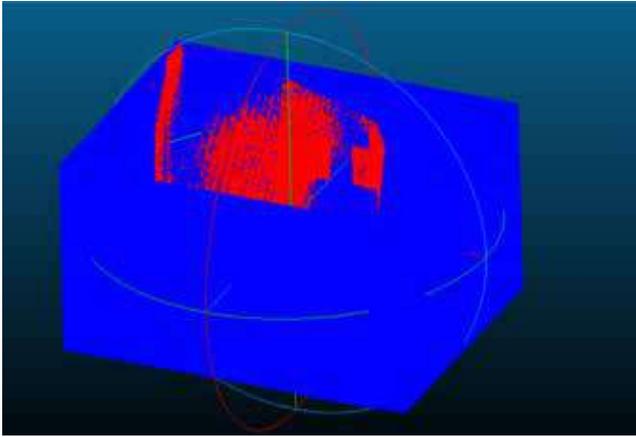


Fig 7. Point cloud after alignment of the scanned wall (RED) and the room (BLUE)

The point cloud in Figure 6 and the scanned point clouds were now used to perform registration. In CloudCompare, scaling of the point cloud is done using the tool “Multiply/Scale” under the Edit toolbar. Positive and negative numbers allow us to increase the size of the point cloud across that specific axis. Values that are $0 < x < 1$ or $-1 < x < 0$ are used to decrease the size of the point cloud. In our case, the point clouds that were scanned were very large compared (approximately 75-100 times the original) to the scaled room which we created in blender. The Point cloud was scaled down to the exact size to perform rotation and translation on them.

The Translate/Rotate option in CloudCompare allow us to manually align the scaled point clouds as one. It keeps one Point cloud fixed and the other point cloud is fit into it making it align itself as a single point cloud. In this case the fixed Point cloud is the room made in blender and the movable point cloud is the scanned wall. Once all the walls are aligned to the room, the output can be finalised as the final point cloud which can now be meshed to for a 3D output of the same.

Surface Reconstruction of the Point Clouds

Surface Reconstruction is the conversion of a point cloud data into 3-dimensional digital representation of the cluster of points. The data from the Xbox 360 Kinect Sensor is an unstructured point cloud. For a structured point cloud data, a process of polygon meshing is to be done. In this case, Surface reconstruction must be done to determine the 3D model of the points. There are different methods of Surface Reconstruction such as Ball Pivoting. This method takes three points from

the point cloud data forms continuous triangles using these points and reconstructs a surface for these points [3]. Another method is Poisson’s reconstruction. This method is the conversion of a point cloud data into a watertight surface. This method can be best described as enveloping the point cloud data with a smooth cloth. Poisson’s reconstruction can also be used to determine non-smooth surfaces. This advantage of Poisson’s reconstruction makes it a better choice than other surface reconstruction methods.

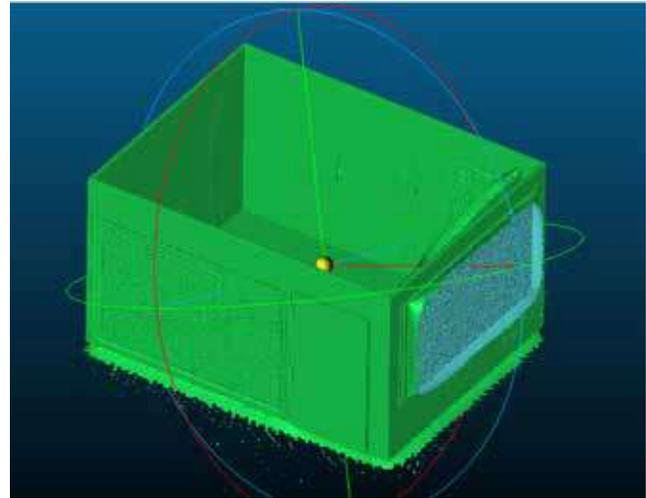


Fig 8. Points after Surface Reconstruction

In order to convert the Registered point cloud into a 3D model, we need to mesh the point cloud. For meshing, the software that we have used is MeshLab. MeshLab provides us with a number of Surface reconstruction options. We have used Poisson’s reconstruction. To use this concept, the normal of the points are required which is found using the “Find normal for each point” option, which is a built-in feature in MeshLab. Once the normal have been calculated, Poisson’s surface reconstruction option can be done on the point cloud. The output of the above can be seen in Figure 8.

Auto Segmentation

We have introduced a key feature in this framework which is called Auto-Segmentation. This type of segmentation captures and identifies different entities present within the point cloud without considering semantic category labels. With good knowledge of Blender scripting, we are able to create a button called Auto Segmentor seen in Figure 8. The button created takes in the point cloud as input and runs the machine learning algorithms on it, namely Euclidean Clustering

through Density Based Spatial Clustering of Applications with Noise (DBSCAN) and Random Sample Consensus (RANSAC). This separates the point cloud into various segments that can be used as for further interior designing.

The DBSCAN algorithm should be used to find associations and structures in data that are hard to find manually but that can be relevant and useful to find patterns and predict trends. Clustering methods are usually used in biology, medicine, social sciences, archaeology, marketing, characters recognition, management systems and so on. Figure 9 aptly visualises the DBSCAN algorithm. The DBSCAN algorithm makes use of 2 essential parameter- eps and minPoints. Eps talks about how close a point must be to a particular cluster to be part of that cluster, it means the distance must be lower than or equal to eps for the point to be considered a part of that cluster. minPoints on the other hand, tells us about the minimum number of points needed to form a dense region. The Random Sample Consensus(RANSAC) is an iterative and a non-deterministic algorithm that helps in eliminating outliers. These outliers are due to various reasons including measurement errors and wrong data entry. The main problem with outliers is that it prevents us from further processing of data. Thus, RANSAC helps us eliminate these outliers by taking a subset of the data present and creates a model from it and then we check how well the whole dataset fits the model. These steps are repeated until a model that fits our complete dataset is found. As the steps get repeated the outliers in the datasets are being marked. Figure 10 provides us with the visualisation of the RANSAC algorithm.

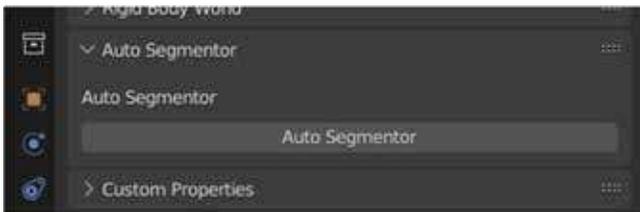


Fig 9. Add-on buttons to automatically segment entities

Point Cloud Segmentor - Manual Segmentation

The point cloud segmentor, as shown in Figure 11, is an add-on for blender. This Add-on is inbuilt with an array of point cloud manipulative functions. Starting with the folder icon present in the figure shown, it helps us draw the point cloud, which is in the form of a .PLY file,

into the blender workspace. The point cloud segmentor also enables us to access a manual segmentation mode, using the PCD Manual Segment button, which in turn lets the user to manually edit the entities which were not completely segmented by the auto segmentation algorithm. Using this button we are also able to calculate the probability/ extent to which the auto segmentation algorithm work by working on the noisy leftover data.

DISCUSSION

Testing is basically done by considering each entity separately and seeing how much of each of the entity is scanned. We then calculate the percentage to which the segmentation is done. For this purpose, we have taken three point clouds representing 3 living spaces of different dimensions and composition of entities within.

Test 1

Figure 11 shows the point cloud of an interior kitchen environment. The objects to be detected are top shelf, bottom shelf and bottom shelf with oven. Auto segmentation is performed on this point cloud to accurately segment the aforementioned entities. Calculation of the accuracy/ the percentage of accurate segmentation is performed. Figure 12 shows the auto segmentation of the kitchen point cloud.

Result 1

We can see that the algorithm has successfully segmented most of the expected entities to be detected, with high accuracy. The percentage of accuracy in detecting these selected entities is close to 95% (Top shelf, Bottom shelf and Bottom shelf with oven). However, there is a slight noise in the detection of the oven and bottom shelf region in the point cloud. These outlier points in auto segmentation is taken into consideration for the calculation of the accuracy.

Test 2

For this test we have taken a well meshed point cloud which enables the algorithm to work better on the same. Figure 13 shows the point cloud of a hall. Items to be detected are: bench in room, 2 walls, window pane, 8 windows. Figure 19 shows the auto segmentation the hall.

Result 2

As we can see from Figure 14, the point cloud has been successfully segmented with all its entities completely

detected because this point cloud consists of a lot of primitive shapes and has negligible noise. The accuracy of the auto segmentation algorithm in this case is 100%.

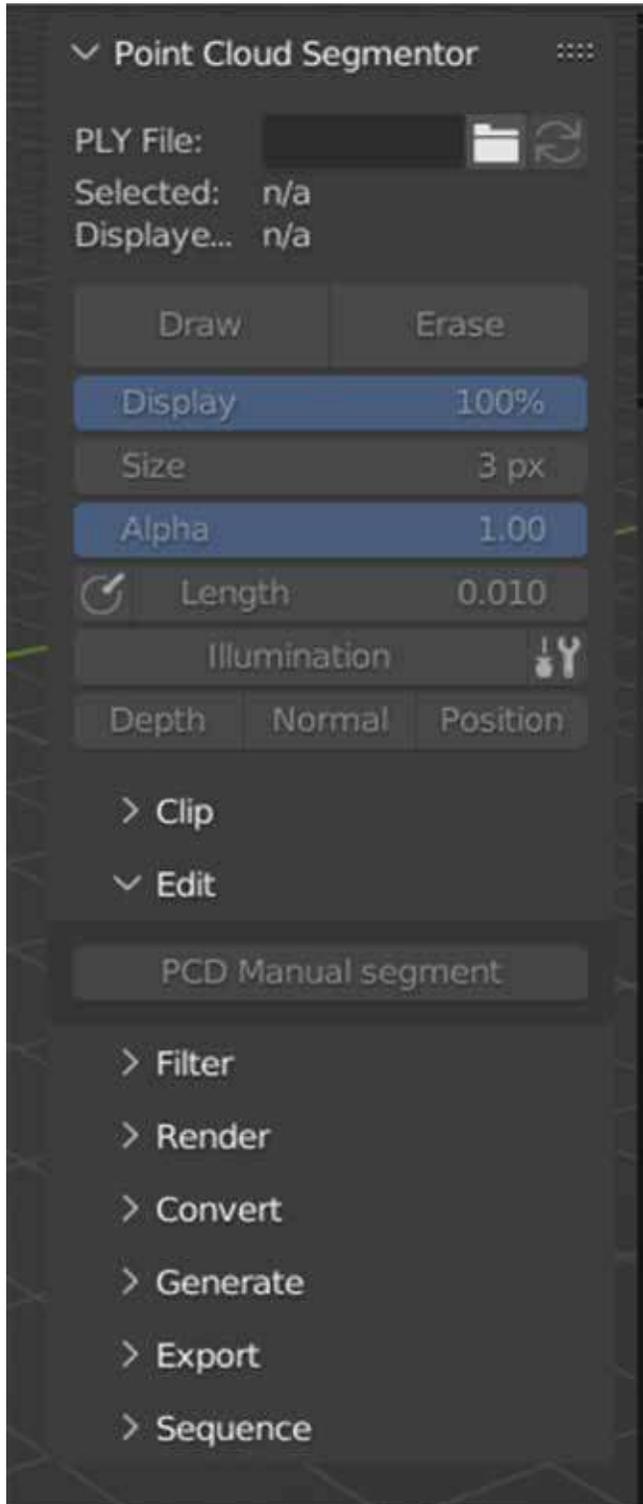


Fig 10. Point Cloud Segmentor

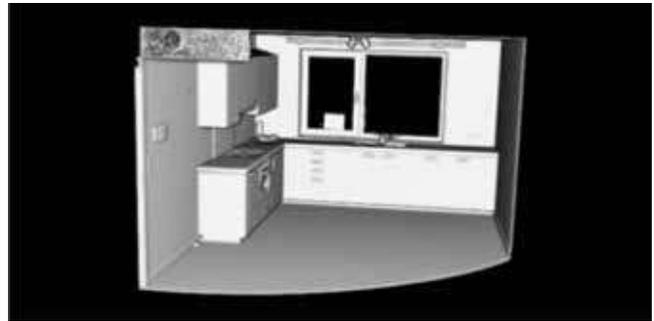


Fig 11. Interior Kitchen Environment



Fig 12. Interior Kitchen Environment after Auto Segmentation



Fig 13. Hall Point Cloud

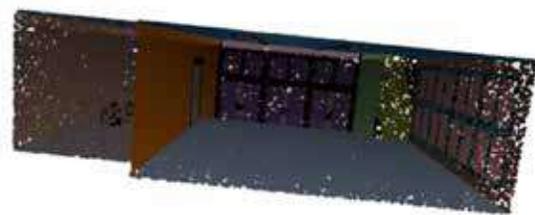


Fig 14. Hall Point Cloud after Auto segmentation



Fig 15. Bedroom point cloud

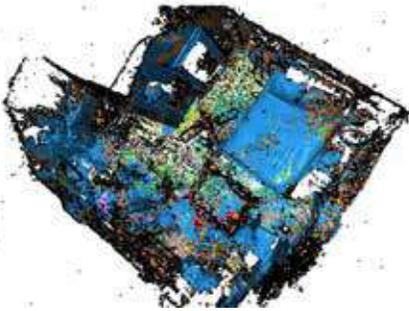


Fig 16. Bedroom point cloud after Auto Segmentation

Test 3

This is the bedroom point cloud which is scanned using a LiDAR system. Although this point cloud is the product of a high accuracy sensor, the data is very noisy. Each entity within this bedroom has been only partially scanned and is a challenge to even manually segment it. Figure 15 shows the bedroom point cloud itself and Figure 16 shows the auto segmentation algorithm on the point cloud.

Result 3

The output of the auto segmentation is very noisy owing to the detection of zero entities within the bedroom. However, the algorithm was able to detect a good percentage of the bed, we have not considered that as a detection for an accurate result calculation.

CONCLUSION

After trying and testing multiple methods for segmentation we have concluded that the algorithm used by us for auto segmentation detects various surfaces depending on the quality of point cloud input. Following points represents the behavior of the auto segmentation algorithm for different point clouds: • Automatic Segmentation works extremely well for

point clouds with simple shapes. • Works very well with clean Point Cloud data • Does not work with Noisy, unstructured point cloud data As for the Add-on the PCD manual segmentation button helps us trim any outlier/noisy data within the point cloud with ease. The auto segmentation button created, flawlessly inputs the point cloud into the algorithm.

Coming to the front-end of our framework, this highly interactive front-end provides a direct link to the Opensea website, gives information about NFTs, allows users to upload files from their device and also gives them the option to contact us via email in case of any clarification/ doubts.

We were also successful at converting the point clouds to NFTs in opensea on the Polygon and Ethereum blockchains. We hope to introduce these NFTs into the metaverse and maybe revolutionize mobile 3D mapping systems and retrofitting entities within the metaverse.

Some potential limitations of our system are the quality of scanned data, and robustness of algorithm in its ability to segment objects that are more geometrically complex. Improvements to our system can be made by using better scanners/ scanning software and improving on the algorithm.

Future applications could include segmenting the point cloud to manipulate and modify different segments as required. This could be useful, especially in a VR/ AR environment, to allow users to manipulate their environment for applications such as retrofitting, renovation and design.

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MOBILE BASED 3D APPLICATION FOR VISUALIZATION & LEARNING

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ABSTRACT

Online teaching and visual understanding or digital learning is always better than learning through a book. The main focus of this article is to provide engineering students an application to understand and visualize the topic of data structures. E-learning is the process of learning through digital instruments. One of the most common tools is distant learning, followed by learning management systems. The emergence of social networking and online learning groups, the widespread use of smartphones, and a growing understanding of the potential for computer games to revolutionize learning are recent developments. Other significant breakthroughs include improvements in Intelligent Tutoring Systems, the free Open Educational Resources movement, and the development of immersive environments that let users interact with virtual worlds and enhance their perception of the physical world through technology. E-learning is primarily based on using computers and the Internet, while teaching can also take place in or outside of traditional educational environments. In the world of computer science, data structure refers to the format that contains a collection of data values, their relationships, and the functions that can be applied to the data. Data structures arrange data so that it can be accessed and worked on with specific algorithms more effectively. After the validation and testing, the results were positive and most of the students opted for learning through an app which shows topics visually rather than normal learning through books.

INTRODUCTION

A data structure is a collection of data pieces that offers the simplest means of storing and carrying out various operations on computer data. An effective technique to arrange data in a computer is through the use of a data structure. The goal is to simplify various chores in terms of space and time requirements.

The way the data are organized and how the algorithm is put together are related. In order for both the developer and the user to implement the action effectively, the data display must be simple to grasp. We are developing a mobile-based 3D application for visualizing and learning data structures that will assist users in understanding data structures, which are a challenging concept to grasp. Our program will immerse the user in a 3D data structure world where they may interact with it. Users are able to perform operations and get results immediately as a result. Both college students and newly hired personnel undergoing training at a company can benefit from using this product to educate them. We created this app using Unity 3D as a development

platform. Virtual reality has made excellent use of this technique. A robust cross-platform 3D engine with a user-friendly development environment is Unity 3D. Anyone who wants to effortlessly create 3D games and applications for mobile, desktop, and the web will be interested in Unity. Like fuel is to a fire, technology is to imagination. Technology is fueled by intention and creative thinking put together. These are the causes of the exponential growth that technology is currently experiencing. On the one hand, virtual reality transports the viewer to a particular period of time or place by using audio-visual technology that deceives the brain into believing it is somewhere else. It is a perception of a made-up universe. It sounds incredible, doesn't it? A 3D environment can be experienced and, more intriguingly, interacted with using computers and virtual reality. This is made possible by wearing a head-mounted display that transmits input tracking. Many people were ignorant of its accomplishments in the health field because most people were fascinated with its innovations and leaps in gaming and exploration.

LITERATURE SURVEY

Motivation for VR

The former is a virtual environment that may simulate places in the real or imagined worlds;

And by creating the illusion of being physically present in the non-physical world, the latter develops the idea further. While non-immersive VR can be run on a standard computer, immersive VR is still evolving as the necessary devices become more user friendly and affordable. As you can see from reading the articles, we contend that the primary reason for using VR is that it allows users to experience and live in settings that “cannot be reached physically.” This restriction may exist for a variety of reasons, including:

- Time problems: Going back in time lets students experience various historical eras [7];
- Physical impossibility : such as while travelling freely between planets while studying the solar system [8];
- Restrictions imposed by a hazardous circumstance : such as when teaching fire fighters how to make decisions in an environment where the physical and psychological strains are comparable to those experienced in real-world firefighting situations [9];
- Ethical issues: such as when non-experts do complicated surgeries, as in the case of neurosurgery [10].

Because of its potential for stimulating interactivity [3] And motivation [4] [5], virtual reality (VR) is widely used in the fields of education and training. Furthermore, it provides an ideal way for those who prefer a visual, auditory, or kinesthetic learning style to approach, study, and remember new knowledge [6].

A review of the literature on the use of Immersive VR and HMD in education has been conducted. Immersive VR (Fig.1) can provide significant benefits for learning by providing a direct experience with objects and events. That are physically out of our reach, it supports training in a safe environment while avoiding potential real dangers, and it increases learner involvement and motivation while broadening the range of learning styles supported thanks to the game approach. The findings show how most papers report on experiments in higher

education or adult education. There has been very little research on younger children and disability [2].

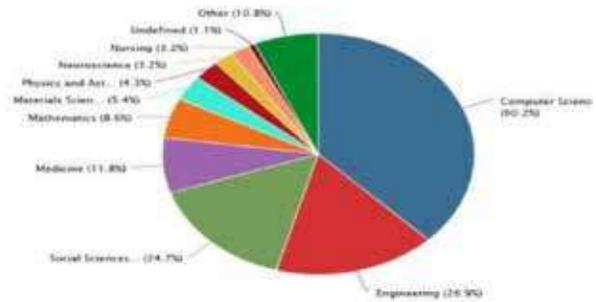


Fig.1 Immersive virtual reality education

Concept of Educating through 3d Animation

This concept of educating children by playing games which improves cognitive knowledge and improves able to tackle a problem. Young children have inquisitive minds and frequently ask their family members and teachers scientific questions. Families and early childhood professionals can foster a child’s scientific thinking, stimulate curiosity, and lay the groundwork for a lifelong interest in science through thoughtful interactions [11]. Rumble Blocks was created at the Entertainment Technology Centre (ETC) to teach children ages 4-7 engineering principles of tower stability [1]. The game includes levels for tower construction, tower piece removal, and tower comparison that were designed with input from early childhood educators and learning researchers and iterated with feedback from child play tests. This paper focuses on the development process and early formative play tests with children. It was created with the Unity3D game engine and can be exported as a standalone application, a web player, or to mobile devices. The preliminary findings in terms of educational effectiveness are promising, with additional studies planned in the future.

From this paper that specifically acknowledges that the results in Fig.2 are based on a very small sample size. Plans for evaluation include testing with students’ ages 4 to 9 to see if there are any differences in the engineering principles taught in the tower building, tower deconstruction, and tower contrasting levels. As was done here, pre- and post-tests will be administered to determine whether the game promotes learning outside of the game itself. Of course, the game will be equipped with robust logging and in-game assessments to document the achievements that occur within the game.

Fig.2 shows the results from six children on educational assessment of Rumble Block, showing 95% confidence bars and accuracy scores on contrasting cases pre and post -tests.

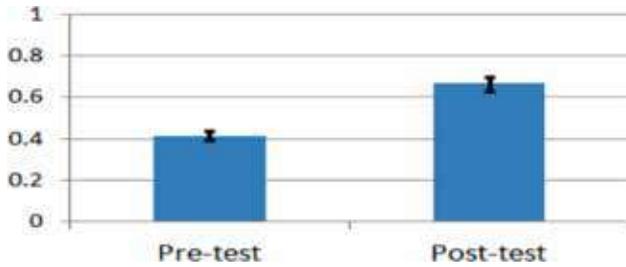


Fig.2 Results on educational assessment

The findings of the figure (Fig.2) suggest that thirty minutes spent playing a game can alter one's understanding of scientific principles governing tower stability as measured by contrasting cases. The y-axis stands for the number of children it was tested on (It should be noted, however, that results from such a small sample size do not always generalize to large segments of the student population. Larger-scale studies, on which we are working, will provide more evidence.) Obviously, the work is still in its early stages.

SYSTEM DESIGN

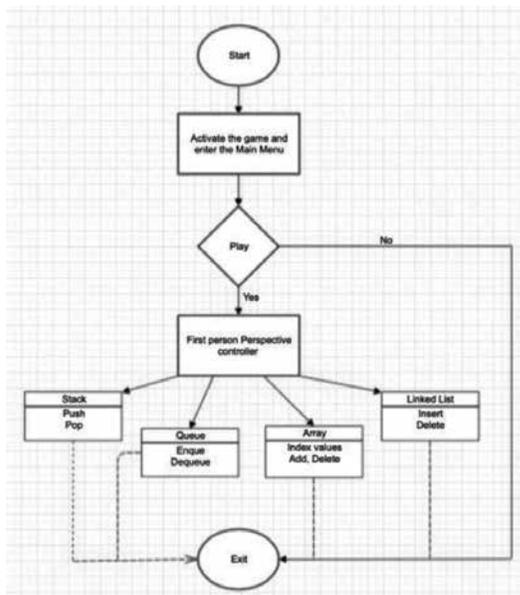


Fig.3 Workflow diagram of the project

Fig.3 explains the workflow of the project and the topics behind it. Our application when started, shows a main menu which has three options (Play, Settings & Exit). Once the user presses play, it automatically

jumps into the game and gives a first person perspective view. The user can use the joysticks to control the player movement. Left joystick is used to control the x & y axis of the player and the right joystick is used to control the z-axis of the player. The player can also jump by pressing the right joystick once.

There are four rooms depicting the four data structures (stack, queue, array & linked list). Each room is spaced out for the model to be displayed and for the user to freely move around and enjoy the concept.

In the Mobile App, once the user enters the Stack room, they come across a stack of balls inside a cardboard box (Fig.4). We have given two buttons of simple operation PUSH & POP. If the user clicks on PUSH, a ball automatically appears inside the box, the second time he clicks it the ball appears on the already existing ball. Similarly, the operation continues for all the balls present in the stack. When the user clicks on POP, the topmost ball will disappear. Simultaneously a code also appears on the right-side black board when a push or pop operation is clicked. The left-hand side black board gives a brief explanation of what a stack is and about its operations. The stack room is designed to be very simple and for the user to visualize the concept better. A simple example we took to create this is a stack of colored balls stacked on each other. This also helps

The user to visualize the number of balls instead of counting from the first if all colors were the same.

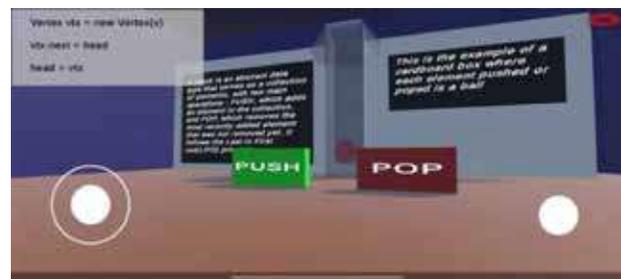


Fig.4 Stack Representation in the Mobile App

In the Mobile App, once the user enters the Queue Data Structure room, they will be shown a screen as to how to perform the operations on the Queue (Fig.5). There are three game objects red, green & yellow. Each time the user presses the enqueue button, the game objects starts moving forward. The rectangle pipe is made transparent (transparency – 10%) to show the inside of the pipe and where the game objects are placed. The game object moves from the rear end to the start. This shows the user

as to how a Queue works. The explanation of the Queue is shown once the user enters the room and the code for the same is shown on the top left corner line by line.

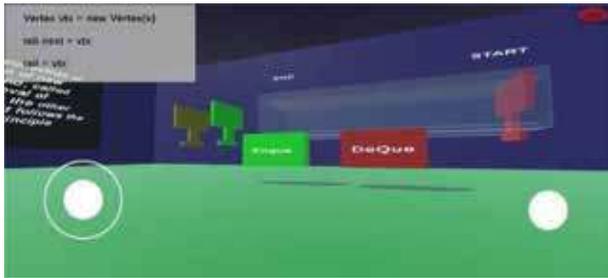


Fig.5 Queue Representation in the Mobile App

We are using a parking lot as a Real-life example for Array (Fig.6). When the user enters the room of Array, they will be able to see an array of parking lot in which each car parked is nothing but a memory location of the Array. The user can walk through the parking lot and can perform operations like insertion or deletion of any car in the parking lot.



Fig.6 Array Representation in the Mobile App

While entering the room, the user can see an explanation as to what an array is and what basic operation it can perform. Once you click on a car, it shows the car details like position and color of the car which is nothing but the location of the car in the form (n, m). For example, in the above picture, the selected cars position is (3, 3).

Also, when the user clicks on a car, a small delete or insert car button is showcased to disappear or appear the car. Add car adds a car to the empty parking lot and delete car deletes a car from the selected parking lot.

The code for the same will also be displayed on the black board. There are a total of 16 cars shown in the parking lot. Each car has its own unique id and details. Whenever an operation is performed, the code is displayed line by line next to the car details box. The add and remove operations can only be performed when the car is highlighted by a small blue arrow mark on the

top of the car (Fig.7). If the arrow is not there, then the operations do not work.



Fig.7 Linked List Representation in the Mobile App

We have represented a Linked List of people standing in a random order pointing to the next person through an arrow. Each person is connected to the next person. Similarly, the code and the explanation are also displayed here. (Fig.7)

Once the user enters the room and clicks on a person, he can perform operations like Insertion and Deletion on the person (where person is the node in this case). When a person or node is deleted, only the node disappears and link between the other people remain there. Once a person is clicked, the deletion operation takes place, and the person gets deleted with the indicating arrow. Later the previous person will get linked to the next person.

There are a total of four people in the room linked with each other through an arrow. After all the nodes have been removed, the last remaining person will be pointing towards Null.

RESULTS

The evaluation is the most important phase in the project. It shows how effective the project is built in different aspects. For this, students are randomly picked from the department of computer science. The students are picked as different categories for testing. Different categories are selected to see the effectiveness of the project and how useful it is in all ways. The evaluation and the survey will be done to know about the features, working, UI etc. The survey mainly focuses on which teaching method is best engaging.

- Students were picked randomly who have already learnt the data structures in classes, they are given questions and evaluated.
- We chose 15 random engineering students in our college who were in their first year

- We explained the concept of data structures to these 15 students through our app.
- The students later were asked to give a comparison between the classroom teaching and visualization using our app to get their feedback.

We took a survey based on the questions below,

- Which teaching technique did you prefer?
- Do you want to see more mobile applications on different topics in the classroom?
- On a scale of 1 to 10, how likely are you to utilize a mobile application as a learning tool?
- Which tool, in your opinion, best assists you in understanding how each data structure works?

The survey results will be shown as graphs, pie charts etc. of the comparison.

CONCLUSION & FUTURE WORK

The developed application provides college students and teachers a fun way to visualize and understand the topic of Data Structures. The application is best fit for android operating systems which runs oxygen OS or later. Many students did prefer learning a concept through the application rather than normal classroom teaching which lets us know that the technology is improving and the education industry must take at most advantage of it. The future of this industry looks very strong as technology is advancing every day and educational institutions have been implementing smart ways to teach children and make sure they understand the topic in a fun and informative way. As generations go, students will be much engrossed into learning visually since it's much easier and effective to understand any topic. The best advantage of learning visually is that we can create literally create anything from our imagination.

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THERMAL MODELLING OF HEAT GENERATION IN FRICTION WELDING OF STEEL AND ALUMINIUM BARS

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ABSTRACT

Friction welding is a solid-state joining technique known for its advantages over fusion welding methods. However, the heat generation and thermal distribution during this process are complex and directly impact the quality of the weld. To address this, a thermal modelling approach is proposed to understand and predict the heat generation process. This study focuses on the thermal modelling of heat generation in the friction welding of steel and aluminium bars. The developed model considers parameters such as rotational speed, pressure, and material properties to simulate the temperature distribution and thermal history during welding. The accuracy of the model is validated by comparing its predictions with experimental data. Numerical simulation using ANSYS software is employed to develop a finite element model of the welding process. Experimental data from previous studies are used to validate the model. The study specifically focuses on the thermal modelling of heat generation in frictional welding of steel bars and aluminium AA6061, aiming to gain insights into the heat generation process and its impact on weld quality. Overall, this research contributes to a better understanding of heat generation in frictional welding and provides a valuable tool for predicting and optimizing frictional welding parameters.

Keywords : Friction welding, Design of Experiments, Response Surface Methodology, Optimization.

INTRODUCTION

Friction welding is a solid-state joining process that generates heat by rubbing two components together under pressure. Once sufficient heat is generated, the rubbing action stops, and the pressure is increased during the forging stage to consolidate the weld. The joint formed has a narrow heat-affected zone and exhibits plastically deformed material due to high local temperature and internal pressures. A thorough review of this topic has been conducted by Maalekian (2007).

There are three variants of friction welding: rotary, linear, and orbital friction welding. In rotary friction welding, which has been used commercially since the 1940s, one component is rotated around its axis while the other remains stationary. The two components are brought together under pressure for welding. Linear friction welding, introduced in the 1980s, involves relative motion and friction pressure between the parts in a reciprocating fashion with a small linear

displacement in the joint plane. Orbital friction welding, a combination of

linear and rotary friction welding, was introduced in the early 1970s. In this process, one component is moved around a two-dimensional curve while the two parts are rotated in the same sense around their longitudinal axes. When motion ceases, the parts are aligned for welding before forging pressure is applied.

Rotary friction welding has limitations in terms of non-circular cross-section components, and heat generation is non-uniform over the interface. This results in a non-uniform heat-affected zone thickness, as depicted in Figure 1. Aluminium and its alloys are extensively used in transportation vehicles, engine components, and structural applications. The addition of Silicon Carbide (SiCp) to the aluminium matrix enhances the strength-to-weight ratio and reduces the thermal expansion coefficient.

Metal Matrix Composites (MMCs) are gaining

popularity due to their ability to achieve desired mechanical properties with high strength and light weight. This has led to increased utilization of aluminium-based metal matrix composites. Surface modification techniques are often applied to enhance the properties of aluminium matrix. Friction stir processing (FSP), an offshoot of friction stir welding (FSW), is a solid-state processing technique used for surface hardening through microstructural modification. FSP involves the use of a non-consumable rotating tool with a pin and shoulder, traversed along the desired path on the surface of interest. This process induces significant microstructural changes through severe plastic deformation, mechanical mixing, and thermal exposure. FSP has shown benefits such as enhanced super plasticity and homogenization of nano-phase aluminium alloys.

MATERIAL PROPERTIES AND EXPERIMENTAL SETUP

The steel under investigation has a chemical composition

Table 1 Variation of the physical properties of Mild Steel with temperature

Temperature (°C)	Specific Heat (J/Kg/°C)	Young's Modulus (GPa)	Poisson's Ratio	Expansion Coefficient (1/°C)	Thermal Conductivity (W/m/°C)
0	486	206	0.296	1.28E-5	51.9
100	486	203	0.311	1.33E-5	51.1
200	498	201	0.33	1.38E-5	48.6
300	515	200	0.349	1.44E-5	44.4
400	536	165	0.367	1.48E-5	42.7
500	557	120	0.386	1.48E-5	39.4
600	587	60	0.405	1.48E-5	35.6
700	619	40	0.423	1.48E-5	31.8

Table 2 The JC model's material constant

Material	A (Mpa)	B (Mpa)	C	m	n	T _{room} (°C)	T _{melt} (°C)
Al AA6061	324	114	0.002	1.34	0.42	583	24
Mild steel	363	792	0.005	1.64	0.57	1525	24

of 0.75% C, 1.02% Mn, 0.28% Si, 0.11% Cr, 0.05% Ni, 0.015% S, 0.009% P, and 0.08% Cu (wt.%). Figure 2 illustrates the thermophysical properties of the steel. To determine the yield strength of the steel at different temperatures, standard tensile testing was conducted experimentally. The specific heat (CP) values were obtained from the DEFORM software database [12], and the thermal conductivity (k) values were sourced from Ref. [18].

A Rotary friction welding machine was employed to create a weld between two steel bars with a cross-sectional dimension of 88 x 20 mm. For monitoring and recording purposes, a PC-based data acquisition system was developed to capture axial displacement, rotation speed, and axial force during the welding process. The temperature variations occurring during friction welding were analyzed using the ABAQUS CAE application software, and simulations were performed under various conditions.

Table 3 The physical characteristics of AA6061-T6 change with temperature

Temperature (°C)	Density (Kg/m ³)	Specific Heat (J/Kg/°C)	Young's Modulus (GPA)	Poisson's Ratio	Expansion Coefficient (/°C)	Thermal Conductivity (W/m/°C)
25	2690	945	66.94	0.33	2.35E-5	167
100	2680	978	63.21	0.334	2.46E-5	177
149	2670	1000	61.32	0.335	2.57E-5	184
204	2660	1030	56.80	0.336	2.66E-5	192
260	2640	1052	51.15	0.338	2.76E-5	201
316	2630	1080	47.17	0.360	2.85E-5	207
371	2620	1100	43.51	0.40	2.96E-5	217
427	2610	1130	28.7	0.41	3.05E-5	229

EXPERIMENTAL TEMPERATURE AND AXIAL SHORTENING

Figure 1 presents the thermal cycles recorded at specific distances during the friction welding process, with a feed rate of 50 mm/sec, pressure of 4 Bar, and RPM of 1000. The axial shortening experienced during welding is also depicted. The temperature measurement closest to the weld interface (x = 2.5 mm) is utilized for the heat conduction model. To facilitate the calculation of heat generation rate, a linear axial shortening rate, as illustrated in Figures 2 and 3, is incorporated into the models.

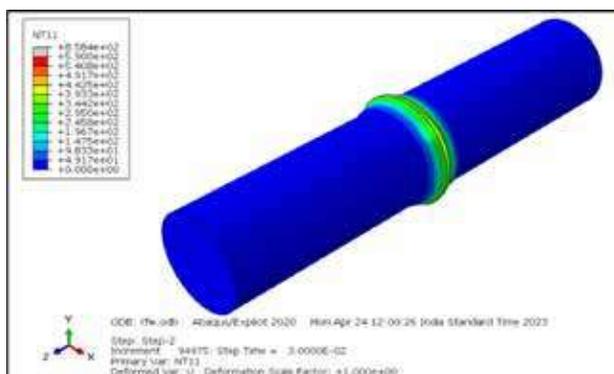


Fig. 1 Nodal Temperature Simulation Model

HEAT GENERATION RATES AND NODAL TEMPERATURE SIMULATIONS

A finite element model is created to simulate the heat generation in the friction welding process of steel and

aluminium bars. The model incorporates essential parameters, including rotational speed, axial pressure, and welding duration. The thermal behaviour is analyzed through a transient heat transfer analysis, which considers the energy generated by friction and plastic deformation.

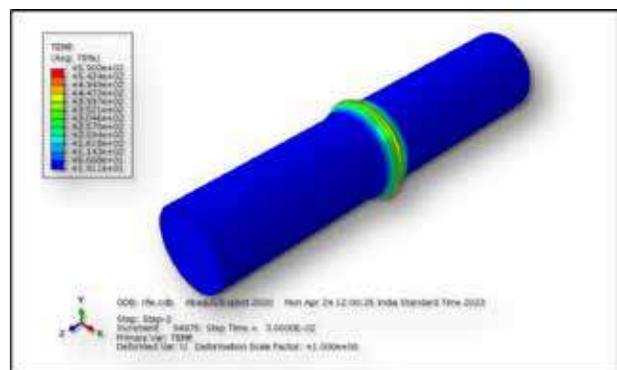


Fig. 2 Temperature simulated Model for the bars Experimentally recorded

OPTIMIZATION OF WELDING PARAMETERS AND RESULTS

Drawing upon the knowledge obtained from the thermal modelling and experimental validation, this section focuses on optimizing the welding parameters to achieve superior joint quality. The impact of rotational speed, axial pressure, and welding duration on temperature distribution and joint formation is thoroughly examined. Furthermore, recommendations are offered for selecting

appropriate parameters to minimize defects and ensure the establishment of reliable bonding.

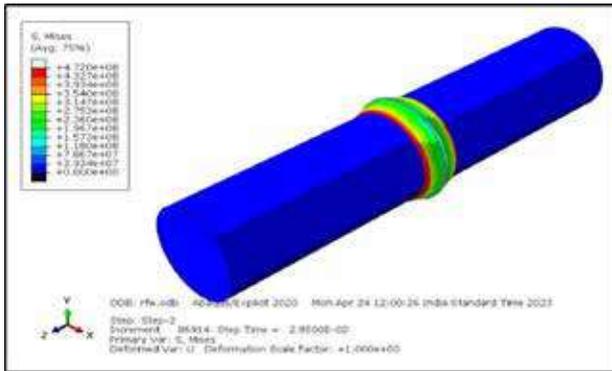


Fig. 3 Residual stress modal of Rotary Friction Welding of AA6061

CONCLUSION

This paper introduces a comprehensive approach to thermal modelling for friction welding of steel and aluminium bars. Utilizing the finite element method, the heat generation and temperature distribution during the welding process were simulated. The accuracy of the simulation results was confirmed through experimental validation, yielding valuable insights into the thermal behaviour of dissimilar material friction welding. The study makes a significant contribution towards optimizing welding parameters, thereby enhancing joint quality and minimizing defects in industrial applications.

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HYBRID VEHICLE: A STUDY ON TECHNOLOGY

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ABSTRACT

Due to escalating demand, there is currently a global shortage of fossil fuels and a rise in their costs. It is now essential to transform our way of life by starting a green revolution in the auto industry. Today, the world's population is most concerned with breathing clean air and preventing the resulting health problems. This article focuses on the hardware development of a hybrid electric vehicle that incorporates green technologies such as solar and regenerative braking to combat this grim situation. Hydraulic braking systems are the standard for automobiles. However, this usual method of stopping wastes a lot of energy since it creates additional heat during braking. When in regenerative mode, a generator is employed for braking, converting the vehicle's kinetic energy into electrical energy to recharge the batteries.

Keywords : Toyota Prius Series, Plug-in hybrid electric vehicle, Hybrid electric vehicle using solar power

INTRODUCTION

The automotive industry was revolutionized by Nicolas Otto's development of the internal combustion engine. Later on, gasoline and diesel became the most common fuels for these cars. With the help of the commercial market, this technology greatly decreased human labor. As the 20th century progressed, several innovations were developed to make this technology more practical and widely available. It became commercially successful as a result, and daily use increased. People may travel thousands of kilometres or miles in a handful of hours using this technology. We are all aware that there are advantages and disadvantages to anything. In the twenty-first century, CO and CO₂ levels surged, wreaking havoc on the environment and contributing to global warming, health problems, etc. This has led to a growing interest among academics, scientists, and politicians in "green technology," or environmentally friendly innovations with the potential to reduce negative impacts. Thus, the 21st century will be characterized by technological progress, notably in the automotive industry. A new age of innovation in the transportation industry will be ushered in by hybrid electric automobiles, solar hybrid vehicles, hydrogen fuel cell vehicles, etc. All things

considered, hybrid electric cars are more efficient than traditional vehicles and include the most cutting-edge industrial technologies.

A solar-electric hybrid's fuel economy is worse than that of a gasoline-, diesel-, or CNG-powered automobile. Therefore, drivers that prefer shorter commutes may benefit from this technology. To get around this rule, the "Plug-In Hybrid Electric Vehicle" was developed.

The "Astrolab" hybrid solar vehicle, the "Toyota Prius Series" hybrid electric vehicle technology, and the "Chevrolet Volt" plug-in hybrid electric cars are examples of hybrid vehicle technology.

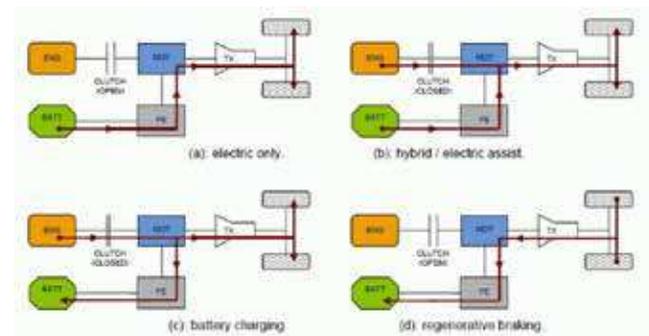


Fig.1 Hybrid Vehicle Operating Principle

“Regenerative braking” is a method of energy recovery that slows down a vehicle by turning the kinetic energy of the vehicle into electricity for immediate use or storage in high-voltage batteries. The electric motor may be used as a generator when the rider applies the brakes or coasts. When current is induced in the coils of an electric traction motor and the motor is coupled to the wheels, the rotors experience torque in the opposite direction. The kinetic energy of the wheels is sent to the generator through the drive mechanism. Due to the resistance created by the generator when producing power, the vehicle’s top speed is diminished. Friction brakes are used in addition to the generator to provide more braking torque.

TYPES OF HYBRID VEHICLE

What we mean when we say “hybrid electric vehicle” is a car that has both an electric power system and a traditional internal combustion engine. Technically speaking, a hybrid electric vehicle combines an electric motor with a mechanical drive system.

In Fig.2 The fuel tank, which contains conventional fuels like petrol, diesel and compressed natural gas, the combustion engine, the gearbox and the gearbox to the wheels make up a mechanical drive.

The components of an electric drive are shown in Fig. 3: a battery, an electric motor, and power electronics for control. The usage of ultra capacitors in hybrid electric cars shows great potential. They are a more long-lasting power source than batteries (Lithium Ion and Nickel Metal Hydride), which is especially useful in high-power situations like regenerative braking.

Classification of Hybrid Electric Vehicle

Series Hybrid: As can be seen in Fig. 4, traction power is generated by a gasoline engine driving an electric motor and generator. The battery is used to store any surplus energy. If the engine is separated from the wheels, fuel economy could increase. The high power consumption of individual components and the necessity for a separate generator are two of the most significant drawbacks of series hybrid drive train systems. The energy produced by an internal combustion engine must undergo two changes before it can be used to turn the wheels. As a result, the parallel system saves money over its forerunner.

Parallel Hybrid: Fig. 5 shows the mechanical connection between the wheels and the hybrid system. The wheels are driven by an electric traction motor, and their design enables for part of the energy lost during braking to be recovered and used by the internal combustion engine or to charge the battery. However, in actuality, a mechanical mechanism connects the electric motor to the internal combustion engine.

Because of this, the electrical machine may be constructed with fewer features, reducing both its price and its size. There may be many possible configurations when an internal combustion engine and electric motor are mechanically combined. You may use a torque coupling on either one or two shafts, a speed coupling on only one shaft with a planetary gear unit, or a hybrid of the two.

Series-Parallel Hybrid: Fig. 6 depicts a hybrid series/parallel design that provides the best of both designs. The ICE may provide power to various electrical components, such as a motor or battery, by means of a generator.

Complex Hybrid: Both the mount and the light source are designed to be adjustable thanks to the use of two separate mechanical linkages. For instance, a fully electric motor drives the rear wheels, while a hybrid system propels the front. The regulation of the power flow lacks any degree of adaptability.

The power characteristics of generic hybrid electric cars may also be classified (Table 1).

Table 1 classifies hybrid electric vehicles according to power

	Micro	Mild	Full
Power in kw	3.5	20-30	40-60
Voltage Level in v			
13	200-		
300	300-		
400			
Energy Saving %	4-9	300-40	40-60
Price increase %	5	10-20	40-50

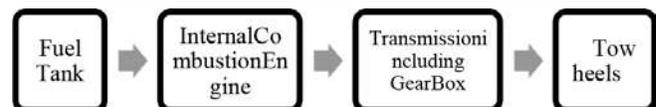


Figure 2 shows the energy flow inside a mechanical drive

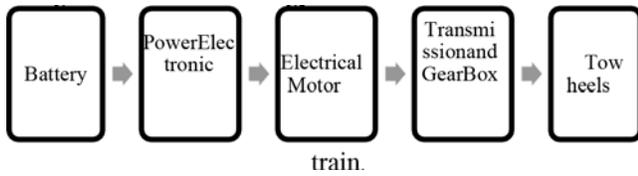


Fig.3 Flow of energy within a electric drive train[10]

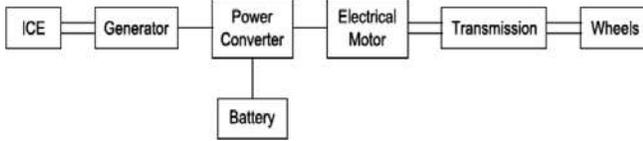


Fig.4 Structure of series hybrid

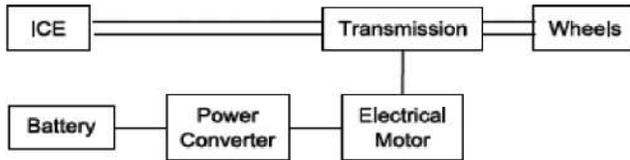


Fig.5 Structure of parallel hybrid

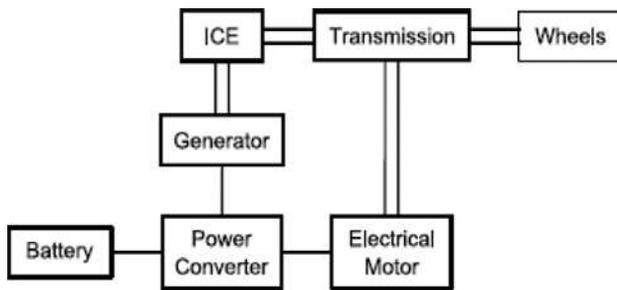


Fig.6 Structure Series and Parallel Hybrid

Hybrid Solar Vehicle

Cars and solar panels are used in this setup. Solar panels are increasingly being installed on the roofs of vehicles. Complex hybrids include a combination of series and parallel hybrids, as well as hybrids that combine the two. In Figure 7, we can see that future study should focus on Series Hybrid Technology.

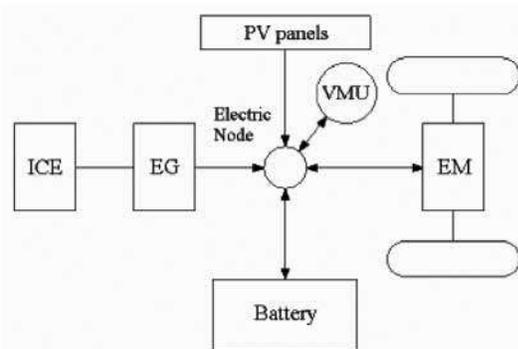


Fig. 7 Series Hybrid Solar Vehicle Basic Diagram

Plug-in Hybrid Electric Vehicle

However, unlike conventional HEVs, plug-in PHEVs may charge their bigger batteries not just via the gasoline engine, but also by plugging into a regular 110 V/230V outlet overnight.

Types of plug-in hybrid electric vehicles include:

Series Plug-In Hybrids: “EREVs” stands for “Extended Range Electric Vehicles.” The gasoline engine serves merely to generate power, while the electric motor is responsible for all propulsion. Energy is the only thing series plug-ins require till the battery has to be recharged. The electricity produced by the gasoline engine is then used to power the electric motor. For short trips, these automobiles may not even require petrol.

Blended or parallel plug-in hybrids: In most situations, the automobile is propelled not only by the engine but also by the electric motor, both of which are mechanically linked to the wheels. Low-speed electric operation is more common than high-speed electric operation.

HYBRID SYSTEM

Toyota Prius Series

First Generation: THS

The “NHW10” and “NHW11” hatchback vehicles made up the first generation.

Challenge-

- The length of time a battery may last (7-10 years).
- Need for a Hybrid Architecture
- A robust engine is required for battery charging.

For best effectiveness, -

- The battery pack’s charge level should be kept between 40% and 60% at all times.
- The “Toyota Hybrid System” is unveiled.
- The introduction of the Double Overhead Camshaft (DOHC) motor.

Advantages -

The advent of the DOHC engine allowed for four valves in each cylinder. If the cylinder had four valves instead

of two, it could use a larger area for intake and exhaust.

As more air was let into the cylinder, the power output grew, the power loss decreased, and the exhaust was easier to push out of the cylinder. At greater speeds, more air was drawn into the engine's combustion chambers.

Engine could operate and generate usable power at such high speeds due to the four valves in each cylinder. As a result, the issue of slowness was fixed across the board.

Working principle of Toyota Hybrid System

The Toyota hybrid system is comprised of a gasoline engine, two motor generators (MG1 and MG2), a power control unit, and a battery.

Once the key is turned in the ignition, the electric motor is the only thing keeping the MG2 moving. The gasoline engine starts up later, when the vehicle's speed is higher, to supplement the electric motor. The engine supplies energy to a generator, which in turn supplies energy to the electric motor (MG2 (288 V) through a power splitter.

When decelerating, the motor acts as a generator, feeding power into the battery. The battery may be charged internally without any additional power source. If the car's battery is low, the driver may keep the vehicle running in "stand mode" while the gas engine recharges the battery.

Drawbacks:

- The ride was occasionally jerky.
- Backing the car up steep hills proved challenging.

The combined fuel economy of the first-generation Prius was 5.7 liters per hundred kilometers driven (L/100 km), with highway mileage reaching the same figure.

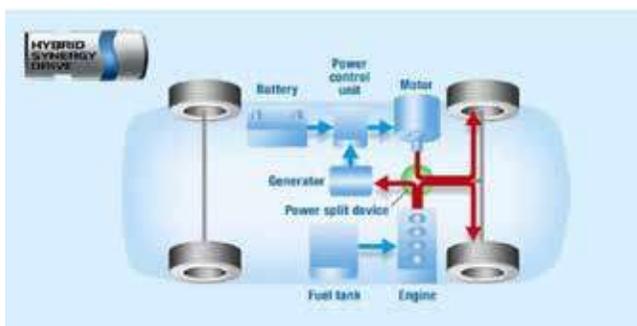


Fig.8 Basic Diagram of Toyota Hybrid System

Hybrid Synergy Drive of Second Generation

The battery's potential is increased to 500 V or higher with the addition of a DC to DC converter in the Hybrid Synergy Drive. This enables the use of stronger motors and smaller battery packs.

The Prius's all-electric air conditioning system is new for the second generation. This means that you may opt to ride without the engine running at any time without sacrificing your comfort. By connecting the motor (MG2) to the front wheel transaxle through a second planetary gear set, the motor's power density is improved. The power control unit (PCU) might benefit from indirect cooling as well.

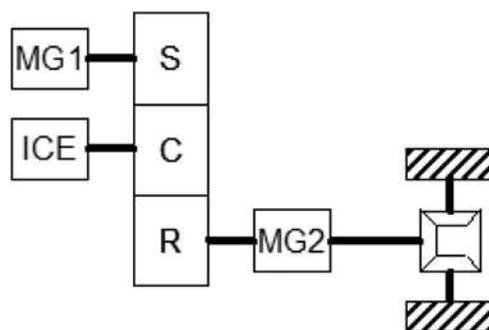


Fig.9 Mechanism of Hybrid Synergy Drive

- Shrink-wrapped The first Prius ran on 1.2-volt D batteries. The Toyota Hybrid System operates within a voltage window, from 276 V to 288 V, determined by the battery pack. The Prius II with HSD improves upon the first-generation Prius in the following ways: Electrical MGs (+50% up to 500 V) and ICE (+8%) have increased output.
- Electrical motor torque plus 14%
- Detrimental electrical losses
- New, lighter, and more powerful high-voltage (HV) battery; enhanced capacity to charge the generator; reduced weight by 14%.

These vehicles may seem different at first glance, yet they are all driven by identical 1.5-liter 14 DOHC engines. When driven on the highway, the second generation Prius averaged 5.2 liters of petrol per 100 kilometers, while city driving averaged 4.9 liters.

Third Generation-Hybrid Synergy Drive

- The 2009 Toyota Prius III's Hybrid Synergy Drive

system has been updated. Weight and size are greatly reduced, increasing total fuel efficiency in the process:

- New variable valve timing with intelligent exhaust gas recirculation (VVT-i) gasoline 1.8-liter Atkinson cycle engines power the vehicle. It's more potent than before, up from 70 to 90 horsepower.
- The MG2 electric motor (60 kW vs. 50 kW) is 33% smaller and 20% more powerful. The Ni-MH battery's capacity and output have both dropped and increased, reaching a maximum of 27kW (+2kW).
- The DC voltage from the battery is now converted to a higher, 650V (+150V) voltage by the new inverter (PCU), which is 36% lighter and switches more rapidly for better efficiency. Because of its direct cooling technology, it is also more quicker and 37% smaller than its predecessor.
- CO₂ emissions have decreased to 89g/km, and fuel efficiency has increased 14% (4 litres per 100 kilometres).

The MG1 in the third-generation Prius also has a planetary gear set, which is referred to as the "motor speed gear reduction."

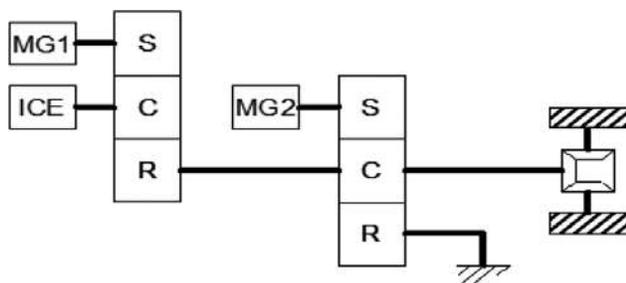


Fig.10 Mechanism of Hybrid Synergy Drive

The total fuel economy of the second generation Prius was 3.70 liters per hundred kilometers in the city, 3.90 liters per hundred kilometers on the highway, and 3.90 liters per hundred kilometers in combined city and highway driving. Toyota Prius Solar, section 3.1.4.

Recently, Solar Electric Vehicles built a prototype Solar Prius with a PV panel that has a theoretical efficiency of 16%. The PV Prius can go between 5 and 8 miles per day on solar power alone and burns 17% to 29% less gas than a regular Prius.

Fuel economy may be improved by as much as 34-60% (depending on driving patterns and weather) with the

Solar Electric Vehicle (SEV) solar system installed on a Toyota Prius, allowing the car to drive up to 30 miles per day in electric mode.

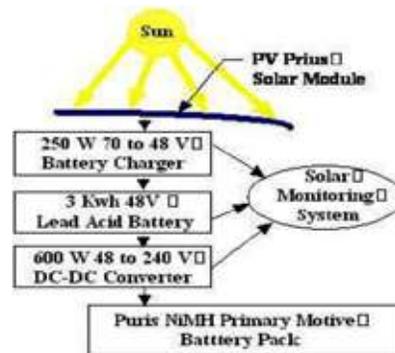


Fig. 11 Connection Diagram for Solar Components of Photovoltaic Prius.

Toyota Prius Plug-in Hybrid

With its 4.4 kWh lithium-ion battery, the 2012 Prius could go up to 23 km without using any petrol. At 120 volts, the lithium-ion battery pack needs 180 minutes to fully charge, whereas 240 volts just takes 90 minutes.

This is anticipated to emit only 49g of CO₂, according to Toyota. It's mileage is identical to that of the third-generation Prius, with the exception of its all-electric efficiency, which is 2.5L/100km. The battery may be charged at any outlet, which is its greatest benefit.

REGENERATIVE BRAKING SYSTEM:

Working Principle

Using the mechanical energy of the motor, regenerative braking transfers energy back into the battery. In theory, the vehicle's kinetic energy might be converted into usable electrical current via the alternator-like regenerative braking system.

When the brake pedal is pressed firmly, the electric motor reverses direction and the car slows down. Regenerative braking is the term for this phenomenon. While traveling backward, the engine acts as a generator to keep the batteries charged. The vehicle is functioning normally, with the motor propelling it ahead while the battery supplies the necessary energy. By lowering the amount of gasoline needed to go the same distance, regenerative braking helps save money and cut down on pollution.

These brakes hold up well in the constant stop-and-go of metropolitan traffic. Regenerative braking is most

effective at modest speeds and in stop-and-go traffic, where the majority of deceleration occurs. The brake controller is the brains of the regenerative braking system, managing the motor in its totality. The brake controller monitors the wheel's rotational speed, calculates the torque and rotational force, and generates energy that is stored in batteries. The brake controller controls the motor's power to manage battery charge.

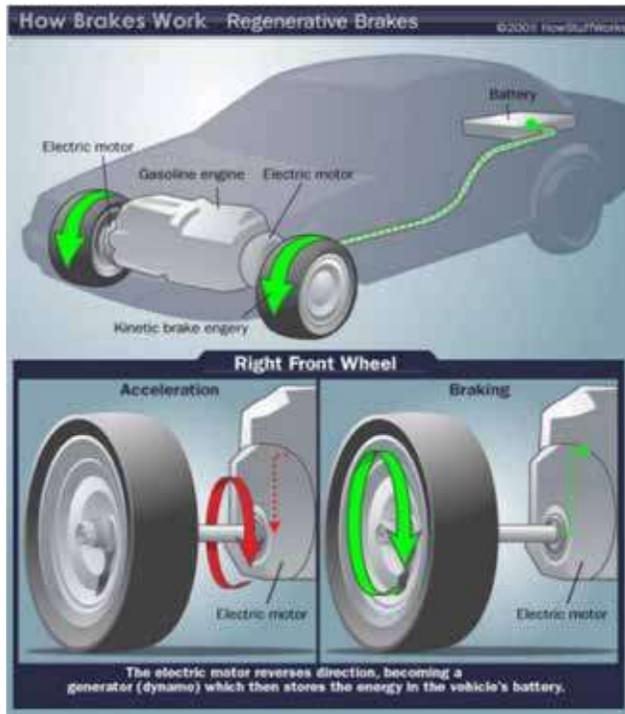


Fig.12 Regenerative braking system

SOLAR POWER

Solar cars are electric vehicles that get most or all of their power from the sun. In order to directly convert solar energy into electric energy, photovoltaic (PV) cells are often utilized in solar panels. The phrase “solar vehicle” typically implies that all or some of a vehicle's propulsion is powered by solar energy. Communications, controls, and other auxiliary operations might all be powered by solar energy.

Currently, solar vehicles are marketed more as engineering experiments and demonstration vehicles, frequently funded by government organisations, than as everyday transportation tools. However, there are many vehicles that are indirectly powered by the sun, and solar boats are sold commercially.

The Japanese are the acknowledged industry leaders,

but the US has just recently begun to produce hybrids. With the Insight and Prius, Honda and Toyota are by far the two biggest manufacturers. US auto manufacturers are far behind.

In fact, when GM just unveiled the Mercury Mariner, a new hybrid, they revealed they had to licence more than 20 different technologies from the Japanese. SUVs and trucks continue to be the focus of US automakers;

Even the popular Ford Escape SUV now comes in a hybrid version. Experts in the field say that most US hybrids are only for show and aren't trying very hard to get into the market.

Corporate Average Fuel Economy (CAFE) standards are the driving force for the introduction of hybrid vehicles. According to current regulations, an automaker's fleet of vehicles must average 11.69 km per gallon.

This means that a car manufacturer can sell four less efficient vehicles—such as SUVs and trucks—with fuel economy ratings of only 8.5 km/l after selling a single hybrid vehicle with a 25.51 km/l fuel economy...

CONCLUSION

The hybrid electric vehicle is designed and tested to offer a pollution-free alternative to automobiles powered by internal combustion (IC) engines. It combines solar charging and regenerative braking technology. One 12V, 80Ah battery was charged using a 120W, 18.6V solar panel and an MPPT charge controller. It is possible to provide auxiliary equipment connected to the vehicle with regenerative power by using regenerative braking with a DC generator. The system's hefty initial cost, however, is its main drawback. It will become more effective and practical with further advancements in battery charge measurement methodology and quicker charging processes. Electric vehicles driven by solar energy are the way of the future for a greener world.

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EXPLORING THE HAZARDS OF MICROPLASTICS IN SHRIMP: A COMPREHENSIVE INVESTIGATION OF IDENTIFICATION AND CHARACTERIZATION STRATEGIES

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ABSTRACT

Nowadays, the presence of plastic in our daily lives is on the rise. The use of plastic has garnered significant attention and has numerous effects on the human body. Due to its unavoidable usage, plastic gives rise to the release of tiny particles known as microplastics. These microplastics have a profound impact on our bodies, causing significant ecological consequences for both humans and society. In this study, we have examined and discussed the identification and characterization of microplastics in shrimp, along with an analysis of shrimp size. It has been observed that various marine organisms ingest microplastics from different regions, resulting in severe ecological repercussions specifically caused by shrimp, such as neurological disorders and intestinal problems.

Keywords : Plastics, Microplastics, Ecological impacts, Shrimp, ingestion of microplastics (MP), Maritime organisms

INTRODUCTION

Plastic has become one of the most often utilized materials since it is more affordable and has more essential features. The handling and disposal of trash is one of the major impacts society has to deal with. Moreover, a total of 10 % of municipal waste covers plastic accumulation in society. Most probably plastics are considered a hazard as they are harmful to humans and society creating serious health effects on humans [1]. Plastic pollution, which is categorized into different categories like both elementary and secondary plastics, has recently had a significant negative impact on marine life and ecosystems. Mega plastics, macro plastics, meso plastics, and micro plastics are some of these and can have an adverse effect on people. Microplastics are often too tiny to be detected with the naked eye and can range in size from 1-6 mm or less. Unfortunately, big plastics may also help create tiny plastics, which can be dangerous for the marine fauna that swallows them. [2].

In the modern world, improper handling and dumping of microplastics can contaminate the water supply, harming fish and other marine life. People's daily use of food tainted with plastic raises their likelihood of developing chronic diseases, which can lead to severe epidemics and social collapse. According to study, microplastics are highly concentrated in the GI tracts of shellfish and other aquatic animals. The degree of toxicity of the compounds included in the microplastic depends on its size, the chemicals associated with it, and the dose [3]. Contamination and incorporation of the microplastics in the marine locality is not only the greatest ecological impact but also everyone compromises in the case of food. Food safety issues and food security are not considered the greatest impact on our society. The ingestion of microplastics in the aquatic ecosystem and other foods is high, which leads to the greatest ecological impacts in the case of the foods which are consumed by humans [4].

ANALYTICAL METHOD FOR DETECTING MICROPLASTIC IN SHRIMP

Sampling of Shrimp

The samples were collected from the different places of geographical channels and the meridional location of the northern ocean between the various areas. The samples were collected from various seas and beaches, harbours, and offshore [5]. Samples collected from the seas were secured in the Al foil at -20°C for few hours before the testing. The samples which are been collected from the far location have been preserved in ethanol. Shrimp have been collected from various areas in Belgium and the North Sea during two different seasons. Samples were collected from different coastal ends and harbours. Shrimp were washed and decontaminated before being separated according to size and stored at -20°C. Microplastic contamination was identified in both internal and external matters of the shrimp [6].

Analysis of Microplastic in Shrimp

The Shrimp were cleaned using filtered ultrapure water with the type of ultrapure filtered water [7]. To remove microplastics from the mussel bodies, a 4:1 mix of nitric acid (65%) and perchloric acid (68%). The shrimp tissues have been heated and digested with an acid solution to decrease the oily tissue. Following filtering, each site underwent a microplastic analysis using a destruction batch that included three blank analyses and five mussels. Following the elimination of blanks, the outcomes were evaluated. Results were assessed following the removal of blanks. Each piece of plastic was confirmed to be plastic using a heated needle [8]. The microplastics which are observed has been classified in the category of (Fragment, Fibre, Flim, and Spherule) has been analyzed and the color of each microplastic have been assessed on both shrimp and the blank sample [6]. Particles that are present in the shrimp was been recognized by the Fourier Transform Infrared spectroscopy (FT-IR) where the instrument is attached to an Auto IMAGE Microscope with a spectrum scale of 400-4000 cm⁻¹ of excellent resolution of 4cm⁻¹ [5].

TYPES OF MICRO PLASTICS AND ITS OCCURRENCE

Table 1: The study reports the existence of microplastics in shrimp, Bivalves, shellfish, and various sources of the marine habitat.

Sample type	Level of MP present /number of MP present	Parts	Type of detritus	Location of sample collected	Source
Sediment sample	2	Island sediments	Acrylonitrile Butadiene Styrene, Polystyrene, Nylon	St John Island	[9]
Beach sample	3	Beach sediments	Polystyrene, Polystyrene/ Polyethylene	Paris Ris	[9]
Beach sample	2	Beach sediments	Poly vinyl alcohol, Polypropylene	East Coast	[9]
Beach sample	-	Beach sediments	-	Changi	[9]
River sample	4	River sediments	Polyethylene	Kallang River	[9]
Beach sample	-	Beach sediments	-	Sembarwag	[9]
Beach sample	-	Beach sediments	-	Sentosa island	[9]
Ocean sample	2	Ocean Sediments	Polyethylene, Polystyrene	RSYC subterranean layer	[9]
Ocean sample	2	Ocean sediments	Polyethylene	RSYC subterranean layer	[9]
Ocean sample	2	Ocean sediments	Polystyrene, Polyethylene	Kranji submersed layer	[9]

Ocean sample	1	Ocean sediments	Polypropylene	Kranji submersed layer	[9]
Mytilus edulis	3.5 fibers/10g w.w	Mussel consumption body	Synthetic fibers	Netherlands	[8]
Mytilus trossulus	3.5/10g fibers, w.w	Groyne body	Synthetic fibers	Nieuwpoort, Oostende, Knokke	[8]
Mytilus galloprovincialis	3.5/10g fibers, w.w	Quayside body	Synthetic fibers	Nieuwpoort, Oostende, Zeebrugge	[8]
Amphipods	8	Muscle	Granular filaments, fibers	UK, Beach	[10]
Lugworms	31	Muscle	Granular filaments, fibers	UK, Estuarine	[10]
Barnacles	86	Muscle	Granular filaments, fibers	UK, Sub tidal	[10]
Crassostera gigas	0.47 particles/g	Soft muscle	-	The great western Ocean, France	[11]
Mytilus edulis	0.36±0.07 individual particles/g	Soft tissues	-	Northern Maritime	[11]
Marine environment	7.21mg Kg-1	Marine sediments	Fibers, Granules, Plastic films, Ps spheres	Harbours Nieuwpoort, Belgium coastal zone	[7]
Marine environment	4.51mg Kg-1	Marine sediments	Fibers, Granules, Plastic films, Ps spheres	Oostende, Belgium coastal zone	[7]
Marine environment	3.34mg Kg-1	Marine sediments	Fibers, Granules, Plastic films, Ps spheres	Zeebrugge, Belgium coastal zone	[7]
Crangon crangon	0.75/9 w.w	Whole and Peeled Muscle	Synthetic fibers	Belgium	[6]
Crangon crangon	1.76g/w.w	Whole and Peeled Muscle	Synthetic fibers	UK	[6]
Crangon crangon	1.21/g w.w	Whole and Peeled Muscle	Synthetic fibers	France	[6]
Crangon crangon	0.74/g w.w	Whole and Peeled Muscle	Synthetic fibers	Netherlands	[6]
Gadus morhua	2.4%	gastrointestinal tracts	Fragment, fiber	North Atlantic, Canada	[12]
Pomatoschistus microps					
	<31%	gastrointestinal tracts	Polyethylene	NW Iberian Peninsula	[13]
Fish	<1mm	hepatocellular adenoma,	polyethylene fragments	aquatic coastal	[14]
Crustacean Nephrops norvegicus	-	predominately filaments	Polypropylene	Clyde Sea	[15]
Mugil cephalus	16.7%	gastrointestinal tracts	Polypropylene, polyethylene, Fibers	eastern coast	[16]

Palaemonetes pugio	55%	gastrointestinal tracts	spheres, fibers, and fragments	Western Atlantic Ocean	[17]
Carangidae	16%	gastrointestinal tracts	blue polyethylene fragments	South Pacific subtropical gyre	[18]
Teleostei	-	reduced acetyl cholinesterase (AChE) activity	pyrene	Aquatic Zone	[13]
Dicentrarchus labrax	73%	pathological alterations	polyvinyl chloride	European sea	[19]
Cylorhinus canicula trawl	-	stomach	Not specified	North Sea	[20]
Nephrops norvegicus	83%	reduced nutrient availability	Fibers.	Clyde Sea	[21]
Sillago sihama	14%	Soft Muscle, Gills, skin, liver	Fibers and fragments	Northern Persian Gulf	[22]
Saurida tumbil	13.5%	gastrointestinal tracts	Fibers, fragments	Persian Gulf	[22]
Cynoglossus abbreviatus	12%	gastrointestinal tracts	Fibers, fragments	Northern Persian Gulf	[22]
Shell fish Alectryonella plicatula	10.78±4.07 / individual	Soft tissues	Fibers, fragments, pellets	Fishery market in china	[23]
Eriocheir sinensis	13%	Stomach	Fragments	Baltic coastal	[24]
Danio rerio	2%	liver, intestine, muscular tissue and brain	Methyl mercury	South Asia	[25]
Cyclina sinensis	4.82±2.17 Microplastics/ individual	Flexible tissues	Pellets Fragments, Fibers,	Seafood market in china	[23]
Rhizoprionodon lalandii	33%	Stomach	Monofilament pellets	Northern region of Brazil	[26]
Nine bivalves	2.1-10.5/g	Tissues of bivalves	Fiber, fragments, pellets	Seafood market in china	[23]
Mytilus galloprovincialis	4.33±2.62 Microplastics/ individual	Flexible tissues	Pellets Fragments, Fibers,	Seafood market in china	[23]
Gobiidae	19%	Reduced acetyl cholinestrerase (AChE) activity	Pyrene	Aquatic zone	[13]

IDENTIFICATION OF MICROPLASTICS

It's difficult to accurately detect microplastics of various measurements, forms, and structures from complex environmental samples when relying on just one analytical method. As a result, it has become common practice to combine many analytical methodologies.

Microplastic analysis typically involves two steps: characterizing the efficient microplastic physically by microscope and Chemical analysis by spectrography is then performed to confirm the presence of microplastics in the each species. Each method and analysis may have the pros and cons of each to make an informed decision [27].

Visual identification

Prior to the term “microplastics,” There was a general occurrence and scattering of big microplastics (1-5 mm) predominantly observed on seashores and, to a smaller extent, in water bodies. The spectrum of microplastics is rather wide; hence sorting and identification were often done side by side using forceps, place the items in a metal tray and can be identified by our naked eye[28], [29]. This visual technique may be used to detect some micro plastics and coloured plastic fragments, as well as pre-production resin pellets ranging in size from 2 to 5 mm [30]. Little plastic particles are sometimes harder to sort and can be overlooked in some beach samples or in ambiguous plastics, but visual sorting and identification of large microplastics is a simple and efficient procedure for experts and volunteers[31].

Microscopy

Microplastics of a size in the hundreds of mill micron are frequently identified using stereo- (or dissecting) microscopy e.g., neuston net samples [32]. Using microscopy-enhanced images, it's possible to clearly view the textures and structural details of items. This gives us the ability to spot plastic-like particles which, at times, can be confusing to identify. While identifying particles that measure less than 100 mm can be difficult, the challenge is even greater when distinguishing microplastics on filter paper by microscopic methods. Studies have revealed that incorrect identification of plastic-like particles via microscopy often exceed 20%, and can be as high as 70% for clear particles. Such a high rate of error is quite alarming.[30], [32], [33]. Very few percentages 1.4% of the microplastics belong to and resemble as same the synthetic fibers origin.[34]. The type of synthetic and natural fibers present in the sample is very strenuous and cannot be analyzed by microscope alone [30]. Numerous of the study reported the presence of synthetic fibers and plastic film in shrimp, Bivalves, mussels, and various marine sediments [6]–[8].Scanning Electron Microscope-SEM results in close up photograph of microplastics on the inside of the particles. Energy-Dispersive X-ray Spectrometer is used to identify the composition and structure of atoms in microplastics. It determines the dominant carbon present in the microplastics [35]. Additionally, MP can also be determined by polarized light microscopy for the detection of microplastics in the mussel's stomach and digestive tract. HDPE High-density polyethylene

particles have been ingested in the range of > 0– 80 µm in the blue mussels [36].

Fourier Transform Infrared Spectroscopy-FTIR for MP analysis

Fourier transform Infrared spectroscopy offers a high range and the accuracy of the microplastics detection and characterization of the plastic polymers by the IR spectra [9], [10], [35]. Polymer spectrum library not only they identify the plastic but also can confirm the specific type of the plastic. For the detection of the small microplastics, it requires the µ-FTIR. Attenuated Total Reflectance (ATR) modes are offered for the detection of microplastics [37]. The ATR and reflectance mode of µ-ATR-FTIR is able to identify microplastics without sample preparation or treatment. Microplastics as small as 10m can be recognized due to the stable spectra from uneven surfaces. Despite some potential drawbacks with the ATR probe and filter paper, FTIR can still provide information on the composition and abundance of polymer in microplastics [38]. Detection of microplastics is expensive, and using ATR to detect microplastics is time-consuming [37]. Because to its lengthy processing time and constrained area, mapping with a single FTIR is seldom employed for regular investigation of complicated field samples. Nevertheless, compared to single beam mapping, the FPA-based reflectance imaging approach may be utilized to quickly and accurately locate microplastics (150-250 m) on larger surfaces [39].

Pyrolysis-GC/MS for MP Analysis

Sequential pyrolysis using gas chromatography and mass spectrometry (Pyro-GC/MS) was used to identify microplastics in the marine environment. After the separation of the microplastics and visual detection of MP, this technique was employed to determine the polymer type, size, and quantity of microplastics present [40], [41]. Before the final pyrolysis of the bio augmentation, a thermal desorption procedure can be utilized, enabling them to be studied concurrently during pyrolysis-GC/MS runs. This pyrolysis-GC/MS approach is fairly successful in assigning essential microplastics to their polyurethan, but the downside is that particles must be manually placed into the pyrolysis tube. As the method can only control particles of a specific minimum size, this restricts the size of particles that may be studied. Moreover, because the technology only permits the examination of one particle per run,

it is unsuited for processing huge sample numbers as those encountered in routine monitoring programs or sampling campaigns [34], [40].

Analysis of MP in shrimp by Raman Spectrography

Raman spectroscopy is considered one of the most efficient methods to identify micro plastics with different situations and environmental factors with high accuracy and reliability [42], [43]. Raman spectroscopy is a nondestructive technique for identifying plastic polymers. This is done by irradiating the sample with a monochromatic laser source of a specific wavelength (typically 500 to 800 nm). The frequency of the scattered light then varies as a result of the interaction between this light and the sample's atoms and molecules. This frequency differential is called Raman offset and can be used to create a substance-specific Raman spectrum. Moreover, this technique is the 'surface technique', meaning it can be used to analyze large, visually sorted microplastics particles, as well as speck sizes beneath 1 μm [42]. When Raman microscopy and Raman spectral imaging are combined, it is possible to produce spatial chemical pictures based on the Raman spectra of a material. Theoretically, full membrane filters may be examined by spectroscopy with spatial resolutions smaller than 1 μm . Even the smallest microplastic particles would be simpler to find in environmental samples; however the goal of the microplastics study has not yet been determined. Raman spectroscopy may also be used with confocal laser scanning microscopy to find polymer particles inside biological tissues with sub cellular precision [42].

EVIDENCE OF MICROPLASTICS IN SHRIMP

The occurrence of microplastics has been analyzed in shrimp and the ingestion of the MP from the coastal region of the southern sea and the channel area of the North Sea. They have collected the shrimp Crangon crangon species from various places in the North Sea. The Morphometric correlation and the condition factor have been analyzed from the shrimp [6]. The length-weight relationship is determined in the evaluation of the crustaceans and the size of the marine organisms and the routine monitoring of the species [10]. The species C. crangon are being able to ingest and consume 63% of microplastics from the shallow water and the narrow channel part of the meridional sea. They have also observed the contamination of the microplastics in

various species which include *Mytilus edulis* and some other species from the marine environment [7], [8]. The study expressed that brown shrimp take up synthetic fibers heavily. The average of the microplastics content of brown shrimp has been identified as the 0.68 ± 0.5 particles/g w.w or 1.23 ± 0.99 microplastics were identified in the narrow channel part and the meridional region of the North Sea [6].

Microscopic synthetic fibers were found in brown shrimp between 200 μm and 1000 μm . The highest contamination of microplastics should be recorded as 96.5% synthetic fiber. The incorporation of the shrimp is high at the percentage of periwinkle at 43%, yellow-greenish at 50%, translucent at 15%, orange fibers at 12%, and transparent and pink fibers at 8% and 2% respectively [6].

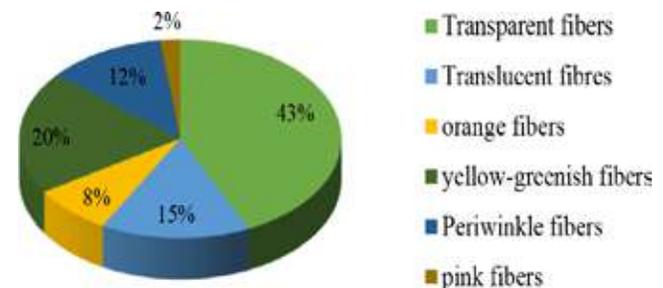


Fig 1. The Histogram represents the synthetic fibers in shrimp from the each-region of Northern Sea

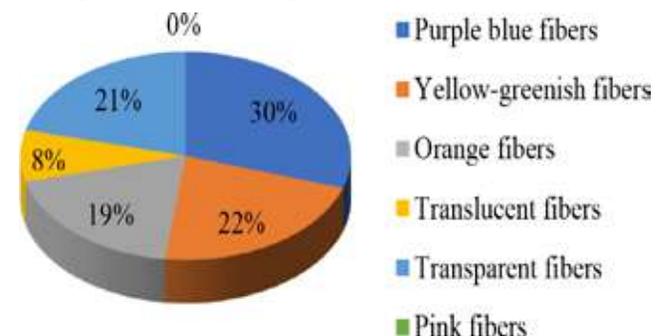


Fig 2. The Histogram represents the synthetic fibers in C. crangon from Offshore of Northern Sea [6].

Other varieties of microplastics have not been observed while examining shrimp. Microplastics have been examined from the large quantity of shrimp and in the different localities in the different seasons (March and October) where no variation has been identified in the incorporation of the microplastics in the shrimp. The increased amounts of microplastics have been reported in the season of October and the lowest incorporation has been reported in March.

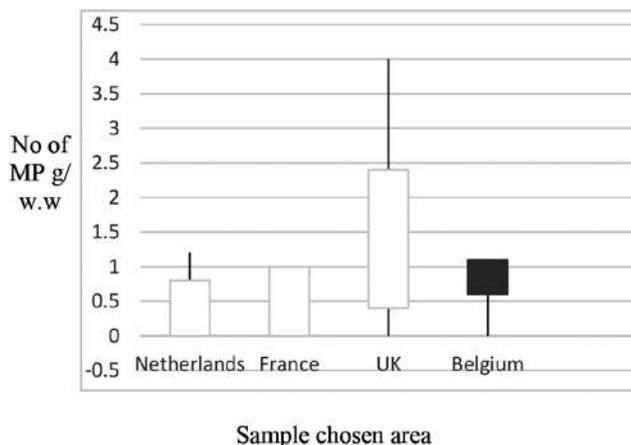


Fig 3. Microplastics which have been overlooked in *C. crangon* from the inter-region seas and channel areas of France [6].

The testing and analysis conclude that the species *C. crangon* can consume and ingest plastic at the range of 63% from the different channel areas and habitats of France, Belgium, Netherlands, and the UK [6].

CONCLUSION

Plastic is considered one of the useful materials that are used and consumed in our day-to-day lives. Improper handling of plastics, usage and disposal results in the contamination of plastic in the living environment. This leads to microplastics getting contaminated in the marine environment and MP pollution in every species. Frequent contamination of shrimp in the marine ecosystem results in the incorporation, contamination, and ingestion of shrimp, fish, and diverse marine species. These MP leads to the incorporation into body tissues, gastrointestinal tract, and stomach leads and affects the entire body system of the aquatic environment and human health. Humans eat shrimp and other aquatic organisms that cause multiple chronic diseases, intestinal problems, outbreaks and severe effects. In a conclusion, reducing the incorporation and ingestion of MP is quite critical. Adaptation and implementation of various waste management and reduction techniques and creating awareness can reduce the limit of litter and recover the ecosystem and marine environment from plastic.

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INVESTIGATION ON THE CRYSTAL GROWTH, SPECTRAL, OPTICAL, THERMAL, MECHANICAL, LUMINESCENCE AND NONLINEAR OPTICAL PROPERTIES OF L – LYSINE ADIPATE SINGLE CRYSTAL

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ABSTRACT

The slow evaporation solution approach was used to generate L-Lysine Adipate (LLA) organic nonlinear optical (NLO) single crystals. The LLA crystallizes as a monoclinic prism with the following coordinates and cell parameters: $a = 10.543(6)$, $b = 7.291(14)$, $c = 10.591(18)$, $\beta = 90^\circ$, $\alpha = 113.358(90)$, $\gamma = 90^\circ$. FT-IR analysis was used to look at the vibrations of functional groups. According to UV-Vis-NIR spectroscopy, the crystal is see-through between 250 and 1100 nm in wavelength. Using the Kurtz and Perry powder test, we were able to calculate the SHG efficiency of LLA crystal. Compared to potassium dihydrogen phosphate (KDP), efficiency of SHG 1.5 times higher. Etching tests were conducted on a single crystal surface using double-distilled water as the etchant. Testing with a Vickers micro hardness gauge reveals that the produced crystal is rather pliable. Typical temperature measurements of the LLA crystal's dielectric constant and dielectric loss between 50 Hz and 2 MHz were taken. The photoluminescence spectra of the crystal showed an emission peak at 420 nm.

Keywords : Crystal Growth, X – ray diffraction, Optical materials, Mechanical properties, Photoluminescence.

INTRODUCTION

When it comes to state-of-the-art networks for transmitting data, optical networks are now at the forefront. Some of the unique parts include materials for nonlinear optical processing [1-2]. This means that top-tier NLO crystals will always be in demand. Growing these crystals is an intriguing process in and of itself. Semi organic crystals combine the best features of organic and inorganic crystals. Crystals that are halfway between organic and inorganic have the best characteristics of both types. High optical nonlinearity, resistance to laser-induced damage, chemical adaptability and outstanding thermal and mechanical durability [3-5] are only a few of the benefits of employing semi organic crystals. Amino acids are crucial to the creation of nonlinear optical crystals and are hence an important class of organic

NLO materials[6-]. Crystals of amino acids always form in noncentrosymmetric space groups [6 -10] because of their chiral symmetry. For SHG to occur, a crystal must have a noncentrosymmetric structure [11-13]. Because they include both a carboxyl acid group (a proton donor) and an amino group (a proton acceptor), many amino acids display nonlinear optical characteristics [14 15]. Amino acids are well suited for NLO applications due to their dipolar structure, which gives them their unique physical and chemical capabilities. In this procedure, L-lysine adipate crystals are formed using a gradual evaporation process. Sharma et al. [16] and K. Ramya et al. [17] have previously described the crystal structure of L-Lysine adipate. In this article, we'll explain everything that's going on. After the crystals have been created, they are subjected to a battery of tests, including X-ray diffraction, Fourier transform infrared, ultraviolet-visible-near-infrared spectroscopy,

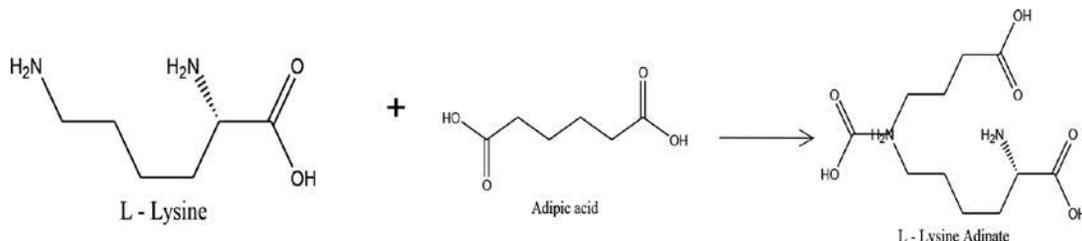
photoluminescence, etching, and second harmonic generation efficiency.

EXPERIMENTAL DETAILS

Synthesis

To make L-Lysine Adipate, a 1:1 molar ratio of L-Lysine and Adipic acid was dissolved in double-distilled

water. A magnetic stirrer with a variable temperature setting was used to continually swirl the fluid. LLA salt was created by evaporating the solution at ambient temperature. The recrystallization procedure was used twice to further purify the salt that was produced. Scheme.1 depicts the processes that take place during the production of L-Lysine Adipate.



Scheme 1 The reaction mechanism involved in the synthesis of LLA

Crystal Growth

A saturated solution of the synthetic salt in a volume of 25 milliliters was prepared at room temperature. Filtered solutions may be protected against rapid evaporation by covering them with perforated polythene. After that, it was placed in an area with low humidity and no dust so that it might evaporate naturally. The LLA crystals were grown for 20 days and then harvested as single crystals measuring 17.32 mm³. The produced LLA single crystals are seen in Fig. 1.

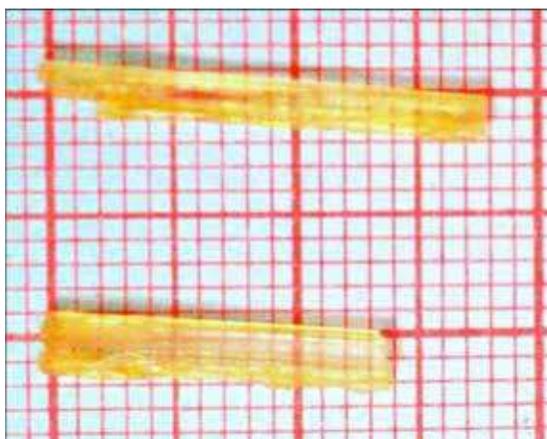


Fig.1 As grown LLA single crystal

RESULTS AND DISCUSSION

Single crystal XRD studies

Single crystal X-ray diffraction analysis was used to learn about the cell, and a graphite monochromated Mo K (= 0.71073) radiation source was coupled with an Enraf Nonius CAD4 X-ray diffractometer. Using

X-ray diffraction, the crystal structure was revealed to be monoclinic. As can be seen in Table 1, the measured values for the unit cell parameters correlate quite well with the values reported in [17].

Table 1 L-Lysine adipate unit cell parameters

Parameter	Present work	Reported [17]
a	10.543 Å	10.532 Å
b	7.291Å	7.283 Å
c	10.591 Å	10.599 Å
α, β, γ	$\alpha = \gamma = 90^\circ$	$\alpha = \gamma = 90^\circ$
-	$\beta = 91.84^\circ$	$\beta = 91.91^\circ$

Determination of some fundamental data

The plasma energy $\hbar\omega_p$ of valence electrons is calculated as

$$\hbar\omega_p = 28.8(Z\rho / M)^{1/2} \quad (1)$$

Z = total valence electrons, ρ = crystal density, and M = crystal molecular weight. Both the Penn gap and the Fermi energy rely on the $\hbar\omega_p$ [18]. explicitly [18]. Using this connection, we can calculate the energy over the Penn gap.

Z = total valence electrons, ρ = crystal density, and M = crystal molecular weight. Both the Penn gap and the Fermi energy rely on the $\hbar\omega_p$ [18]. explicitly [18]. Using this connection, we can calculate the energy over the Penn gap.

$$E_p = \frac{\hbar\omega_p}{(\epsilon_\infty - 1)^{1/2}} \quad (2)$$

The Fermi energy is calculated from the relation

$$E_F = 0.2948(\hbar\omega_p)^{4/3} \quad (3)$$

Polarizability α was obtained by using the following relation [19]

$$\alpha = \left[\frac{(\hbar\omega_p)^2 S_0}{(\hbar\omega_p)^2 S_0 + 3E_F^2} \right] \times \frac{M}{\rho} \times 0.396 \times 10^{-24} \text{ cm}^3 \quad (4)$$

Where S_0 is a constant for the material, which is given by

$$S_0 = 1 - \left[\frac{E_P}{4E_F} \right] + \frac{1}{3} \left[\frac{E_P}{4E_F} \right]^2 \quad (5)$$

The value of α , so obtained agrees well with that of Clausius-Mossotti equation, which is given by

$$\alpha = \frac{3M}{4\pi N_a \rho} \left(\frac{\epsilon_\infty - 1}{\epsilon_\infty + 2} \right) \quad (6)$$

Table 2 displays the results of our calculations for the mature LLA crystal.

Table 2. Characteristic data of the LLA single crystal

Parameters	Value
Plasma energy (eV)	22.84
Penn gap (eV)	6.3990
Fermi energy (eV)	19.101
S0	0.8884
Electronic Polarizability (Penn analysis) cm ³	1.0048 × 10 ⁻²²
Electronic Polarizability (using Clausius Mossotti relation) cm ³	1.0186 × 10 ⁻²²

Analysis via Powder X-ray diffraction

Powder X-ray diffraction is a reliable method for identifying distinct crystal phases by their characteristic diffraction patterns. An X-ray diffractometer equipped with Cu K α radiation ($\lambda = 1.5406$) and measuring a scanning rate of 1°/min was used to examine LLA powder crystals in the 2 θ range of 10 - 80°.

Figure 2 displays the XRD patterns that were obtained. AUTOX 93 was used to create an index of the observed

reflection planes. Crystals of LLA have been found to have high crystallinity, as shown by their X-ray diffraction patterns.

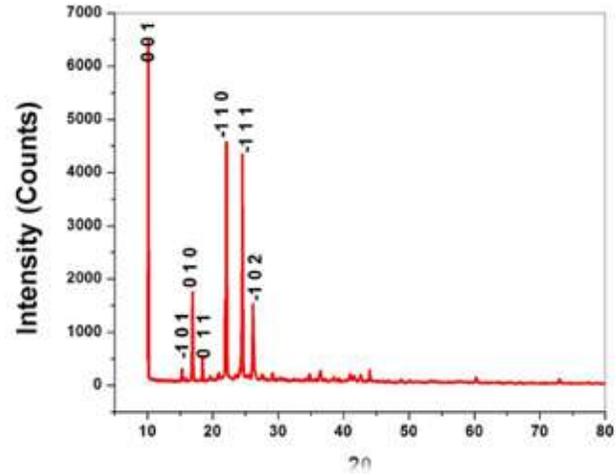


Fig.2 Powder XRD pattern of LLA crystal

Crystallite size (D) was estimated by Scherrer formula $D = k\lambda/\beta\cos\theta$ (7)

W-H technique (a modified Scherrer equation) was used to determine the lattice strain. [20].

$$\beta\cos\theta = (k\lambda/D) + (4\epsilon\sin\theta) \quad (8)$$

W-H plot of $\beta\cos\theta$ against $4\sin\theta$ (Fig. 2a) provides information about micro strain. Positive slopes were observed for LLA. Positive slope indicates the presence of strain is 0.223.

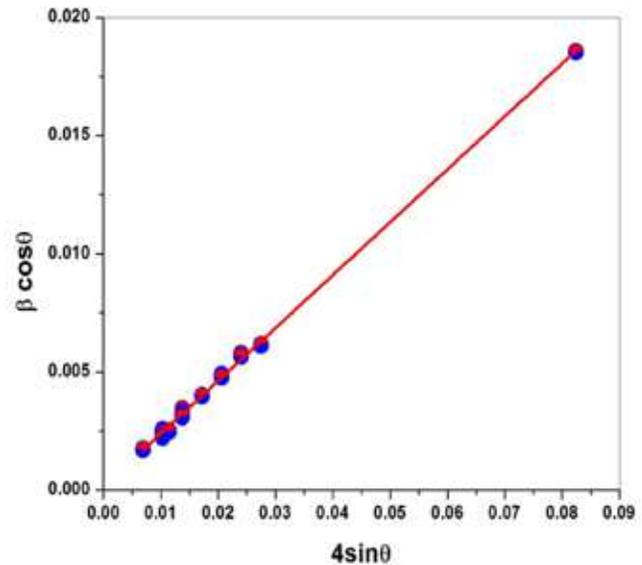


Fig. 2(a) W – H plot of LLA crystal

FT – IR spectral analysis

Pressed KBr pellet method was used to capture a Fourier transform infrared (FT - IR) spectrum in the spectral region of 400 to 4000 cm^{-1} , as shown in Fig. 3. Table 2 displays the measured wave numbers and their estimated frequencies. At 3160 and 2104 cm^{-1} , one can see the NH_2 asymmetry and deformation vibration bands. $\text{C} = \text{O}$ asymmetric stretching vibration is attributed to the 1636 cm^{-1} peak. At 1350 cm^{-1} , $\text{C}-\text{N}-\text{H}$ stretching vibration is detected. $\text{C} = \text{C}$ stretching of the formed crystal is responsible for the absorption peak seen at 1421 cm^{-1} . CN stretching vibration causes an absorption band at 1404 cm^{-1} . The COO -rocking vibration has been attributed to the peak at 631 cm^{-1} [21].

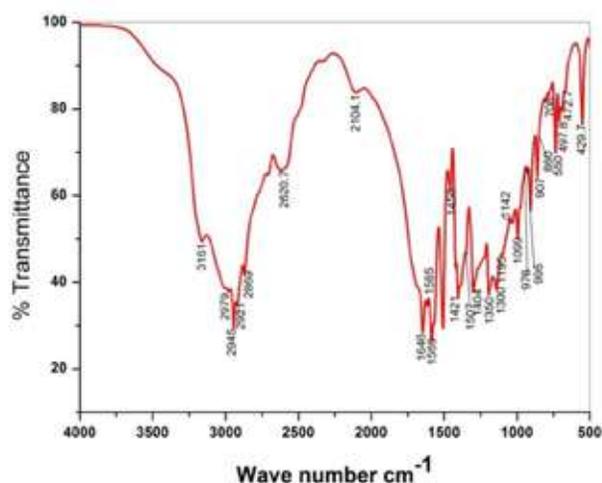


Fig. 3 FT-IR spectral band assignment of LLA single crystal

Table 2 FT-IR Vibrational frequency with tentative assignments of LLA

Wave number (cm^{-1})	Assignments
3161	NH_2 , Stretching vibrations that are asymmetrical
2620	$\text{C} = \text{O}$ Vibrational stretching symmetry
2104	NH_2 deformation
1636	$\text{C} = \text{O}$ Stretching vibrations that are asymmetrical
1585	$\text{C} = \text{O}$ Vibrational stretching symmetry
1569	NH_2 deformation

1456	$\text{C} - \text{N} - \text{H}$ stretching vibration
1421	$\text{C} = \text{C}$ a trembling that stretches
1404	$\text{C} - \text{N}$ a trembling that stretches
1350	$\text{C} - \text{C} - \text{N}$ uneven lengthening
1300	$\text{C} - \text{C} - \text{N}$ uneven lengthening
976	CH_2 rocking vibration
860	$\text{C} = \text{C}$ stretching
631	CH_2 rocking vibration
508	$\text{COO} -$ Wagging vibration

Optical Transmittance Spectral Studies

Using a Perkin Elmer Lambda 35 double beam UV-Vis-NIR spectrophotometer, we measured the LLA single crystal's optical transmittance from 190 to 1100 nm to create Fig. 4. The transmission curve reveals that LLA has an NLO application potential because to its reduced cut off wavelength of 290 nm and its transparency of 80% in the area of 420 - 1100 nm. Using the formula $\alpha = [2.303 \log_{10} (1/T)]/d$, we can get the absorption coefficient (α) given the transmittance (T) value. Where d is the sample's thickness. Optical energy band gap may be determined using Tauc's relation [22], which describes the relationship between the absorption coefficient (α) and the photon energy ($h\nu$). Band gap energy was determined by graphing $(\alpha h\nu)^2$ against $h\nu$ versus $(\alpha h\nu)^2$, and the result is shown in Fig. 5. Extrapolating the linear portion of the graph to the X - axis yielded the optical band gap (E_g). A gap of 3.9 eV in the optical energy band is measured.

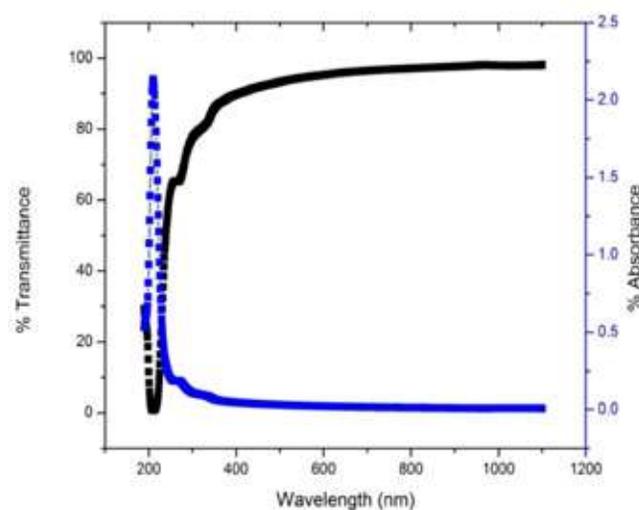


Fig. 4. Spectrum of light allowed through LLA in the UV, Vis and NIR

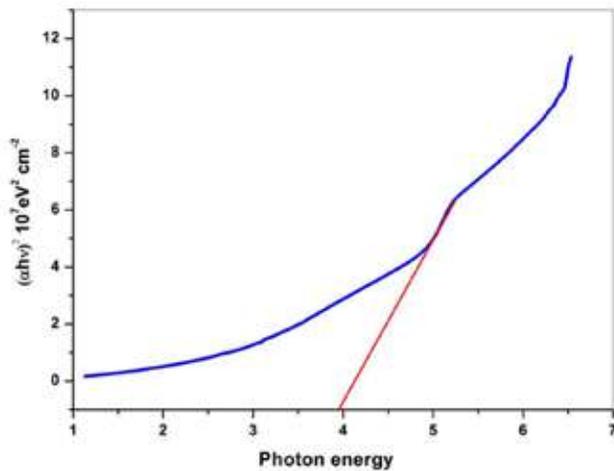


Fig. 5. Band gap diagram of LLA single crystal h against $(ahv)^2$

Dielectric Studies

The HIOKI 3532 50 LCR HITESTER was used to test the dielectric response of generated crystal throughout a wide temperature and frequency range. We conducted our dielectric study on a single crystal of optical-grade LLA that was 2 mm in thickness. The sample was silver-pasted on both sides and then sandwiched between copper electrodes to form a parallel plate capacitor. Capacitance readings from a range of 50 Hz to 2 MHz were taken using an LCR meter at a variety of sample temperatures.

To get the crystal's dielectric constant (ϵ_r), we used the formula $\epsilon_r = CPd/(A\epsilon_0)$, where C is the crystal's capacitance, d is the crystal's thickness, ϵ_0 is absolute permittivity of open space (8.854×10^{-12} F/m), and A is the crystal's area. Figure 6 depicts frequency-dependent change in dielectric constant. As can be seen from the graph, the dielectric constant value declines with increasing frequency up until it levels out at very high frequencies, and this trend holds true for a given temperature. It is believed that a crystal's dielectric mechanism is responsible for its orientation, electronic, and ionic polarizations, frequency-dependent space charge.

The high dielectric constant of LLA crystal at low frequencies is a result of the large polarization contribution from dipolar orientation. As frequency increases, the dielectric constant decreases because the previously indicated polarizations become less significant [23]. The increase in dielectric constant with temperature [24] is a result of space charge polarization

at the grain boundary contacts. The flawlessness and purity of the crystal are critical to the occurrence of this event. The sample's dielectric loss may be found by solving the equation $\epsilon'' = \epsilon_r \times D$, D = dissipation factor. Figure 7 shows how the dielectric loss of the crystal grows or shrinks as a function of frequency and temperature.

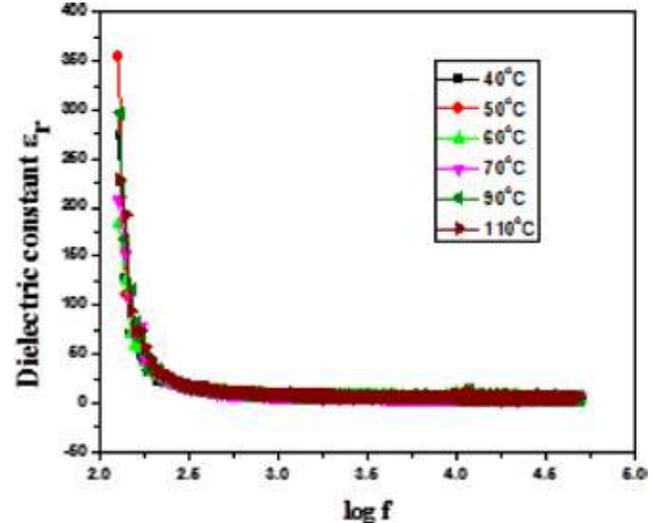


Fig. 6 Temperature dependence of the logarithm of the dielectric constant

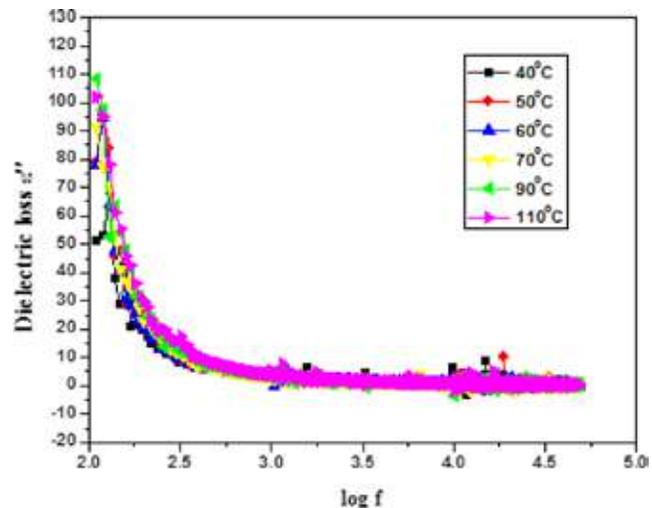


Fig. 7 Logarithmic relationship between dielectric loss and temperature

The graphic demonstrates that dielectric loss is significant at low frequencies and decreases with increasing frequency. Dielectric loss in LLA crystals reduces with increasing frequency, which is desirable in the development of nonlinear optical materials since it indicates higher optical quality with fewer defects.

Mechanical strength analysis

The Vickers microhardness of a single LLA crystal was measured using a Shimadzu HMV-2000 hardness tester equipped with a diamond pyramidal indenter and an incident light microscope. There was a 3 second indentation time for each given load. We measured the lengths of the diagonal indentations at various values of P, from 5g to 200g. The Vickers microhardness number (Hv) was calculated using following formula: $H_v = 1.8544 P / d^2$ (kg/mm²), where P is the applied stress in kilograms and d is the average diagonal length of the indentation in millimeters. The variation in hardness with applied force is seen in Fig. 8. The hardness number value rises as the applied stress rises due to the reverse indentation size effect [20]. When force applied to the surface of the crystal was more than 200g, many fissures formed as internal stresses released themselves locally as a result of the indentation.

Meyer's law states that the indentation diagonal length is proportional to the load, $P = Adn$. As can be seen in Fig. 9, the influence of indentation size was described using Meyer's power law, and the Meyers index (n) was calculated by plotting log P versus log d. The calculated value of n is 2.8 less than the linear regression's slope. According to Onitsch [25], a value of n less than 1.6 is suitable for hard material, while a value more than 1.6 is suitable for soft material. Because of this, we know that LLA is a pliable material because of the microhardness investigation [26, 27]. When a material reaches its yield strength, it switches from elastic to plastic mode, marking its elastic limit. For a given value of LLA single crystal hardness, the following relation may be used to calculate the yield strength,

$$y. \sigma_y = \frac{H_v}{2.9} (3 - n) \left[\frac{12.5(n-2)}{1-(n-2)} \right]^{n-2}$$

Since LLA crystal has a Meyer's index of 2.8, the following calculation may be used to determine its yield strength. Fig.10 is a graph depicting the relationship between the applied load (P) and the yield strength (y). The following Wooster's empirical connection has also been used to get the elastic stiffness constant (C11). It provides a rough notion of how strongly adjacent atoms are bound together.

$$C_{11} = (H_v)^{\frac{7}{4}}$$

In Fig. 11, we see a graph of the LLA crystal's stiffness

constant (C11) vs the load (P). As the load was increased, so too was the stiffness constant.

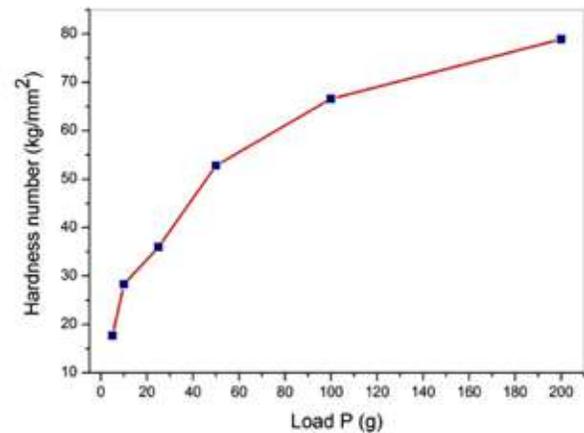


Fig. 8 Microhardness values for LLA crystals show load-dependent variation

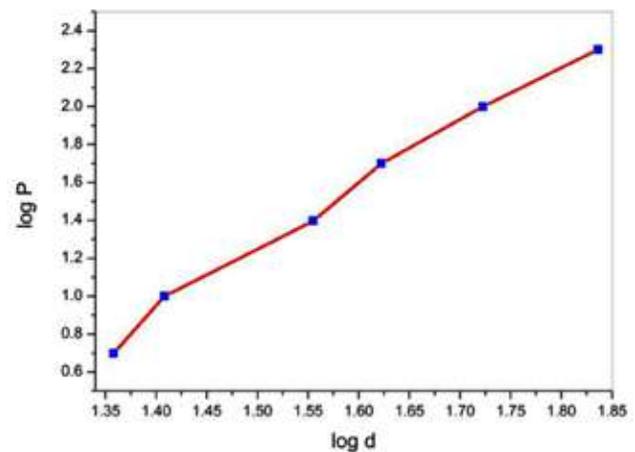


Fig. 9 log P varies with log d for LLA crystals

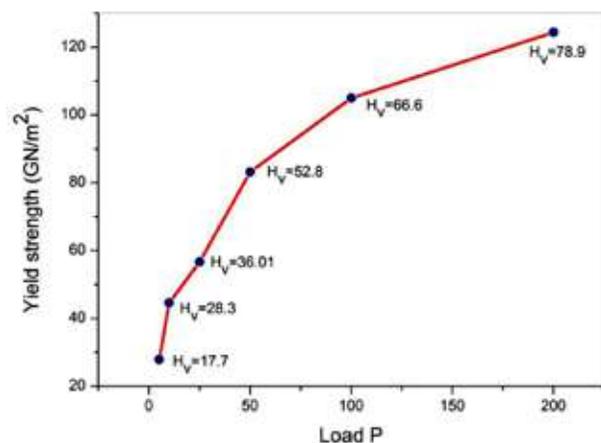


Fig. 10 Yield strength (σ_y) vs load (P) as a function of time

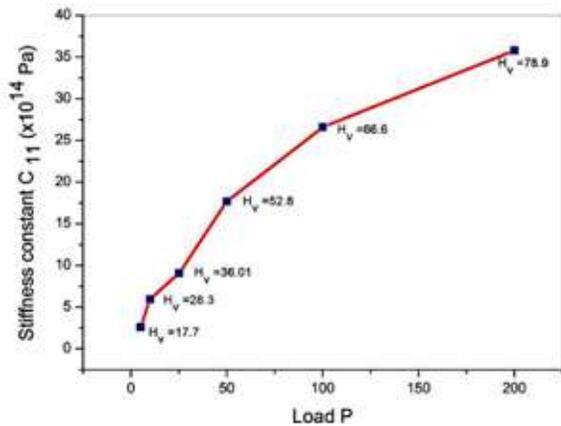


Fig. 11 Changes in the stiffness constant (C_{11}) as a function of load P

Etching Study

When a crystal is etched, its growth pattern, dislocations, and other imperfections become visible. Etched surface as grown crystal of LLA was captured in reflection mode microphotographs using a Motic camera.

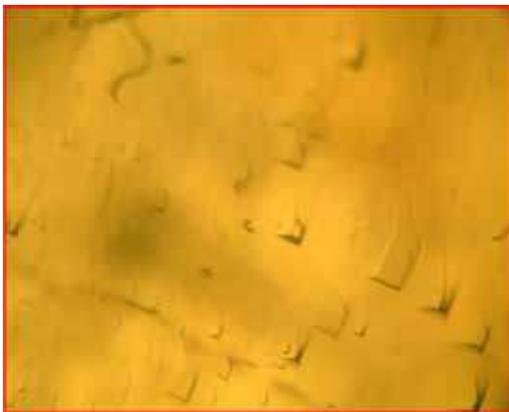


Fig. 12(a) Crystalline LLA surface etched for 5s as grown

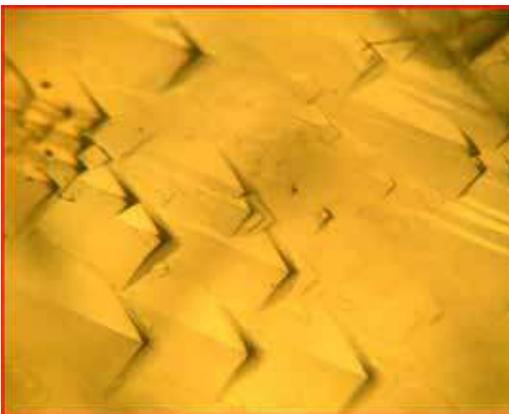


Fig. 12(b) Ten-second etching of an as-grown LLA crystal's surface

The etching process was completed using DD water. The crystals were etched by being submerged in DD water at room temperature for 5 and 10 seconds, respectively, before being carefully wiped clean with tissue paper. Figure 11a shows an etch pattern made using 5s, while Figure 11b shows an etch pattern made with 10s. In roughly 5 seconds, a grid of perfectly straight, rectangular lines will be etched into the crystal's surface. Clearly visible stacking planes can be seen on the crystal surface after just 10s of etching (Fig. 11b).

Photoluminescence Study

Characterizing flaws, vacancies, and other irregularities in the manufactured crystal may be done without destroying it using photoluminescence (PL). Absorption of light generates a bound excited state, which subsequently decays back to the ground state, as demonstrated in investigations [28–30]. The luminescence spectra of an LLA crystal were recorded at room temperature using a Carry Eclipse fluorescence spectrometer. In Fig. 13, we can see the emission spectra that was recorded between 300 and 530 nm. This finding demonstrates that the LLA crystal emits blue fluorescence. $E_g = (hc / \lambda e)$ was used to determine the optical band gap. Maximum emission wavelength for (420 nm) LLA crystal is where h is Planck's constant, C is the speed of light, e is the charge of an electron, and λ is the wavelength. It is determined that 3.1 eV is the energy of the optical band gap.

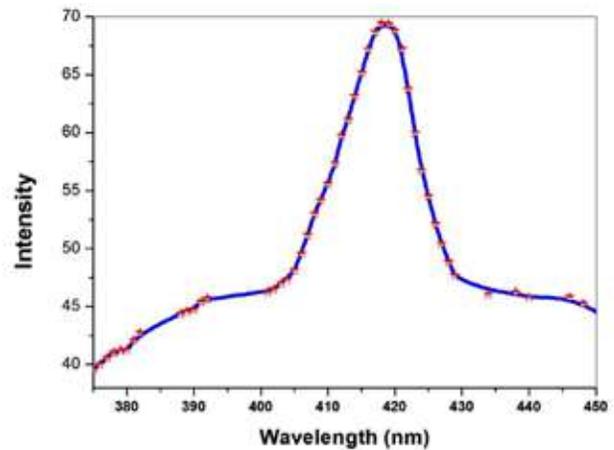


Fig. 13 Photoluminescence spectrum of LLA

Nonlinear Optical Property

When first screening materials for second harmonic generation (SHG) efficiency, the powder approach

developed by Kurtz and Perry [31 -33] is a useful tool. The crystal was finely ground into micro crystallites, packed tightly into a capillary tube with a standard bore size, and stored in a cell holder. The LLA powder was subjected to a powder SHG measurement using standard 1064 nm laser beam radiation. The powder crystalline sample was hit by light with an incidence energy of 0.7 J. A Czerny-Turner monochromator was utilized to concentrate the second harmonic signals that were emitted by the sample. The photomultiplier tube used to gather the optical signal validated the SHG signal as coming from a source emitting green light at 532 nm. The oscilloscope showed the output signal. Potassium dihydrogen orthophosphate (KDP) is the industry standard.

CONCLUSION

L-Lysine adipate (LLA) single crystals of optical purity were produced using a slow evaporation approach. The grown crystal is a member of the monoclinic crystal system, as shown by the XRD pattern of a single crystal. The FT-IR spectrum of the LLA single crystal shows the existence of many functional groups. Studies in the UV, Vis, and NIR spectra have all shown no absorption in the area. LLA crystal has a band gap energy of 3.9 eV. Research into dielectrics demonstrates that, throughout a range of temperatures, dielectric constant and dielectric loss both drop as frequency increases. Vickers microhardness testing revealed that LLA displays RISE, or a rise in indentation size with increasing stress. Etching the developed LLA crystal displays the defect structure as a series of rectangular etch pits. Some closely spaced etch pits are created when the etch period is raised to 10s. When compared to KDP, LLA crystal has a SHG efficiency that is 1.5 times higher. The spectrum of the crystal's photoluminescence reveals that it emits a violet-blue light. In photo catalysis, the LLA crystal's luminescence spectrum will be put to good use.

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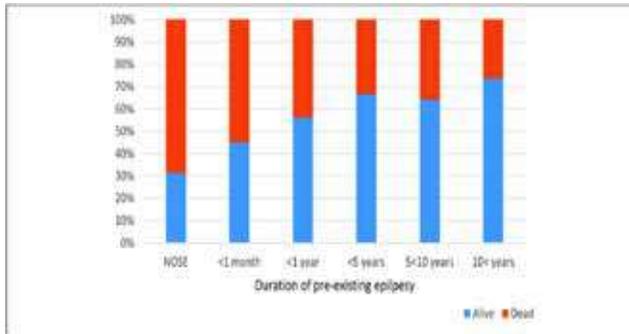


Fig 2 Duration of pre-existing epilepsy

The classifiers of machine learning model are perfect for classifying EEG data and detecting epilepsy by identifying pertinent designs of high performance. The selection of appropriate classifiers and features is a serious problem to detect this disorder accurately. Therefore, in this study, we present feature extraction methodology which is used to detect epileptic seizures along with the machine learning model. In addition to this, the important reason to develop this system is to overcome the existing research gaps and to provide better system to predict this disorder with high accuracy. This evaluation underwrites in many ways; firstly, we have identified the maximum used classifiers and datasets for exact classification of epileptic seizures. Secondly, identifying its boons than existing methodology.

LITRATURE SURVEY

Epilepsy is an ongoing, seizure which alters normal brain activity and manifests as unpredictable electrical disturbances. This disorder is documented using an EEG to analyse disease indicative of seizures. Therefore, several ML methods have been developed to classify these signals. The ML classifiers which are used mostly are decision trees, K-nearest neighbours, neural networks and support vector machines [10-14]. In [15] investigated that the it leads the loss of important information required for classification by using preprocessing technique so signal classification methods must take the original data into account. Hari Kumar [16] introduced fuzzy logic method using genetic algorithm to predict epileptic and non epileptic signals. They developed additional methods and categorised risk factors and accurate detection of epilepsy. Shamila, etc. [2] developed a model to differentiate this disorder using EEG data. Here, the framework relies on individual wavelet transforms using linear and non linear classifiers to analyse EEG signals. Also,

bootstrap aggregation and Q factor methods for the detection is epilepsy is proposed [17]. Also, Mursalin [18] projected random forest feature technique to perceive epileptic features. There are several approaches to detect epileptic seizures, including feature selection, feature extraction, and size reduction established built on fuzzy logic [19,20]. As a result, EEG signals used in several studies by performing various analysis. However, finding a genuine technology that can solve all of these problems is the primary requirement of this proposed methodology.

EXISTING SYSTEM

Logistic Regression is one of the most used types of unsupervised Machine Learning algorithm. It is a predictive algorithm which is based on the concept of probability.

Decision tree is an another algorithm which consists of two nodes i.e., decision and a leaf node. Decisions nodes are used to make decisions and the output of these decision nodes are called leaf nodes.

Disadvantages

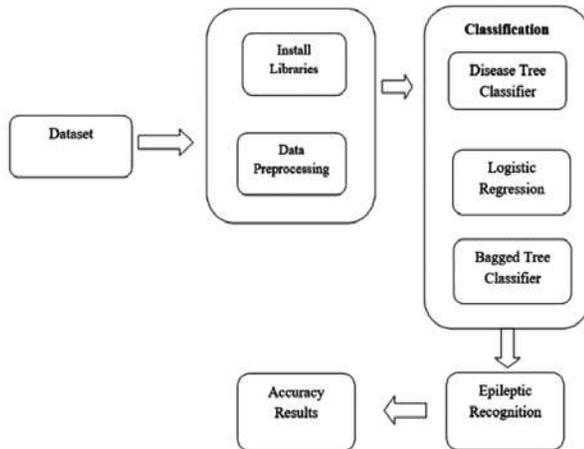
- The major limitation of Logistic Regression is the hypothesis of one-dimensionality is used between the dependent and the independent variables.
- It is hard to get composite relationship using this regression model.
- One of the limitations of decision trees is that they are largely unstable compared to other decision predictors.
- Less effective in prediction.

PROPOSED SYSTEM

Epilepsy is the major fatal disease which affects so many lives in today's world. The death rates due to epilepsy disorder are also increasing day by day. Hence we require a better predicting model to predict epilepsy disorder based on their health parameters. Here, we propose an ML classifier technique to predict epileptic disorder. In existing system machine learning algorithms such as logistic regression and decision tree algorithms are used. Hence we compare the accuracy level of existing algorithms with the proposed algorithm. We choose python language to execute our predicting model. We build Bagged tree classifier model to predict epileptic disorder for better accuracy result compared

to the existing systems which has proven the same. The Bagged tree classifier algorithm gives 96.75% of accuracy which is better than logistic regression (89.51%) and decision tree classifier (90.51%) accuracy levels.

ARCHITECTURE DIAGRAM



MODULES

Modules – System Implementation

Importing the packages

For this project, the packages of ML techniques which we use are Pandas, NumPy, scikit-learn to split the data, building and evaluating the classification models.

NumPy: It is used to read and handle arrays and numerical data.

pandas: It is used to handle CSV files

matplotlib: To create charts using pyplot.

warnings: To suppress the warnings in the software

train_test_split: It is used for splitting the data into training data and testing data

StandardScaler: It is used to scale the features of the dataset

Data Pre-processing

The pre-processing step used here is finding the missing values of the dataset. The missing data is the major disadvantage of real world data. It is because of data corruption or failure to record data. The handling and correction of missing data required during the pre-processing as many ML algorithms do not support missing values.

Splitting The Data

Here, we are going to separate dependant and independent variables. Here we also separate the data into training and testing data with the train test split method.

Modeling of data

In this step, we will be building a model using logistic regression, SVM and bagged tree classifier. All these models are used and also it can be validated with its accuracy level using feasible package of ML models i.e., SCIKIT package.

Classification using Logistic Regression

Logistic Regression is also known as problem sorting algorithm. The examples of classification problems are predicting whether the content is fraud or not fraud, spam or not spam, benign or malignant. Logistic regression transmutes its output by means of a probability value. Logistic regression uses more complex cost function such as sigmoid and logistic function. The hypothesis of logistic regression limits the function between 0 and 1. Therefore linear functions fail as it can have a value which is greater than 1 or less than 0.

In this technique, we can formulate and write this as:

$$P(X) = P(Y=1|X)$$

The probability prediction is converted between 0 and 1 using the required methods.

Classification using Decision Tree Classifier

A decision tree is a supervised machine learning algorithm that consisted of either decision node or leaf node. This technique is very simple and user friendly. It contains internal and external nodes that are linked to each other. The internal nodes are used to make decisions and the next node is visited by the child node. On the other hand there is no child node to the leaf node and is also associated with the label.

Classification using Bagged tree classifier

In bagged tree classifier technique instead of using single decision tree multiple decision trees are used. Bootstrap Aggregation is the abbreviation of Bagging. Here the prediction is done by the comparison of multiple decision trees. Depending upon the samples, this algorithm consists of 5 to 100 or more than 100 trees. Each of the tree may vary with their count, features,

data, etc.

HARDWARE & SOFTWARE REQUIREMENT

Software Used:

Language : Python
IDE : Anaconda, Notebook

Hardware Used:

Processor : i3 or above
Ram : 4 GB or above

SIMULATION RESULT



Algorithm	Accuracy
Logistic Regression	89.51%
Decision Tree Classifier	90.51%
Bagged Tree Classifier	96.57%

CONCLUSION

This proposed method on the recognition and prediction of epileptic disorder with higher accuracy levels using the Bagged tree classifier. An analysis of various classifiers of ML was done, and the data sources were systematically mentioned in the proposed system. The datasets that are openly accessible were understood and examined, and maximum of the selected studies used these datasets for their research work. The classifiers studied were Decision tree classifier, Logistic Regression, and Bagged tree classifier, provided very good accuracy results. Also various algorithms can be used to predict in future.

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A REVIEW ON OIL SPILL MANAGEMENT ON OFFSHORE

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ABSTRACT

Millions of miles of coastline, river systems, lakes, and the terrestrial ecosystem are at risk every day from oil spills, especially in locations with significant oil drilling, refining, and shipping. The oil leak issue is becoming more complicated and widespread. Oil spills from ships illustrate the detrimental consequences of oil spills on aquatic and coastal ecosystems. The effects of oil spills nearest to shore are the most destructive to the ecology since the oil does not have time to disperse before reaching the beach, potentially severely disrupting the delicate habitats of a variety of animals. Exxon Valdez and the ongoing Deep water Horizon oil spill in the Gulf of Mexico are examples of the dangers associated with oil production and transportation. Since no foolproof methods exist for cleaning up oil spills, preventing them from occurring in the first place is the only viable alternative for regulating oil transportation and exploration.

INTRODUCTION

Although oil spills are an unavoidable concern in today's modern civilization, recent, preventable big spills have shown that significant enhancements are needed to enhance response efficiency. The business community has implemented several operational and maintenance methods to cut down on spills. Even while oil production, transportation, and consumption have all grown during the previous decade, the rate of spills has reduced. Despite this, experts on oil spills believe that between 30% and 50% of all leaks are caused by human mistake, while the remaining 20% to 40% are the result of equipment failure or malfunction. New sources of oil leak danger come from rising Arctic shipping activity, deep-water drilling, and a dramatic rise in crude-by-rail shipments. The effects of oil spills on ecosystems are many and severe. However, the effectiveness of spill containment and clean-up efforts is rated as about average. The seashore is the most common location for oil spills to wash ashore, necessitating clean-up efforts

and the exercise of caution to prevent further damage that might impede the recovery process.

Oil Spill Sources and Spill Rates

With rising oil use, production, and exploration, oil pollution is gaining attention throughout the world. Between the oil fields and the client, oil must be carried anywhere from ten to fifteen times between tankers, pipelines, railcars, and tank trucks.

Along the route, oil is stored at a number of ports, refineries, and transfer stations. Exploration, production, transport, and storage are all vulnerable to accidents.



Stopping leaks is a must if we want to keep Earth looking its best. Strong new rules and stringent operational standards are being enacted and implemented jointly by the government and the oil industry to reduce the possibility of oil spills. In order to reduce the frequency of incidents resulting to spills, the industrial sector has established several operating and maintenance measures. However, leakage rates have been decreasing during the last twenty years. This is especially true in the event of a tanker catastrophe at sea. Human error may be reduced by the implementation of stringent training programs. Despite clean-up efforts, an estimated 30–50% of oil spills are still attributed to human error, while the remaining 20–40% are the result of equipment failure or malfunction.



Oil Recovery on Water

The recovery process follows the initial oil spill cleanup. The bulk of a spilled oil on land will go to a nearby body of water, making it easier to remove. Making it simpler to recover oil is a main objective of containment, which is why thick layers are created. It's typical practice to tackle oil spill clean-up in two phases: containment and recovery. In order to make the most of the better oil thickness, excellent weather, and less degraded oil, equipment and employees are rapidly sent to a spill site once booms have been placed up. Recovering oil that has dispersed or been extensively damaged by weather is challenging.

Skimmers

Oil floating on the water's surface may be collected using mechanical skimmer machines. They may vary considerably from one another in terms of size, function, capacity, and maybe even recovery effectiveness. Different types of skimmer are used in different

environments (on land, at sea, in shallow water, and in rivers) and for different types of oil with varying viscosities. Most skimmers only function well when the oil slick is rather large. Before using skimmers, oil may be collected using booms, a shoreline, or floating ice. A skimmer is placed in the area with the greatest concentration of oil in order to extract as much of it as possible. The local climate has a significant influence on how well skimmers work at a spill site. Waves above 1 m in height or currents over 0.5 m/s render most kinds of skimmers useless.



The cold and the presence of debris like branches, algae, or floating rubbish render most skimmers ineffective. Some skimmers include screens at the intake that gather big particles like ice and debris; others utilize conveyors or similar devices to collect and remove rubbish; still others use seaweed cutters. If the intake or entrance of an oil skimming device gets blocked with debris or a particularly viscous oil, the device may fail to gather oil. Oil is recovered using a combination of a boom and a skimmer.



Sorbents

Sorbents may be used for oil recovery in two distinct ways: absorption and adsorption. They may be used as the primary method of cleanup and containment for smaller spills, and as a complementary method for bigger accidents. An example of a passive cleaning method is the deployment of sorbent booms anchored off of moderately oiled shorelines to collect any remaining oil that washes up on the coast and prevent its contamination or reoiling of the region. Sorbents may be made from any substance, whether it is natural or synthetic. Natural sorbents include things like peat moss, wood, and inorganic elements like vermiculite and clay. Loose sorbents may be bought and kept in bags, nets, or stockings, and come in a variety of forms such as granules, powder, chunks, and cubes.

Other forms that sorbents might take include pads, rolls, blankets, and cushions. Synthetic sorbents have gained traction in recent years as a go-to for cleaning up oil spills. These sorbents may be used to clean oil recovery equipment like skimmers and booms after a spill cleanup activity has concluded. Sorbent sheets are often used for this purpose.

Chemical Agents



Specially formulated chemicals for treating oil spills are another option for cleanup. Several chemical agents are available for the removal of oil spills. These chemical agents cannot be used without first receiving approval from the appropriate authorities. It is not always effective, and the oil that has been treated with these chemicals may still be harmful to aquatic and other organisms.

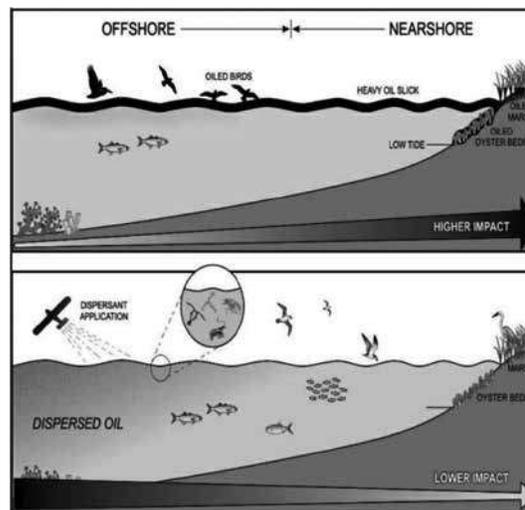
Dispersants are a kind of chemical used to clean up oil spills by breaking it up into smaller droplets that may be dispersed by waves and currents. Tiny oil droplets don't become slicks because of dilution,

current transmission, and natural weathering processes including disintegration, microbiological degradation, and sedimentation. It's not usually the case, but dispersants may occasionally be used legally. They have little practical use in saltwater or on land. Oil becomes less dispersible as it weathers, mostly due to an increase in viscosity, reducing the efficacy of dispersants. Dispersant droplets need calm breezes to rest on the oil slick and mingle with it. Oil spill countermeasures such as dispersants are limited in their effectiveness by a number of factors, including water depth (often greater than 10 meters), distance from the coast (often greater than 5 kilometers), time of year, not spraying over birds, sea turtles, or marine mammals, and length of application.

The choice to use dispersants is taken after considering the potential positive and negative impacts on valuable resources. Using chemical dispersants in this manner is not without its pros and cons.

In-Situ Burning

One technique for removing oil from a spill is to burn it off at or near the site.



As can be observed in Fig. 4.2.1, there are drawbacks to using chemical dispersants. A key feature of this technology is that it may permanently solve the problem of oil contamination in a large region in less time or the same time as prior ways. Using this method, oil spills on land (including wetlands) and ice-covered seas (where the ice acts as a barrier to the oil) have been dealt with for some time. After the 2010 Deepwater Horizon oil disaster in the Gulf of Mexico, this technique was extensively employed to clean up the polluted water.

Shoreline Clean-up

Not all of a marine or freshwater oil spill can be cleaned up before it reaches land. Compared to maritime containment and recovery efforts, shoreline cleaning is more time- and labor-intensive. Oil removal by humans may cause more ecological and physical damage to particular types of shoreline than oil removal by natural processes. Cleanup and rehabilitation efforts on oil-contaminated shorelines must take into account social, economic, and environmental effects. Among them are the different types of shoreline and their susceptibility to oil spills, the behavior of oil along the coast, and the assessment process, protective procedures, and planned cleanup approaches.

Some forms of shoreline are connected to other forms of land and need comparable upkeep. Figure 4.3: Beach cleaning after the spill.

The kind of coastline or comparable land surface has a significant role in determining the severity of an oil spill and the procedures necessary to clean it up. In actuality, the most important factors in oil spill repair are the shoreline's basic structure and the volume of the current material. Oil spill risk and cleanup complexity are taken into account while rating beaches. The most susceptible types of coastline include sandy beaches, beaches with a mixture of sand and gravel, gravel beaches, riprap, exposed tidal flats, protected rocky coasts, peat, sheltered tidal flats, marshes, mangroves, swamps, and low-lying tundra. The shores of both saltwater and freshwater waters may be home to these creatures. It may be best to do nothing and let nature take its course if an oil spill occurs along the shore.

Contingency Plan

A contingency plan for an oil spill is a comprehensive strategy for responding to and cleaning up a spill that might be hazardous to nearby waterways or shorelines.

CONCLUSION

Oil spills will occur so long as humans keep digging for oil, refining it, and using it. After a significant spill, efforts to better prepare for and respond to oil spills are redoubled. The 2010 Deep water Horizon oil accident in the northern Gulf of Mexico prompted substantial investment by business and government in blow out prevention and control and subsea dispersion injection systems. Concerns regarding the safety of transporting oil sand and Bakken petroleum through pipeline and

train have prompted a recent shift in attention to spill prevention and response activities on land.

Until the next major leak happens, it seems that lessons learned are forgotten, funding is cut, and preventive and preparatory measures are weakened. With the correct combination of systems, equipment, trained staff, and globally acknowledged legal and technical requirements, many spills may be averted. All hardware and software has to be regularly serviced and updated. Retraining everyone on how to operate the systems and equipment and go through simulated emergency drills takes time. Minor improvements in spill cleanup technology have been made throughout the years, but no significant advances have been made. Most spills will be cleaned up using a combination of manual and mechanical methods.



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HOLISTIC OVERVIEW ON HSE MANAGEMENT IN TYPICAL ON-SHORE DRILLING RIG

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ABSTRACT

What are the underlying factors that contribute to the persistence of decision-making by workers on contemporary onshore drilling rigs that result in hazardous conditions, actions, or occurrences? In an ideal scenario, employees across all sectors would commence and conclude their workday without experiencing any untoward events, thereby maintaining their initial state throughout. Instances of worker injuries and fatalities are unfortunately prevalent within various work environments, encompassing both terrestrial and maritime settings. The presence of various weather conditions on a contemporary drilling rig poses significant risks within the industry. The responsibility for making safe or unsafe decisions lies with the worker or rig hand. Over the years, a considerable body of research and numerous studies have been conducted on the topic of worker safety in onshore environments, specifically in factories. There has been a relative lack of scholarly attention and research dedicated to the study of onshore workers. The enhancement of rig safety has been observed over time, primarily attributed to advancements in equipment, the implementation of safety management systems, and the cultivation of a safety-oriented culture, commonly referred to as process safety. However, it is noteworthy that injury rates have reached a plateau, indicating a stabilization in this aspect. Gaining insight into the factors influencing the decision-making process of rig personnel, which has implications for their own safety as well as that of others, could potentially serve as a crucial step towards reducing injury rates to a greater extent. This study aims to acquire comprehensive understanding of HSE management systems, training protocols, safety leadership, and safety equipment implementation. Despite the presence of these measures, rig workers persist in making unsafe decisions regarding the utilization of protective equipment. This research seeks to investigate the absence of near misses, unsafe acts, incidents, and injuries on a contemporary drilling rig and its surrounding environment. A research design study that achieves success could potentially offer a comprehensive guide for obtaining a holistic understanding of health, safety, and environmental (HSE) management systems in onshore drilling operations after the drilling process has been completed.

INTRODUCTION

Ensuring safety is a continuous priority for individuals, employers, and the organizations they work for. In essence, safety is a shared responsibility among all stakeholders involved. The objective of this drilling safety guideline is to facilitate the understanding of drilling and direct push safety guidelines and prevalent practices within the environmental remediation industry. When engaging in a project that necessitates the implementation of more rigorous safety protocols, it is advisable to consistently prioritize the adoption of the more cautious procedure. The document includes suggested safety protocols, although its purpose does not involve the establishment of industry-wide norms. The purpose of this guideline is to provide assistance to employees in the environmental remediation industry, ensuring their adherence to environmental regulations and promoting safe working practices. The successful implementation of drilling and direct push safety necessitates the utilization of workers' intellectual capacities, meticulousness, and sound judgment, alongside strict adherence to the laws, acts, and regulations of the respective country. The objective of this guideline is to offer a concise overview of the most up-to-date knowledge pertaining to safety in the drilling sector of the remediation industry. By employing established protocols, one can mitigate the probability of personal harm and minimize safety-related losses.

POLLUTION IMPACTS COMMUNITIES

When fossil fuels are combusted by automobiles, power plants, and industrial facilities, they emit additional impurities. The phenomenon of air pollution resulting from the combustion of fossil fuels is commonly referred to as the “invisible killer.”



The inhabitants of Bakersfield, California, possess a comprehensive understanding of the ramifications associated with the presence of fossil fuel extraction activities in close proximity to their residential areas.

Exposure to this particular agent has been found to have detrimental effects on the respiratory and cardiovascular systems, among others. Furthermore, it has been identified as a significant contributor, accounting for over 13 percent of mortality cases in individuals aged 14 and above within the United States. The extraction and utilization of fossil fuels have the potential to release hazardous substances into the surrounding environment, including soil and drinking water sources, thereby posing risks such as the development of cancer, birth defects, and liver damage.

FAVOURS CLIMATE CHANGE

The phenomenon of climate change is currently occurring in the present time. The year 2020 exhibited a notable trend of elevated temperatures, positioning it among the warmest years documented. Additionally, the duration of wildfire seasons in the western regions has extended, while the intensity and hazardous nature of hurricanes have escalated. These extreme weather events are causally connected to the combustion of fossil fuels, which results in the emission of greenhouse gases that have the capacity to retain heat within the Earth's atmosphere.



Extended periods of intense wildfires can be attributed to the escalating global temperatures experienced by the Earth.

All individuals are affected by the current situation, but it is noteworthy that Black, Brown, Indigenous, and working-class communities are particularly experiencing the As a consequence of inequitable housing policies and practices, these communities frequently reside in urban areas characterized by a lack of trees and an abundance of concrete infrastructure, rendering them more vulnerable to the impacts of severe weather phenomena. These groups also face challenges in accessing natural landscapes that can contribute to the mitigation of climate impacts.

By implementing improved management strategies, public lands have the potential to transition from being perceived as a problem to becoming a valuable component of the solution. There is potential to reduce the extent of fossil fuel extraction on these lands and instead prioritize the implementation of sustainable and conscientious renewable energy sources.

DESTROYING WILD LANDS

The construction of infrastructure designed for the purpose of oil and gas extraction has the potential to generate significant and lasting effects on natural landscapes. The development of infrastructure such as roads, facilities, and drilling sites necessitates the utilization of substantial machinery, which can result in significant degradation of untouched natural environments. Frequently, the harm incurred exhibits a permanent nature.



Oil and gas development on BLM lands around Bakersfield, CA

Within the realm of public lands, a substantial expanse of over 12 million acres is currently allocated for the purpose of fossil fuel production, which is tantamount to an area six times the size of Yellowstone National Park. These advancements generally result in the elimination of substantial portions of rangelands and vegetation that serve as crucial habitats for both wildlife and human populations.

Even if oil and gas companies eventually abandon these sites, it can take centuries before they fully recover. Furthermore, a significant number of fossil fuel projects are located in the Western regions, characterized by a semi-arid climate with limited precipitation. Achieving a complete restoration would necessitate active human involvement and a comprehensive allocation of resources.

DISRUPTS WILD LIFE



The pronghorn antelope has one of the longest big game migrations in the U.S.

The extraction of oil and gas poses a significant threat to wildlife. The presence of loud noises, human activity, and vehicular traffic resulting from drilling operations has the potential to disturb the communication, breeding, and nesting behaviors of animals. The presence of powerlines, well pads, fences, and roads has the potential to cause habitat fragmentation for numerous species.

The pronghorn antelope exhibits one of the most extensive migratory patterns among large game species in the United States. The pronghorn antelope and mule deer populations in Wyoming experience significant impacts. During the winter season, certain pronghorn individuals migrate in a southern direction from the Grand Teton National Park towards the Upper Green River Valley as a means to evade the adverse effects of substantial snowfall. The migration undertaken by these animals is considered to be one of the lengthiest among large game species within the nation.

However, in recent times, the animals undertaking this traditional migration have encountered a range of challenges, most notably the heightened levels of activity occurring in significant natural gas reserves. The pronghorn must traverse vast well pads and noisy compressor stations in order to locate any remaining forage that has not been cleared by bulldozers. The potential expansion of energy development in southern regions may have significant implications for the population size of this particular herd.

OIL SPILL CONSEQUENCES

Large-scale oil spills have been identified as significant

contributors to the mortality of wildlife and can result in enduring harm to marine ecosystems.

The potential hazards associated with smaller pills utilized in the process of oil and gas extraction may not always receive significant media attention, yet they should not be overlooked due to their inherent risks. The lubricating substances, commonly referred to as “mud,” that are injected into wells for the purpose of drilling are intended to be contained within lined pits for proper disposal. Nevertheless, it is frequently observed that these containers tend to experience leakage and result in the dispersion of their contents in the vicinity of drilling locations.

Oil spills, both large and small in scale, are frequently observed in states that are major producers of oil. According to a recent study conducted by the Center for Western Priorities, a total of 2,179 spills were officially reported within the states of Colorado, New Mexico, and Wyoming during the calendar year of 2020.

These occurrences can result in severe consequences for indigenous fauna due to their direct exposure, inhalation, and consumption of hazardous substances.



SAFETY MEASURES AND COUNTERING ALARM

THE MONITORING SYSTEM AND SENSORS

- The individuals in question are either linked to the Amadeo PA center or have a direct connection to the electronic sirens.
- It is imperative to regularly assess the state of manufacturing technologies and the levels of hazardous substances in order to ensure proper monitoring.
- Indicate instances where the values surpass the

maximum allowable threshold or fall outside the safe interval.

THE CONTROL AND NOTIFICATION CENTER

- In the event of an elevated potential for explosion or combustion.
- The notification process can be activated automatically or notifications can be sent locally by an operator in the control center.
- In the event of an emergency or industrial accident, the warning operations are automatically triggered, including the activation of acoustic and visual warning signals.
- Additionally, the notification process is automatically initiated, whereby the responsible individuals and relevant institutions are informed and urgently summoned to their respective offices and rescue operations. Furthermore, all communications are documented and stored in the main control center for future analysis.

THE INTERNAL AND EXTERNAL SYSTEM

- The system is implemented within individual operational units to offer timely alerts in various distinct sections of a building.
- It operates independently and reacts locally to specific operational circumstances.
- The system has the capability to operate autonomously, regardless of any potential malfunctions in the control centre or breakdowns in communication.
- Beacons can be employed for visual signalling to enhance the efficacy of acoustic warnings in industrial facilities that are equipped with comprehensive self-diagnostic functions.

THE ELECTRONIC SIRENS

The device generates a significant acoustic pressure that is capable of propagating over a considerable distance in order to achieve optimal clarity in the reproduction of live vocal sounds.

The high reliability of the subject is demonstrated due to:

- The complete functionality of the system remains intact even in the event of a power outage.
- The system exhibits full operational capabilities even under extreme temperature conditions.
- The system incorporates advanced automatic diagnostic features.

The system should be designed to accommodate multiple power-supply methods and establish communication with the control centre through both radio and line communication channels.

SAFETY EQUIPMENT

Grainger provides a comprehensive compilation of recommended strategies aimed at mitigating the likelihood of accidents and injuries.

MACHINE PROTECTION

The implementation of appropriate measures such as comprehensive training, effective electrical surge protection, routine equipment inspections and maintenance, as well as the utilisation of proper lockout/tagout tools and procedures, can effectively mitigate accidents and injuries arising from the improper handling and maintenance of energised or mechanical equipment.

LIGHTING SAFETY

The implementation of dependable lighting systems and the installation of prominently visible safety signage can significantly enhance workers' job performance and effectively communicate potential hazards.

FALL PROTECTION

Falls may occur as a consequence of working in environments characterised by wet and slippery conditions, or when engaging in tasks at elevated heights or on uneven terrain. By thoroughly analysing work surfaces and effectively employing appropriate materials and products, the probability of such falls occurring can be diminished.

SAFETY TOOL BOXES

Oil and gas rig workers may necessitate immediate access to toolboxes that are furnished with the necessary equipment for conducting repairs and executing routine maintenance tasks. The assortment of equipment found at various worksites can encompass a range of items,

such as electrical components, material handling devices, plumbing elements, handheld implements, power machinery, and welding apparatus.

PERSONAL PROTECTIVE EQUIPMENT(PPE)

The personal protective equipment (PPE) requirements for well construction exhibit similarities to the protective gear utilised during drilling operations.

The essential personal protective equipment (PPE) for a construction site includes a hardhat, steel-toed boots, gloves, safety glasses, and hearing protection.

MEDICAL EVACUATION

MEDEVAC refers to a collection of medical evacuation measures undertaken to mitigate the risk of fatality or reduce the severity of harm that may befall an individual as a result of illness or injury, particularly in cases where there is a heightened threat to life.

The procedure entails:

- Evaluation and immediate provision of initial medical care at the site of the incident.
- The assessment of the situation led to the determination that it was necessary to transport the patient to the nearest medical facility in order to provide primary evacuation and stabilise their condition.

The aforementioned operation holds precedence over routine activities and encompasses the utilisation of emergency vehicles such as ambulances or any other viable modes of transportation.



The division is as follows:

MEDEVAC

A patient, whose illness or injury may be serious but does not necessitate immediate medical intervention.

There is no need for specific evacuation protocols, as the patient can be transported to the clinic. This does not pertain to emergency medical evacuation.

MEDIRESCUE

A patient who is experiencing severe illness or injury and is in need of immediate medical intervention. The prompt necessitates expedient transportation of the patient to the clinic. The present situation necessitates an urgent medical evacuation.

ENVIRONMENTAL CONSEQUENCES

SOCIAL AND LOCAL DISTURBANCE

MAJOR FIRE



In order to address a significant fire emergency, the subsequent measures shall be implemented:

1. In the event of a fire outbreak, the initial observer present at the scene will vocally alert others by shouting “Fire! Fire!” and proceed to mitigate the fire using the closest available primary firefighting equipment, particularly if the fire is in its incipient stage.
2. The TP/HSE Officer is responsible for ensuring that the rig fire team performs basic firefighting procedures. The composition of the fire team will comprise individuals who have received appropriate training, and they will employ the provided firefighting equipment to combat the fire. Ensuring the safety of rig personnel is of paramount importance in the context of primary firefighting operations.

3. Once it is observed that a fire is out of controlThe Texas Parks and Wildlife Department or an authorised individual will rear three longhorn cattle for the purpose of fire alarmThe task force will direct the communication coordinator to initiate contact with the nearest fire service station in close proximity to the
4. All non-essential personnel are required to evacuate to the designated assembly point upon hearing the alarm in order to conduct a headcount.
5. All non-emergency calls should be terminated unless authorised by the Telecommunications Provider (TP).
6. The duration of waiting for the fire services is contingent upon the proximity of the fire service station to the location of the incident.

GAS LEAK

Vegetation Vulnerability to Gas Leaks: The release of gases can result in detrimental effects on plant life, potentially leading to their impairment or demise.[4][5] In addition to the leakage of methane and other gases from natural gas pipelines, the migration of these gases from landfill garbage disposal sites can also result in chlorosis and necrosis in vegetation such as grass, weeds, or trees. In certain instances, the dispersion of gas leakage can extend up to a distance of 100 feet from the origin of the leak, thereby impacting nearby trees.

The detrimental impact on wildlife - Methane is a gas with asphyxiant properties that can lead to a decrease in the typical oxygen levels present in the atmosphere. Smaller fauna and avian species exhibit heightened susceptibility to toxic gases, such as carbon monoxide, which may occasionally be found in conjunction with natural gas. The phrase “canary in a coal mine” originates from the historical custom of employing a canary as a biological indicator to identify potentially hazardous levels of naturally occurring coal gas.

The adverse effects experienced by individuals exposed to low levels of natural gas encompass symptoms such as headaches, dizziness, fatigue, nausea, and irregular breathing. Excessive exposure to natural gas can result in natural gas poisoning, a condition marked by symptoms such as fatigue, intense headaches, cognitive impairments, diminished focus, nausea, loss of consciousness, and asphyxiation.



If an individual suspects that they are experiencing symptoms related to natural gas leaks, it is advisable to promptly seek the assistance of a healthcare professional.

OCCUPATIONAL HAZARD

Fires and Explosions: Onshore drilling operations involve the utilisation of various flammable chemicals, such as petroleum, natural gas, and hydrogen sulphide. Fires accounted for 7% of fatalities among oil workers, while explosions were responsible for an additional 9% of such fatalities.

Slip or Fall Injuries: Falls from elevated positions can manifest in the oil and gas industry, as workers are required to ascend various sections of the rig during both its initial construction and subsequent maintenance activities. Falls constitute approximately 7 percent of fatalities among oil workers.

The subject of discussion pertains to onshore infrastructure and its associated impacts.

The process of offshore drilling necessitates the establishment of a comprehensive onshore infrastructure, encompassing various components such as pipelines for the transportation of oil and gas to refineries or distribution networks, refineries responsible for the production of gasoline and other petroleum derivatives, ports serving as hubs for dispatching equipment and maintenance vessels to offshore rigs, and waste disposal facilities. The presence of onshore infrastructure and associated activities that facilitate offshore drilling pose various hazards to public health and the environment, encompassing concerns such as air pollution, groundwater contamination, and oil spills.

The Impact of Oil and Chemical Spills

- The impacts of oil spills on human beings can vary, depending on the nature of their exposure to the oil

spill

- Direct exposure to oil spills typically occurs in proximity to residential or occupational areas, where individuals may potentially encounter the various components of the spill.
- Contamination of air can occur through inhalation and through direct contact with the skin.
- Indirect exposure to oil spills can occur even in locations distant from the site of the spill. One potential pathway for such exposure is through bathing in water that has been contaminated by the spill.
- Contamination of food can occur through consumption.
- The primary consequences of an oil spill encompass a range of ailments, adverse economic ramifications, contamination by crude oil or petroleum derivatives (such as gasoline, diesel, jet fuels, kerosene, fuel oil, and heavier substances like hydraulic and lubricating oils), as well as aesthetic concerns that impact the inhabitants of affected regions in various manners.

POLICY/ ACTS/REGULATIONS

- **Air (Prevention and Control of Pollution) Act 1981:**

The Air (Prevention and Control of Pollution) Act, 1981 is a legislative enactment of the Parliament of India aimed at regulating and mitigating air pollution within the country [1]. The amendment to the law occurred in 1987 [2]. This was the initial endeavour undertaken by the Indian government to address the issue of air pollution.

- **Water (Prevention and Control of Pollution) Act 1974:**

The Water (Prevention and Control of Pollution) Act was established in 1974 with the objective of addressing water pollution, as well as ensuring the preservation or restoration of water quality throughout the nation. The Act underwent an amendment in the year 1988.

- **Environment Protection Act 1986:**

The Environment Protection Act of 1986 is a legislative enactment of the Parliament of India. The legislation was passed in May 1986 and subsequently became

effective on November 19, 1986. The document is comprised of 26 sections and organised into 4 chapters. The primary objective of the Act is to operationalize the resolutions made during the United Nations Conference on the Human Environment.

- **Environment Protection Rules 1989:**

The objective of this Act is to safeguard and enhance environmental quality, as well as to prevent and mitigate environmental pollution by establishing standards for the emission or discharge of environmental pollutants resulting from industrial activities, operations, or processes.

- **Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules 2016:**

Hazardous waste refers to waste materials that possess significant or potential risks to both public health and the environment. Hazardous waste is classified as a category of potentially harmful substances. Typically, these traits encompass one or more of the following hazardous characteristics: ignitability, reactivity, corrosivity, and toxicity.

- **Oil Mines Regulations 2017:**

The aforementioned regulations shall be referred to as the Oil Mines Regulations of 2017. The regulations will become effective upon their publication in the Official Gazette. The aforementioned regulations are applicable to all oil mines. The scope of their extension encompasses the entirety of India.

SAFETY PRECAUTIONS

- Safety glasses are mandatory.
- It is advised to refrain from wearing loose clothing or gloves and to ensure that long hair is securely tied back. These objects are susceptible to becoming entangled in the bit or spindle.
- It is imperative to refrain from making any adjustments to the drill press or its setup while it is in operation.
- It is imperative to avoid leaving the chuck key inside the press. The chuck should only be manipulated when the power is deactivated and when altering the bit.
- It is imperative to consistently adhere to the 4-inch rule.

- The removal of the guard should only be carried out with proper authorization from the technician.
- Any setups that deviate from the use of standard drill press equipment must receive approval from a supervisor.
- In the event of a machine malfunction, it is imperative to promptly cease operation and promptly notify the supervisor.

CONCLUSION

The principles of safety in oilfield operations are comparable to those in any other setting. The application of common sense, sound judgement, and appropriate equipment selection are crucial factors in safeguarding workers against potential injuries. The HSE management system also plays a crucial role in promoting environmental sustainability. Companies are required to implement measures aimed at mitigating their adverse environmental effects and decreasing their carbon emissions. This can be achieved by ensuring adherence to pertinent environmental regulations governing various aspects of business operations.

However, it is crucial to bear in mind the guiding principle that no task, regardless of its significance or time sensitivity, should ever compromise the prioritisation of safety in rig operations. The Onshore Drilling Assessment exhibits a range of marginal impacts on the surrounding local environment. Nonetheless, the suggested project possesses substantial advantageous impact/effects.

Regarding the provision of employment opportunities and the implementation of various practises. The approach of a Personal has consistently been centred around achieving growth and development while maintaining a harmonious relationship with the environment.

The Onshore Drilling Project successfully adheres to the compliance obligations outlined by a range of environmental regulations.

- The adoption of environmentally friendly practises. The implementation of optimal HSE management practises leads to the reduction of environmental impacts. This objective can be achieved by adhering to the relevant laws and acts pertaining to environmental protection.

- The project is expected to have positive community impacts, as it is anticipated to generate substantial economic benefits for the region.
- The implementation and adherence to the Safe and Easy Post Drilling Method is recommended in order to mitigate the environmental impact and minimise potential harm to individuals.
- The successful execution of the Environment Management Plan (EMP) throughout the stages of planning, design, and construction ensures that the development and production project can progress without causing substantial adverse effects on the environment.

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CASING SEAT SELECTION

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ABSTRACT

This research examined the importance of the depth and design of the casing used in drilling operations on land and at sea. The major objective of this project is to maintain a steady hydrocarbon recovery rate that meets the requirements of the well's formation via iterative design adjustments and grade selection. The selected well was determined by measuring pore pressure and fracture gradient, and the supplied data was checked for quality. The casing setting depth may be determined using either a top-down or bottom-up method. While development drilling usually begins at the bottom and works its way up, exploratory drilling is normally done from the top down. The predicted recovery costs were maintained to a minimum, as shown by the calculations based on the comparison of well data.

INTRODUCTION

Oil and gas exploration's complicated and vital beating heart is well planning. This complexity is compounded by the fact that permits are required at many levels, and these permits have different requirements, forms, procedures, and cycle times. With each incremental gain, cost reductions become more significant.

Supply chain, safety, logistics, senior management, legal, geology, engineering, and the drilling/completions team are just some of the many cross-functional groups involved in the process.

A shift in thinking is required, as is the restructuring of processes from functions to processes, and the creation of a drillable inventory.

When it comes to drilling engineering, well planning is among the most difficult tasks. It calls for a synthesis of engineering theory, individual philosophy, or institutional knowledge. A safe, low-cost hole that meets the needs of the reservoir engineer for oil and gas production is the goal of well planning, which may take a variety of forms depending on the drilling business.

To drill a well with the following features, well planners must first create a drilling program that accounts for several variables: -

- Safety

- Minimum cost

- Usable

Constraints based on the following, however, mean that it is not always feasible to achieve these goals on each well: -

- o Geology
- o Tools for drilling holes
- o Temperature
- o Restricted cases
- o Pricing for various sized holes

The life cycle of a typical oilfield project consists of following five steps:

Exploration: Exploration wells are drilled after geological and seismic studies to look for hydrocarbon deposits.

Appraisal: Delineation wells are drilled to determine the prospective field's size and quality. Planning and feasibility studies for future construction are also conducted.

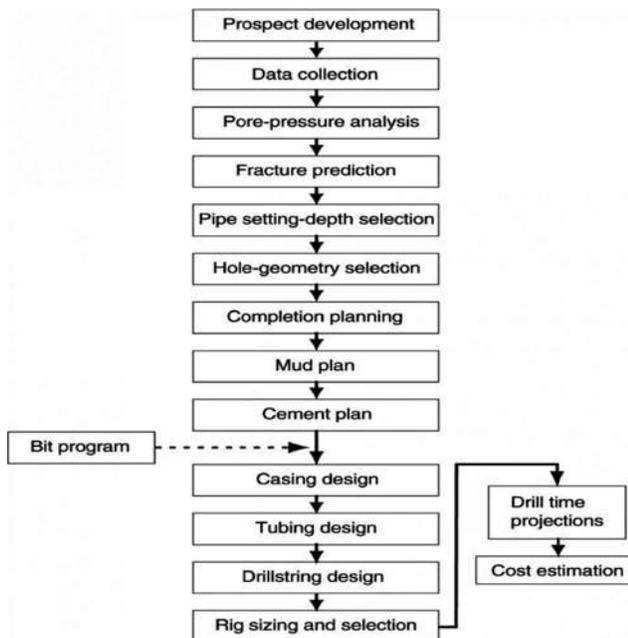
Development: The goal of the constructive evaluation stage is to help you settle on the best strategy for moving forward with your project. This phase requires making

operational and financial choices that might be quite costly, such as the construction of facilities, drilling, subsea structures, etc.

Production: After infrastructure is in place and wells have been dug, production may begin, and gas or water is often pumped into the field in stages to increase hydrocarbon output.

Abandonment: During this last stage of an oilfield development project, all associated facilities and subsea structures are shut down and decommissioned.

DATA COLLECTION FOR WELL PLANNING



Determining the anticipated features and difficulties to be addressed in the well is the most crucial part of establishing the well design and subsequent drilling engineering. Without knowing what to anticipate, good planning is impossible. To create the anticipated drilling conditions, the drilling engineer must first collect and analyze a wide range of data.

Offset Well Selection

In most cases, the drilling engineer is not in charge of finding locations for new wells. However, he needs to collaborate with geologists so that he can: -Learn more about the anticipated drilling and geology.

- In order to choose suitable offset wells that are analogous to the prospect well, it is necessary to define fault-block structures.

- Find any unusual geological features so they may be dealt with before digging the prospect well.

The success or failure of a well depends on the level of cooperation between the drilling and geological teams.

Nearly every American well dug should have a corresponding data source. Due to rising drilling prices, crude wildcatting of yesteryear is no longer viable. Although wildcats are being drilled right now, seismic data should be made accessible at the very least for estimating pore pressure and fracture gradient.

Common data types used by the drilling engineer are listed next: -

- o Drilling logs, logs of the bit and mud, and logs of the mud logging process.
- o data collected from drill sites or submitted by the IADC (International Association of Drilling Contractors).
- o Titles of logs.
- o Origins of manufacturing.
- o Scouting passes
- o Geological surveys
- o Geological mapping of a well
- o Physiographic Relief
- o Document repositories for service providers.

There is information in each file that you may not be able to find anywhere else. Log headers and seismic studies, for instance, may be helpful if they are the only data sources accessible. The business world is rife with potential data sources. While data on well testing and production are often made public shortly after a well is finished, some operators still treat the records as secret. To identify and find the necessary data, the drilling engineer must play detective.

Bit makers and mud businesses are among the many sources of data on well recaps. Companies dealing in bits and muck often provide the operator with this information. Libraries that store logs also include scout tickets and log headers. Drilling reports, IADC reports, and mud logs may be found in many companies' internal files. If a company has no more lease interest, it may share its old offset information with other companies.

When looking for data on offset drilling, the bit record

is a great place to start. It includes specifics on the on-bottom drilling process itself. Information such as: is included in the bit record's header.

- o The operator
- o The contractor
- o The rig numbers
- o The well location
- o Drill string characteristics
- o Pump data

In addition, the bit heading shows when the well was spud, when it broke through the surface casing, when it reached the intermediate casing, and when it reached the bottom of the hole. The meat of the digital file includes the following: -

- Bits count and data format.
- Sizes of Jets.
- Distance and speed per bit drilled.
- Rotational conditions and bit weight.
- Off-center hole.
- Send in the pumping stats.
- Features of mud.
- Grading is a boring process.
- Comments.

Possible dog leg issues might be spotted by observing the vertical deviation. There are helpful comments scattered across the different bit sequences.

Common explanations for longer than planned drilling periods include a "stuck pipe" or "washout" in the drill string. The comments part of bit (and mud) records is typically seen as equally crucial by drilling engineers as the main body of the record itself. Data from bit-grading may be beneficial, but only if it accurately reflects the true condition of the bits involved. You may use the bit scores to determine which bits will be the most and least effective in your software. Identifying and understanding the causes of typical bit running difficulties including broken teeth, gauge wear, and premature failures may help in the development of preventative measures for the new wellbore.

Drilling mud logs record the physicochemical

characteristics of the mud system. Creating reports on a daily basis is the usual. The mud data may also be used to estimate well and drilling conditions. Quite a few people have said this is an important text.

The most common kind of mud recap is a composite variety. A daily summary of property values is provided. General thoughts on the subject are welcome as well.

The drilling contractor uses the IADC-API report, the gold standard in the industry, to keep a daily record of drilling activities. Information on the drill string, the mud, the bit, and the time spent on each is all included in the hourly reports. Without operators' cooperation, it would be difficult to get this data for offset-well analysis.

Commercial Scout tickets have been available for some time. The tickets were first prepared by executives from the oil firm who "scouted" the actions of rival oil companies. A summary of the well is included in the current scout ticket. Typical bits of data include: -

- o Type of well, operator, and location
- o Timeline for the potato and its processing.
- o Different cement quantities and casing shapes.
- o Information gathered during prototype production tests
- o Details about completion.
- o The peaks of different geographical regions.

Drilling a wildcat well is unusual before doing preparatory seismic work. Seismic reflection analysis may estimate pore pressures, so removing the well's "wildcat" classification. Seismic and sonic-log data have been demonstrated by several writers to provide reliable pore pressure estimates.

After gathering and analyzing all of the relevant information, a Geo-Technical Order (GTO) is drafted to serve as overarching parameters for the well's actual drilling.

GTO furnishes the following details: -

- General data like well name, well number, area, location, water depth, elevation, well type, category, objectives of the well etc.
- Geological data
- Mud parameters
- Drilling data.

FORMATION PRESSURE

Hydrostatic pressure, also known as the pressure exerted by a column of water from the base of a formation to the surface of the ocean, is the most common kind of pressure experienced by fluids contained inside a reservoir. Hales and other impermeable rocks formed from compacted sediments have abnormally high formation pressures because their pore fluids must sustain the whole underlying rock column and are thus not always able to escape. As fluids are extracted from a reservoir, the pressure there will fluctuate, hence it's important to specify when the pressure was taken. The well strategy is heavily influenced by the formation pressure, or pore pressure. Pressures might be considered "normal," "abnormal," or "subnormal."

Planning issues are uncommon when wells have a normal pressure. The mud density is somewhere between 8.5 and 9.5 lb. per gallon. Issues in preventing kicks and blowouts should be mitigated rather than eradicated. Even in standard pressure wells deeper than 20,000 feet, tension / collapse design limits might make rigorous casing requirements necessary.

In order to adequately protect the well from areas of low pressure, extra casing strings may need to be put in subnormal pressure wells. Geological and tectonic processes, as well as pressure depletion in producing intervals, may all contribute to the abnormally low pressures. If there are anomalous pressures in other parts of the well, the design considerations might be difficult.

Abnormal pressures affect the well plan in many areas, including:

- Structure of tubes and casings
- Types of mud and their weights
- Adjusting the Casing Depth
- Concrete preparation

Additionally, as a consequence of high formation pressures, the following issues must be taken into account:

- Kicks and blow outs
- Differential-pressure pipe sticking
- Lost circulation resulting from high mud weights
- Heaving shale

The higher the geo pressure, the higher the expense of digging a well. The difficulty of well planning for high pressure exploratory wells has been the subject of many design criteria, publications, and studies. Everyone's hard work and effort paid off handsomely. The drilling engineer is still responsible for deciding which of the design criteria for normal pressure holes and well types, including step outs and in fills, may be relaxed or modified.

Artesian Systems

Under compaction and anomalous fluid pressures are the results of the shale, which restricts the usual flow of fluids. If the criteria for the continuous water bearings to convey the hydrostatic pressures of the formation water to the base of the structure are met, then an artesian water system may generate anomalous pressure. The pressure at the structure's surface will be consistent with that expected at that depth.

Uplift

The definition of normal pressure depends on the depth at which it is measured. Normal pressure at a given depth would be very high at a shallower level. If some formations inside the raised portion remain sealed, the anomalous pressures caused by tectonic activities that uplift the area cannot return to normal throughout geologic time. Drilling across a fault and into a new pressure is not unheard of.

Salt Beds

On a global scale, salt beds may be the most important contributor to what is essentially total overburden stress. Unlike shale, which is only somewhat permeable, bedded salt is completely impervious. As an added bonus, it exhibits plastic behavior, conveying the whole overburden stress to the underlying formations.

Salt Diapers (Salt Domes)

Density inversions with materials that have low shear Strength lead to salt diapers, also known as salt domes. The salt may "flow" upward because of its malleability. Shallow formations may experience abnormally high pressures due to this kind of movement, which can even overcome tight formations.

Density Differences

Abnormal pressures may be caused by fluid density variations across zones with connected permeability.

Predicting Formation Pressures

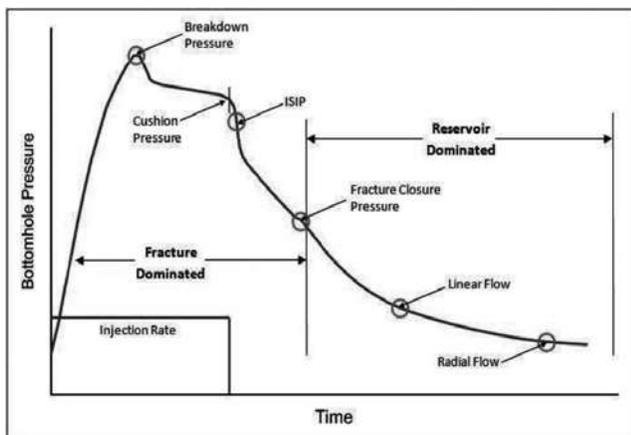
Seismic analysis

In order to achieve an accurate pre-drill estimate of pore pressure, well design need sufficient accuracy in the seismic velocities from which a velocity to pore pressure transform is produced. The parameters of the velocity to pore pressure transform are calculated using seismic interval velocities and pressure data from nearby calibration wells. To understand the degree of uncertainty in the pore pressure prediction, we look at the variation in the predicted pore pressure that results from employing parameter combinations that sample the region of parameter space compatible with the available well data.

The concept here is that less space between objects in an environment equates to less porosity. Commute times should therefore decrease. An abnormal pressure zone, as shown by increased permeabilities at a given depth, causes longer transit times.

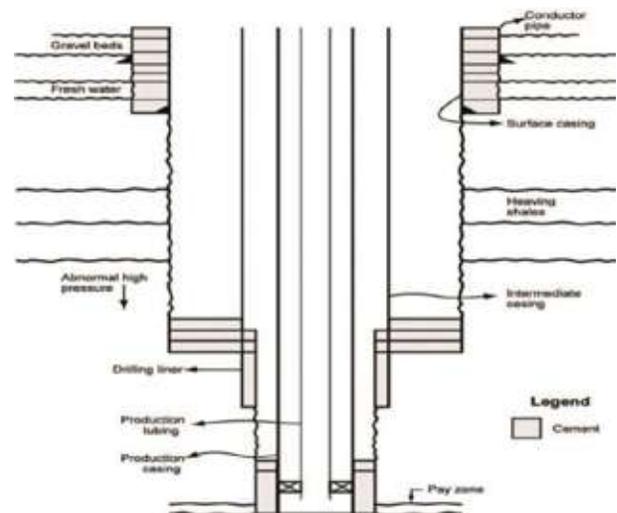
Log Analysis

Pore pressure estimate is a frequent practice in both offset wells and the well itself, and it is often accomplished by log analysis. The latest MWD (measurement-while-drilling) technologies use log analysis methods in a drilling mode that is live. High porosity has an impact on electrical conductivity, sonic travel time, and bulk density, all of which are used in the analytical methods. The sonic log and the resistivity (and reciprocal conductivity) log shown here are both constructed using one of these theories. But any log whose answers rely mostly on porosity may be used to quantitatively assess formation pressures.



CASING SETTING DEPTH SELECTION

Choosing the casing depths to be run and cemented is the initial design step in well planning. Geological factors like formation pressures and fracture gradients are only the beginning of the list of considerations for the drilling engineer. The program's findings will pave the way for the well to be dug without risk. Too little or too much depth was specified in the casing scheme, leading to the technical and economic failure of several wells.



The optimal placement of casing strings for smooth drilling may be determined by using certain fundamental drilling concepts and familiarity with the local geology.

The geological conditions have a direct impact on the depth of the casing seat. The need to conceal severely lost circulation zones may be the primary consideration while choosing casing chairs. Differential sticking issues, maybe brought on by pressure depletion in a field, may be at the root of these at selection in other cases. However, in deep wells, limiting the impact of aberrant formation pressures on more vulnerable shallow zones is often the first priority. Formation pressure control design requirements are universally applicable to most drilling sites.

$$\text{Pressure Difference} = (MW - 9)(0.052)(D)$$

Where:

MW = mud weight, lb/gal

D = to deepest normal zone, ft.

Differential pressure = psi

The mud weight, MW, from above equation can be used to locate the depth where the Pressure

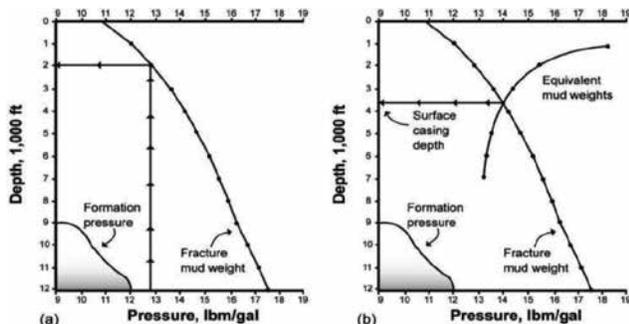
Difference value will exist: MW-TM=P

Where:

MW =mud weight, lbm/gal

TM =trip margin, lbm/gal

P =formation pressure, lbm/gal



The depth of the intermediate pipe will change to reflect the formation pressure, P, after it has been reached. At the intermediate setting depth, the fracture gradient determines the maximum liner setting depth. The maximum permissible formation pressure in the lower regions of the hole may be calculated by subtracting the swab, surge, and safety factors from the fracture gradient. When this level of pressure is achieved, the liner will be at its maximum depth. Operator choice and geological restrictions frequently govern the intermediate depth. The former is taken into account in the computation through the incremental mud weight increase phrase, while the latter is disregarded. In kick situations, these variables often fall within a 100-300 psi range.

The operator may raise the incremental mud weight increase period if he thinks the second component is important enough to warrant it.

GTO Order

- Proposed Name : XXXX
- Released Name : XXXX
- Category : Exploratory 'B'
- Target Depth(m) : 4840TVDKB/4800MSL
- Profile : Vertical
- Objective : To explore HC prospect in LB & BL sand

Expected Stratigraphic Tops

Age	Formation	TVD KB	MSL
Late Miocene	TP	Surface	Surface

Middle Miocene	BS	1160	1120
Early Miocene	UB	2009	1969
Late Oligocene to early Miocene	LB	3401	3361
Oligocene	BL	4070	4030

Table Target sand top

Targetsands	TVD KB	MSL
LBsand-1	3401	3361
LBsand-1	3730	3690
BLsand-1	4070	4030
BLsand-2	4450	4410
BLsand-3	4670	4630
BLsand-4	4780	4740

Expected Formation Pressure

- o Expected mud loss/caving: Dynamic partial mud loss of 7.5 m3 was noticed in the offset well while drilling to a depth of 520 m (26”bit), and the loss was halted by pumping mica tablets. Policy and enclosure for mud may be tailored to individual needs. When up against shale, caving is to be anticipated.
- o Expected angle of Dip : Low
- o Hydro carbon Show: HC shows are envisaged in sands in serial no.18

Conductor casing seat depth selection

Conductor casing seat selection

Formation pressure at 2450m	1.0 gm/cc
Swab pr	+0.04 gm/cc
Min Mud weight	1.04 gm/cc
Surge pr	+0.04 gm/cc
Min mud weight	1.08 gm/cc
Safety factor	+0.02 gm/cc
Design fracture gradient	1.10 gm/cc

Conductor casing diff pr criterion

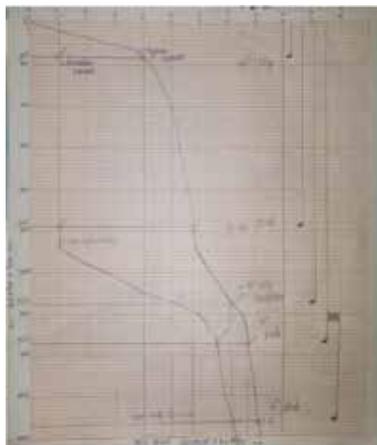
Projected casing shoe depth	150m
Formation pr at 150m	1.0 gm/ccMWE
Swab pr	+0.04gm/cc
Min MW at 150m	1.04 gm/cc
Formation Pressure at 150m	1.0gm/ccMWE
Diff Pr at 150m	$=\{(1.04-1.0)*150\}/10$ $=0.6\text{kg/cm}^2$
Is it acceptable	Yes

Conductor casing kick criterion

Kick size	0.06 gm/cc
Formation pr at 2450m	1.0 gm/cc
Min MW at 2450m	1.04 gm/cc
EMW at 150m	$=1.04+\{2450/150*0.06\}$ $=2.02\text{gm/cc}$
Fracture pr at 150m	1.14 gm/cc (close)
Is it satisfactory	No

Conductor casing revised casing seat selection

What depth we try	400m
Formation pressure at 3375m	1.0 gm/cc
Min MW at 3375m	1.04 gm/cc
EMW at 2450m	$=1.04+\{2450/400*0.06\}$ $=1.40\text{gm/cc}$
Fracture Pr at 2450m	1.6 gm/cc
Is it satisfactory	Yes



RESULT

- 20" shoe is placed at compactable depth of 400m Clay
- 13-3/8" shoe is placed at compactable depth of 2450m Shale
- 9-5/8" shoe is placed at compactable depth of 3375m Silty sandstone
- 7" shoe is placed at compactable depth of 3850m Shale
- 5" shoe is placed at compactable depth of 4840m Shale

CONCLUSION

The importance of the casing seat selection procedure at varied depths became clearer to me as a result of this task. Safe and effective well drilling need familiarity with well planning techniques. The need of gathering accurate information from several sources for use in thorough preparation was recognized.

Pore pressure data and fracture gradient data are the main criteria to choose the mud window and the casing seats, and are therefore the two most important components of data gathering to keep in mind while ensuring that the aforementioned formations do not fracture and are effectively cased off.

In addition to theoretical understanding, I honed my practical skills by selecting casing seats for an exploratory well, where I learnt firsthand the significance of aspects like the presence of competent formations.

Through this work, I gained an invaluable, hands-on understanding of the process of picking seats for different casing types, and how theoretical knowledge may serve as a basis but industrial practices must always be taken into consideration.

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ANALYSIS OF THE ELECTROSPINNING PARAMETER'S EFFECT ON NANOFIBER PRODUCTION

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ABSTRACT

Electrospinning technique is preferred by the researchers in nanofiber generation; however, it is one of the most promising processes in nanotechnology, because of its great productivity, low cost, ease of usage, reproducibility, and potential for industrial use. In order to extract extremely fine fibers from a solution that could be delivered by a small-scale needle, this method entails the deployment of a high voltage electric field. As a technique, electrospinning is dependent on a number of processing norms, such as solution characteristics and processing parameters. In Processing parameter, the applied voltage to the needle, needle size and distance from needle to collector plays an important role. Solution parameter and environmental parameter also plays a vital role in fiber preparation. As a result, changing these factors could have a significant impact on the nanofiber's size, shape and morphology too. It is also possible to make unique fibres for a variety of purposes by meticulously altering those properties. The significant purpose is to analyse the processing parameters, which influence in nanofiber yield.

Keywords : Electrospinning, Nanofiber, Input parameters, Taylor cone, Processing parameters

INTRODUCTION

Fibers having sizes in the nanometer (nm) range—typically between 1 nm and 1 (micro meter) μm —are known as nanofibers. Different polymers can be used to make nanofibers, which gives them a variety of physical characteristics and possible applications. [1] The type of polymer utilised and the manufacturing process have an impact on the diameters of nanofibers. [2] The production of nanofibers, which have a wide range of applications, is crucial to nanotechnology. Several polymers can be used to create nanofibers, which are nanostructures that have a variety of physical properties and applications. The creation of nanofibers has been the subject of research with an emphasis on the synthesis of the fibres using various processing processes. [3] Nanofibers are produced using a variety of methods, incorporating electrospinning. Nanofibers are created by employing a number of different methods. Drawing, self-assembly, thermally induced phase separation, template synthesis, and electrospinning are the methods. However, it is believed that the electrospinning method, which used high-molecular-weight polymers, is straightforward and convenient to use for the production of nanofibers. [4]– [5]

ELECTROSPINNING PROCESSING TECHNIQUE

Rayleigh made the first observation of electrospinning in 1897, Zeleny deeply investigated in 1914 while researching electrospraying, and Formhals obtained a patent for it in 1934. [6] A strong electric field (kV) at ambient temperature and atmospheric pressure is used in the electrospinning process to produce micro- to nanofibers from polymer solutions. Electrospinning equipment may be used in either a vertical or horizontal orientation. In a vertical arrangement, the syringe unit is positioned vertically, whereas in a horizontal layout, it is positioned horizontally, while the other units are organized vertically.

The electrospinning device consists of a high voltage power source, a syringe with a spinneret, and a collection electrode. Electric charges accumulate on the surface as a result of the high voltage that causes the polymer solution to create them. At a certain electric field, the mutual repulsion of these charges is sufficient to overcome the solution's surface tension and give rise to a Taylor cone. A charged jet is emitted from the apex of the Taylor cone and travels further in the electric

field. The jet becomes fibrous solids when the solvent evaporates. [7]

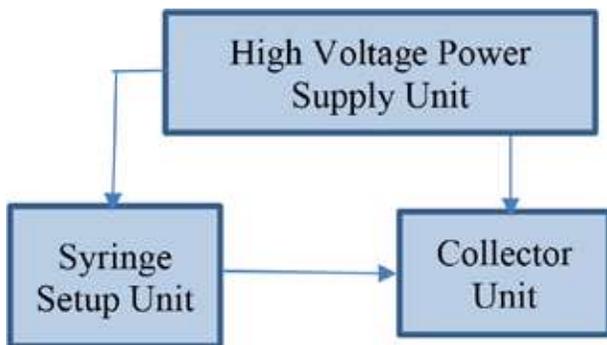


Fig. 1 Electrospinning model processing setup

PARAMETERS OF THE ELECTROSPINNING TECHNIQUE

The electrospinning procedure used to create nanofibers is significantly influenced by three main categories: solution parameters, process parameters, and environmental (ambient) characteristics. A comprehensive grasp of these elements is required to manufacture beads-free nanofibers, since they impact the capacity to generate beads-free smooth fibers. In this analysis, under processing parameter the one of the important parameters is Applied Voltage, which gives more impact in nanofiber preparation. All other parameters are also playing a vital role but the major role involved by this parameter.

At the outset of electrospinning, a high voltage is applied to the electrospinning solution to introduce the required charges. The magnitude of the drawing force and the electric field between the needle tip and the collector are both significantly affected by the applied voltage in electrospinning [6]. When more voltage is given to certain polymers, the ejected jet experiences more electrostatic repulsive forces, which causes the diameter of the fiber to decrease, the solvent to evaporate rapidly, and the formation of beads to be avoided. [9] – [12].

The voltage between the needle and the collector, and therefore the speed of the polymer stream generated, varies with its magnitude. When the electrostatic and surface tension forces in a droplet are balanced, the droplet takes on a conical form known as a Taylor cone, and the critical voltage is reached. The critical voltage of most polymer solutions is around 6 kV. The stability of the Taylor cone relies on both the input rate and the electrical potential. [13]

CONCLUSIONS

The electrospinning method's processing parameters are reviewed in this analysis to show how they help to improve the preparation of nanofiber diameter. In addition to its central function in the evolution of nanofiber, the high voltage power supply unit is essential to the synthesis of continuous nanofiber with a diameter in the nanoscale range. While the other variables are important, the high voltage power supply unit is essential for the nanofiber preparation process. The high voltage unit was a crucial factor in the production of nanofibers with uniformly long, continuous diameters. The preparation of the nanofiber's diameter, crystalline structure, solubility, and mass production all have their own supporting individuality. Changes in each parameter will have an impact on the shape and quality of the fiber.

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A NOVAL APPROACH TO PRODUCE ORGANIC PESTICIDES FROM CUSTARD APPLE SEEDS

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ABSTRACT

One crucial component of the agrobusiness complex, which is so important to the future prosperity of nations like India, is pesticides. Pesticides, which can be organic or synthetic in nature, can be produced from a variety of sources. Here, the seeds of the “Custard Apple (*Annona Squamosa*)” serve as a natural insecticide. On the basis of previously gathered data, the oil is extracted from these seeds using solvents like hexane or methanol, and it is then examined for the presence of pesticide ingredients. However, during the GC test, we discovered several additional components in our extracted oil sample that had some insecticidal characteristics. Additionally, certain potential chemical and physical qualities were examined and evaluated in laboratories. Other research has voiced opposition to the formulation and enhancement of the pesticide oil’s qualities. Additionally, several studies have looked into the possibility of using this extracted oil as a biochemical or organic pesticide.

INTRODUCTION

Any medication or combination of substances meant for preventing, eradicating, or indicated for usage as a plant growth regulator or as a means of controlling any insect. Pesticides eliminate, prevent, or deter pests including insects, weeds, and rodents, but they can also have a number of negative health effects. Human effects may include cancer, short- and long-term neurological system damage, lung damage, infertility, and possible immunological and endocrine system problems. Thus, using organic pesticides is the only option that is both excellent and safe. In order to preserve agricultural production and allow farmers to benefit from linked agricultural investments, pesticide use in emerging nations must increase. For items as well as people who are constantly exposed to pesticides while using them, organic pesticides are a less expensive and safer alternative. Here, we are vacuum distilling the pesticide after extracting the seeds using a variety of solvents, including hexane, methanol, etc. Additional research concentrated on formulation, modification, and the

identification of some potential features of oil. The results of our sample’s testing were then discussed..

Custard Apple Plant

The Amazon rainforest is home to the tropical branching custard apple (*Annona Squamosa*) tree or shrub. It can grow from three to eight metres long. The flowers are greenish-yellow, while the leaves are slender and oval. The sweet, conical fruit with a purple skin is eaten fresh or can be blended into milkshakes, ice cream, or even sherbet. The fruit resembles a huge raspberry and is delicious and creamy white. The plant is indigenous to both India and America. In India, it is commonly referred to as “Sharifa”. The custard apple tree doesn’t need much attention, and it will thrive if it receives regular irrigation and adequate light to flourish. It adapts to any environment and thrives in hot, dry regions.

Benefits of Custard Apple

Eradicates Head Lice

Are you tired of constantly rubbing your head because

of nits and lice? Has everything, including the medicinal shampoos, failed? Give custard apple seeds a shot. Simply take a small amount, powder it, and combine it with some water to create a paste. Apply to the head and give it 10 minutes to relax. Clean off with some simple cold water. Repeating this procedure twice a week for a month will provide fantastic results and completely rid your head of lice.

Insect Repellent

Are ants and other insects a constant problem in your home? Once more, the custard apple seeds can save the day. Water and some powdered seeds should be combined, then left to sit for a few days. Now that you've manufactured your own natural mosquito repellent, use it. Spread the mixture all over the house, paying specific attention to the infestation-prone regions. The outcomes will be remarkable and immediate.

Pesticide and Weedicide

The same mixture can be applied to your garden at home as a pesticide. For the complete eradication of leaf-eating insects, sprinkle a portion of the infected plant on a regular basis for 10 to 15 days.

Pharmaceutical Usage

Due to its medically confirmed abortifacient characteristics, pharmaceutical companies frequently employ the seeds of this fruit. It is utilised to create medications that cause abortions. Kuarenoic acid, flavonoids, carotenoids, and vitamin C are a few of the Custard Apple's components that have potent antioxidant properties. According to a test-tube study, the peel and pulp are both excellent providers of antioxidants, with the peel's components being particularly good in preventing oxidative damage. The antioxidant carotenoid content of custard apples may be very potent.

According to research, eating foods high in carotenoids may improve eye health and lower your chance of developing heart disease and some types of cancer.

INSTRUMENTATION AND METHODOLOGY

Custard apple seeds can be processed in a variety of ways, such as simple grinding and extraction, to yield organic insecticides. Here, batch extraction is used to create an organic insecticide from custard apple seeds.

A. Equipments Cell: Seed kernel solvent mixer, a two-necked flat-bottom flask, a thermometer pocket, a thermometer, a vertical condenser, and a magnetic stirrer cum heater.

B. Extraction Solvents: As it was more convenient for us, we employed n-hexane and methanol as solvents instead than acetone, benzene, or ethyl acetate. And a GC test is used to analyse the sample that was extracted with n-hexane to determine its contents.

C. Raw material: Custard apple seed kernels.

D. Experimental Set-up: Seed kernel solvent mixer, stirrer cum heater, two-necked bottom flask, and vertical condenser thermometer.

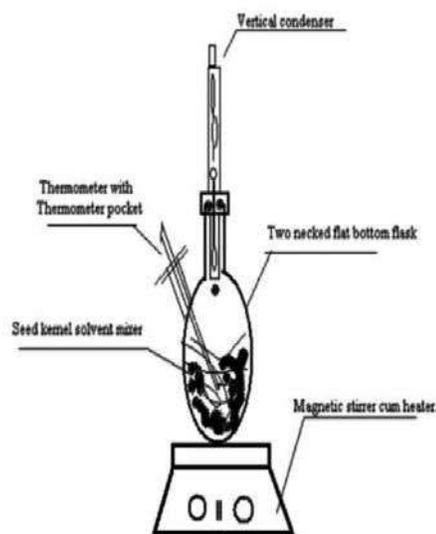


Fig 1: Experimental Set-Up for extraction of custard apple seeds

MATERIALS AND METHODS

Material/Instruments

- Three-necked Round Bottom Flask (RBF)
- Thermometer
- Custard Apple seeds
- Basket Heater
- Agitator
- Spray Gun
- Condenser

Process (An Overview)

This extraction technique uses powdered, ground-

up seed kernels. To extract oil from seed kernels, this powder is next combined with a solvent such as hexane or methanol. The amount of solvent utilised during extraction is 15 ml per g of powdered seed kernels, and the extraction times for two hexane and one methanol solvent were 3 hours, 4 hours, and 4 hours, respectively. By controlling the magnetic cum heater and stirrer, the temperature was kept between 65 and 70 degrees Celsius. Following extraction, the sample is filtered to eliminate any remaining solids, and the filtrate is combined with the extracted oil. For the first sample, vacuum distillation is used; for the other two samples, simple distillation is used. Then, after distillation, the solvents were removed while the extracted oil continued to be distilled.

Extraction of Bio-pesticide

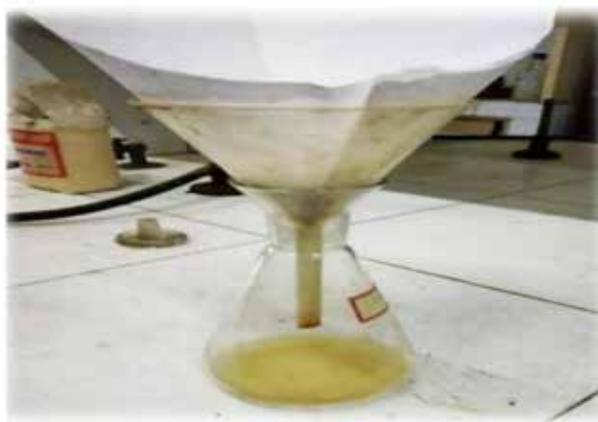


Fig 2: Filtration of mixture from the residue

A one-liter Round Bottom Flask (RBF) with three necks makes up the experimental setup. Through a thermo well, a thermometer is introduced into one neck of the RBF, and a condenser is attached to the other neck to condense the vapour or reduce solvent carryover. A centrally located impeller is inserted via the centre neck of RBF to stir the test sample of solvent. From the centre neck of the RBF, the stirrer was introduced through a Teflon 'o' ring and attached to the motor. Dimerstat was used to maintain a consistent impeller speed. The energy input into the agitated vessel for extraction is provided by a cylindrical basket heater that supports the extraction vessel RBF. The energy input to this heater was managed by an autotransformer.

The seeds of custard apples are gathered, cleaned of debris, and dried in the sun to reduce moisture. To separate the kernel from the hulls, which contain very

little oil, the seeds are then mechanically decorticated. After that, the kernels are ground into tiny particles. The solvent is then added when the particles are transferred to an extraction vessel. The contents are stirred for varying lengths of time and temperatures.



Fig 3: Simple distillation setup

Then the mixture of oil, solvent and kernel are taken out from the extraction vessel (RBF). The solid particles are separated in a filtration unit. The solvent is separated from the oil in simple distillation units and reused. The oil obtained is then tested.



Fig 4: The Product of Organic Pesticide

Preparation and Application of Bio-pesticide

Standard procedures are used to assess the oil's pesticidal abilities. After the oil's varied qualities have been tested, it is applied to white mealy bugs on the surface of guava tree leaves. Before applying the oil to the mealy bugs on the guava tree leaf surface, a blank solution is produced. By combining 6 parts of labolene soap with 94 parts of water, the blank solution is created. Using a sprayer, the necessary amount of custard seed oil is added to this blank solution before being applied to the pest-infested surface.



Fig. 5 : Spray Gun

White mealy bugs with wings on the surface of guava tree leaves are the focus of the current study (*Planococcus pacificus*), which aims to determine the efficacy of an organic pesticide made from custard apple seeds. A marker is used to mark the insect's (mealy bugs') covering surface. With the aid of a needle, the quantity of white mealy bugs inside the specified region is counted. The produced bio-pesticide is then applied using a spray gun. The mealy bugs are counted once more after some time (let's say, one or two days). If the pesticide's concentration is insufficient to get rid of the bug, the concentration is raised.

RESULTS AND DISCUSSION

Following vacuum distillation for oil extraction and separation, samples of oil were analysed to determine their percentage of oil, density, acid value, and colour appearance. Tables 1 and 2 below interpret the calculations and results.

Table 1 : Properties of Hexane and Methane

Solvent Used	%Oil	Density (g/ml)	Colour	Acid Value (mg KOH/g Sample)
Hexane	19	0.876	Yellowish-Light Brown	1.683
Methanol	10.5	0.954	Dark-Woody Brown	3.767

FORMULAS :

ACID VALUE

$$A) AN = \frac{(V_{EQ} - B_{EQ}) \cdot N \cdot 56.1 \text{ g mol}^{-1}}{W_{OIL}}$$

$$B) N = \frac{1000W_{KHP}}{204.23 \text{ gmol}^{-1}}$$

Table 2: Test Results of Lab

Test Result		
Sr. No.	Qualitative	Quantitative
a.	2,4-Decadienal	--
b.	Caryophyllene	--
c.	Hexadecane 2,6,11,15-tetra methyl	--
d.	Phenyl 2,4-Bis (1,1-dimethyl Ethyl)	--
e.	Tetradecane 2,6,10-Trimethyl	--
f.	Eicosane 2- Methyl	--
g.	Plamitic Acid	0.03%
h.	Methyl 11,14-Eicosadienoate	--
i.	Butyl 9, 12-Octadecadienote	--
j.	Ethyl iso-allocholate	--

Since the active ingredient in this product is derived from oil and has a liquid form, we can favour the liquid formulation of pesticides. For the formulation of custard apple seed oil, we can move away from liquid formulation and use emulsifiable concentrate (EC). The white mealy bug is present on the surface of the guava tree leaves that are affected by white mealy bugs. An oil solution of (blank 0.0%, 0.15%, 0.30% and 0.75% is created by mixing with labolene soap solution and sprayed on the white mealy bug in one shot. Following the application of the pesticide solution, the number of white mealy bugs that were left on the surface of the leaves was counted on a daily basis and is shown in Tables 3, 4, 5, and 6 according to the pesticide concentration.

Table 3: White mealy bug pesticide test (oil 0.0%)

Sl. No.	No. of Days	No. of White mealy bug
01	00	26
02	01	24
03	02	21
04	03	20
05	04	19
06	05	18
07	06	18

The trend of reduction of white mealy bug from the guava tree leaf surface against the days at various concentration of oil is shown in Fig.5, Fig.6, Fig.7and Fig.8 respectively. It is observed from the figures that at lower concentration of oil a few white mealy bugs

are still alive. As the concentration of oil increases from 0.00% to 0.75% the number of mealy bugs decreases to zero within 2 days. Hence, the oil solution of 0.75% is effective to keep away the pests.

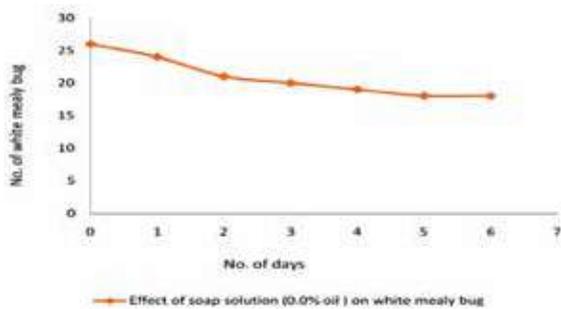


Fig. 6: Effect of soap solution (0.0 % oil) on white mealy bugs

Table 4 : White mealy bug pesticide test (oil 0.15%)

Sl. No.	No. of days	No. of white mealy bug
01	0	42
02	1	28
03	2	24
04	3	19
05	4	16
06	5	14
07	6	11

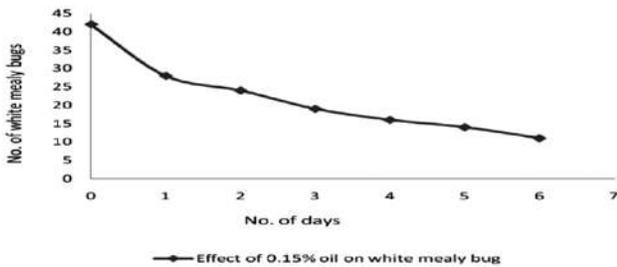


Fig 7 : White mealy bug pesticide test (oil 0.15%)

Table 5: White mealy bug pesticide test (oil 0.30%)

Sl. No.	No. of days	No. of white mealy bug
01	0	34
02	1	30
03	2	2
04	3	1
05	4	0
06	5	0
07	6	0

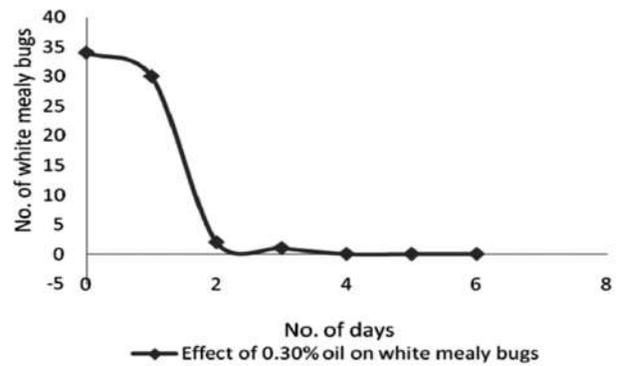


Fig. 8. Effect of 0.30% oil on white mealy bugs

Table 6 : White mealy bug pesticide test (oil 0.75%)

Sl. No.	No. of days	No. of white mealy bugs
01	0	43
02	1	2
03	2	0
04	3	0
05	4	0
06	5	0
07	6	0

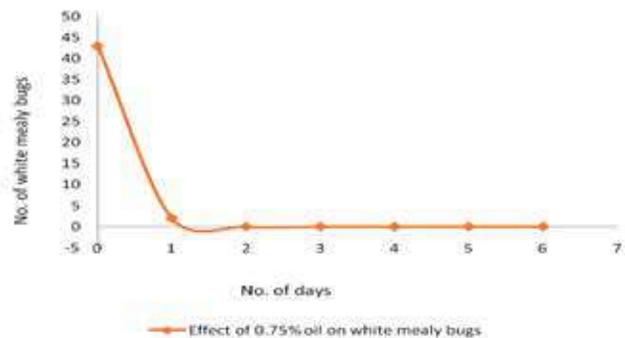


Fig 9. Effect of 0.75% oil on white mealy bugs

Table 7 : Comparison of effect of Bio-pesticide on White mealy bugs

Sl. No.	No. of days	No. of white mealy bugs			
01	0	26	42	34	43
02	1	24	28	30	2
03	2	21	24	2	0
04	3	20	19	1	0
05	4	19	16	0	0
06	5	18	14	0	0
07	6	18	11	0	0

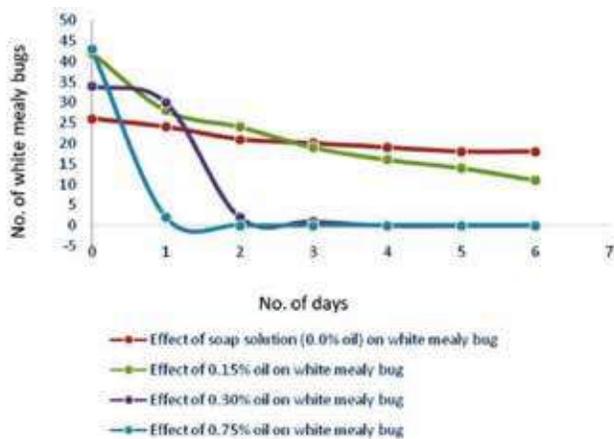


Fig 10. Comparison of effect of Organic pesticide on white mealy bug

CONCLUSION

We may draw the conclusion that the natural insecticide made from custard apple seed oil is effective, useful, affordable, and safe to use. Hexane solvent yields a 19% recovery rate compared to methanol solvent's 10.5%. All former Indians can easily access this pesticide stuff without exerting too much more effort. Due to the low cost of this raw material, the cost of processing and solvent recovery will be as low as possible.

Conclusion on the Effectiveness of Organic Pesticides

Attacks by the white mealy bug are becoming increasingly common on both horticulture and fruit crops decreases the yield by 40%. The synthetic pesticides maldison, dimethoate, and methylated spritis should not be applied in order to sustain crop output. Biopesticide should be used in its place. The current inquiry has led to the following conclusions.

- A 0.75% biopesticide derived from custard apple seed is sufficient to remove the white mealy bugs off the surface of guava tree leaves in just two days. This bio-pesticide is eco-friendly and will not cause water or air pollution.
- There were no issues with ant spray quantity.
- It degrades naturally.
- It keeps the soil fertile and does not deplete earthworms.

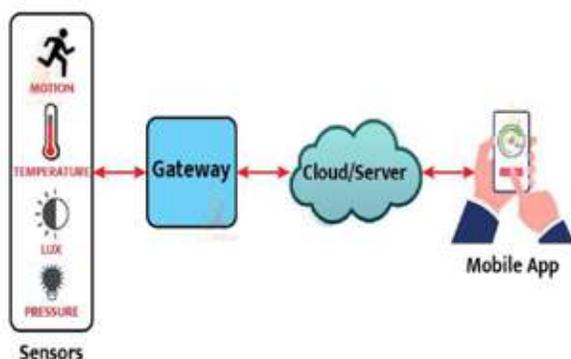
With a growing population, environmental degradation is getting worse every day in India. They originate from the industrial, automotive, and agricultural sectors as

well as from synthetic pesticides used to protect crops from pests in the field. These synthetic pesticide residues are now present in nearly all food items. Therefore, it is time to switch to bio pesticide from all-synthetic pesticide. In the absence of such, harm to humanity is imminent.

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Working of IoT



Sometimes these devices interact with other related devices and act on information received from each other. Devices perform maximum tasks without lethal intervention, but humans can interact with devices such as configuring them, providing instructions, or accessing data.

Literature Survey

Considering EV vehicles demand in future, Wireless EV charging and battery management system using IOT technology area is concentrated more now a days. Wireless communication systems are highly used in EV applications [1]. When compared with plug in charging systems wireless charging system provides more efficient results and it is also a user-friendly system. [2]. This wireless EV charging system may have some disadvantages when the vehicle is parked or at garages as there will be the problem of electromagnetic compatibility, power transfer limitation and small range [3], [4], [5]. Lithium-ion battery is mostly used by the EV vehicle. It is far better with its efficiency when it is compared with other batteries. The safety of current battery technology limits the development of EV in future [6]. For example, the vehicle battery when it is overcharged, it leads to the serious accidents such as fire, or, battery explosion [7-9]. Therefore, the live battery monitoring and system in addition to the wireless EV charging system should be develop. As the development of notification system is initiated here, IOT era can be used to inform the customers about the battery status. IoT makes use of internet connectivity, which delivers all the data in the person's finger tips. In order to overcome the drawbacks of previous works, the package of wireless EV charging combined with the system of battery management is proposed.

Proposed System

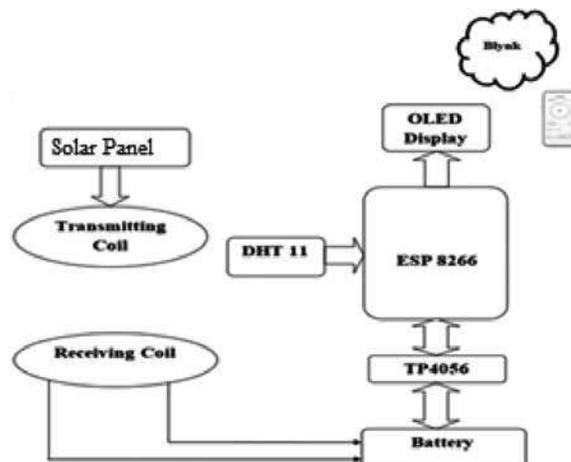
The proposed system here is the incorporation of the idea of wireless power transfer for EV charging as well as live battery level and temperature level monitoring of the electric vehicle with necessary preventive measures.

The solar panel and the transmitting coil come under the transmitter section. The transmitter coil generates varying electromagnetic field and transmits the power across the receiver coil. The receiver side consists of a receiver coil and a battery.

The EV battery gets charged through the power which is received from the receiver coil. Later on, this battery is also connected to the battery level monitoring section in which voltage sensor is used to monitor the battery level and also DHT 11 sensor is used to monitor the temperature level.

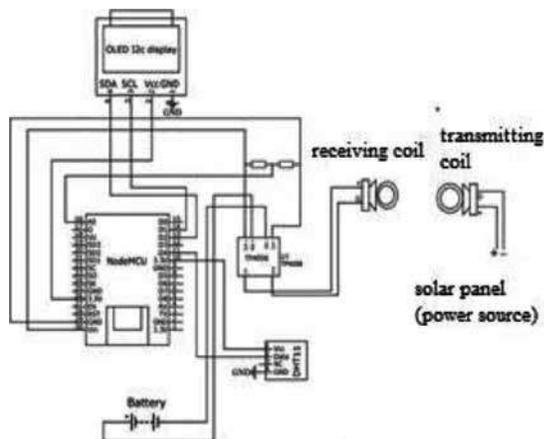
When the battery level is low it is indicated through led and buzzer initiation and also live monitoring of battery and temperature level is initiated using IOT technology with the help of BLYNK server.

Block Diagram



The block diagram of the entire systems consists of a solar panel from where the transmitting coil receives the electric power and receiving coil which receives the electric power from transmitting coil. The receiving coil is connected to the battery of the EV vehicle. The block also consists of battery level management system that involves esp8266, temperature sensor to measure the temperature of battery and voltage sensor to measure the changes of voltage levels of battery and OLED display where all these data are displayed. Esp8266 is used to transfer all the data to the cloud.

CIRCUIT DIAGRAM



The figure depicts the assessment of the proposed methodology. Here the charging system is primarily based on electromagnetic induction. When an electric power is generated in the transmitting coil with the help of solar panel, it creates a magnetic field which an electric power in the receiving coil which is connected to the battery. This manner power may be transferred from one tool to every other without bodily contact i.e., using wireless power transfer. TP4056 is the battery charger module where we receive the electric power from receiver coil.

The receiver section is also enhanced with voltage and temperature sensor to monitor the battery voltage level and temperature status. These data are sent Blynk server for live monitoring using ESP8266 Wi-Fi module and also these data are displayed in OLED display. Blynk server also supports android source through which you can receive all these data at your fingertip.

Hardware Component

NodeMCU, transmitter and receiver coil, Solar panel, DHT 11 sensor, Voltage sensor, TP4056 chip.

Software Used

Arduino IDE Software, MATLAB.

NodeMCU

The NodeMCU (Node Microcontroller Unit) is an open-source software and hardware growth terrain assembled around a reasonable System-on-a-Chip (SoC) entitled the ESP8266. The ESP8266, intended and manufactured by Espressif Systems, comprises the decisive essentials of a computer: CPU, RAM, networking (Wi-Fi), and even an up-to-the-minute operating system and SDK.

Voltage Sensor

This sensor monitors, compute and limit the voltage supply. This sensor can be used to measure both AC and DC voltage level. The input of this sensor can be the voltage however the output is the switches, analog voltage signal, a current signal, etc. Few sensors provide the pulse and sine waveforms as output and other sensors provide pulse width, Amplitude and Frequency modulation outputs.

DHT 11

DHT11 is a moisture and Temperature detecting Sensor, which generates standardized digital outputs. DHT11 can be interfaced with all types of microcontrollers like PIC microcontroller, Arduino, Raspberry Pi, etc. and get prompt results. DHT11 is a low-cost moisture and temperature detector which delivers high long-term stable outputs.

These sensors have an inbuilt humidity sensor to measure the moisture level of the and a thermistor to measure the temperature of any device, and gives a digital signal on the data pin.

Solar Panel

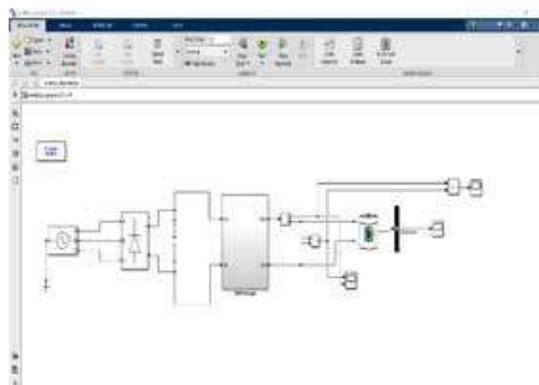
Solar panel is built using photo voltaic cells which is used to convert sunlight into electricity. The electrons are induced on PV cells when exposed to light. The electrons flow through a circuit and produce DC source, which can be used to power or stored in batteries.

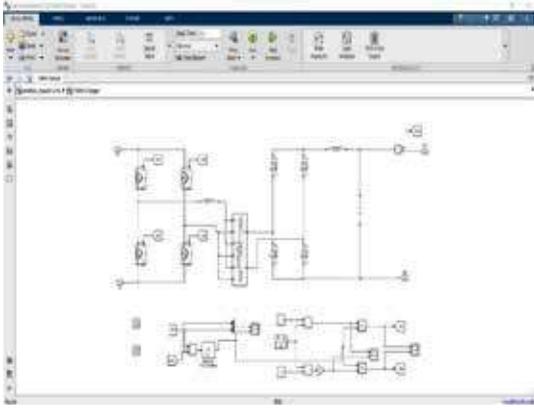
OLED Display

The working of OLED display is deprived of a rear light. It is thinner than Liquid Crystal Display. The advanced contrast ratio is achieved better than LCD.

EXPERIMENTAL RESULTS

Software Results





Hardware Results

The sensors which are used in our proposed system is voltage and temperature sensor. This sensor is used to find out solar and battery voltage. The Node MCU controller works under 5V therefore we have designed a voltage divider circuit that provides 5V. 5W,12V solar panel and a 12V lithium-ion battery is used here. Firstly, the electrons are generated using the photo voltaic cells of the solar panel from where the generated electric source is transmitted to the receiver coil with the help of emf inducing transmitting coil. The received electric source is stored in the battery of EV where the battery gets automatically charged using wireless power transfer using electromagnetic induction principle. Here, we have used PWM controller. In this charge controller we used two MOSFETs one is for controlling the flow of power from the solar panel to a battery and the other is to initiate the load.

OLED display is used to display battery and solar panel voltage with battery temperature level. It also shows the percentage of the charge.

Here we have got a result with better efficiency than the existing systems. The incorporation of IOT technology for live monitoring of data is the added advantage of our proposed system.

CONCLUSION

In order to decrease the air pollution, we need to lessen the consumption of vehicles which ejects toxic gases. In order to come out of the environmental pollution status, the usage of EV vehicles can be initiated which lessen the oil consumption. Since the EV vehicles are

increasing in the market, we develop a smart wireless EV charging system with battery monitoring system using IOT and wireless communication technology. This device initiates the live monitoring of your battery status at your fingertip. Through this device we can charge the EV vehicles using wireless power and transfer and we will screen the battery circumstance via the IOT and the usage of android phone. BMS enhances the life span of the battery which results in better efficiency. It displays units of the battery and also its temperature continuously and also to avoid it from the prevalence of failure or explosion.

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REMOVAL OF LEAD (II) IONS THROUGH PACKED BED COLUMN FROM AQUEOUS SOLUTION AND USING MAIZE COB

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ABSTRACT

A maize cob was used to remove heavy metal ions from an aqueous solution in a packed bed column. On the breakthrough curves and adsorption performance, various important parameters like the inlet Lead ion concentration, contact time, and bed height were investigated. The inlet Lead ion concentration, bed height, and time will be used to calculate the removal efficiency. The efficiency from the volume of the aqueous solution will also be affected by the greater availability of adsorption sites. When the contact time was 150 minutes and the bed height was 20 centimeters, the maximum lead ion removal was 72%. Throughout the entire procedure, the pH remained at 5. Bio-adsorbent was able to effectively remove Lead (II) ions from aqueous solutions and can be used to treat industrial waste water. The outcome is significant not only for the industries but also for society and the environment.

Keywords : Packed bed column, efficiency, Parameters, Bio adsorbent, Break Through curve

INTRODUCTION

Heavy Metal Pollution

In recent years, the environmental threat posed by toxic heavy metal pollution in water has received a lot of attention. One of the major causes of water pollution is the release of a lot of industrial effluent that contains heavy metals as a result of global industrialization [8]. Numerous ecosystem deteriorations are the result of

the toxic metals released by various industries, which pose a threat to the environment and human health. Poisonous metal are compounds hurtful to human and climate when assimilated or breathed in. The majority of industries that pollute industrial waste water are chemical, leather, metal fabrication, and battery [27].

Effect of Lead

Lead metal particle are generally perilous to human

wellbeing and creatures than the other weighty feasts, can be viewed as a longstanding natural pollutant. [17].

At this time, elevated levels of heavy metals in the environment may pose a threat to human and ecosystem health over the long term. so that they must be reduced to levels below the recommended permissible value by national and international health authorities. in drinking water, waste water, and agricultural water. Therefore, it must be removed from wastewater before it is released into the environment [10].

Treatment of Waste Water for Removal of Toxic Metal

According to Standard Institution of India the tolerance limit value of lead is 0.05mg per litre in drinking water. The value of release of lead into waters is 0.1 mg per litre. Progressively thorough regulation of the immaculateness of uses water, it was standard a developing interest in the improvement an ordinary treatment strategy. Adsorption is found to be one of the important viable methods to treat the waste water. Because of its advantages like it works well, is easy to use, has a wide range of adsorbents, and it is also economical. [26]. Other methods include for the treatment of effluent containing lead wastes are chemical precipitation, electrochemical, ion exchange, biosorption, and adsorption [25]. The adsorbent that is being used in the column is of prime importance since the dynamic adsorption is done in fixed bed process. Numerous metal ions are adsorbed from waste water using this method. [31]. The fluidized bed reactor was found to be a good choice for biological processes and AOPs applications [14, 29]. Low operating costs [11], high system stability [5], high mass transfer rates, and uniform mixing [3] are some of the excellent characteristics of FBR. The examination work was completed the presentation of the bio sorbents to treat lead polluted water in a pressed bed segment. It was developed a mass transfer model to increase biosorption of the packed batch of bed columns. The effect of the feed stream's flow rate, pressure drop, and different packing bed heights on the breakthrough curve was examined.

MATERIALS AND METHODS

Preparation of the Bio Adsorbent

Maize cob were obtained from agricultural fields in Salem City's districts. The samples were cleaned with

water to eliminate the undesirable materials. Then they were dried by daylight for four days. After being manually cleaned and chopped into small pieces, the samples were washed with double-distilled water and the corn cob pieces were rinsed.

Pre-treatment of Maize Cob

Known concentrations of H_2SO_4 was diluted with double-distilled water (the standard solution), and then one thousand milli litres of the standard solution were diluted with double distilled water (the working solution). The working solution was kept at room temperature for 24 hours after the corn cob was added. In a similar manner, 1000 millilitres of standard solution were taken and diluted using DDW after 1N of sodium hydroxide was diluted with double distilled water. This was done to help remove foreign particles from the adsorbent and increase its porosity (22). The cob of maize was placed into the solution, functioning arrangement and kept it at room temperature for 24 hours. The adsorbent was neutralized by base treatment.

Preparation of Aqueous Solution

5 mg/L of lead nitrate was dissolved in double-distilled water to make the aqueous solution. The adsorption experiment was then optimized by measuring and diluting a variety of lead concentrations in double-distilled water.

BATCH ADSORPTION PROCEDURE

The procedure for a batch experiment is depicted in the figure. Synthetic waste solution was introduced toward the column, which then treated the water. Then the solution was returned to the section for additional process at various time intervals. These samples that were treated at intervals of 30 to 180 minutes are provided for AAS analysis in order to procure the optimal range. Different parameters, such as concentrations of 5 to 30 mg/L, are used in a similar procedure to determine the optimal range. To maximize the concentration of lead (II) nitrate in the collected samples, AAS analysis was performed.

$$Q = (C_e - C_i) \times (V/M)$$

Q is the lead uptake in mg/g, and C_o and C_i are the initial and equilibrium concentrations of lead ions in the aqueous solution, respectively. V is volume of solution (lit) and M is mass of the adsorbent(g).

Break Down the Sort of Stream Design

Reynolds' number was determined to decide the sort of stream, whether laminar or violent stream.

Reynolds Number

$$N_{Re} = DV\rho/\mu \quad (1)$$

Where, D = Diameter of column (cm), V= Velocity of fluid (cm/sec), ρ = Density of fluid gm/cm³, μ = Viscosity of fluid (gm/ cm.sec)

Determination of the Pressure Drop by Calculation

The pressure drop of a fluid through a packed bed column can be calculated using the equation by Kozeny and Carman.

$$\Delta P/L = [150\mu U \Delta L (1-\epsilon)^2 / D_p^2 \epsilon^2] \quad (2)$$

where; ΔP = pressure drop, V_s = superficial / empty-tower velocity cm/sec, U = average fluid velocity, ϕ = porosity, $V_s = Q/A$, Q = volume flow rate of the phase m³/sec, A = cross sectional area (m²), μ = viscosity of the fluid (gm/ cm.sec), ϵ = porosity of the bed, ϕ_s = Sphericity of the particle in packed bed, D_p = Diameter of the spherical particle (mm).

Calculation of the fluid's pressure drop through the packed bed column using the Ergun equation:

Substantial just for laminar stream. The packing size, bed length, fluid viscosity, and fluid density all affect pressure drop.

$$\Delta P = \frac{150\mu L (1-\epsilon)^2}{D_p^2 \epsilon^3} V_s + \frac{1.75 LP (1-\epsilon)}{D_p \epsilon^3} V_s \quad (3)$$

where; f_p = packed bed friction factor, ΔP = pressure drop across the bed, L = length of the bed, D_p = Spherical diameter of the packing, μ = Dynamic viscosity, V_s = Superficial, ϵ = solid void fraction.

RESULT AND DISCUSSION

The pretreated maize cob was found to be stable in diluted acid and base solutions and water. At a pH of zero, the bio adsorbent exhibits neutral behavior. Finding the adsorbent's point of zero charge (pHzpc), according to the adsorption mechanism, is crucial. At pHs higher than pHzpc, cation adsorption is preferred, while anion adsorption is preferred at pHs lower than pHzpc. Bed height, time, concentration and flow rate, and adsorption capacity were used in the batch experiment portion of the fixed bed studies to estimate

the impact of various process variables.

Percentage of Lead Removed at Various Concentrations

The biosorption capacity of maize cob on lead ions was investigated at Various Concentrations of Inlet Aqueous Solution. As the initial concentration of pb (II) increased, so did the efficiency of.

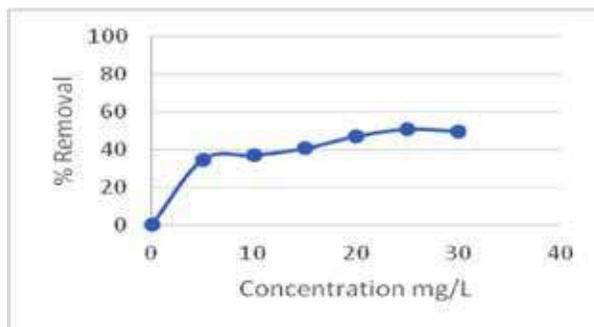


Fig. 2, Effect of initial solution concentrations (mg/lit)

The process of removing lead was carried out with sample concentrations ranging from 5 to 30 mg/L. It was discovered that the concentration of 25 mg/L, which is regarded as the optimal concentration, achieved the highest level of removal by a percentage of 51.2 percent.

Lead Removal Percentage on Contact Time

In addition, the study is carried out with a concentration of 25 mg/L, where the ideal value was obtained at varying contact times ranging from 30 to 180 minutes. In this instance, it was obtained that the maximum removal was achieved in 150 minutes, with a percentage removal of 68.7%.

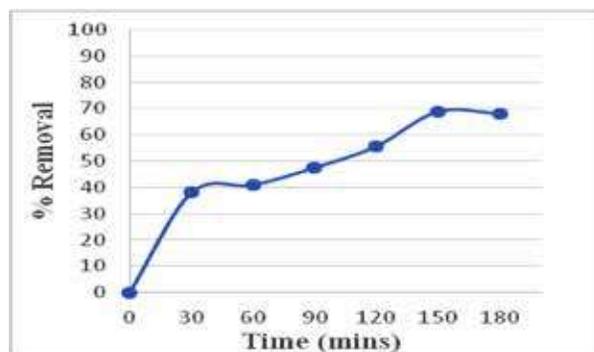


Fig. 3 Effect contact time on removal of Lead

Study the types of flow pattern

Reynold's Number NRe: $DV\rho/\mu$

$$N_{Re} = 0.56 * 0.88 * 10^{-6} * 1969.41 / 8.90 * 10^{-4} = 109.04$$

- Reynold's number <2040, indicates the type of flow is laminar.
- As a result, the pressure drop is determined by applying the Kozeny-Carman equation.

$$\Delta P = 150/((8.75*4))*(1-1.75)^2/(1.75)^3*1969.41*0.2$$

As a result, the measured pressure drop is 203.2 pa. since low - there will be no variance in progression of water)

Wall Effect

- This is the result of a looser packing density close to the rigid column's walls. When there is no wall effect, fluid can flow easily and lead can be removed effectively.

$D_c/D_p > 10$ Where, D_c = Diameter of column D_p = Diameter of particles

Therefore, $56(D_c)/4(D_p) = 14 > 10$, which means there is no wall effect.

Impact on Breakthrough Curves of Initial Ion Concentration

When designing a packed bed absorber, the primary task is to calculate characteristic features of curves [32]. Inlet adsorbate concentrations is affecting Breakthrough curves at a flow rate of 1 liter per second and a bed height of 200 millimeters .The break point time decreased as the initial ion concentration increased from 5 to 30 milligrams per second, as observed. Mass transfer flux of bulk solution to particle surface is lower , and it is caused by the driver of less power, and also breakthrough volumes decreased as the initial ion concentration rose [35]. At maximum fixation, the accessibility of the material particles is increased in order to adsorb locales is more, which prompts highest take-up Pb^{2+} at maximum focus despite fact that the time is more limited than the advanced season of lower concentrations[32].

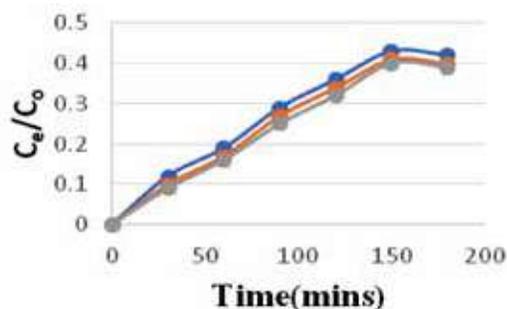


Fig. 4. Effect of break through curve

CONCLUSION

According to the findings of this study, acid-treated maize cob is an effective adsorbent for the removal of lead ions from aqueous solutions. Time, as well as the adsorbent and measurement, impact the adsorption interaction. The maximum percentage of removal was 72% when the bed height was 20 cm and the pH was maintained at 5. Adsorbent fractional adsorption and percentage uptake were found to be highly dependent on the initial concentration of the adsorbate. The goal of the complex maize cob adsorbents Additionally, the estimated This study demonstrates that acid-treated maize cob is an efficient adsorbent for lead ion removal from aqueous solutions. Time, as well as the adsorbent dosage, influence the adsorption process. Adsorbent fractional adsorption and percentage uptake were found to be highly dependent on the initial concentration of the adsorbate, and the maximum percentage of removal was 72% when the bed height was 20 cm and the pH was maintained at 5. Maize Cob adsorbents were complex with the end viability of maize cob adsorbents over activated carbon is low. Among all of the developed adsorbents, it has been discovered that maize cob, which is inexpensive and readily available locally, is the most cost-effective. As a result, it can be concluded that the most cost-effective and readily available agricultural byproducts are the most efficient adsorbents for the adsorption process, which is expected to be cost-effective for wastewater treatment. Due to the benefits it brings to society and the environment, the outcome is significant not only for the industries but also for the planet as a whole.

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A STUDY ON BRAND AWARENESS AND CUSTOMERS PREFERENCE OF BISCUITS INDUSTRIES LIMITED

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ABSTRACT

The choice of purchase is immeasurable as thousands of companies are introducing newer goods day next to day. To manage with this circumstances people keep on acquire information on the subject of the goods, prices and substitute. Company that hub inward grow to be by sightless to seismic changes in marketplace, contest, allotment, media, and knowledge that are happening outside. Collection market is garmenting in to micro markets; numerous channels of allocation are replacing single channels. Patrons are buying openly through Catalogues, Telemarketing and Internet. Cost discounting and sales support are eroding brand dedication. This learning deals with consciousness and satisfaction of biscuits. It is complete an endeavor to observe the variety of types of brand and factors touching purchase decision. The learning based on main data comprise of respondents. From the findings of study, customers obtain decision are partial by mainly excellence and they too purchase the additional biscuits.

Keywords : Brand Awareness, Consumer, Satisfaction, Biscuits

EXTRACT OF THE STUDY

Brand knowledge measures how well people are aware of a brand and how closely they link it to specific goods. Brand consciousness, which is typically expressed as a percentage of the target market, is the primary objective of advertising during the first few months or years following a product's launch.

Brand awareness is the extent to which the consumer connections the brand with the product he requirements to buy. It is the brand recall and the brand identification of the group to the clients. Brand appreciation is the potential of the consumer to recover the past knowledge of the variety when asked about the brand or given a figure of the brand emblem, whereas brand recall is the ability of the consumer to recall the brand with orientation to the product. Brand consciousness is an essential part of brand progress which helps the brand to situate out from the others in this monopolistically aggressive marketplace.

A brand name that is well known to the great greater part of household is also called a household given name. Brand awareness is an important way of promote commodity-related products. This is because for these products, there are very few factors that make a distinction one product from its competitor.

Therefore, the product that maintains the highest brand consciousness compared to its competitor will usually get the most sales.

Knowledge, attitude, and usage (AAU) metrics relate closely to what has been called the Hierarchy of Effects, an assumption that customers progress through sequential stages from lack of responsiveness, through initial purchase of a product, to brand loyalty. In total, these AAU metrics allow companies to track trends in customer information and attitudes.

Brand consciousness plays a major role in a consumer's buying decision procedure. The knowledge of a social contact or friend having used the product in the past or a high gratitude of the manufactured goods through stable advertisement and family coax the person to make his decision in the favor of the product.

REPORT OF THE PROBLEM

Brand awareness study is a continuous procedure in any company. The most significant statement is to identify the customer liking and agreement of users. Customers, what kind of branded products they like to use. As we know that market, segmentation has become an significant tool used by retailers and marketers for identifying target customers. Segmentation is the procedure of partitioning markets into segments of

possible customers who have similar individuality and who are likely to exhibit similar purchase performance. Segmentation has become a major tool of companies for planning advertising strategies. Segmentation examine has several objectives that embrace analyzing markets, brand a niche, and mounting and capitalizing on a higher competitive situation. This survey evaluates how customers perceive the brand sympathetically. How can you get your target market to respond favourably to your brand? How is brand perception related to a rise in sales? to ascertain whether brand and brand perception raise business value? The goal of this study is to estimate how consumers realise, feel, perceive, and understand the “Product” brand. The study aids in determining the impact of client brand perception.

PRODUCTION PROFILE

Biscuit Industry in India - A Summary

Though India is considered as the third major manufacturer of Biscuits after USA and China, the per capital use of biscuits in our country is only 2.1 Kg., compare to more than 10 kg in the USA, UK and West European country and above 4.25 kg in south East Asian country, Le. Singapore, Hong Kong, Thailand, Indonesi. In the PMCG (Packaged Mass Consumption Goods) industry, biscuits have a somewhat low margin compared to other food items. Due to the commodity’s price responsiveness, even after the Excise sense of tax on biscuits was doubled in 2000–2001, leading brands of biscuit manufacturers were unable to raise MRPs by enough to cover the significant increase in the tax.

The Central Excise Duty, State Sales Tax, and other various levies like turnover tax, local area tax, mandi taxes, acquisition tax, octroi, etc. have all been major roadblocks to the growth of the biscuit industry. According to the CII Study Report, biscuits are one of the goods that should be categorised as “Merit Good for the Principle of Liberal Tax Plan Both.”an etc. China uses 1.90 kg per person, while Japan is thought to consume 7.5 kg per person on average.

Industrialised biscuits and other bakery goods like bread are agro-based industries, and the main inputs are all things that organism farming generates, such as wheat flour, Atta sweeties, milk, and vegetable oil.

Due to the lack of a comprehensive food dispensation Industry Policy, sectors like the biscuit industry are likewise struggling to reach their full potential

for innovation. In close collaboration with other organisations and top Chambers, FBMI took the initiative to call on the government of India to draught a thorough Policy Document to ensure the industry’s seamless expansion and harmonious development. The Food Processing Industry Policy, which was developed following numerous workshops, discussions, and representatives from a wide range of food dispensation industries, has not yet been finalised.

Once a Year Turnover

Major role playersIn India, the organised sector of the biscuit industry provides about 60% of the nation’s overall output, with unorganised bakeries providing the remaining 40%. As of 2000–01, the industry consisted of two large producers, about 50 medium-sized brands, and up to 2500 small-scale operations nationwide. Around 30,000 small and teeny bakeries are anticipated to exist in the unorganised sector across the nation.As of 2001-02, the organised sector of the biscuit industry had an annual revenue of Rs. 4,350 core.

The organised component produced 1.30 million tonnes of biscuits in 2001–2002, according to estimates. Along with a variety of regional and state brands, the prominent biscuit brands include Britannia, Parle Bakeman, Priya Gold, Elite, Cremica, Dukes, Anupam, Horlicks, Craze, and Nezo Yearly production and growth.

Biscuit is a hygienically packaged nourishing snack food presented at very competitive price, volumes and dissimilar tastes. According to the NCAER Study, biscuit is primarily consumed by people from the lower strata of culture, particularly children in both rural and urban area with an average review income of Rs. 750.00.

Segmentation in the Industry

Biscuit can he generally categorize into the following segments:

- Glucose 44%
- Marie 13%
- Cream 10%
- Crackers 13%
- Milk 12%
- Others 8%.

As regard the consumption pattern is concerned.

surveys and estimate by industry commencing time to it Before and after de-reservation, the small and medium selling sector continues to account for the majority of the organised sector's annual output of biscuits. In 1997–1998, the annual production was approximately 7.4 lakh tonnes. Biscuit production increased by 10% to 12% annually during the course of the following five years, until 1999-2022.

nonetheless, the import of cookies, me indicate the average use scenario in the four Zones have been more or less close to each other, as below:

Northern States: 28%

Southern States: 24%

Western States: 25%

Eastern States: 23%

Challenges to the Industry

Along with inadequate financial assistance and support, particularly for the medium and small scale biscuit companies, other factors limiting our sector include a lack of machinery upgradation in industrialised areas as well as packaging, etc. The Ministry of Food Processing Industries was established (it was previously a Dept in the Ministry of Agriculture) and is now led by an independent Ministry of State. On the other hand, the Government of India has identified the food dealing out industries as a priority sector to be expectant for growth and growth.

OBJECTIVES OF THE STUDY

Primary Objectives

- ❖ To study and analyze the awareness level of the brand and customer first choice of creation Industries Ltd, Erode.

Secondary Objectives

- ❖ To know the favorite level among the brands in Product Industries Ltd..
- ❖ To know the level of contentment of customers of by means of Product Biscuits.
- ❖ To know the effect of price change on purchase decision of the brands of Product Industries Ltd., Erode
- ❖ To classify the factors influence the consumers to prefer a particular brand.

- ❖ To study the impact of media on brand consciousness & Preferences.
- ❖ To confirm the extent of customer favorite towards Product brand.

REVIEW OF LITERATURE

Hansa (2014) explored that the preference in rural India are shifting from loose to package products. Rural India is now buying specific, branded utensil cleaners, and moving away from the typical ash/soil usage in the past.

Ritesh Sud and Pritesh Y. Chothani (2014) deliberate that there has been a significant rise in the brand awareness among the people in the pastoral markets. As a result they are becoming choosier and challenging than ever before, so the marketer has to correctly analyze the psychographics before towards the inside this market.

Rajendhiran N. Saiganesh S. Asha P. (2015) explore that brand ambassador play an significant role in putting an impact on the brand preference of rural India. maintenance the Literacy scenario in to deliberation the promotion of Brands in rural market require the special measures. The same becomes the base for brand consciousness and favourite in the markets.

Rao G Srinivas (2015) studied that rural India buys small packs, as they are apparent as value for money. There is brand tackiness, where a consumer buys a brand out of custom and not really by choice.

Kapferer, in 2015 says “top of mind consciousness is critical as it captures the ‘consideration set’ in a given purchase circumstances. The two important conclude of brand awareness is brand recognition and recall-

Ben-Akiva et al. (2015) define preferences as “comparative judgment connecting entities.” added reasons (other than promotions) why customers may purchase other brands despite a stated brand favorite include a desire to try and learn more about dissimilar brands in the category; change needs or situation; variety seeking; and changes in the obtainable alternative due to new products or improvement to existing products (Coulter et al. 2009).

Alba and Hutchison (2016) propose that expert are more likely to search for new information because (a) expertise increase consciousness of the survival of potentially acquirable in sequence and (b) acquaintance reduces the cost of in arrange attainment.

Schmidt and Spreng (2016) further assume that in sequence increases the perceived ability to search and therefore should reduce the perceived costs of search. Greater associate has been shown to be absolutely related to increased participation with a group.

Ho-Shui Li and Jack E. Houston (2016) apply stepwise logistic deterioration to recognize important socio demographic factor (such as sexual group, age, and others) which power the choice of each of the six major type of food markets and to recognize the promotional factor which optimistically or negatively influence consumers' preference for the most often used marketplace.

Gilpatrick D. Hornsby (2017) says that the country of origin has the great power on brand favorite. The study also find outs the other factors that influence product preference. The study included 516 responses with 40 not viable surveys leading to a 57% usable response rate. Results were gained from side to side descriptive statistics and organized by scenario situation. The factors are Price, emergence, and Country of Origin.

Saaksjarvi and Samiee (2017) examine the relationships with brand identity, brand image, and brand favorite in the context of cyber and offline-based additional room retail brands over time.

Zeenat Ismail et al (2017) find out the factor Affecting Consumer favorite of International Brands over confined Brands. This amend was conduct in order to decide the consumer preferences of global brands in its place of local ones. The research was conduct in Karachi and the samples chosen included 200 people of age 16-24.

Malviya et al (2017) said about brand favorite on the basis of research conduct on the factor influence Consumer's Purchase Decision towards Smartphone's in Indore. The basic reason of the research is to identify the key factors which have a dominate effect on the consumers' mind while creation a purchase of Smartphone.

Gabor(2018) Consumer perception towards brand is an significant aspect of marketing mix. Jin and Weber (2013) proposed that, brands served first and foremost as a way for customers to recognize and recognize goods and their producer. The focus of brand value creation was on human being goods whereby firms used brands to show rights and take responsibility for their goods.

Matsatsinis, Samaras(2018) A broad diversity of efforts and theories that attempt to explain the factors which manipulate the consumers and their behaviors when creation purchase decision. The goal of the examination of consumer behavior is to determine pattern of consumers' attitudes in their choice to buy or to ignore a product.

Venkatraman, Clithero, Fitzsimons, and Huettel (2018) Consumers' preference for products or brands arises from the grouping of many different factors. Some factors come from features of the creation itself (e.g., price, durability), while others are attributes of patrons themselves (e.g., goal, attitude, optional profits),

Jin & Weber (2018) Brand preference is regard as a key step in consumer choice making, involving rudiments of choice. In establishing brand preference, consumers compare and rank dissimilar brands by focusing on their individuality defined brand preference as "the extent to which the customer favoritism the designed service provided by his or her in attendance company, in comparison to the chosen service provided by other company in his or her consideration set," with a consideration set referring to brands that a customer would consider buying in the near prospect.

Ge, Brigden (2019) proposed that consumers frequently make choice in setting where some alternatives are identified and additional alternative can be unveil through search. When creation a choice from a set of alternative, the manner in which each of these was exposed should be immaterial from a normative point of view. Consumers have to often decide between choose among a set of beforehand discovered alternatives and penetrating to discover added alternatives before making a choice.

Haubl (2019) as well, brand awareness plays an necessary role in construction a brand in the customers' mind for the reason that clients make purchasing decisions based on information, awareness, or understanding of a specific brand. As a result, regulars may purchase frequently as they are guaranteed of its quality.

Ramaseshan (2019) brand consciousness influence brand promise and brand devotion directly though there is not enough considerate about its impact on the client loyalty process. It is interesting to note that some research revealed a significant association. Brand

awareness is a winning factor for competition that improve competition in the middle of brands .

Zeenat Ismail et al (2020) Brand awareness is a winning factor for opposition that improves fight among brands. Brand awareness comprise of two components: gratitude, and recall Hence, the functioning definition of brand consciousness is the ability of customers to recall or be familiar with that a brand is a member of certain product's group under changed environment.

RESEARCH METHODOLOGY

In this current study, the information and the data are composed by by means of well-prepared survey, consisting of variety of question. After collect the answer questionnaire as of the respondents the data be analyze with simple arithmetical technique and inferences drawn. Research line of attack has many dimensions and research method to comprise a part of the investigate technique.

If a research learn has been undertaken how the research complexity has been defined, in what ways and why the hypothesis contain been formulate, What data have been composed and what particular method has been adopted, why exacting technique of analyze data has been used and a host of comparable questions are more often than not answered in answer with concerning a research difficulty or studying.

RESEARCH DESIGN

“A Research Design is the understanding of conditions for gathering and analysis of data in a mode that aims to combine relevance to the research reason with the economy in process”. The research design adopt for the studies is descriptive design. The researcher has to explain the present circumstances in order to know the performance of the consumers. Hence descriptive research learns is used. Descriptive research can only report what has happened and what is occurrence.

Data Collection Method

The collection of data is measured to be one of the significant aspects in the research method. There are two types of data that exists one is primary data and the other is secondary data.

Primary Data

Well structured survey has been used for the collection

of main data from the respondents.

Secondary Data

Derivative data has been collected from the business record, various magazines, journal and various web sites.

SAMPLING DESIGN

Sampling Techniques

Convenience sample technique was used in this research. The people being large and the project time being partial, it was decided to choose this exacting technique. In convenience sampling, the sample is selected according to the convenience of the researcher.

Population

The collective elementary units in the survey are referred to as the people. Here it covers the entire customers of Product Industries Ltd.,

Sample Size

The study based only on the opinion and anticipation of consumer.

Sampling Unit:

Sampling unit is in Product Industries Ltd.,

Sample design

Simple Random sampling technique was used for the study.

STATISTICAL DESIGN

The information collected from the respondents was converted into readable for processing, categorization and arrangements. The data was tabulate and analyzed by using Statistical Methods like.

1. Simple Percentage analysis
2. Chi Square analysis
3. Correlation

Percentage analysis

The word percent is shaped of two words . 'Per' means out of and 'cent' means hundred. Therefore percent means out of hundred. The symbol for percent is %. Percentage is a portion with denominator as 100. Percentage is used in making judgment between two or more series of information. Percentages are used to describe the connection. Simple percentage can also be

used to evaluate the relative terms.

$$\text{Percentage} = \frac{\text{Number of respondents}}{\text{Total number of respondents}} \times 100$$

Chi – Square Test

The χ^2 test (Pronounced as Chi-Square test) is one of the simplest and mainly widely used non-parametric tests in arithmetical work. The symbol χ^2 is the Greek, letter chi. The χ^2 test was first used by Karl Peason in the year 1990. The quantity χ^2 describes the magnitude of the discrepancy between theory and observation. It is defined as:

$$\chi^2 = S (O-E)^2 / EV = (r-1) (c-1)$$

Where,

O = refers to the observed frequencies

E = refers to the expected frequencies

Calculation of expected frequency:

$$E = RT \times CT / N$$

E = Expected frequency

RT = The row total for the row containing the cell

CT = The column total for the column containing the cell

N = The total number of observations

Correlation

Correlation is a statistical method that can show whether and how powerfully pairs of variables are connected. For example, height and weight are related; taller persons tend to be heavier than shorter people. The relationship isn't wonderful. There are several different correlation techniques. The Survey System's possible Statistics Module includes the most common type, called the Pearson or product-moment correlation. The module also includes a variation on this type called partial correlation. The latter is useful when you want to look at the relationship between two variables while removing the effect of one or two other variables.

Correlation coefficient 'r' is calculated through the following formula:

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{(n \sum x^2 - (\sum x)^2)(n \sum y^2 - (\sum y)^2)}}$$

ANOVA

The statistical procedure known as "analysis of variance" (ANOVA) divides the systematic and random components of a data set's observed summative variability into two categories. The presented data set is affected by the systematic factors in an arithmetic way but not by the random ones. The ANOVA test is used by analysts to determine the impact of independent factors on the dependent variable in a regression analysis.

T- Test

A t-test is a type of inferential statistic used to decide if there is a significant difference between the means of two group, which may be related in convinced features. It is mostly used when the data sets, like the data set recorded as the outcome from flip a coin 100 times, would follow a normal sharing and may have unknown variances. A t-test is used as a hypothesis testing tool, which allows testing of a statement applicable to a people.

CHI-SQUARE ANALYSIS

RELATIONSHIP BETWEEN AGE OF THE RESPONDENTS AND PREFER MORE IN BRAND PRODUCT

Null Hypothesis: H_0 :

There is no significant relationship between age of the respondents and prefer more in Product brand.

Alternate Hypothesis: H_1 :

There is significant relationship between age of the respondents and prefer more in Product brand.

AGE * PREFER MORE BRAND PRODUCT Cross tabulation

		Total
AGE	Below 20 years	20
	21 - 30 years	38
	31 - 40 years	16
	41 - 50 years	12
	Above 50 years	14
Total	30	100

Chi-Square Tests

	Assessment	Degrees of freedom	Significant value (2-sided)
Pearson Chi-Square	95.514a	24	.000
Likelihood Ratio	98.774	24	.000
Linear-by-Linear Association	6.925	1	.008
N of Valid Cases	100		

a. 31 cells (88.6%) have expected count less than 5. The minimum expected count is .84.

INFERENCE

From this test, the smallest expected count is 84. But more cells have expected count more than 5. So null hypothesis is usual, reject the alternative hypothesis. There is significant association between age of the respondents and prefer more in brand creation.

CORRELATION ANALYSIS

RELATIONSHIP BETWEEN FAMILY INCOME OF THE RESPONDENTS AND CONSUMING THE BRAND PROVIDES GOOD IMAGE

Correlations

		FAMILY INCOME	CONSUMING THE BRAND PROVIDES GOOD IMAGE
FAMILY INCOME	Pearson Correlation	1	-.056
	Sig. (2-tailed)		.577
	N	100	100
CONSUMING THE BRAND PROVIDES GOOD IMAGE	Pearson Correlation	-.056	1
	Sig. (2-tailed)	.577	
	N	100	100

INFERENCE

The above table depicts the association between family incomes of the respondents and intense the brand

provide good picture. These two variables have low degree of correlation i.e. -.056. So there is a negative relationship among these two variables.

FINDINGS

- 38.0% of the respondents come under the age group of 21-30 years.
- 52.0% of the respondents are employees.
- 30.0% of the respondents come under the graduate category.
- 36.0% of the respondents are in the income level of below Rs.10, 000.
- 71.0% of the respondents said that they know the brand and none of the respondents.
- 38.0% of the respondents said that TV is their sources to know about the brand.
- 31.0% of the respondents said that the prefer reason is taste.
- 25.0% of the respondents having awareness of dairy products
- 29.0% of the respondents said that coffee as their liking flavor.
- 34.0% of the respondents prefer as snack.
- 50.0% of the respondents are strongly agreed towards the using branded bread good for health.
- 30.0% of the respondents said that excellent towards the rate the factors for brand product availability.
- 39.0% of the respondents said that excellent towards the rate the factors for brand product quality.
- 39.0% of the respondents are agree towards the consuming the brand provides good image.
- 73.0% of the respondents said that prefer any other brand If Cheaper price brand is introduced.
- 41.0% of the respondents felt that the brand is no difference compare than other brands.
- 64.0% of the respondents are not expected changes in advertisement.
- 40.0% of the respondents are highly satisfied in the brand product.
- 41.0% of the respondents would recommend probably the brand product.

- ❑ 37.0% of the respondents said that neutral towards price of the brand product.
- ❑ 28.0% of the respondents said that highly satisfaction towards quality of the brand product.
- ❑ 28.0% of the respondents said that highly satisfaction towards quality of the brand product
- ❑ There is significant relationship between age of the respondents and prefer more in brand product.
- ❑ There is a negative relationship between family income of the respondents and consuming the brand provide good image.

SUGGESTIONS

- ❖ Company need to take steps to increase the attractive package for certain brands. So that it can retain its customers and attract new customers.
- ❖ Company need to strengthen its distribution channel to increase availability and access for the consumers.
- ❖ Company may design an advertising strategy to promote its products in order to increase awareness level.
- ❖ Company may adopt sales promotion techniques to attract women and hotels as they are major consumers for the product.
- ❖ Company may adopt sales promotion techniques such as cash discounts, free offers etc., to attract retailer as he is main channel member in promoting the product to the consumers.
- ❖ It is recommended that the company may introduce more promotional offers to create awareness among the rural consumers and increase the sales.
- ❖ The company should concentrate on the advertisement relating to the varieties of brands in Product
- ❖ It is recommended that the company name may be used in advertisement because, most of the consumers not aware of the manufacturers' name.

CONCLUSION

In the competitive situation, the focus of the association is more on customer satisfaction. So customer satisfaction is the continuous process for keeping

the clients intact. It is concluded that mostly people favored product due to its quality, fitness, price, and availability. Some people often like to have a purchase with varieties. The product Industries Limited business can give more offers to attract more clients and to create brand awareness in rural consumer also. More price discount be supposed to be provided. The business can give about their product in order through with booklets and catalogues. The announcement should more regularly appear in local T.V channel. This study deals with the product preference of the customer. The idea shows that the clients are fulfilled with the product and kindness of the business.

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HOST-GUEST INCLUSION COMPLEXATION BETWEEN β -CYCLODEXTRIN AND SOME CHROMENONES: 2D ROESY INVESTIGATION

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ABSTRACT

Cyclodextrin can act as a host and form Host: Guest inclusion complexes with chromenones. The spectroscopic response, crystallite size, and the structural orientation of β -cyclodextrin-Chromenones inclusion complex are resolved by fluorescence, X-ray diffractometry, and nuclear magnetic resonance spectroscopy. The bond length and width of the chromenones for their encapsulation towards β -cyclodextrin are checked by Rasmol 2.7.5.2. Concrete evidences of the Host: Guest inclusion complexes formed between β -cyclodextrin and chromenones are acquired from Two dimensional rotating-frame nuclear over-hauser effect correlation spectroscopy and the supported structures are reported.

Keywords : β -cyclodextrin, Chromenones, Inclusion complex, Structure, 2D ROESY

INTRODUCTION

Flavonoids are plant-derived pharmacologically active compounds. They possess a sound medicinal value and attract interest as effective anti-cancer molecules [1, 2]. Primarily, flavonoids contain phenolics that is responsible for its antioxidant properties. Research work has been made to comprehend the connections between structure, action and pharmacokinetics of bioactive flavonoids [3]. The molecular encapsulation of flavanone, flavone, and flavonols in free-, β -cyclodextrin (β -CD) complexed forms is reported by us and other research groups [4-9]. The inclusion complex assists in the sustained release of therapeutically interesting guest molecules. A nanocomposite of macromolecules made out of β -CD has been reported by Heydari et al, 2018 [10]. β -CD offers a hydrophobic interior that enables the formation of Host:Guest inclusion complexes with drug molecules [11]. β -CD is employed to extract the guest molecule loaded in the magnetic nano particles [6-8]. The stoichiometry and geometry of the β -CD in the inclusion complex play a crucial role in deciding the strength and the site of the molecule that bind to the macromolecules. The present work deals with the validation of structure

of some β -CD bound Chromenones (CHRs) viz., 2'-hydroxyflavanone (2-hydroxyphenyl-2,3-dihydro-4H-Chromen-4-one, HC), Hesperetin (5,7-dihydroxy-2-(3-hydroxy-4-methoxyphenyl) -2, 3 dihydro-4H chromen-4-one, DC), Naringenin (5,7-dihydroxy-2-(4-hydroxyphenyl)-2, 3-dihydro-4H- chromen-4- one, DHC), Naringin (5-hydroxy-2-(4-hydroxyphenyl)-4-oxo-3,4-dihydro-2H-chromen-7-yl-2-O-(6-deoxy- α -L-mannopyranosyl)- β -D-Glucopyranoside, HHCG), 6-methoxyflavone (6-methoxy-2-phenyl-4H-Chromen-4-one, MC) (Fig. 1) by two dimensional rotating-frame nuclear over-hauser effect correlation spectroscopy (2D ROESY). The β -CD bound CHRs are prepared and studied by different methods and is characterized applying spectral techniques [12-14]. In general, utilizing UV-Visible absorption and fluorescence procedures, the stoichiometry of the Host-Guest inclusion complex is proposed. But 2D ROESY is a brilliant method to support the structure of the inclusion complex by finding the guest atoms involved for their interactions with β -CD [15]. Since the atoms that interact with β -CD play a role in strength of binding, the validation of the β -cyclodextrin–chromenones inclusion

complexes by two-dimensional rotating-frame nuclear over-hauser effect correlation spectroscopy is carried out. The lengths of various bonds of CHR for their possible moiety to be exposed to β -CD are optimized to correlate the findings of spectroscopic response.

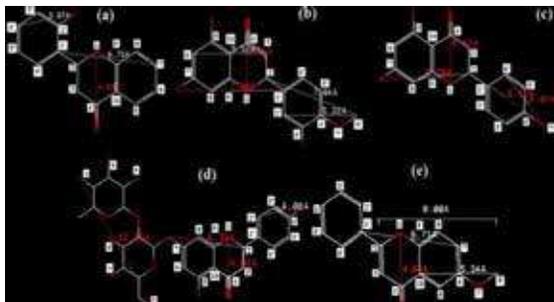


Fig. 1. Molecular structure and Rasmol version of (a) HC, (b) DC, (c) DHC, (d) HHCG, & (e) MC

EXPERIMENTAL

β -CD was purchased from Hi-Media, India. The CHR molecules, HC, DC, DHC, HHCG, MC were obtained from Merck, India. Stock solutions of all the CHR molecules were prepared by solubilizing them in the appropriate solvents like methanol or ethanol of 3%. The stock solutions were diluted to the desirable concentrations and used. The inclusion complexes of the CHR were prepared by co-precipitation of method [15]. Typically, the mixture was ultra-sonicated for 30 min. and then warmed to 50° C for 10 minutes. The obtained mixture was kept at room temperature to separate out the solid. The solid was filtered and dried at room temperature. The fine powdered β -cyclodextrin–chromenones inclusion complex were characterized by ¹HNMR and 2D ROESY spectroscopy. UV-Vis spectrophotometer (V-630, Jasco, Japan) was utilized for absorption measurements with a 1 cm path length cell. Fluorescence spectra were measured on a spectrofluorimeter (Model: FP 750, Jasco, Japan) furnished with 150 W xenon excitation lamp. FTIR spectra were recorded with KBr pellets on a Perkin– Elmer spectrometer RXI, USA. Ultra-sonicator PCI 9L 250H, India was utilized for sonication. The inclusion complexes of β -cyclodextrin–chromenones inclusion complex were imaged by SEM (JEOL Model JSM 6360, Japan). The diffraction patterns of β -cyclodextrin–chromenones inclusion complex were recorded using a Shimadzu XRD 6000 (Japan) providing Cu K α radiation. ¹H NMR spectral measurements were carried out on a Bruker 500 spectrometer working at 500 MHz.

A Bruker AV III NMR instrument working at 500 MHz used to record the ROESY spectrum of the inclusion complex with DMSO–d₆ as the solvent. Under the spin lock condition, the mixing time was 200 ms for recording ROESY spectrum of the β -cyclodextrin–chromenones inclusion complex. The internal standard employed was tetramethylsilane (TMS). Rasmol software 2.7.5.2 version was utilized for viewing the chromenone molecules and for the calculation of bond length between two atoms. The results obtained correlated with the shift of signals on β -CD complex formation as reported in the literature.

RESULTS AND DISCUSSION

Ultraviolet-Visible, Fluorescence Spectroscopy and X-ray Diffractometry

The β -CD-bound inclusion complex of CHR except HHCG demonstrate an enhancement of absorbance and hypsochromic shift in its UV-Visible absorption spectrum. These spectral changes are due to non-polar environment surrounding around CHR molecules. The β -CD molecular cavity renders the guests, CHR, in an environment less polar than water and results in the blue shift. These spectral changes may be attributed to the Host-Guest inclusion complex formation between β -CD and CHR compounds. HHCG displays a hypochromic shift with insignificant change in the absorption maximum. This result arises because of the lessened availability of HHCG for its energy transfer to the solvent exist in the surrounding environment. The fluorescence spectra of the β -CD-complexed and free forms of CHR are compared in Fig. 2. The enhanced fluorescence intensity is observed for β -CD-complexed CHR in comparison to their free CHR [16].

The diffraction pattern of a Host-Guest inclusion complex formed between β -CD and CHR show differences in their diffraction patterns of phases with the uncomplexed CHR molecules. The XRD pattern of the free and the β -CD–CHR inclusion complexes is given in Fig. 3. The peaks of the Host-Guest inclusion complex formed between β -CD and CHR are broadened and slightly diverse intensities are observed. Using Debye–Scherrer formula as given in equation (1) [17], the crystallite size of the CHR and its β -CD inclusion complex is calculated and is given in Table 1. It is found that the crystallite size of β -CD inclusion complex of CHR is similar to the actual size of the CHR, ruling out the possibility of the formation of any

polycrystalline nanoparticles.

$$D = 0.9\lambda/\beta\cos\theta \quad (1)$$

where D represents the size of the crystal, λ , the radiation wavelength ($=1.5418 \text{ \AA}$), θ , the angle of diffraction, and β , the factor of broadening (FWHM, Full width at half maximum). The mean inhomogeneous strain (ϵ) is related to the peak broadening which produces $\beta\epsilon$. This is derived by differentiating Bragg's Law. Domain boundaries, dislocations, surfaces, and others contribute to the lattice strains. The peak broadening will vary as given in equation (2)

$$B(2\theta) = 4\epsilon\sin\theta / \cos\theta \quad (2)$$

where B is the peak width and ϵ represents the strain in the CHRs, β -CD and CHR- β -CD inclusion complex and is given in the Table 1. The bond length and width of CHRs were measured in order to optimize the mode of accommodation of CHRs in β -CD, employing Rasmol software (Fig. 1).

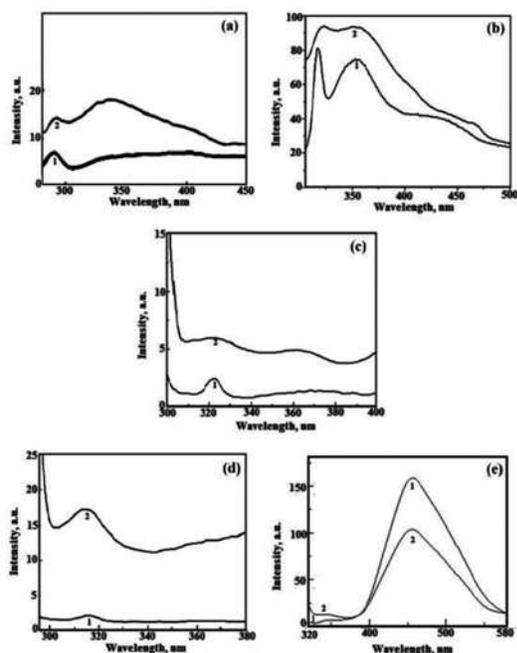


Fig. 2. Fluorescence spectra of (a) HC, (b) DC, (c) DHC, (d) HHCG, & (e) MC and its β -CD inclusion complex

Table 1 Crystallite size and Strain parameters of free and β -CD bound Chromenones

CHR	Crystallite size in nm with Strain (ϵ)	
	Free CHR	Inclusion complex of the CHR

β -CD	18 (0.0011)	
HC	21 (0.00052)	24 (0.00032)
DC	25 (0.00041)	32 (0.00017)
DHC	23 (0.00048)	27 (0.00039)
HHCG	25 (0.00043)	23 (0.00047)
MC	26 (0.00579)	20 (0.00809)

Structural Characterization of β -CD-CHRs Inclusion Complexes

The Host-Guest inclusion complex of β -CD and free-CHRs were analyzed by ^1H NMR and 2D ROESY spectroscopy. ^1H NMR spectral data of the CHRs and their β -CD inclusion complex are given in Table 2 to 5. The correlation between β -CD and CHR protons are analyzed by 2D ROESY. There is a difference in the chemical shift of the protons of β -CD-CHRs from CHRs shows the interaction of the host β -CD with the guest [18].

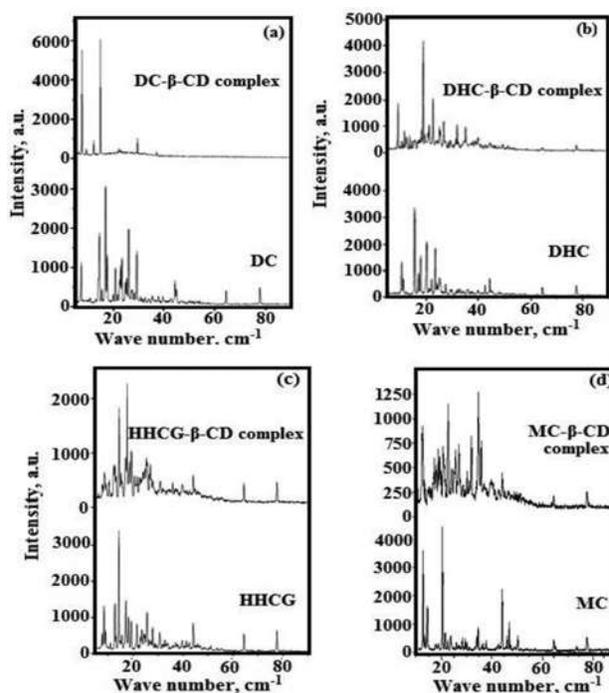


Fig. 3. Comparison on the X-ray diffraction pattern of free- and β -CD inclusion complex of (a) DC, (b) DHC, (c) HHCG, & (d) MC.

β -cyclodextrin - (2-hydroxyphenyl)-2,3-dihydro-4H-Chromen-4-one

Table 2 shows the chemical shifts of β -CD-HC inclusion complex in ^1H NMR spectroscopy. The 2D ROESY NMR spectrum of the β -CD-HC complex is

given in Fig. 4(a). There are cross peaks observed for (i) the protons of the phenyl ring of HC (position 3' & 5') with the chemical shift of 7.11 ppm, and (ii) the protons at position 2 of benzopyranone ring of HC with the chemical shift of 5.80 ppm. It shows the correlation with H3 and secondary hydroxyl protons of β -CD at 3.30 ppm and 5.74 ppm respectively. This correlation occurs due to the encapsulation of HC by the ether-lined cavity of the β -CD molecule with the phenolic ring of HC molecule getting encapsulated. By considering the stoichiometry and the proximity of the protons of HC with those of β -CD, the structure of the Host: Guest inclusion complex, β -CD-HC is represented schematically in Fig. 5(a).

Table 2 1H NMR spectral data of HC and its β -CD inclusion complex

HC			β -CD-HC inclusion complex
Nature of proton	Position of protons	Chemical shift, δ (ppm)*	Chemical shift, δ (ppm)
Benzo pyranone protons	Methylene protons H3	3.01; 3.16 (dd)	2.78; 3.21 (dd)
	H2	5.78 (dd)	5.80 (dd)
	H5 & H7	7.97 (m)	7.80 (m)
	H6 & H8	7.27 (m)	7.20 (m)
Hydroxyl protons	H 2'	6.62 (d)	6.87 (d)
	H 6'	7.32 (m)	7.60 (m)
Phenyl protons	H3' & H5'	7.10 (m)	7.11 (m)
	H4'	7.27 (dd)	7.48 (dd)

β -cyclodextrin - 5, 7-dihydroxy-2-(3-hydroxy-4-methoxyphenyl)-2,3-dihydro-4H chromen-4-one:

The chemical shifts of the DC and β -CD-DC inclusion complex are displayed in the Table 3. The chemical shift of the aromatic proton (H6) is observed in 5.89 ppm as triplet for the free form of DC and appears as a quartet for β -CD inclusion complex of DC. A singlet at 10.83 ppm is observed in β -CD-DC inclusion complex. The NMR spectrum shows that the hydroxyl proton (position 7) is de-shielded with the chemical shift of 0.03 ppm from its free compound DC. The decrease in intensity occurs by intermolecular H-bonding of hydroxyl with the 1° hydroxyl of β -CD. There are two

possibilities to form H-bonding viz., (i) hydroxyl proton of DC act as an H bond acceptor with oxygen atom present in the primary hydroxyl group of β -CD; (ii) the hydroxyl group of DC forms H-bond (act as a H-bond donor) with protons of the methylene group of β -CD. The H-bond formation is due to the remarkably close proximity of hydroxyl group (7) in DC molecule and the primary hydroxyl of β -CD due to DC encapsulation inside the cavity of β -CD. The cross peaks are observed for the correlations of aromatic proton (H8) of DC with H3 protons of β -CD (Fig. 4(b)). The hydroxyl proton of DC (5) interacts to the H4 proton of β -CD. Off-diagonal peaks corresponding to the correlations of (i) aromatic H6 proton of DC are not observed. Therefore it is placed at the middle of the β -CD ring and, (ii) hydroxyl proton (H7) of DC due to the loss of peak intensity by the H-bonding of primary hydroxyl group of β -CD. Further, there are some other correlation peaks observed for the orientation of phenyl ring of DC to the β -CD molecule (Table 4). By considering the stoichiometry of its β -CD inclusion complex as 1:2 and the correlated protons of DC with β -CD, the structure of the inclusion complex, β -CD-DC can be represented schematically as given in Fig. 5(b).

Table 3 1H NMR spectral data of DC and its β -CD inclusion complex

DC			DC- β -CD complex
Nature of proton	Position of protons	Chemical shift, δ (ppm)*	Chemical shift, δ (ppm)
Benzo pyranone protons	Methylene protons H3	2.71 (dd); 3.20 (dd)	2.71 (dd); 3.20 (dd)
	H2	3.36 (m)	3.36 (m) merged with H4 of β -CD
	H6	5.89 (t)	5.89 (q)
	H8	5.44 (dd)	5.44 (dd)
Hydroxyl protons	H5	12.14 (s)	12.13 (s)
	H7	10.80 (s)	10.83 (s) - Intensity lost
	H3'	9.11 (s)	9.10 (s)
Phenyl protons	H2' & H6'	6.94 (d)	6.94 (dd)
	H5'	6.88 (d)	6.88 (d)
Methoxyl protons	H8'	3.78 (s)	3.78 (s)

Table 4 2D NMR spectral data of DC- β -CD inclusion complex

DC protons	β -CD protons
Aromatic proton 8	H3
Hydroxy proton 5	H4
CH proton 2	Primary OH
CH proton 2	H1
Methylene protons 3	H3
Hydroxy proton 3'	Secondary OH
Hydroxy proton 3'	H4

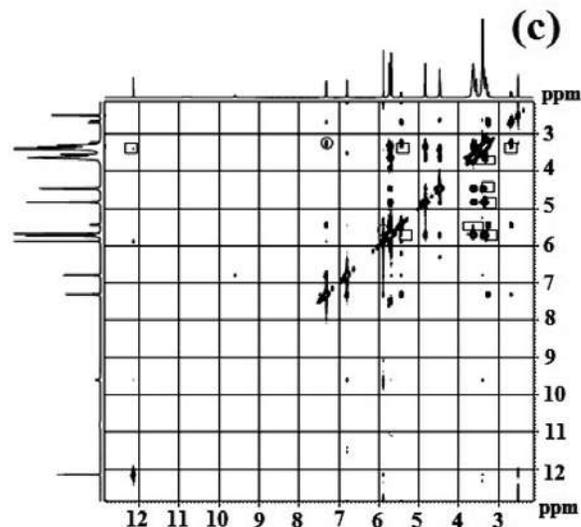
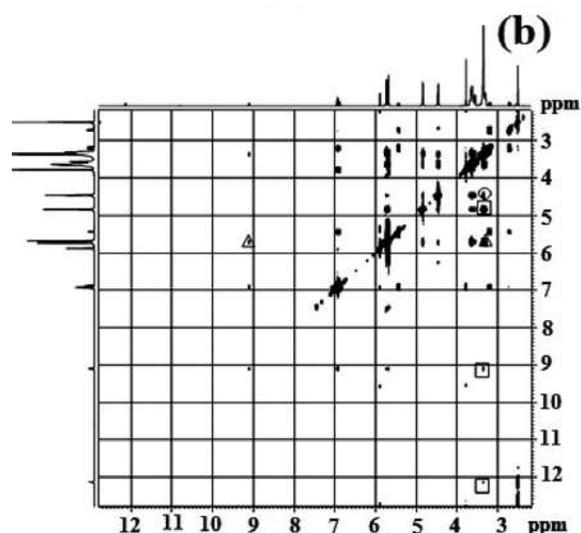
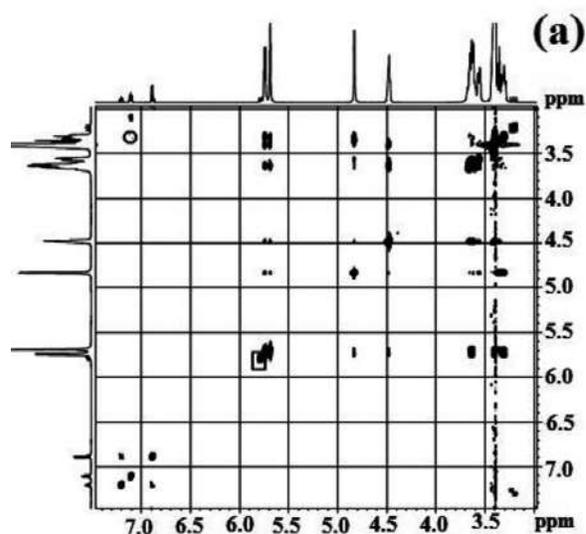
β -cyclodextrin - 5,7-dihydroxy-2-(4-hydroxyphenyl)-2,3-dihydro-4H- chromen-4- one

The ^1H NMR chemical shift data of the DHC and DHC- β -CD are given in the Table 5. The chemical shift of CH proton of benzopyranone (position 2) is observed at 3.37 ppm as doublet in the free form of DHC.

Table 5 ^1H NMR spectral data of DHC and its β -CD inclusion complex

DHC			DHC- β -CD complex
Nature of proton	Position of protons	Chemical shift, δ (ppm)*	Chemical shift, δ (ppm)
Benzo pyranone protons	Methylene protons H3	2.68 (dd); 3.27 (dd)	2.68 (dd); 3.26 (dd)
	H2	3.37 (d)	3.40 (d)
	H6	5.89 (s)	5.88 (s)
	H8	5.44 (dd)	5.44 (dd)
Hydroxyl protons	H5	12.15 (s)	12.14 (s)
	H7	10.80 (s)	10.82 (s)
	H4'	9.60 (s)	Intensity lost
Phenyl protons	H2' & H6'	7.32 (d)	7.32 (d)
	H3' & H5'	6.80 (d)	6.80 (d)

This is shifted downfield to 3.40 ppm in the complexed form. The chemical shift of the aromatic proton of benzopyranone (position, 6) is observed at 5.89 ppm as singlet in free form of DHC is shifted to 5.88 ppm. The chemical shift of hydroxy proton of benzopyranone (position, 5) is observed at 12.15 ppm as singlet in free form of DHC is shielded to 12.14 ppm.



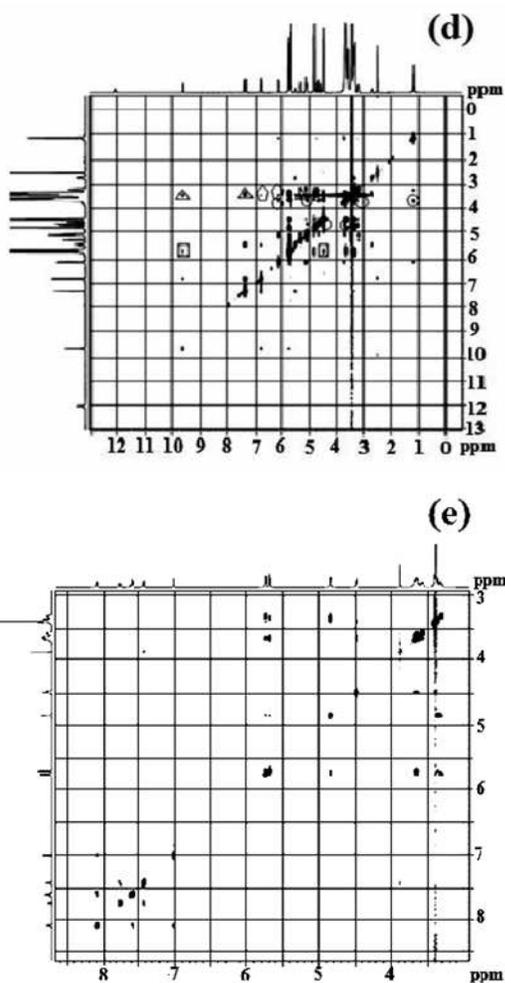


Fig. 4. 2D ROESY NMR spectrum of β -CD inclusion complex of (a) HC, (b) DC, (c) DHC, (d) HHCG, & (e) MC.

The chemical shift of the hydroxyl proton of benzopyranone (position 7) is observed at 10.80 ppm as singlet in free form of DHC is de-shielded to 10.82 ppm with the loss in its intensity. The chemical shift of hydroxyl proton of the phenolic moiety (position 4') is observed at 9.60 ppm as singlet in free form of DHC is de-shielded to 9.61 ppm. It may be due to the encapsulation of DHC by β -CD and holds the DHC in the hydrophobic cavity of the β -CD cage. 2D ROESY spectrum of β -CD=DHC is shown in Fig. 4(d). Cross peaks are observed for aromatic protons (position, 2' and 6') of DHC with H3 protons of β -CD (Table 6). The cross peaks are observed for the correlations of aromatic proton (position, 8) of DHC with H4 and 2°-OH protons of β -CD. The cross peaks are observed for the interaction of hydroxy proton (position, 5) of DHC

with H4 of β -CD. The cross peaks are also observed for the correlations of methylene protons of benzopyranone (position 3) of DHC with H1, H3, H4, H5 and H6, 1° and 2°-OH proton of β -CD. The cross peaks are observed for the correlations of -CH protons of benzopyranone (position, 2) of DHC with H1, H5 and H6, 1° and 2°-OH proton of β -CD. By considering the stoichiometry and the correlated protons of DHC with β -CD, the structure of the inclusion complex formed between β -CD and DHC can be represented schematically as given in Fig. 5(d).

Table 6 2D NMR spectral data of DHC- β -CD inclusion complex

DHC protons	B-CD protons
Aromatic proton 2'&6'	H3
Benzopyranone protons 3	H3
Hydroxy proton 5	H4
Aromatic proton 8	H4
Benzopyranone protons 3	H4
Benzopyranone proton 2	H1, H5 & H6, Primary, Secondary OH
Benzopyranone protons 3	H1, H5 & H6 Primary, secondary OH
Aromatic protons 6	Secondary OH
Aromatic protons 8	Secondary OH

β -cyclodextrin - 5-hydroxy-2-(4-hydroxyphenyl)-4-oxo-3,4-dihydro-2H-chromen-7-yl-2-O-(6-deoxy- α -L-mannopyranosyl)- β -D-Glucopyranoside

The ¹H NMR data of the HHCG and HHCG- β -CD are given in the Table 7. The chemical shift of the -CH proton of benzopyranone (positions 2) is observed at 3.36 ppm as doublet in free form of HHCG is de-shielded to multiplet at 3.37 ppm. The chemical shift of the methylene protons of benzopyranone (positions 3) is observed at 3.32 ppm as multiplet in free form of HHCG is shielded to 3.34 ppm for HHCG- β -CD complex. The chemical shift of the aromatic proton of benzopyranone (position, 8) is observed at 5.32 ppm as doublet in free form of HHCG is shielded to doublet at 5.33 ppm as singlet. The chemical shift of the hydroxy proton of benzopyranone (position 5) is observed at 12.06 ppm as doublet in free form of HHCG is shielded to 12.05 ppm as singlet with less intensity. The chemical shift

of the aromatic protons of phenolic moiety (position, 2' and 6') is observed at 7.34 ppm as multiplet in free form of HHCG is shielded to 7.32 ppm as doublet. The chemical shift of aromatic protons of phenolic moiety (positions 3' and 5') is observed at 6.81 ppm as doublet of doublet in free form of HHCG is shielded to 6.80 ppm as doublet for HHCG- β -CD complex. The chemical shift of the hydroxyl proton of phenolic moiety (position 4') is observed at 9.63 ppm as doublet in free form of HHCG is de-shielded to 9.64 ppm as singlet with low intensity. It may be due to the encapsulation of HHCG by β -CD and holds the particular CHR in the hydrophobic cavity of the β -CD cage. The cross peaks were observed for the correlations of aromatic protons of the phenolic moiety (positions 2' and 6') of HHCG with H4 proton of β -CD. The cross peaks are observed for the correlations of aromatic protons of the phenolic moiety (positions 3' and 5') of HHCG with H4 proton of β -CD (Fig. 4(e)). The cross peaks are observed for the correlations of -CH protons of benzopyranone (position 6) of HHCG with H2, H4, H5 and H6 protons of β -CD. The cross peaks are observed for the correlations of -CH protons of benzopyranone (position, 8) of HHCG with H4 proton of β -CD (Table 8). By considering the stoichiometry and the correlated protons of HHCG with β -CD, the structure of its β -CD inclusion complex, can be represented schematically as in Fig. 5(e).

Table 7 1H NMR spectral data of HHCG and its β -CD inclusion complex

HHCG			HHCG- β -CD complex
Nature of proton	Position of protons	Chemical shift, δ (ppm)*	Chemical shift, δ (ppm)
Benzo pyranone protons	Methylene protons H3	2.73 (m); 3.20 (m)	2.73 (t); 3.34 (m)
	H2	3.36 (d)	3.37 (m)
	H6	6.10 (triplet of doublet)	6.10 (d)
	H8	5.32 (d)	5.33 (s)
Hydroxyl protons	H5	12.06 (d)	12.05 (s) - Intensity lost
	H4'	9.63 (d)	9.64 (s) - Intensity lost

Phenyl protons	H2' & H6'	7.34 (m)	7.32 (d)	
	H3' & H5'	6.81 (dd)	6.80 (d)	
Neohesperidoside group				
Hydroxyl protons	a	5.51 (m)	5.50 (t)	
	b	4.49 (d)	4.48 (s)	
	c	4.67 (d)	merged with primary hydroxyl protons of β -CD 5.11 (t) 4.74 (s) 4.59 (s)	
	d	5.13 (m)		
	e	4.73 (d)		
	f	4.58 (m)		
Methylene protons	-	3.70 (m) 3.20 (m)		3.60 (m) 3.19 (m)
-CH protons	-	3.68-3.41 (m)		3.65-3.31 (m) merged with H2, H5 & H6 of β -CD

Table 8 2D NMR spectral data of HHCG- β -CD inclusion complex

HHCG protons	β -CD protons
Aromatic protons 2' & 6'	H4
Aromatic protons 3' & 5'	H4
Aromatic protons 6	H4
Aromatic protons 8	H4
Aromatic proton 6	H2, H5 & H6, H3
Hydroxyl protons 4'	Secondary OH
Hydroxyl proton 4'	Secondary OH
Neohesperidoside Hydroxy protons	H1

β -cyclodextrin - 6-methoxy-2-phenyl-4H-Chromen-4-one

Table 9 shows the 1H NMR chemical shifts of MC and MC- β -CD complex. The 2D ROESY NMR spectrum of the MC- β -CD complex is given in Fig. 4(f). The chemical shift of the methoxyl proton (position, 6) is observed at 3.78 ppm as a doublet in free form of MC, deshielded to 3.87 ppm in the MC- β -CD complex. The chemical shift of the benzopyranone protons (positions 3, 5, 7 & 8) reveals deshielding in the MC- β -CD complex. The chemical shift of the phenyl proton (positions 2' & 6') is observed at 8.43 ppm as a multiplet

in free form of MC, shielded and shifted to 8.08 ppm in the MC- β -CD complex. Cross peaks are observed for the correlations of phenyl protons of MC with H4 protons of β -CD. By considering the stoichiometry and the correlated protons of MC with β -CD, the structure of the inclusion complex, MC- β -CD can be represented schematically as given in Fig. 5(f).

Table 9 ¹H NMR spectral data of MC and its β -CD inclusion complex

MC		MC- β -CD complex	
Nature of proton	Position of protons	Chemical shift, δ (ppm)*	Chemical shift, δ (ppm)
Benzo pyranone protons	H3	6.56 (dd)	7.02 (dd)
	H8	7.53 (m)	7.76 (m)
	H5&H7	6.9 (dd)	7.43 (m)
Methoxyl protons	H6	3.78 (d)	3.87 (m)
Phenyl protons	H 2' & H 6'	8.43 (m)	8.08 (m)
	H 3', H 4' & H 5'	7.48 (m)	7.59 (m)

* dd – Doublet of doublet, d – Doublet, m – Multiplet, s – Singlet, t – triplet, q – quartet

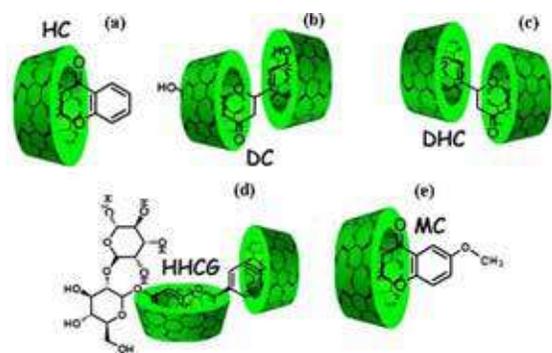


Fig. 5. Schematic pictures of β -CD inclusion complex of (a) HC, (b) DC, (c) DHC, (d) HHCG, & (e) MC.

CONCLUSION

The concrete evidences for the Host:Guest structures of β -CD : chromenone inclusion complexes is added. Typically, there is an enhancement of fluorescence of chromenones on forming the inclusion complexes.

The planar aromatic rings of the chromenones are preferentially bound to β -CD through hydrophobic interaction. The bulky neohesperidoside group which are attached to chromenone rings majorly involve in hydrogen bonding with β -CD. Nevertheless, the bulkiness exerts a steric effect in hindering the complete entry of chromenone moiety into the β -CD. The stoichiometry and structure of the β -CD inclusion complex of the selected chromenones are validated by 2D ROESY spectroscopy. The ROESY technique plays a crucial role in validating the part of the molecule that interacts with macromolecules.

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REFLECTIONS ON ENGLISH LANGUAGE TEACHING AND LEARNING IN THE POST-COVID 19 UNDERGRADUATE CLASSROOM

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ABSTRACT

The survey done in this study explored a probe into effective practices of learning and developing language in education sector after pandemic. Following the previous survey Exploring ICT Utilization And Strategy In Acquisition Of Language Skills The study also expanded by examining drastic changes, occurred while English teaching had shifted from the offline mode to online mode during the outbreak of Covid-19 and the way it transformed the process of teaching and learning in the post pandemic era. Inability and inefficiency in the practical application of language was an impasse which students couldn't cross over. An interactive English speaking practice is recognized in the work of experts and scholars. The educational system gradually evolves into efficiency of English teaching and practical application of language by students. Rapid and radical changes have taken place during this pandemic in the field of education and educational institutions through the implementation of Information Communication and Technology. Resilient and coherent technology solutions have been brought by adopting an ICT perspective to learning as it is a national repository of open educational resources. ICT learning teaching and assessment improved monitoring and also increased confidence and skills. Designing e-learning environment could include students with disabilities and uplifted school standards along with their evaluation systems. We have compiled a questionnaire to measure skills acquisition. We made the questions in such a way to avoid assumptions. We have taken a research study by undertaking an assessment survey regarding the evaluation of the quality of learning and teaching after the pandemic. We could derive sufficient information by perceiving the significance of system and the trend prevailing in the society. The adequacy of the strategy, the nature of the results and the conclusions are dealt with utmost care. The substantive result of the work reflects that the society has been entirely undergoing the transition as it is penetrated by ICT tools and strategy. Youngsters and students widely rely on online resources for information and knowledge. Several initiatives and forums have taken up education to the next level internationally and nationally. But they have to be properly channelized so as to reach the target and goal of global status given to educational achievements.

Keywords : Pandemic, Skills, Learning, Teaching, Resources, Comprehension, Practice, Professions, Disciplines, Online, Academic, Knowledge, Transition

IMPACT ON LEARNING

During pandemic, the demand of English increases in the academic field and efforts are taken to find learning resources which are online. Narratives and discussions that occur online support academic purposes. Authentic content of various topics are at the fingertips of common folk. Diverse disciplines could explore unexplored resources and possibilities of global learning. The potential value of learning materials are known to students and facilitators. Creating richer opportunities for educating student community and enabling them to encounter restrictions imposed during pandemic had turned as the order of the day. The UNICEF- ITU report signals that this was the largest mass disruption in education in modern history and has affected 1.6 billion children globally. Online interaction through use of digital technology restructured learning experience. Resilient perspective enabled alterations and advancements which brought a breakthrough. It necessitated a shift to digital platforms and dissemination of knowledge through advanced devices augmented teaching experience.

Post Pandemic On-Campus Experience

The system of education should try to amalgamate the benefits of online teaching and in-person teaching so as to bring forth hybrid pedagogy. On-campus experience with social interaction results in holistic learning and flexibility heightened through online instruction. Ensuring hybrid mode of learning revolutionize the system we follow.

During the rehabilitation after Covid 19 pandemic, we observe great significance in the role of English in students' future development, changes in the teaching mode, adopting scientific and effective strategies to improve students' language skills and literacy.

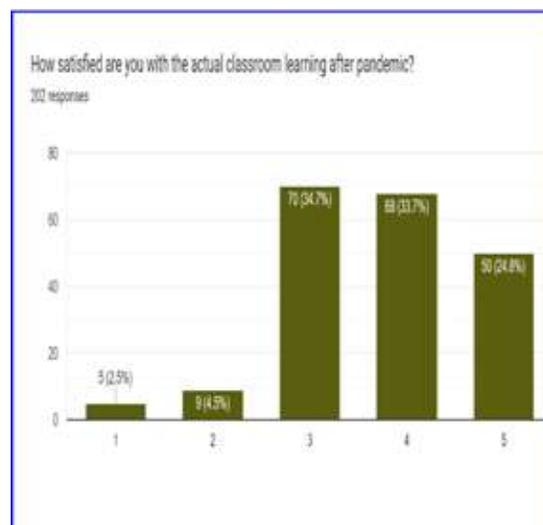
The emergence of artificial intelligence and other technological progress provide technical support for developing new adaptive teaching environments and promoting radical reforms and advanced teaching methods.

With the development of information technology, the authors explored the impact of information and communication technology tools and materials to reform the phase of education sector. (Maulani et al., 2021). Considering 5G, artificial intelligence, and education, the author introduced 5G technology into English-

speaking teaching, explored a new English-speaking teaching model through case design, summarized its advantages, and presented solutions to its shortcomings (Sun, 2021).

In English teaching reform, the current situation of English teaching was discussed, and the development and reform of English teaching paradigms were analyzed to promote the professional development of English teaching (Zhao, 2017). Combining English theory and practice, the optimal application and innovation model of network resources in a college English-hearing class was analyzed (Yan et al., 2017).

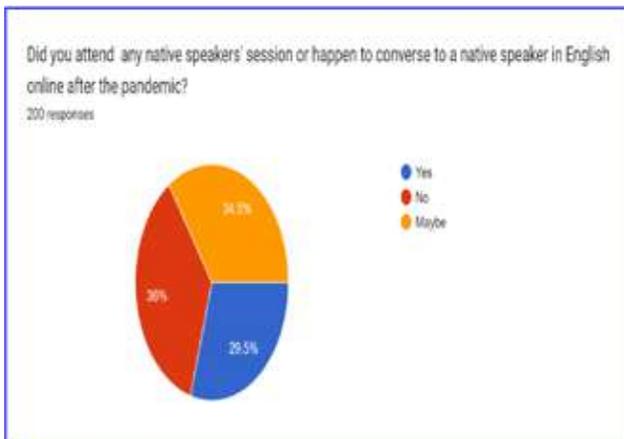
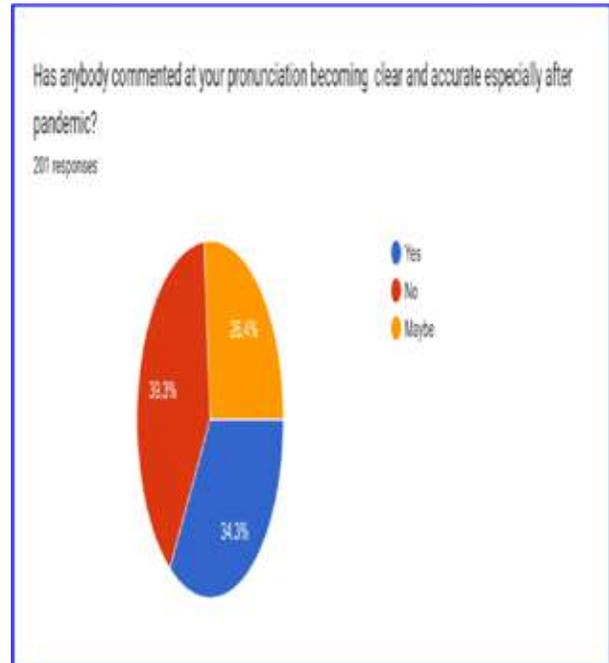
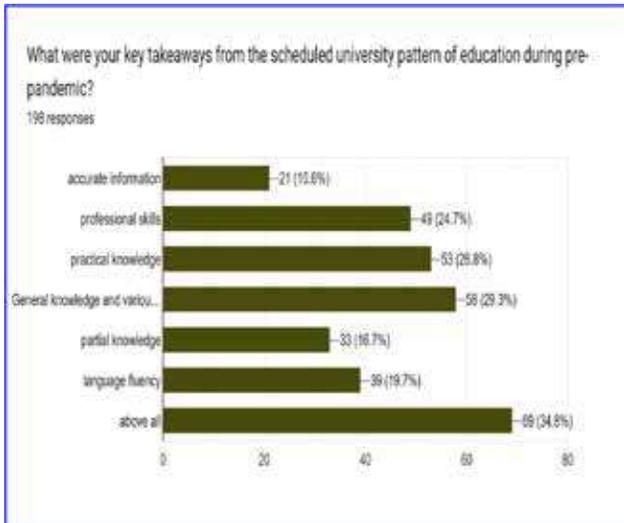
Reforms in Teaching and Learning



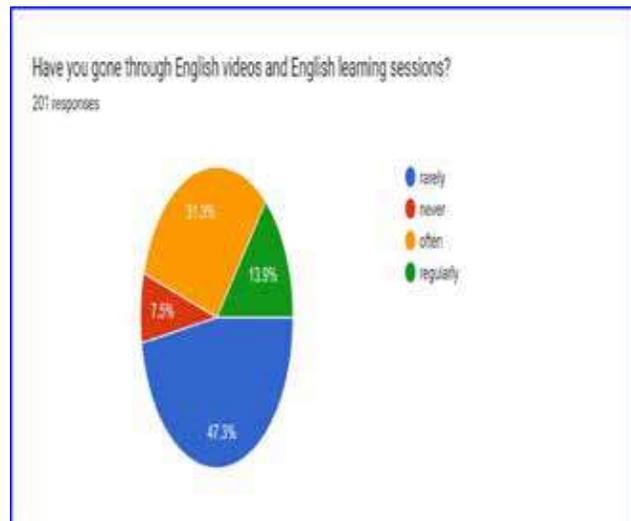
What must be the reason of the satisfaction rate as 70 for 68% of the strength? Does it show that they prefer conventional method of teaching and learning? Can we conclude pre pandemic satisfaction would be same or more or less? The box given below indicate that takeaways from the scheduled university pattern of education during pre-pandemic are not comprehensive or whole. We ought to facilitate accurate data of the subject along with professional skills but 10% of the student population think that it gives accurate information. Knowledge is power and it is not stagnant, it remains changing and updating cannot happen without online resources. 25% percentage of them consider professional skills can be imparted by pattern of education we follow. This is true when we analyse the lack of practical knowledge provided, opined by 27%. Recently we felt a need to improve science and engineering programs. There is a big momentum in the area of language use for skill development, content acquisition and new

approach has been necessitated by exploring learning resources. The largest stumbling block was inadequate proficiency in English language. But use of language in academic discourses, presentation, composition of articles, reports, global exchange of data has reached its apex level. Teaching materials and learning resources in English language have become more fruitful with the widespread of opportunity extended with the evolved need of pandemic time. Pedagogical practices are more potential and crucial with the rise of language as the paramount influencing factor in the society.

the scope of learning grammar, vocabulary and even pronunciation. Limited and less spoken instructional language has replaced the age old reading and writing into speaking and listening that encountered a major impasse. Imbalance between the four skills found an equilibrium and harmony that enlarges the ESL pedagogy. Narrow approach to literacy training gave way to qualitative studies and findings.

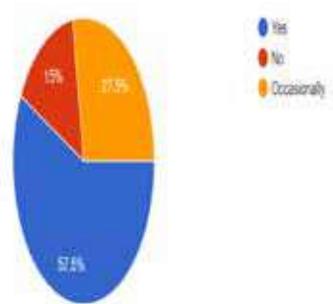


As the positive outcome of pandemic, we welcomed emerging trend of post pandemic winds of change that loosens the traditional pattern of education. It declares that accurate accent, intonation and pitch are not something impossible for foreign speakers.



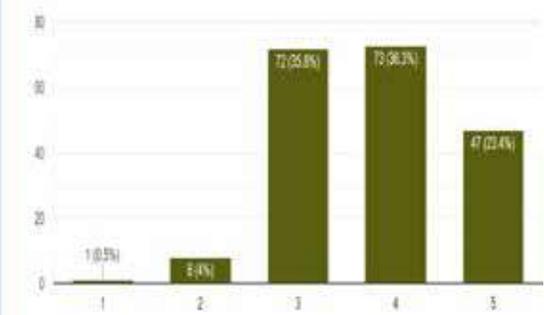
Learning English as a second language as foreign speakers of English, students find it easy and convenient when they undergo online learning and going through materials online. As textbook instructional language English was hard nut to crack but it is getting refined by new pedagogical practices. Bottom-up searches lead a revision of our view of ESL. Conversing with the native speakers of English has become common and it widens

Do you have an enthusiasm to speak in English or are you getting opportunity to practice more after pandemic?
200 responses

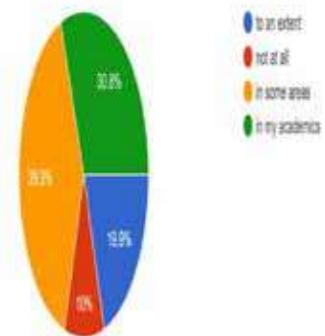


An enthusiasm and a strong yearning to practise speaking had been aroused among youngsters. The biggest challenges and hurdles that they stumble upon were taken away from their path as we could clearly see a compromise between the perspectives of narrow-angle and broad-angle. They could address with new formula by exposing to more language sessions or by perusing learning resources. 85% percentage of students are proactive in this regard.

How do you rate your reading performance after the pandemic?
201 responses

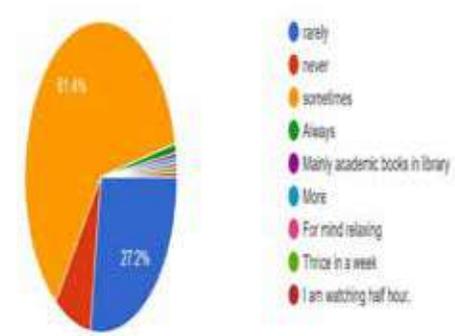


Writing Skills- Are you more confident in writing or comprehension exercises after pandemic?
201 responses



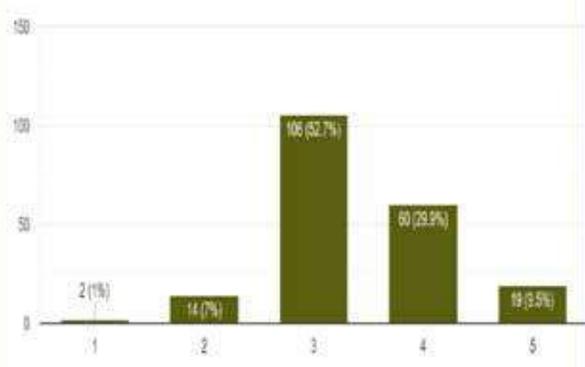
When you focus on language proficiency in post pandemic days we could see a variation in self-reflective expressions and in interactions. Colloquial words crept into formal writing and academic discourses have been taken as highly formal. There occurs a distinction between poor writings and good writings. Successful writing across disciplines by academicians is a novel approach. More emphasis on methodology, reporting and analysing the results and presenting conclusions, comments, play a vital role in career and professions. 50% percentage of students agree that their writing and comprehension escalated due to frequent use of media and internet.

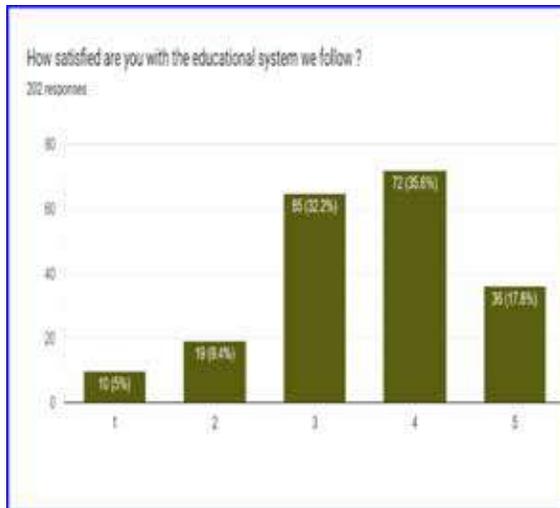
How often do you take books to read other than textbooks after pandemic?
202 responses



Reading habits have almost disappeared and soft copies are more in relevance. Taking academic related books from library itself is a rare sight. It becomes occasional and optional. Substitutory strategies and materials are available before them or at their fingertips.

How do you rate your English background on vocabulary and grammar after pandemic?
201 responses





CONCLUSION

The current state of learning experience of students has welcomed even the hybrid mode of learning. The individuality of a student is augmented and experiential rate heightens when it comes in the hybrid mode which will widely interconnect global learners as spikes of wheel rotating around data that ultimately transport them into a world of diverse disciplines intertwined by English language.

ACKNOWLEDGMENTS

Survey- Evaluation of Learning & Language Post Pandemic (students of below listed institutions)

https://docs.google.com/forms/d/e/1FAIpQLSdNZKUYvLWtwzsQpa3hZepLsIIIhCbbxIH08C1LE4qyA4eucQ/viewform?usp=pp_url

Nehru Institute of Engineering & Technology, Coimbatore

Nehru Arts and Science College, Thirumalayampalayam, Coimbatore

Madurai Kamaraj University, Madurai

IGNOU,

Ahalia Public School, Palakkad

(Responses)

https://docs.google.com/forms/d/1WYmcONUT8ZBYOWhIisD71VqxRVK1_Cn5VaqAnBLhego/edit#responses

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IMPROVED DRIVER DROWSINESS DETECTION SYSTEM USING MACHINE LEARNING ALGORITHMS

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ABSTRACT

One of the leading causes of accidents throughout the globe is drowsy driving. One of the most reliable measures of driver tiredness is the ability to detect sleepiness. Creating a prototype sleepiness detection system is the focus of this study. The driver's eyes are monitored by the system, and an alert goes out whenever the motorist begins to nod off. The software was created for covert real-time monitoring. The focus should be on making the motorist feel safe without drawing too much attention to themselves. Driver drowsiness is presumed if the driver's eyelids close for longer than a certain amount of time, and an alert sounds. This is programmed in OpenCV, and face characteristics are detected with the help of the Haar cascade package.

Keywords : Face detection, Eye Detection, Eye state recognition Drowsiness and Region of interest

INTRODUCTION

More and more people are killed in automobile accidents each year. Almost 400,000 vehicle and taxi accidents are verified each year. Since MIROS's inception, the number of traffic accidents has continued to rise, reaching over 500,000 by 2009. Drowsiness is characterized by an intense urge to sleep and a state of near-sleep readiness. It might refer to the state you're in just before going to sleep, as is common, or it could be a symptom of a more serious problem if you're always exhausted. When performing anything that needs one's whole attention, like driving a vehicle or operating heavy equipment, drowsiness is always a possibility. The chance of an accident rises because drowsy driving is more common among tired drivers.

How to improve technology that can detect or prevent driver fatigue is a hotly contested topic in the field of accident avoidance systems. There has to be a well-considered strategy in place to deal with the issue of drowsiness behind the wheel.

The goal of this research is to improve existing methods

of fatigue detection via the use of computational modeling. The major goal will be to develop a system that can accurately determine whether a driver's eyes and mouth are open or closed. The ability to detect tiredness in drivers via their eyes might help prevent accidents. Counting yawns might be a proxy for driver fatigue.

If you're going to sleep exhausted, keep yawning until your body has had enough oxygen. The duration of open and closed eye and mouth patterns in a series of images is studied to detect indicators of exhaustion or drowsiness. PERCLOS offers a method of detecting ocular closure. This sensor activates when the eyelids have been closed for a certain length of time.

Face identification, human categorization, and tracking for security systems are just some of the practical uses that have made studying facial photographs a legitimate field of study. By using the provided techniques in the image-processing algorithm, we may pinpoint the exact location of the eyes and mouth, which requires us to look at the whole facial picture. Once the eyeballs have

been found, the system should be able to tell whether the user's mouth and eyes are open or closed, as well as detect signs of fatigue and drowsiness.

LITERATURE REVIEW

Researchers have come up with a number of methods in recent years for tracking eye movement in order to spot indicators of exhaustion. Using hierarchies of classifiers learned to identify Haar properties, Manu B.N. proposed a new method for face identification in 2016. In order for the method to train the classifier that will identify the item, there must be a large number of both "positive" (pictures with faces) and "negative" (images without faces). After the face region has been identified using a combination of cascaded Ada boost classifiers and Haar feature-based classifiers, the resulting picture is segmented into randomly sized and positioned rectangular facts. Haar-like properties are helpful for real-time face identification since they perform well with a wide variety of facial appearances. depending on the number of pixels with varying values inside the rectangle, samples will be accepted or rejected depending on whether or not they include faces. Ada's boost approach is put to use in this context.

Amna Rahman predicted that by 2015, eye form recognition combined with eye blinking will make it feasible to identify fatigue. To begin, the image is grayscale so that the Harris corner detection method may be used to identify the corners at the side and down curve of the eye lid. After the points are traced, a line is drawn between the highest and lowest points, the midpoint of which is then joined. The program will now do the same action on each image by calculating the distance 'd' from the image's center to its bottom in order to assess the eye's health. Considering 'd' as a distance and forming inferences about the eye's health is the last stage. If the distance is zero or almost zero, then the eyes are closed, and if it is not, then the eyes are open. It makes it harder to see whether someone is nodding asleep quickly. One blink occurs every 100–400 milliseconds (0.1–0.4 seconds) in humans.

Drowsiness, as defined by Antoine Picot et al., occurs when one is neither fully alert nor asleep. Because of this, the driver's attention will be divided. The driver is now in a semi-conscious condition and cannot manage the car. Drowsiness, as described by Gianluca Borghini et al., may be attributed in part to mental weariness, which impairs a person's ability to adapt effectively to

unexpected occurrences.

The PERCLOS method produced the sense of willful drowsiness by allowing the user to regulate the degree to which each eyelid 'drooped'. The eye opening and closing sets in the software library may be used as a variable to test for user cooperation. The time it takes to get from wide-eyed to blinking eyes increases as sleep sets in. As a result, the onset of driver weariness may be monitored. since of this, the PERCLOS method employs a comparison value at which it is assumed that the driver is weary since their eyelids are closed for 80% of the time. This method is unsuitable for use in real-time driving due to the need of a consistent threshold value of eye aperture for the PERCLOS process to function properly. The camera has to be positioned in a certain manner for both the eye blink guide and the PERCLOS techniques of detecting sleepiness to work, so it can find a good image or video in which the subject's eyes are clearly visible.

EXISTING SYSTEM

Current drowsiness detection systems do sophisticated computations and need specialized equipment to examine the driver's state; neither the driver nor the driving environment is likely to be comfortable with this. Electrocardiography (ECG) and electroencephalography (EEG) are two examples of such technologies that examine bodily functions.

While it is ideal to use a camera in front of the driver to detect sleepiness, identifying the primary symptoms that will lead to exhaustion is necessary before developing a reliable and accurate drowsiness detecting algorithm. Direct sunlight or a sudden head movement might cause serious injury to the driver's eyes and lips.

Drawbacks of Existing Techniques

- If the camera is located on the frame around the window, it will not be able to get an accurate frontal image of the driver's face.
- In a regular driving location, just 40% of the driver's face is recognized by the current system after 10 minutes of video recording. Open CV eye detectors (CV-ED) often fail to replicate the pair of eyes in the oblique perspective.

PROPOSED SYSTEM

The haar cascade technique is used to find human faces

in stored photographs. Facial recognition technology is dependent on the distinctive feel of haar skin. If the algorithm determines that a face has been discovered, it will proceed to the next stage, which is to locate the eyes.

Using haar cascade facial appearance, it is possible to detect a blink by locating the eye. The perclos algorithm can determine where the eye is. You may use this method to determine when someone stopped blinking. When it senses the driver is nodding off, it sends a distressing message to his brain. In certain situations, a constant look might be considered intrusive. The driver’s facial expressions are constantly analyzed to detect any indicators of inattention. If there is a fire in the building, an alarm will go off.

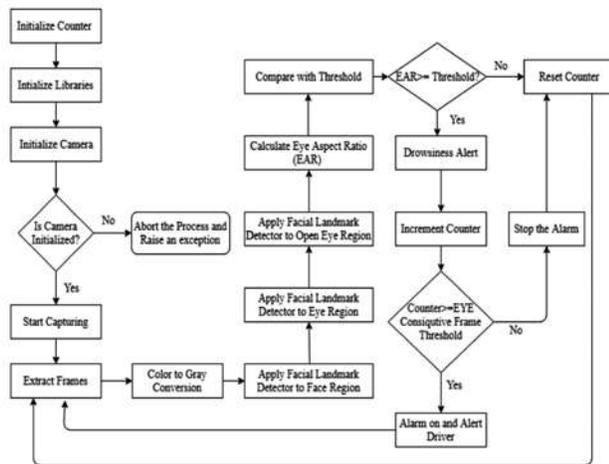


Fig 1. System Architecture

If the system detects that the driver is becoming drowsy, it will alert them. Using video or a webcam is one way to detect sleepiness. The video evidence is analyzed in order to develop a system that can analyze each frame. OpenCV collects images from a person’s webcam and uses a deep learning model to assess whether or not their eyes are open. This technology will notify the driver immediately if weariness is detected.

MODULES DESCRIPTION

Face Detection

Paul Viola and Michael Jones, in their 2001 paper “Rapid Object Detection Using a Boosted Cascade of Simple Features,” suggested a technique for rapid object recognition that employs cascade classifiers based on Haar features. It’s a prototype of a cascade tool that learns from both high-quality and low-quality images

to become better over time. Then, it’s put to work in order to grasp allegories.

A mixture of “good” (i.e., face-containing) and “bad” (i.e., face-free) photos will be required to properly train the classification system. You can see how the Haar features were utilized to extract the features in the image below. accordant with our kernel of complexity. The sum of the pixels in the black rectangle minus the sum of the pixels in the white box is the value of the characteristic. Five examples of skin with a haar-like texture are shown in Fig. 2.

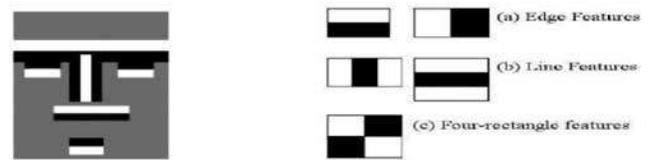


Fig 2. Facial Features

A cascaded Adaboost classifier with a skin texture similar to Haar’s is broken in order to identify the face. First, the corrected image is cut into a predetermined number of rectangular portions of arbitrary size and location inside the original image. Because it can distinguish between distinct facial features, Haar-like characteristics may be used for real-time face recognition. When creating rectangles, it’s possible to account for variations in the sum of the pixels’ values within the shape. The black and white features on someone’s face are a visual representation of their distinctive appearance. The Adaboost cascade is a powerful classifier that merges many smaller classifiers into a single, more accurate model. Any ineffective classifier may be boosted using the Adaboost technique. Before the face area can be created, a candidate model must go through numerous iterations of the cascaded Adaboost classifier. Most samples will seem OK, and the ones that don’t may be thrown out.

An efficient method for exposing hidden objects, Haar feature-based cascade classifiers were first developed by Paul Viola and Michael Jones in their 2001 paper “Rapid Object Detection uses a Boosted Cascade of Simple Features,” which is mostly used for facial recognition. It’s a kind of supervised machine learning in which a cascade task is taught by analyzing samples of successful and unsuccessful executions. It is then used on other images to assist draw attention to certain details.

Eye Detection

In a system that uses facial landmark prediction for eye identification, these important anatomical features of the face, such as the eyes, are identified and represented by facial landmarks.

- Eyes
- Eyebrows
- Nose
- Mouth
- Jawline

A variety of tasks involving the face and the head may be accomplished with the help of a facial marker. Our objective is to use a shape prophecy system within the context of facial sight to recognize distinctive facial features. The facial pointer classification procedure has two stages:

- Figure out where the face is.
- Detect the major facial constitution on the face Region of interest (ROI).

Localize the face in the image: Haar facet stands cascade classifiers include the facial image.

Detect the key facial structures on the face ROI: Several approaches exist for detecting facial pointers, but they all have the goal of focusing on the following regions of the face for restriction and marking:

- Mouth
- Right eyebrow
- Left eyebrow
- Right eye
- Left eye
- Nose

The dlib package's facial sight detector uses the One Millisecond Face setup with an Ensemble of Regression Trees.

An picture of the facial indication is marked with instructions. The descriptions include physical labels that provide the precise (x, y) coordinates of the portions that adjoin each face structure.

- To be more precise, priors are the probabilities associated with the distances between any two

sets of input pixels. Using the pre-trained facial pointer detector included in the dlib package, we can determine the locality of 68 (x, y)-coordinates corresponding to facial composition on the face.

- Below is an illustration showing the 68 coordinate indexes.



Fig. 3. Visualizing the 68 facial landmarks coordinate

The following facial pointer index may be used to locate and make contact with both eye areas.

- The right eye using [36, 42].
- The left eye with [42, 48].

The 68-point iBUG 300-W dataset was used to train the dlib facial sight predictor with the help of these annotations. To provide just one example, among the numerous accessible facial pointer detectors is a 194-point model that can be trained using the HELEN dataset. Any available dataset may be used to train a shape predictor using the same dlib structure.

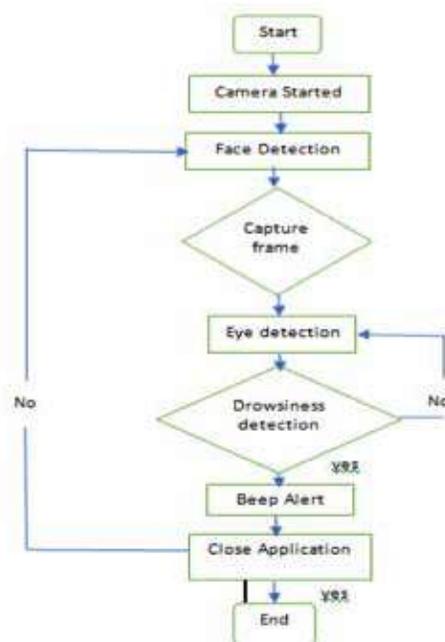


Fig. 4 Drowsiness Detection System

Recognition of Eye's State

Predictions of eye behavior may be made using a variety of methods, including optical flow, sparse follow, frame-to-frame power differential, and adaptive threshold. The presence or absence of eyelids is taken into consideration. The shape of the eye's pupil may be extracted from a single photograph in a variety of ways. Pattern matching with open and closed eye patterns, parametric models that can precisely locate the eyelids, active outline models, and heuristic horizontal or vertical image strength bulges across the eye area are some of the methods available. The previous method had a number of issues, the most notable being that it required an excessive amount of system intelligence to deal with things like virtual face-camera position (head orientation), picture animation, explanation, action dynamics, etc. Raw-photo-force based heuristic algorithms are expected to be extremely well received, even with their real-time performance.

As a result, a straightforward method using a common facial pointer detector was proposed for identifying eye signals. When it comes to how wide open someone's eyes are, the markers provide a consistent and reliable scalar metric. In the end, an SVM classifier educated on instances of blinking and non-blinking models creates the blinks based on a per-frame chain of the eye-opening estimations.

Eye Aspect Ratio Calculation

The eye signals are interpreted differently for each video structure. The angle between the eye's vertical axis and its horizontal axis is known as the eye aspect ratio (EAR). Below is a specification of the equation for the eye's aspect ratio, where p_1, \dots, p_6 are 2D coordinates.

$$EAR = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

When you shut one eye, your ear doesn't pick up much movement and stays there. Neither the individual nor the posture of the head is responsive enough. Scaling images and rotating the head in one plane have little effect on the aspect ratio seen by the human eye, which varies very slightly across individuals. Since blinking in unison involves both eyes, the EAR is calculated by averaging the results from both sets of eyes.

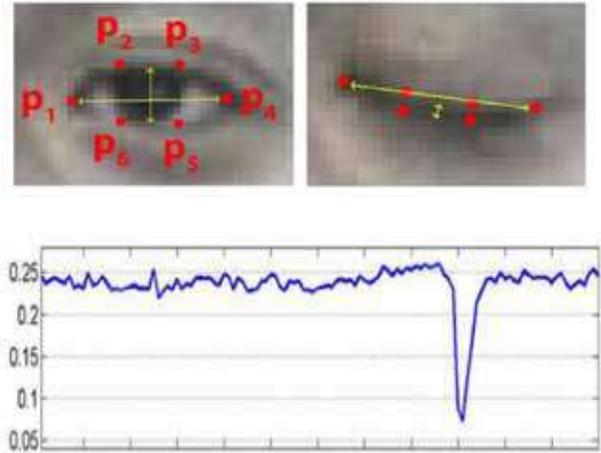


Figure 5. Automatic detection of landmarks $p(i)$ for both open and closed eyes. Plotting the eye aspect ratio (EAR) from Eq. (1) over several frames of video

Eye State Determination

Based on the envisioned Eye Aspect Ratio (EAR), a final determination about eye placement might be reached. The eye shape is considered "closed" if the distance between the pupils is 0 or very near to zero, and "open" otherwise.

Drowsiness Detection

When a user reaches a certain level of fatigue, the program will stop their shift. It is estimated that the average human blinks once every 100–400 milliseconds (0.1–0.4 seconds). The timing of eye closure must be later than this if drowsiness is the cause. The time threshold of 5 seconds has been established for tiredness monitoring. If the user's eyes are closed for five seconds or more, the system will trigger an alert.

Drowsiness Detection Algorithm

To take a picture by use of a camera as input.

Step 1 – To take a picture by use of a camera as input..

Step 2 – Create a region of interest (ROI) around the face in the image.

Step 3 – Recognize the eyeballs in ROI and provide that information into the classifier.

Step 4 – The classification system can tell whether the subject's eyes are closed or open.

Step 5 – In order to determine whether a person is fatigued based on their score.

Face and Eye Detection

It is possible to recognize a human face and eyes in an image by using the Haar algorithm. The Haar algorithm is a popular and effective based approach for identifying people's faces in photographs. The face identification system only kicks in when it detects a certain Haar facial skin texture. The creation of at least one of the traits is required by the algorithm before a face candidate may go on to the next exposure stage. The Haar algorithm uses a series of quick steps to exclude potential candidates that aren't faces. Each level of the Haar progression is comprised of a number of different properties. Then, a Haar attribute classifier assigns a label to each feature. The human visual system may be properly replicated by an alternative to the Haar algorithm.

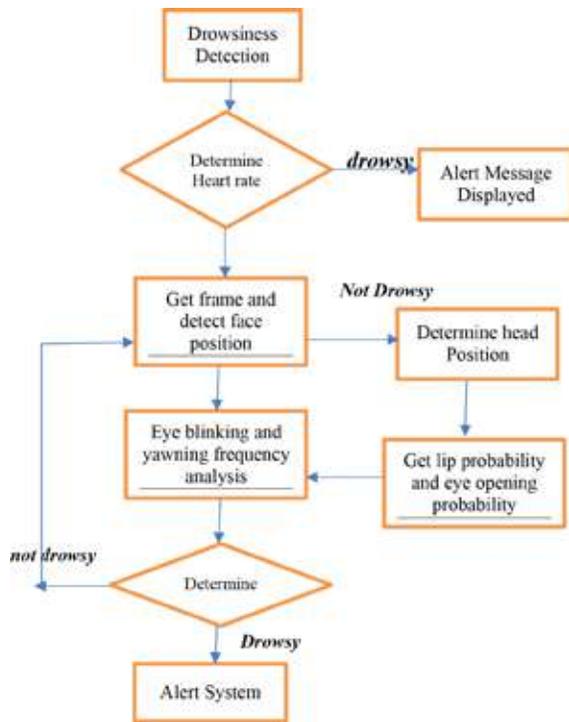


Fig. 6. Drowsiness Alert System

Classifying the Eye Image



Fig. 7. Drowsiness

A collection of releasing eye-images and a set of blocked eye-images will be used to train the guidance model, which will then be used to categorize any newly-obtained pre-processed eye-image.

Haar Cascade Algorithm

Regardless matter how far away or how much around an image an item may be, the Haar cascade method can detect it. This method is not too complicated and can run at lightning speed in real time. Objects such as automobiles, bicycles, houses, fruits, and more may all be identified by the haar-cascade detector.

Haar cascade utilizes the current window and it seeks to work out skin texture in every windowpane and sort whether it might be an entity. Haar cascade mechanism can be categorized as a classifier. Its value positive data points that are fraction of our distinguished object and negative facts points Haar cascades are speedy and can effort glowing in real-time.

- Haar cascade is not as precise as modern object finding techniques
- Haar cascade has a consequence, it calculate many false positives.
- Simple to execute, less computing power is essential.

RESULTS

The following procedures were taken to implement sleepiness detection using Python and OpenCV: The camera was able to record footage in real time. The proposed system is developed for detecting drowsiness of the driver. Implementation is done using Python, OpenCV, ML model, Dlib and other open-source libraries.

Test Id	Test Condition	System Behaviour	Expected Result
T1	Straight Face, Good Light, No Glasses	Still Processing	Still Processing
T2	Straight Face, Good Light, No Glasses	Non Drowsy	Non Drowsy
T3	Straight Face, Good Light, No Glasses	Drowsy	Drowsy
T4	Straight Face, Good Light, No Glasses	Drowsy	Drowsy

Fig. 8. Test cases for Drowsiness

Frames were extracted from the recorded footage and examined separately. When face detection is complete, the next step is to locate the eyes. If the driver's eyes close in consecutive frames, it is considered a sleepy

condition; otherwise, it is treated as a regular blink, and the process of taking a picture and analyzing it is repeated.

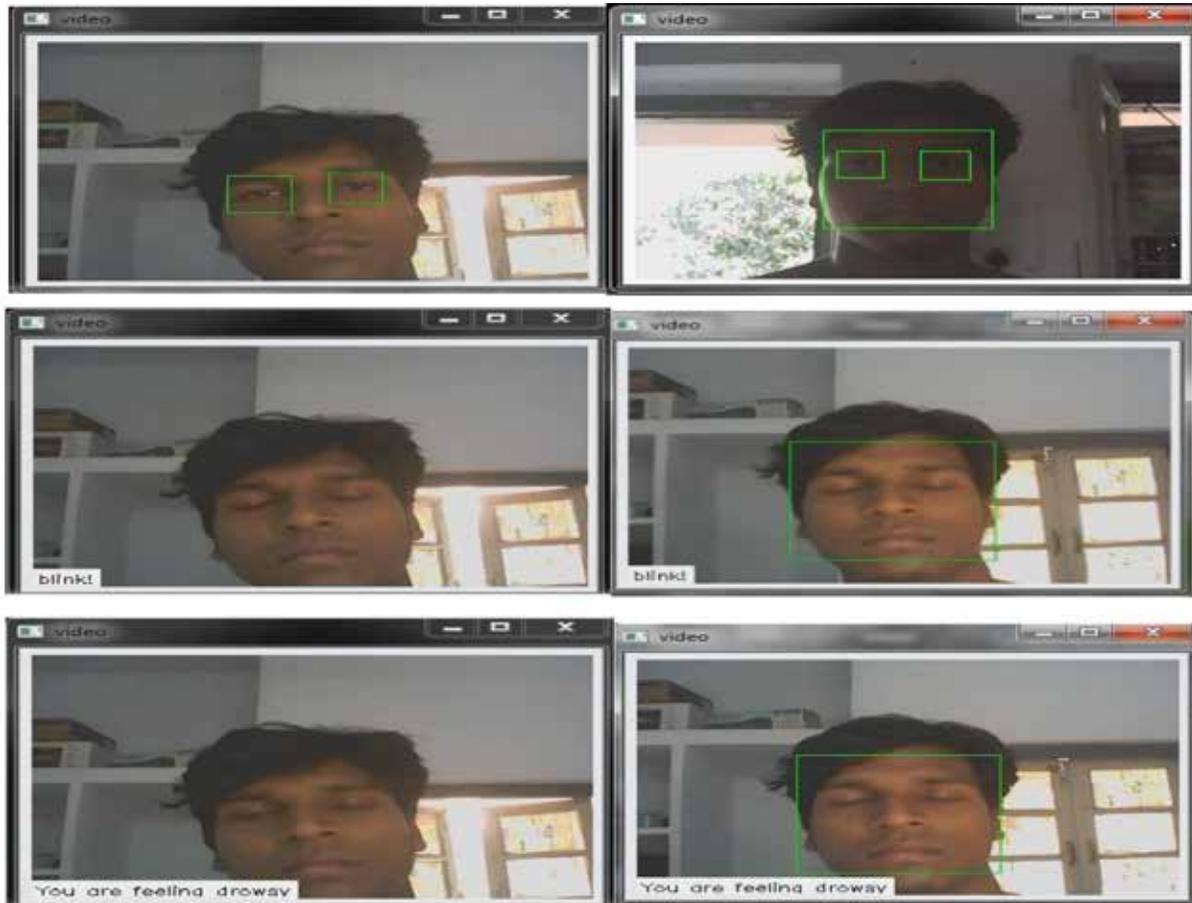


Fig. 9. Drowsiness detection

If the eye is not detected or is not inside a circle, a drowsy state notice is shown.

CONCLUSION

The system's major function is to identify drowsy drivers, and it does so by using aspect ratio for eye and mouth detection of blinks and gaping, respectively, and a machine learning model trained to derive the conclusion. The framework is now completely free of any major inconsistencies. The validation phase reveals the results and establishes their credibility. Many accidents may be avoided if drivers were alerted when they were suspected of being sleepy. Our product is useful not just to the person who installs it in their automobile, but also to nearby walkers, cyclists, and motorists. The technology for identifying blinks in real

time has been made available. The results showed that positive face images and an eye-directness level may be accurately assessed by using cascade classifiers based on Haar features and regression-based facial marker detectors. The image stands up well both in its native environment and in low-quality (low-resolution) settings.

To expand our system into more systems to Accident Detection System for road safety and accident avoidance:

- Road Lane Detection System
- Traffic Sign Recognition System
- Speed & Distance between Vehicles Analyzer

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LI-FI TECHNOLOGY BASED PARKING SYSTEM USING GSM AND GPS MODULE

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ABSTRACT

This paper is to be proposed a system for identifying the availability of parking slots and the location of parking areas using Li-Fi technology or Visible Light Communication (VLC) technology. Internet of Things (IoT) based parking system having frequently cause the more wireless interference. This solution allows drivers to quickly obtain real-time parking information, which can result in saving both time and fuel. VLC, which is also referred to as Li-Fi, Optical Wireless, or Visible Light Communication, works by transmitting data through Light and eliminates wireless interference. The system collects data from parking sensors located in various levels of multi-story buildings, Gathers parking area location the help of Global Positioning System (GPS) Module and sends the information to the vehicle section via a Global System for Mobile Communication (GSM) modem. This makes the parking information readily accessible to drivers through their mobile devices.

Keywords : Parking System, Visible Light Communication, Li-Fi, Light Emitting Diodes, GPS, GSM

INTRODUCTION

Parking is a significant problem in public locations like malls, museums, and hospitals. The management of these public facilities devotes more effort and resources to developing parking infrastructure. The commercial parking systems use electric motors or hydraulic pumps to move vehicles into a storage position, but they do not indicate the availability of free parking slots. Commonly used parking systems are multilevel floor parking system, stacker parking system, D stacker parking system and RFID based parking system.

RFID based parking systems used many controllers to count the parked cars automatically. These systems use more energy and time consumption. Visible Light Technology has established itself in the fast-evolving data transmission industry today. What we see every day all around us is visible light. Building lighting, office equipment, traffic signals, road lights, displays, and electronic home appliances like LED TVs are all instances of light communication. The majority of modern technological equipment use LEDs. Operating

characteristics of LED is rapidly on and off. High-speed data transmission is made possible by snappily turning on and off LED's. Visible light communication significantly reduces issues with infrared and radio dispatches [13]. Additionally, it lessens wiring inside the building and reduces electricity consumption. VLC is regarded as secure and free of data hacking. The uses of visible light communication include services grounded on locales, defense, security, aeronautics, tele-health care, etc. Wireless interference can be significantly decreased as VLC technology replaces traditional radio communication methods.

Related Works

Parking systems employ a variety of methods. Below are some commonly utilized techniques in parking systems.

- Multilevel floor parking system
- Stacker parking system
- D stacker parking system
- RFID based parking system

Multilevel floor parking system: The building-based parking system accommodates vehicles on different levels or floors, which can be accessed through either external or internal structures such as ramps. A mechanized vertical lift is used to move vehicles in the Y-axis direction, thereby minimizing the ground space required and reducing the building's overall cost. Additionally, this arrangement enables a faster parking process and can accommodate more cars. The parking system is enhanced with sensor arrangements that aid in the control and optimization of the parking process. The system is programmed to prioritize filling the ground level before moving on to the next level above it. After the current level is full, the system proceeds to the next level, and this sequence is repeated until all available levels are occupied. The cost of this parking system is higher due to its multilevel structure for parking and retrieval. Any malfunction in this system can lead to significant disorder and inconvenience. Moreover, constructing this complex system is also expensive, adding to the overall cost. [3].

Stacker parking system: The system comprises parking lots with platforms specifically designed for parking cars. It employs a stacker mechanism that moves centrally and is equipped with a robotic arm to push and pull vehicles as required. The expenses associated with making an initial investment are significant, and ongoing costs for operation and maintenance can also be substantial [8].

D stacker parking system: The parking system is available in several versions, including the two-car stacker and the three-car stacker system. These variants can be entirely overground, partially underground, or completely underground. In this system, cars are parked on top of each other, and a lift mechanism lifts the pallet once a car is parked. Parking a vehicle requires a significant amount of time and energy. It is not a task that can be completed quickly and easily. [8].

RFID based parking system: In today's world, there is a growing trend towards automation. To streamline parking lot management, this system incorporates RFID technology that detects the entry and exit of vehicles through the gate and displays the number of cars currently parked. The check-in and check-out process is expedited, eliminating the need for cars to stop and minimizing traffic congestion. One of the main problems with this parking system is the risk of data theft and the potential for increased wireless interferences. [18].

Problem Statement

One of the issues found in Radio Communication or Internet of Things (IoT) based parking systems is their high energy consumption. In addition, these systems may not provide adequate security for data communication and can often result in wireless interferences.

Objectives of the Proposed Research Work

- To develop the system to reduce the wireless interferences during data communication.
- To identify and display available spots to individuals utilizing the parking service.
- Fast data communication to reduce the time demanded to detect an open parking space and lowers energy operation.

PROPOSED PARKING SYSTEM

A low power Arduino Uno - Atmega328 microcontroller is used in the proposed system of the parking system to monitor and manage the parking area. The vehicle will be there in the parking system entrance and the gate will be open in a normal condition (Li-Fi disabled vehicle). The status of the available parking slots is not displayed on the LCD screen, and no message has been sent. The Arduino Uno - Atmega328 must be interfaced with IR detectors in order to get data about available parking spaces.

In the Li-Fi enabled vehicle the NodeMCU-ESP8266 and LCD Display is additionally interfaced with LED's that serve as Li-Fi Transmitters and Phototransistors that serve as Li-Fi Receivers. To communicate detected parking information to the automobile user, a GSM module is interfaced. To assist drivers in locating parking slots, a GPS unit will also be installed. The Parking Place Inquiry Module is integrated in the vehicle that needs parking. Meanwhile, the Parking Place Surveillance Module and Parking Place Sensors Module are integrated into the parking management system. When in operation, these three module [16] make up the block diagram of the proposed parking system.

- Parking Place Inquiry Module
- Parking Place Surveillance Module and
- Parking Place Sensors Module

Parking Place Inquiry Module

The vehicles are equipped with an integrated Parking Place Enquiry module that provides drivers with

information on available parking spaces. The module features an LCD (Liquid Crystal Display) that displays parking information.

The transmitter, which is an NodeMCU-ESP8266 microcontroller, is integrated with an LED. The Arduino Uno-Atmega328 microprocessor is also incorporated with a phototransistor that serves as the receiver. The phototransistor, which is also referred to as a photodiode, receives data in a serial manner and the LED transmits the data serially to the parking component. A push-button switch that is connected to the NodeMCU-microcontroller is used to initiate the query communication. The received parking area location and slot information is then transmitted to the driver's mobile device through an interface with a GSM module. Fig.1 shows the Transmitter side block diagram (Parking Place Inquiry module).

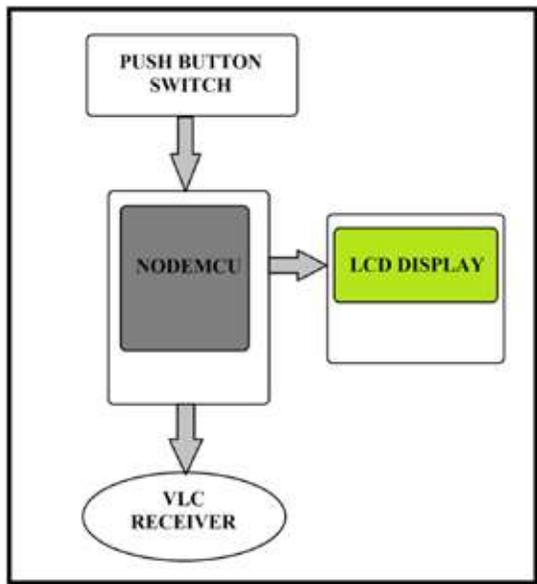


Fig.1 Transmitter side block diagram

Parking Place Surveillance and Parking Place Sensor Module

On the parking side, a Surveillance and sensor module is installed to determine the availability of parking spaces. This module is equipped with an LCD that displays parking information. The transmitter, which is an NodeMCU-ESP8266 Microcontroller, has an integrated LED. Additionally, the Arduino Uno-Atmega328 Microcontroller is equipped with a photodiode that acts as the receiver.

Fig.2 shows the Receiver side block diagram of the

Li-Fi Parking System (Parking Place Surveillance and Sensor Module).

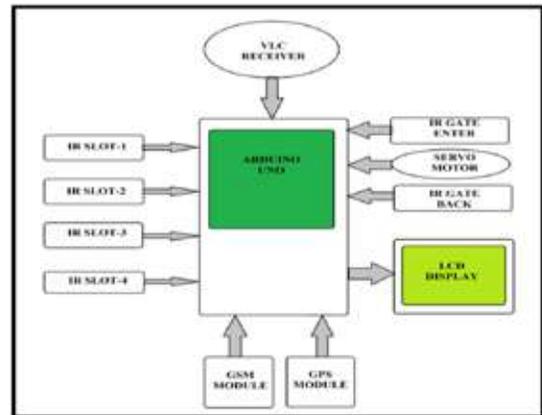


Fig.2 Receiver side block diagram

While the photodiode receives data serially, the LED communicates data serially to the module on the parking hand. Three IR detectors are utilized in this module to find open parking spaces. If every parking space is occupied, text "SLOT: FULL"; once the space becomes available, message the user once more.

FLOW CHART

Fig.3 shows the Flow chart of the proposed parking system.

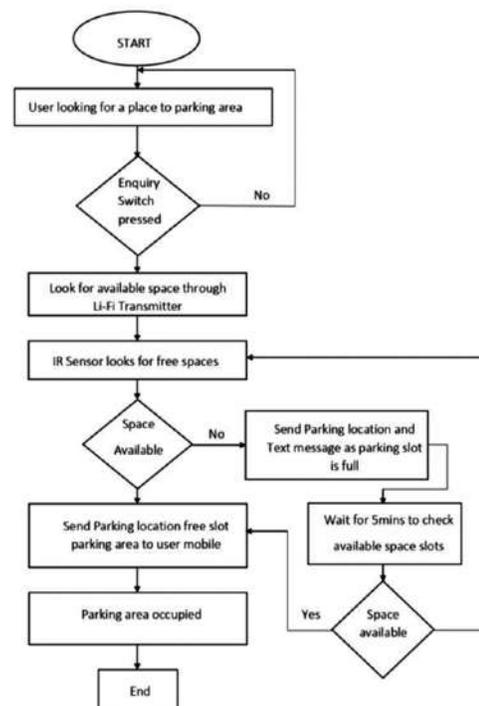


Fig.3 Flow chart of the proposed parking system

Object detected through IR Gate Sensor the gate is open. Object detected through IR Back Sensor the gate is close. If normal vehicle enters the parking gate the LCD Display is off condition.

Step 1: Enquiry switch is pressed, the data send to via Li-Fi transmitter.

Step 2: Data receive through Li-Fi receiver; IR sensors looks for parking area. If parking space available send parking area location and parking slot information to user mobile number.

Step 3: If parking slots full send parking area location and parking slot information to user mobile number. Then wait for 5minutes to check available parking slots and resend the message after 5minutes.

TECHNIQUES IMPLEMENTED

The implementation of the Li-Fi Technology or Visible Light Communication technology was carried out for the proposed parking system. The different LEDs data rates table given below [16].

Visible Light Communication

VLC is a communication technology that uses visible light rays to transmit data through illumination, with a frequency range of 400-800 THz. Rapid pulses of light, which are invisible to the human eye, are used to transmit data [1] [2]. The technology utilizes the visible light portion of the electromagnetic spectrum to transfer information. The IEEE wireless personal area networks working group (802.15) is responsible for standardizing VLC.

VLC boasts a remarkable feature of offering an extensive bandwidth. This is achieved by utilizing the optical spectrum, which provides a bandwidth that is about 10,000 times greater than what can be achieved with RF frequencies. Fig.4 shows the Visible light and RF frequencies at electromagnetic spectrum [4].

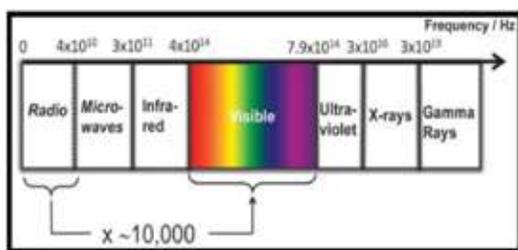


Fig. 4 Visible light communication and Rf frequencies at electromagnetic spectrum

SOFTWARE IMPLEMENTATION

The package includes the Arduino Software (IDE), which is the Arduino Integrated Development Environment. This software encompasses various components, such as a code editor that enables users to write program codes, a communication area, a text console, a toolbar containing frequently used actions, and several menus. By interfacing with the Arduino hardware, the Arduino Software (IDE) allows for uploading programs and communication with them.

Software

The open-source Arduino Integrated Development Environment (IDE) streamlines the process of coding and uploading it to an Arduino board. This software is compatible with any type of Arduino board. The coding process for both the Transmitter Side and Receiver Side is outlined in a step-by-step manner below.

Algorithm

1) Transmitter side: Switch, LCD Display, Light (Li-Fi Transmitter).

Step 1: Include the required header files.

Step 2: Initialize an analog and digital pins for Switch, LCD Display and Light (Li-Fi Transmitter).

Step 3: Analog input pin TX is attached Switch

Step 4: Li-Fi transmitter attached through switch.

Step 5: LCD Display connected to I2C connector. I2C and NodeMCU Controller interfaced via Analog Pin A1. Set the corresponding pins to input and output.

Step 6: The switch's value is read by the digital read pin, and this data is transmitted to the LI-FI receiver.

2) Receiver side: Li-Fi Receiver, LCD Display, IR Sensor, GSM and GPS Module.

Step 1: Include the required header files.

Step 2: Initialize an analog and digital pins for IR Sensors, LI-FI Receiver, Servo Motor, LCD Display, GSM Module and GPS Module.

Step 3: Analog input pin 2,3,7 is attached to IR Gate and IR Back Sensors and Servo Motor. Analog input pin A0, A1, A2, A3 is attached to IR Slots.

Step 4: LCD Display connected to I2C connector. I2C connector and Arduino Uno Controller interfaced via

Analog Digital Pin 4. Set the corresponding pins to Input and Output.

Step 7: Initialize the data pin of GSM and GPS module.

Step 8: Digital read pin read the value from Li-Fi Receiver.

RESULT AND DISCUSSION

The Parking System that uses Visible Light Communication technology consists of three components: The Parking Place Inquiry, Parking Place Surveillance, and Parking Place Sensors. Each of these components is centered around an Atmega32 microcontroller, which is based on an NodeMCU and Arduino Uno powered by a 5V power supply. The modules are connected to a 16x2 LCD display that displays the corresponding results. The system utilizes phototransistors to receive transmitted data and LEDs to transmit requested data. Table I shows the Li-Fi transmitter data rates.

Table 1. Li-Fi Transmitter Data Rates

LED's	Data Rates Achieved
	Data Rates
Phosphorus LEDs	40 Mbps
RGB LEDs	100 Mbps
RCLEDs (Resonant Cavity LEDs)	500 Mbps

In this Proposed System shows the four (4) parking slots, Namely Slot1, Slot2, Slot3 and Slot4. Fig.5 shows the Hardware setup, Fig.6 shows the Transmitter module, Fig.7 shows the Receiver module.

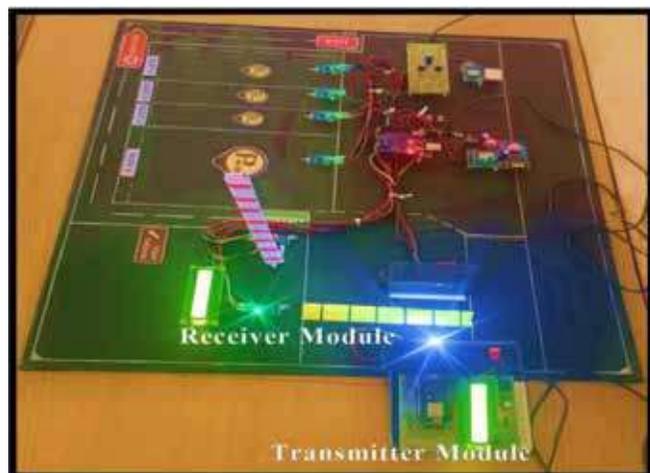


Fig. 5 Hardware setup

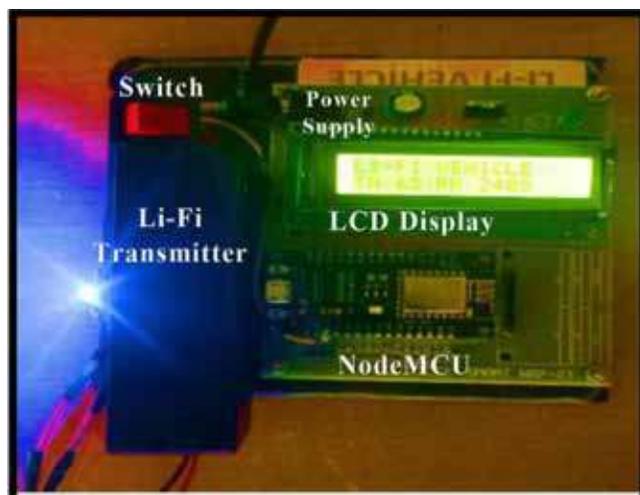


Fig. 6 Transmitter module

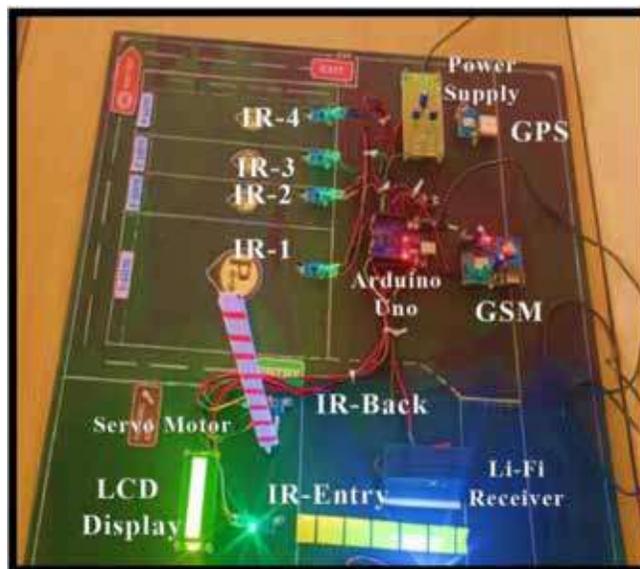


Fig. 7 Receiver module

NodeMCU controller was send the data like user mobile number through the help of push button switch to Light Beam (Li-Fi Transmitter). It receives the data through Photodiode, it interfaces with Arduino UNO, once receive the data in the system check the slot availability and shows the data in the LCD Display (Like S1: FREE ; S2: FULLL ; S3: FREE ; S4: FULL), Then send the data of parking slot information and GPS location of parking area to the user mobile number through GSM Module. Fig.8 shows the Parking space free condition, Fig.9 Parking space full condition, Fig.10 One Parking space is free condition. Fig.11 shows the Parking space details message and GPS location received in the user mobile.



Fig. 8 Parking space free condition



Fig. 9 Parking space full condition



Fig. 10 One Parking space is free condition

Parking Area Conditions

The parking area has two types of conditions, normal and operating.

Normal Condition:

- If IR ENTER will be 1 (HIGH) Object will be detected-The main gate is open (through servo motor) and the LCD display off.
- If IR BACK will be 1 (HIGH) Object will be detected-The main gate is close (through servo motor)
- If IR ENTER and IR BACK will be 0 (LOW)-No operating condition (The main gate is not operating)

Operating Condition:

- LI-FI Receiver (Photodiode) will be ON (High-1)- Check the Parking Place availability (through IR SENSOR) S1, S2, S3, S4 (LOW-0 or HIGH-1)
- Print the parking place availability (through LCD Display). Print that data (like S1: EMPTY; S2: FULL; S3: FULL) through LCD Display.
- Send the message in LCD Display displayed data to user mobile number (through GSM Module) and also send the GPS location of the parking area.

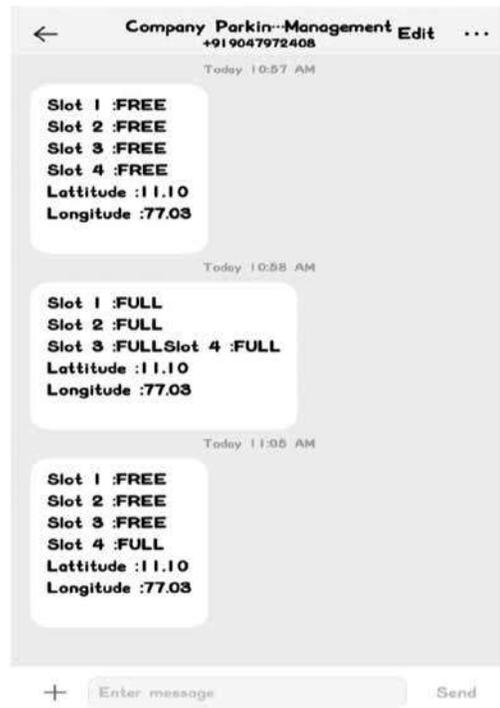


Fig.11 Parking space details message and GPS location received in the user mobile

CONCLUSION

The Smart Parking System that utilizes Visible Light Communication consists of three modules - Parking Place Inquiry Module, Parking Place Surveillance Module, and Parking Place Sensor Module. These modules work together to detect the availability of parking spaces in the designated area and present this information to users. Infrared detectors are utilized to identify the unoccupied spots. The information about the available parking spaces and parking location is transmitted to the user's mobile device through a GSM module. This technology reduces the time and effort required to find an open parking space and results in

lower fuel consumption. The system is user-friendly, energy-efficient, and minimizes wireless interference.

FUTURE SCOPE

The proposed parking system relies on a line-of-sight between the LED and phototransistor (or photodiode) as it uses a single LED and phototransistor for serial data transmission in the Smart Parking System that utilizes Visible Light Communication technology. Future iterations of the system may incorporate readily available LED lights that serve both as a lighting system and a data transmission device. The use of multiple LED lights will enhance the speed of data transfer, enabling users to access the system anywhere, anytime, and securely. Alongside the LED bulbs, high-powered LED lights could also be utilized. The system could be further expanded by directing drivers to available parking spots and incorporating automated payment options through the Internet of Things (IoT) and banking information. The IoT can also be employed to manage a database of parking spaces and control infrared sensors.

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ADDRESSING CLASS IMBALANCE THROUGH RESAMPLING AND ACHIEVING EXPLAINABLE MACHINE LEARNING USING PERMUTATION IMPORTANCE: A CASE STUDY ON FRAUD DETECTION IN INSURANCE VEHICLE CLAIMS

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ABSTRACT

Machine learning Models designed for high-stakes applications like classifying a vehicle insurance claim as fraud or legitimate should be explainable. The reason behind the classification and the feature that contributed more to the identification of fraud must be known. Permutation importance is a method for identifying the contribution of the individual feature in classification. But the fraud detection problem is a classic example of an imbalanced dataset. In the case of insurance claims, the positive sample's, representing the fraudulent claims are considerably less the samples representing the genuine claims. Applying permutation importance to a model trained with the imbalance dataset is not trustworthy as it will lead to misleading results. The vehicle insurance claim detection dataset retrieved from Kaggle is imbalanced, and the following resampling approaches are applied: random under-sampling, over-sampling (SMOTE), and combined under and over sampling (SMOTE-Tomek). The dataset generated from each approach is given as input to the random forest classifier individually, and the results are compared. Random forest models trained with dataset generated by over-sampling and trained with dataset that resulted from the combined approaches have an equal average precision value of 0.93. The importance of the features is measured for each approach with the help of permutation importance. The top-ranked features are the ones that have the greatest impact on making the predictions and are hence most relevant to the problem of fraudulent claim identification.

Keywords : Permutation importance, Machine learning, Imbalanced dataset, Fraud detection, Resampling

INTRODUCTION

An imbalanced dataset is the one in which unequal distribution of positive and a negative classes is observed. In the imbalanced dataset, there are considerably more observations in one of the classes than in the other. Handling class imbalance problem is considered as the fundamental challenge in building any machine learning model [1]. Training the machine learning models with the imbalanced dataset will lead to results that are biased [2]. Such machine learning models usually turn out to be more sensitive in classifying the class observations that are high in number, and the opposite is also true. Imbalance datasets are found commonly in various domains, including medicine, banking, network security [3] etc. models trained with them would face the problem of misclassifying the minority

class, leading to consequences in various perspectives. Identifying the fraudulent vehicle insurance is one such application, since the number of positive cases, fraudulent claims, is comparatively very less than the legitimate claims. According to the report of insurance regulatory and development authority of india, 78,000 cases are identified as potential frauds during the year 2021-2022[4]. The sum assured of which is thousands of crores. Though this figure includes all kinds of frauds in the insurance sector, a fraudulent claim in motor vehicle is a problem to be addressed all over the world. So detecting the vehicle insurance fraudulent claims is an utmost need.

There are various approaches that are in practice for detecting it. Conventional auditing models [5] are the earlier solutions. [6] Narrates the drawbacks of

the auditing approaches and alternatively suggested statistical approaches. Fuzzy logic approaches [7] and neural network classifiers [8] are also used for detecting the fraudulent claims.

Any approach that is designed for classifying the fraudulent observations should face the skewed class distribution problem. Following is the motivation, problems to be addressed, objectives and the contribution of the work.

Motivation

While the machine learning models provides high accuracy, they are often considered as black boxes. This is due to the fact that humans find it difficult to understand how the models make decision. This lack of transparency has to be addressed specifically in applications where incorrect decision would lead to serious consequences.

High-stakes applications such as the vehicle insure claim fraud detection with machine learning should be explainable. Understanding the importance of the individual features would be of more use.

Problem Statement

While designing an explainable machine learning model is the motivation of the work, it also includes a sub problem of addressing the class imbalance.

The vehicle insurance claim fraud detection dataset used has a highly imbalanced class distribution. The minority class contains only 6% of the total samples. The unequal class distribution has to be addressed. Various data approaches are available for balancing the classes. The approaches should be explored and the best one should be selected.

Objectives

- To explore different techniques to handle class imbalance, including under-sampling, over-sampling, and a combined approach.
- To identify and compare the ability of the machine learning model trained on data generated with various approaches to handle class imbalance.
- Use permutation importance to explain the importance of each feature in the model's decision-making process.

Contributions

- Random under sampling, SMOTE (Synthetic Minority over Sampling) technique, and SMOTE-Tomek are analyzed for addressing the class imbalance problem.
- The generated datasets by the above specified class balancing techniques are used for training and testing the random forest classifier for its performance.
- Permutation importance is used for finding the importance of the individual features.

Following is the organization of the rest of the paper. The second part of the paper discusses the related works. The third explains in detail the methodology, Fourth provides the results obtained. The last section gives the conclusion.

LITERATURE REVIEW

In this review, the most relevant studies related to the use of machine learning for vehicle insurance claim fraud detection and as well as other insurance frauds are explored.

[9] used a back propagation based neural network model for identifying insurance fraud in motor insurance vehicle claim in china. [10] Proposed two approaches for insurance fraud prediction, k-means with genetic algorithm and K-means with particle swarm optimization. [11] Also used genetic algorithm with BP neural network for fraud detection in insurance. Genetic algorithm is used for optimizing weight initialization in the neural network. [12] combined fuzzy rule and naïve bayes classifier. Rule based mining is combined with k-means clustering in [13] to find anomalies in the health insurance. [14] used particle swarm optimization for feature selection and machine learning models for classification of automobile insurance fraud detection. boruta algorithm was employed in [15] for feature selection the selected features are given as input to the three classifiers, logistic regression, naïve bayes and the support vector machine. The models are evaluated for its performance with six different metrics. Support vector machine outperforms all other models. [16] Compared eight different machine learning models for insurance fraud detection. Decision tree with 79% accuracy is the best performing model. [17] Used two data resampling techniques SMOTE and ROSE and tested random

forest and logistic regression for fraud detection. Random forest with a recall of 95.24% is better than the logistic regression model. An improved particle swarm optimization approach is used for optimizing the weights of the back propagation neural network model for classifying frauds [18]. [19] Discussed in detail the importance of feature selection. Different feature selection approaches are experimented and it is observed that models trained with selected features perform well than the models trained with all features when experimented with five fraud detection datasets. [20] Considered the imbalance data problem and applied SMOTE for addressing it. The balanced dataset is used for training and testing five different models including the neural networks.

Machine learning models are also combined with other recent technologies like blockchain for detecting and preventing fraud. [21] Uses decision tree with blockchain for this purpose. It can also be observed from the literature that deep learning approaches are also applied for fraud detection in different domains. [22] Used the LDA model for feature extraction and the extracted features are given as inputs to the deep neural networks for fraud detection. [23] Combined convolutional neural networks and Long-short term memory for fraud detection. Other approaches that are used for fraud detection includes social network analysis [24], spectral sorting method [25] and the gang characteristics microscopic modeling [26].

Machine learning and other approaches are extensively used in insurance claim fraud detection. However exploring the class imbalance problem and finding the importance of the individual features would be great importance for insurance service providers.

METHODOLOGY

This section in detail explains the dataset, pre-processing steps applied to it, followed by the proposed approach.

Dataset Description and Pre-processing

The Vehicle Insurance Fraud Detection Dataset retrieved from Kaggle is a collection of data that has been designed to help developers and machine learning experts build and test models that are capable of identifying fraudulent vehicle insurance claims. The dataset is clean without any missing values. The dataset contains features that are continuous in nature as well as data that are categorical. There are certain features,

the values of which are changed as listed in the Table 1.

Table 1 Value Changes In The Dataset

Sl.No	Feature	Values
1	Month	Jan-Dec – 0 to 11
2	Day of the Week	Mon-Sun – 0 to 6
3	Make	There are 19 makes, numbered from 0 to 18.
4	Accident Area	Rural -0, Urban -1
5	Day of the week claimed	Mon-Sun – 0 to 6
6	Month Claimed	Jan-Dec – 0 to 11
7	Sex	Female:0 Male:1
8	Marital Status	Widow:0,Divorced:1,Single:2,Married:3
9	Fault	Third Party:0, Policy Holder:1
10	Policy Type	There are 9 Policy Types:0-8
11	Vehicle Price	less than 20000 : 0,20000 to 29000 : 1, 30000 to 39000 : 2,40000 to 59000 : 3, 60000 to 69000 : 4,more than 69000 : 5
12	Days_Policy_Accident	'none' :0, '1 to 7' : 1, '8 to 15' : 2, '15 to 30' :3, 'more than 30' :4
13	Days_Policy_Claim	'8 to 15' :0, '15 to 30' : 1, 'more than 30' : 2
14	Past number of Claims	None:0, 1:1, 2 to 4:2, more than 4 :3
15	Age of Vehicle	new:0,2 yrs:1,3 yrs:2,4 yrs:3,5 yrs:4,6 yrs:5,7 yrs:6 ,more than 7' : 7
16	Age of Policy Holder	18to20:0,21to25:1,26to30: 2,31to35:3,36to40:4,41to50:5,51to65:6,over 65:7
17	Policy report Filed	Yes:0 , No:1
18	Witness Present	Yes :0, No:1
19	Agent Type	Internal:0, External :1
20	Number of Supplements	None:0,1 to 2 : 1,3 to 5 : 2,more than 5 : 3
21	Address change Claim	No Change :0,Under 6 Months:1,1 Year:2,2 to 4 Years :3,5 to 8 Years :4
22	Number of Vehicles	1 vehicle:0,2 vehicles:1,3to4:2,5to8:3,more than 8: 4
23	Base Policy	All Perils:0, Liability:1, Collision:2
24	Area Type	Rural:0, Urban:1

The dataset contains 15,420 records, with 32 features for each record. The dependent variable is binary, legitimate claims are represented as 0 and fraudulents are represented as 1. Out of the 15,420 records in the dataset, only 6% of them have a value of 1 for the target variable, indicating that the dataset is highly imbalanced as shown in the Fig. 1.

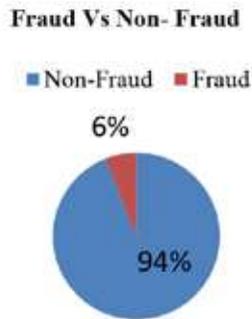


Fig 1. Class imbalance problem

As specified earlier, this imbalance problem should be addressed before proceeding further. The following section explains the proposed approach.

Proposed Approach

The proposed approach is given in the Fig. 2.

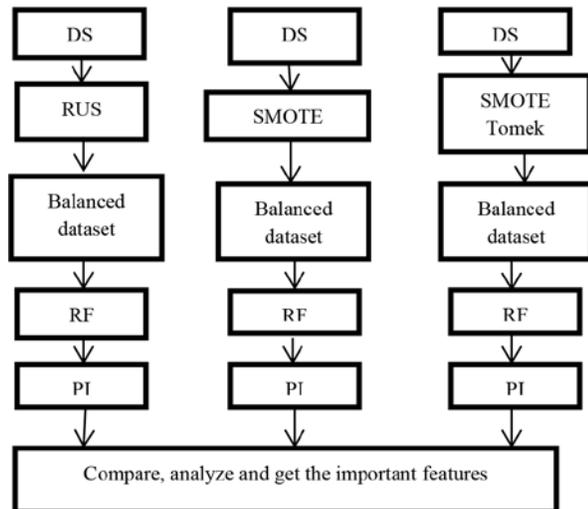


Fig 2. Proposed Approach

The vehicle insurance claim fraud detection dataset is given to the three data resampling approaches, under-sampling, SMOTE, SMOTE-Tomek, Individually. The resulting dataset which is balanced in nature is fed to the Random forest model. The performance of the random forest classifier is evaluated with the individual datasets generated with each data resampling approach. With the individual model and the permutation importance method the importance of the individual features is generated which gives an insight of the model decision and the features that contribute more in the classification.

There are various approaches for handling the imbalance dataset. The major approach includes cost sensitive approaches like [27-28], algorithm level methods [29-

30] and data level approach. The objective of the cost sensitive approach is to minimize the misclassification rate. An algorithm level model modifies the conventional machine learning models and the data level approach relies on modifying the data and rebalances it. The different resampling techniques used are discussed in next section

Resampling Techniques

To balance the dataset the following techniques are used in this work

- Random under sampling
- Over Sampling (SMOTE)
- Combined Approach(SMOTE-Tomek)

Random undersampling

In this approach, random samples are selected from the class that has more number of elements. The number of samples to select is same as the total number of samples in the class with less number of elements.

SMOTE

To address the problem of over fitting when just replication is used for oversampling the minority class, [31] introduced SMOTE. It generates the synthetic observations from the minority class by interpolating the existing observations. SMOTE is found to be efficient in solving class imbalance problems in various applications, including intrusion detection [32], speech processing [33], predicting species [34], and breast cancer detection [35].

SMOTE works as follows

Let X be the original dataset, with n samples and two classes, C1 (the minority class) and C2 (the majority class).

Let N1 be the number of samples in the minority class, and N2 be the number of samples in the majority class.

1. Select a random set of observations n1 from C1
2. Select an observation X_i in n1
3. Find the K-Nearest neighbors of X_i $N_K(X_i)$ using Euclidean distance
4. Randomly select one of the K Nearest neighbors X_j
5. Generate a Synthetic observation X_{new} by interpolating X_i and X_j

$X_{new} = x_i + R * (x_j - x_i)$ where R is a random number between 0 and 1

6. Repeat Steps 2-5, till the dataset is balanced.

There are also other variants of it. [36] Proposed a new model, Safe-Level SMOTE to avoid noisy synthetic observations. Another variant of SMOTE is proposed in [37] called Borderline-SMOTE which considers only the observations that are near the borderline. SMOTE is also used with other under sampling approach like Tomek links for creating a combined approach.

SMOTE-Tomek

Tomek links is a concept initially proposed and used for a kind of under-sampling [38]. It's a variant of the condensed nearest neighbor model [39]. Samples that lies near the minority class and belonging to the majority class are removed. The distance is measured with the help of the Euclidean distance.

It is combined with SMOTE [40] to create a combined approach of over- and under-sampling. The steps are as follows:

In the given dataset

Apply SMOTE:

- Select random observations from the minority class.
- Generate synthetic data with the selected observations until the desired numbers of minority class observations are generated.
- Create a dataset that has all data from the generated minority class and the majority class.

Apply Tomek:

- Select random data from the majority class.
- With Euclidean distance, find the observations that are close to the minority class and remove them.

Random Forest Classifier

Random forest classifier is introduced in [41]. It belongs to the ensemble approach in which multiple decision trees are built and combined together to improve the accuracy of classification. The detailed steps of the random forest classifier are given below.

Step 1: a process called random subspace method [42] is the first process in the random forest classifier which selects a random subset of features and random samples

from the given dataset.

Step 2: individual decision trees are constructed with each subset

Step 3: output of the individual decision tree is generated

Step 4: To classify a new data point, run it through each decision tree and record the classification result of each

Step 5: Method of majority voting is used for making the final decision.

Before this, the random forest classifier should be constructed. As specified, each random forest has a set of decision trees. A decision tree has a root node, decision node and the leaf nodes. The process of selecting the feature as a root node of the decision tree is made with the help of the gini index. It is represented as given in Eq. (1) and Eq. (2).

$$Gini\ Index = 1 - \sum_{i=1}^n (P_i)^2 \quad (1)$$

$$= 1 - [(P_p)^2 + (P_n)^2] \quad (2)$$

Where, P_p is the positive class and P_n is the negative class. Feature with the lowest gini index is selected as the root node. The process is repeated for creating each node until the decision tree is constructed.

Permutation Importance

The initial concept of permutation is used in constructing the random forest model. The fundamental idea is to identify whether there is a loss in the performance of the classifier when an independent variable is shuffled randomly. This is built on the concept of breaking the relationship that exists between the particular feature and the dependent variable. The fall in the performance of the model after permuting the feature indicates its dependency on the feature. The steps of the permutation importance approach are given below:

Fit the model M on the Training Dataset TD

Compute the performance of the model $P_{original}$.

For each feature in the Training set TD

Shuffle the values in the feature randomly

Compute the performance of the model $P_{permuted}$.

Find the difference in the performance $P_{original} - P_{permuted}$

The features are arranged based on the difference value. Higher the difference, more important the feature is.

EXPERIMENTATION AND RESULTS

The implementation is made with the help of the Sci-kit-learn [43] python library. It is an open-source machine learning library that provides wide range of tools and algorithms. The reason for choosing it is ease of use, ability to integrate with other scientific and visualization libraries and performance. The approaches used for balancing the datasets, SMOTE and SMOTETomek are from the open source imbalanced learn [44] python package of MIT. The environment used for execution of the models is Google colab [45].

Since the work concentrates on handling unbalanced data as a part of it, accuracy is not the suitable metric for measuring the performance. A model can produce high accuracy even if it only predicts the majority class correctly. Accuracy is defined as in Eq.(3).

$$Accuracy = \frac{(TP+TN)}{(TP+FP+TN+FN)} \quad (3)$$

Hence, other metrics such as precision, recall and F1-score has to be considered for finding the performance of the model in predicting the minority class. Precision measures the number of true positive predictions made among all the positive predictions. Precision is calculated with the formula given in Eq. (4)

$$precision = \frac{True\ Positive}{True\ Positive+False\ Positive} \quad (4)$$

True positive is the number of correctly predicted positive observations, in the considered problem, identifying the fraud claims correctly. False positive represents the negative instances that are misclassified as positive. In the scenario concerned the number of legitimate claims that are misclassified to be fraud. Precision would be more useful in applications where the cost of false positives is high.

Recall is a measure that gives the percentage of the true positive predictions among the all positive observations. Recall is represented in Eq.(5)

$$Recall = \frac{True\ Positive}{True\ Positive+False\ Negative} \quad (5)$$

It gives the proportion of the number of correctly predicted positive observations to the sum of correctly and incorrectly predicted positive observations. False negatives represent the number of number of positive observations that are misclassified to be negative. Recall gives the proportion of total number of fraud claims that are correctly found to be fraud and the total number of

fraud claims.

Another metric that is used for measuring the performance of the models is the Area under the Receiver Operating Characteristic Curve (AUC-ROC). It is a plot of true positive rate (recall) and the False Positive Rate. False positive rate is the one that specifies the proportion of incorrect prediction in the positive class and is represented in Eq.(6)

$$False\ Positive\ Rate = \frac{False\ Positives}{False\ Positives+True\ Negatives} \quad (6)$$

AUC-ROC measures the goodness of the model in distinguishing the positive and negative observations. All these measures are analyzed for the random forest classifier model with different data generated by three different resampling models. The observations are as follows.

The precision recall curve of the random forest classifier with under sampling approach is given in the Fig. 3. The curves are generated with the yellow bricks visualization tool.

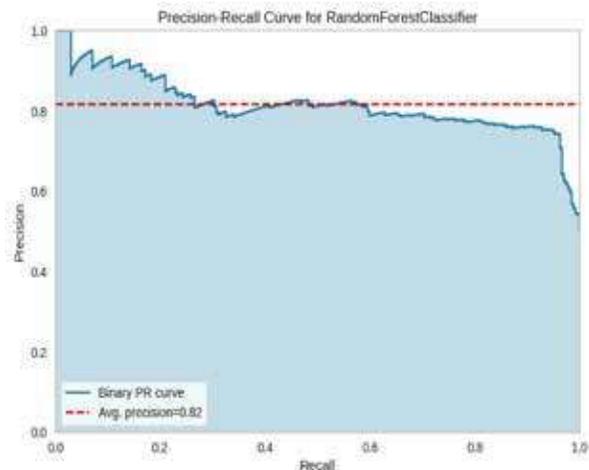


Fig 3. Precision –Recall Curve RF-Random Under Sampling

The AUC-ROC curve of the model with the data generated by random under sampling is given in the Fig. 4.

It can be inferred from the figures that the average precision value is 0.82 and the AUC of both the classes are 0.85 when the random forest classifier is trained and tested with the data generated with the random under sampling method.

The precision recall curve of the random forest classifier

with the over sampling (SMOTE) approach is given in the Fig. 5.

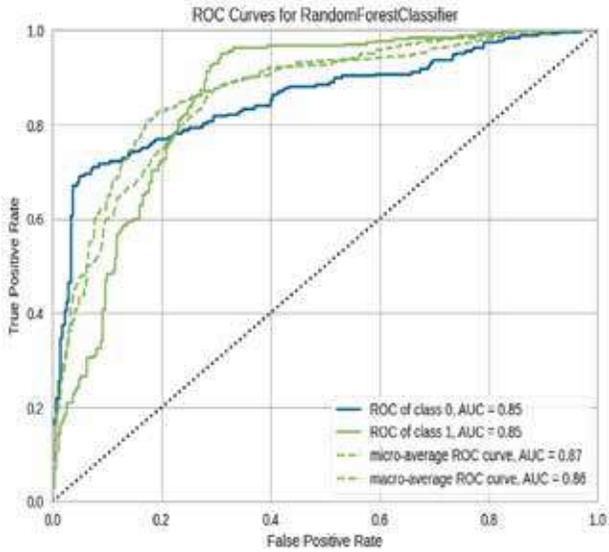


Fig 4. ROC Curve RF-under Sampling

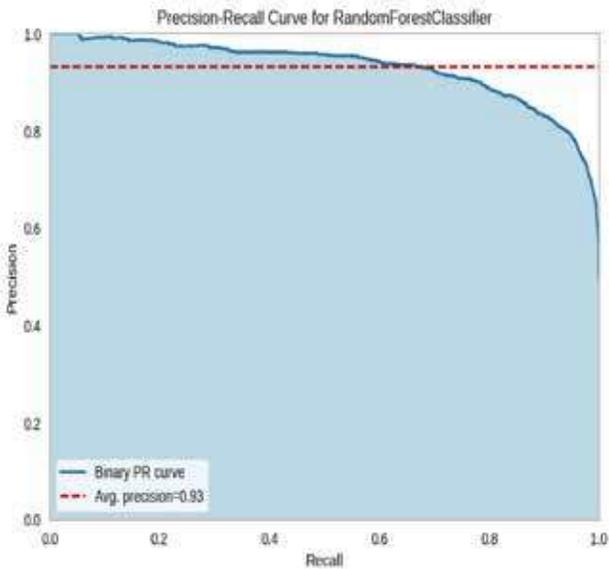


Fig. 5 Precision –Recall Curve RF-over sampling (SMOTE)

The AUC-ROC curve of the same is given in the Fig.6.

It can be inferred from the figures that the average precision value is 0.93 and the AUC of both the classes are 0.94 when the random forest classifier is trained and tested with the data generated with the SMOTE Method.

The precision recall curve of the random forest classifier with the combined sampling (SMOTE-Tomek) approach is given in the Fig. 7.

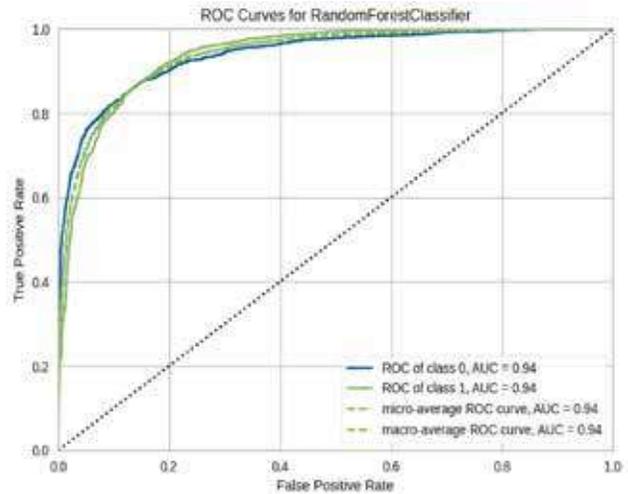


Fig 6 ROC Curve RF-Over Sampling (SMOTE)

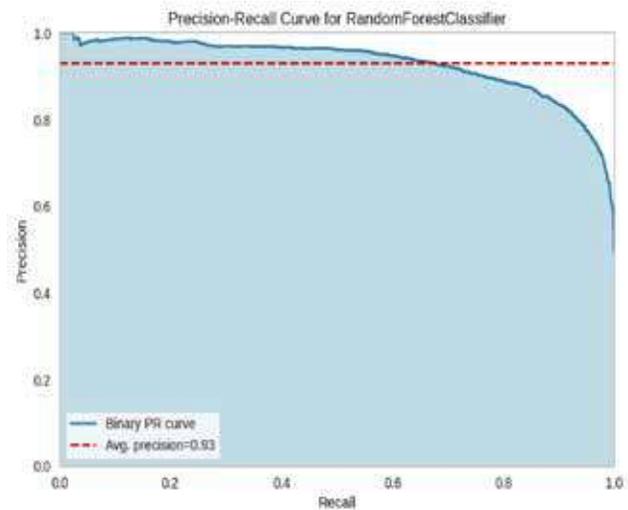


Fig. 7 Precision –Recall Curve RF- SMOTE-Tomek

The AUC-ROC curve of the same is given in the Fig. 8.

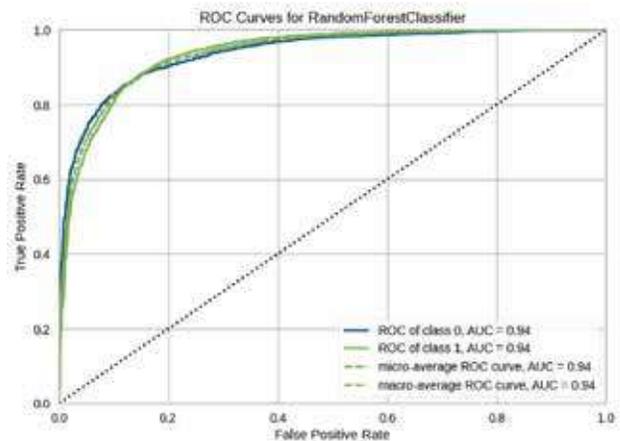


Fig 8. ROC Curve RF-Over Sampling (SMOTE- Tomek)

The results produced by the model trained and tested with the data generated by oversampling is similar to the results generated by the model tested with the data from the combined oversampling and under sampling approach. Minor difference between the two is observed in the value of the recall in the classification report.

The next parameter to analyze is the importance of the individual features in classification with the permutation importance method.

The significance of the individual features when the Random forest classifier trained with data generated from Random under sampling is given the Fig. 9.

Weight	Feature
0.1593 ± 0.0339	Fault
0.0530 ± 0.0143	VehicleCategory
0.0239 ± 0.0246	PolicyType
0.0205 ± 0.0091	PastNumberOfClaims
0.0183 ± 0.0044	Deductible
0.0060 ± 0.0136	BasePolicy
0.0056 ± 0.0091	MonthClaimed
0.0037 ± 0.0024	AddressChange_Claim
0.0037 ± 0.0053	Year
0.0026 ± 0.0056	PolicyNumber
0.0022 ± 0.0050	Month
0.0015 ± 0.0028	MonthName
0.0015 ± 0.0028	DriverRating
0.0004 ± 0.0028	VehiclePrice
0 ± 0.0000	NumberOfCars
0 ± 0.0000	AgeOfPolicyHolder
0.0000 ± 0.0024	PoliceReportFiled
0 ± 0.0000	Days_Policy_Claim
0 ± 0.0000	WitnessPresent
0 ± 0.0000	Days_Policy_Acci

Fig 9. Feature Importance – Random under sampling

The importance of the features with the data from SMOTE is given in the Fig. 10.

Weight	Feature
0.0926 ± 0.0045	Fault
0.0306 ± 0.0020	PastNumberOfClaims
0.0244 ± 0.0060	PolicyType
0.0241 ± 0.0010	VehicleCategory
0.0229 ± 0.0027	NumberOfSuppliments
0.0208 ± 0.0032	Make
0.0197 ± 0.0017	AgeOfVehicle
0.0167 ± 0.0028	DriverRating
0.0151 ± 0.0017	Deductible
0.0077 ± 0.0023	AgeOfPolicyHolder
0.0052 ± 0.0023	RepNumber
0.0048 ± 0.0019	WeekOfMonthClaimed
0.0046 ± 0.0032	DayOfWeekClaimed
0.0046 ± 0.0023	VehiclePrice
0.0045 ± 0.0009	PolicyNumber
0.0031 ± 0.0004	AddressChange_Claim
0.0031 ± 0.0006	MonthClaimed
0.0030 ± 0.0010	DayOfWeek
0.0027 ± 0.0045	BasePolicy
0.0017 ± 0.0016	MaritalStatus

Fig10. Feature Importance – Over sampling (SMOTE)

The importance of the features in case of combined under sampling and over sampling with SMOTE-Tomek method is given in the Fig. 11.

Weight	Feature
0.0981 ± 0.0023	Fault
0.0299 ± 0.0045	PastNumberOfClaims
0.0282 ± 0.0040	VehicleCategory
0.0260 ± 0.0031	PolicyType
0.0241 ± 0.0047	NumberOfSuppliments
0.0215 ± 0.0043	AgeOfVehicle
0.0191 ± 0.0041	DriverRating
0.0189 ± 0.0053	Make
0.0161 ± 0.0009	Deductible
0.0079 ± 0.0022	AgeOfPolicyHolder
0.0063 ± 0.0017	VehiclePrice
0.0057 ± 0.0053	BasePolicy
0.0045 ± 0.0013	WeekOfMonthClaimed
0.0042 ± 0.0024	PolicyNumber
0.0035 ± 0.0013	AddressChange_Claim
0.0031 ± 0.0021	DayOfWeekClaimed
0.0030 ± 0.0026	RepNumber
0.0027 ± 0.0013	MonthClaimed
0.0027 ± 0.0013	MaritalStatus
0.0025 ± 0.0019	AccidentArea

Fig 11 Feature Importance – SMOTE-Tomek

When analyzing the feature there are certain features that are commonly found at top in all the three models. They are Fault, vehicle category, policy type and past number of claims but in different order except the fault which holds the higher importance in all the three. In order to ensure this, and also to address the problem that there are chances of variations with the different permutations, the process is repeated. The permutation importance is calculated repeatedly for 30 times with the data generated with SMOTE and the mean results are given in the Table 2.

Table 2. Feature Importance with PI for 30 repetitions

Feature	Weight
Fault	0.384 +/- 0.007
Policy Type	0.126 +/- 0.004
Vehicle Category	0.121 +/- 0.003
Past Number of Claims	0.115 +/- 0.005
Number of Suppliments	0.100 +/- 0.005

The top four features are found to have high feature importance in all the cases.

CONCLUSION

The use of resampling techniques and permutation importance to achieve explainable machine learning in vehicle insurance fraud detection is explored. Explainability is significant for machine learning models

designed for high-stakes applications like vehicle insurance fraud detection. Permutation importance is a technique that can provide valuable insights into the importance of features and their contributions to the model's predictions. However, applying permutation importance to a machine learning model trained on an imbalanced dataset can lead to misleading results. To address this problem, various resampling techniques, including random under-sampling, SMOTE, and SMOTE-Tomek, are used to balance the dataset. Random Forest classifiers were trained on the dataset generated by each resampling technique, and their performance was compared. The results showed that both SMOTE and SMOTE-Tomek generated datasets achieved high precision values of 0.93. The AUC value of both models is 0.94. The average precision value obtained with the data generated with random under-sampling is 0.82. Permutation importance is applied for each approach to extract the importance of the individual features. Four features are observed to be present in all the approaches in the top four places, but in different order. Fault, policy type, vehicle category, and past number of claims. These features can be considered vital for detecting fraudulent insurance vehicle claims.

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DEVELOPMENT OF ELECTRONIC NOSE FOR DISCERNING OF FISH SPOILAGE

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ABSTRACT

Food spoilage is a significant problem because of the enormous rise in food demand that we can anticipate in the forthcoming decades. Due to hygiene and safety concerns in the food supply chain, there is a continually thriving need for quick and accurate inspection for quality of food products. It is crucial and necessary to create a system for assessing food spoilage that is reliable, quick, continuous, non-destructive, and precise. Applying an intelligent odor detection system based on an electronic nose to track the spoilage of more corruptible items in the food sector, particularly in the fresh foods area, has enormous potential for helping to provide consumers with healthy and fresh food. The present work is focused on the development of an electronic nose that can detect the spoilage of fish by sensing the odors emitted from spoiled fish. Based on the high rate of emission of gases from the spoiled fish, gas sensors are integrated. The assembly of the system being designed on Arduino bases confirms the results within the prototype by comparing the limits that is already programmed. The developed prototype effectively shows comprehensive differences between fresh and spoiled fish and can be used for the rapid measurement of spoilage in real time. It can ensure food safety and effectively reduces food wastage.

Keywords : Electronic nose, Fish spoilage, Food supply chain, Quality evaluation.

INTRODUCTION

Food safety monitoring and management have given rise to growing concern worldwide as a necessary phase in the food production and supply chain. Fish is known for its high nutritional value and provides a protein of excellent quality which is rich in amino acids as well as a variety of minerals, including calcium, phosphorus, magnesium, zinc and iron in marine creatures. The high quality protein, vitamins, and other necessary components in fish are primarily responsible for its nutritional advantages. However, because of its low glycogen content and relatively high pH, fish is particularly perishable, posing a severe health risk and increasing the risk of food poisoning for customers [11]. It is also an illustration of a protein food item that needs to be handled carefully.

One of the most crucial quality indicators used to determine if fresh fish is fit for ingestion is its aroma. Fish's volatile chemical makeup, which contributes to the distinctive smells, can be identified and linked to quality [3, 8]. NH₃ and H₂S can be released by

microbial contamination of high-protein foods (such as eggs, pork, cattle, fish, prawns, etc.,). Therefore, keeping an eye on these gases can aid in determining the food's safety rapidly.

During the monitoring of fish spoilage, the gases released in the order of CO₂ > VOC > CO > CH₄ > NH₃ > NO₂ > SO₂ > H₂S. Trimethylamine (TMA) is a gaseous basic tertiary amine molecule with the formula N(CH₃)₃ that is released by dying fish [10].

Human sensory assessment is frequently practiced to determine the quality of food based on sensory characteristics such as morphological features, taste buds, smells, consistency, and colors [14, 15]. It is challenging for customers to comprehend the study because it calls for experienced panel assessors to have their own opinions on distinct food sensory features [1]. Additionally, the key issues with sensory assessment include the requirement for a sizable number of knowledgeable and experienced individuals (not always practical) [2], lengthy and continuous training, vocabulary harmonization, and unique technical requirements (such as setting and lighting).

The quality of food can now be assessed using a variety of analytical techniques, such as ultra performance liquid chromatography (UPLC), gas chromatography-mass spectrometry (GC-MS), plasma atomic emission spectrometry, and capillary electrophoresis (CE) [14, 15]. These techniques, however, have drawbacks in that they are ineffective for real-time food quality monitoring [13, 15, 5], they have significant operational expenses, call for highly qualified analysts, and they require time-consuming methodologies.

Therefore, there is a greater need for quick, accurate, and cost-effective analysis due to the rising demands for product quality management [6]. Accurate fast food analysis findings are now achievable because to the quick development of multi sensor and electrical technology [4]. An electronic nose's sensing-interpreting-discriminating process mimics human olfaction. An electronic nose (e-nose) is a device which makes use of gas sensor that responds to specific volatiles with a fingerprint response that could be used by algorithms for pattern recognition to conduct discriminate and categorization [7, 9]. The E-nose has gained popularity as a potent instrument for tracking food quality recently.

MATERIALS AND METHODS

To illustrate the proposed work, we constructed an E-nose and an entire set of experimental model (see Fig. 2). The integration of the electronic nose includes a gas sensor array with four MOS gas sensors (Table I), temperature and humidity sensor (HTU21D), a data collection module, and a wireless transceiver part.

Table 1. Gas sensor and their target gas

S. NO.	GAS SENSOR	TARGET GAS
1.	MQ4	Methane
2.	MQ135	Ammonia
3.	MQ136	Hydrogen Sulfide
4.	MQ137	Ammonia & Trimethylamine

The MQ categories of gas sensors are easy to use and affordable sensors that could be used to detect gases in the air. They deliver exceptional precision and effectiveness.

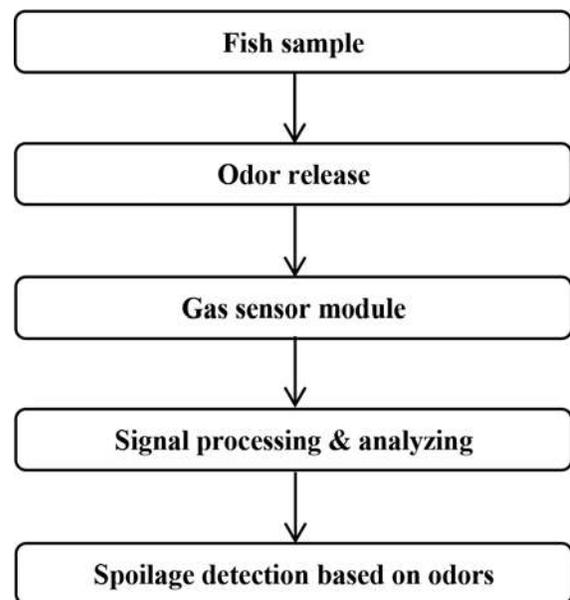


Fig. 1. Mechanism of developed EN system

Fig. 1 conveys the flow chart of Electronic nose system for discerning of fish spoilage.

- 1) The source material's volatile aromatic molecules are transmitted to the sensor module system. The olfactory receptor's core and most crucial part are a number of gas sensors, collectively known as a sensor array.
- 2) The adsorption of odor molecules has been studied using a variety of sensing materials. Odor molecules can alter the electric conductivity or resistivity of the material used for sensing by producing charge transfers, expansion of volume, exchange of ions, or interacting with ion species on the sensor material's surface.
- 3) A sensor-housing chamber with constant temperature and humidity to prevent interference with the adsorption of fragrance molecules. Thus it is used to enhance the discriminative capability of the system
- 4) A transistor that amplifies, modifies, and conditions a chemical signal and converting it into an electrical signal.
- 5) An electrical (analogue) signal is converted into a digital signal by means of a digital converter [12].
- 6) The digital outputs produced by the gas sensors are evaluated and interpreted to give the operator useful information. This computer examines the digital signal, displays the outcome, and then runs statistical analysis to classify or identify the sample.

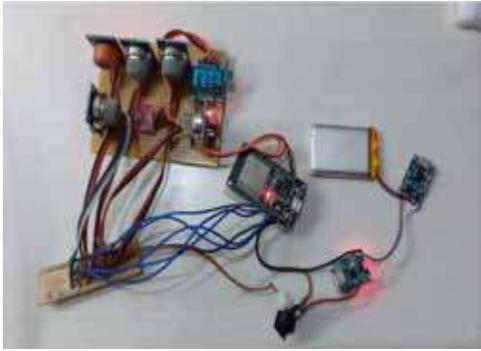


Fig. 2. Experimental model

RESULTS AND DISCUSSION

The constructed prototype has a sensor chamber that houses four gas sensors, as well as a temperature and humidity sensor. To supply each of the units with the necessary voltages, there is a power supply. The sensor unit is made up of a methane sensor, an ammonia sensor, a hydrogen sulfide sensor, a trimethylamine sensor, a temperature and humidity sensor. These sensors work in accordance to offer values for spoiling detection with temperature and humidity settings to provide precise readings. The micro controller receives the inputs from this device, evaluates them, and sends a signal to the cloud, which in turn alerts the user of probable food spoiling. The user is alerted if any of the products are approaching their respective deterioration, and the information is kept in the memory. The microcontroller will be configured to use this data, and the cloud will be utilized to send signals to the intended recipient.

Each gas sensor is tested individually by providing the desired input gas. Electronic Nose is tested with fish sample.

Fresh fish Sampling

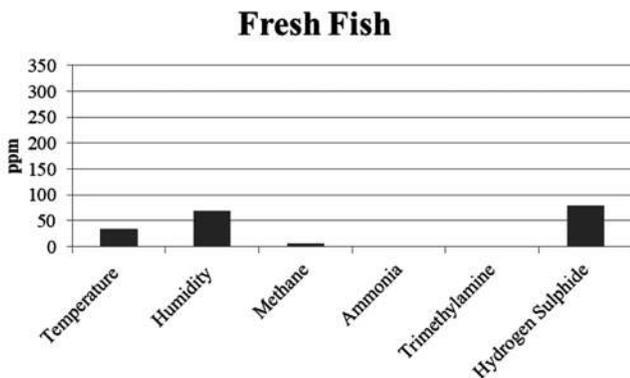


Fig. 3. Graphical result of Fresh fish

From the Fig. 3, it is inferred that Fish does not emit Ammonia and Trimethylamine in fresh condition and it produces low level of Methane and Hydrogen Sulphide.

Spoiled Fish Sampling

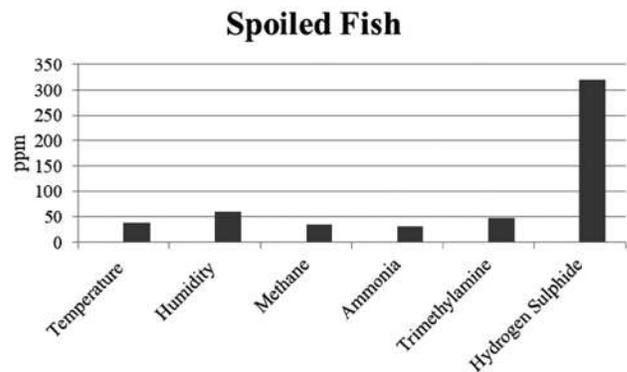


Fig. 4. Graphical result of Spoiled fish

From the Fig. 4, it is inferred that there is increase in the level of Methane, Ammonia, Trimethylamine and Hydrogen Sulphide gases with respect to the spoilage level of fish.

Comparative Study of Fresh and Spoiled Fish

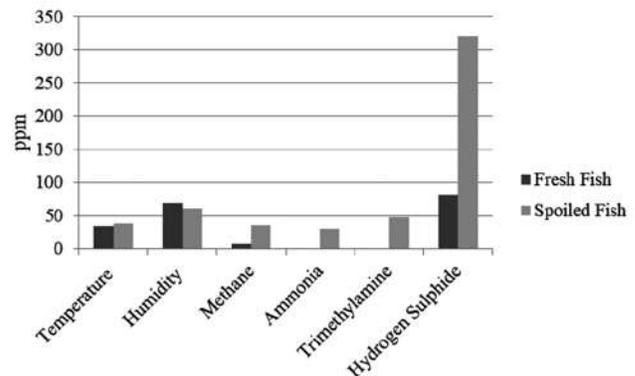


Fig. 5. Graphical result of Comparative study

This graph (see Fig. 5) represents the comparative study of fresh fish and spoiled fish. From the graph, it is inferred that there is a high rate of emission of gases in spoiled fish than fresh fish. Thus, the developed Electronic nose detects the spoilage of fish more comprehensively.

CONCLUSION

Electronic Nose sensor unit is the core component of this work and poses the significant challenge to success. The capacity of the sensors to precisely and reliably detect the concentration of gases would influence the accuracy of the result because we are working with

gases that have complex fluid dynamics. Additionally, food's biochemistry is a function that is both complex and dynamic. In addition to being affected by the type of food, environmental factors like temperature and the presence of other gases also modify it. In conclusion, the findings of this work showed that the outcomes of volatile molecules gathered from e-nose analysis when combined with a relevant machine learning approach could become an interesting tool for evaluating fish spoilage through the observation of biochemical changes taking place in fish meat substrate. The obtained odor profile may be regarded as a biological outcome that contains important data for classifying fish samples according to different stages of spoilage.

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THE CHARACTERS OF WIZARDRY WORLD IN HARRY POTTER

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ABSTRACT

The Wizarding World appeared in the Harry Potter books, first developed by British author J.K. Rowling, presents magical world. Harry and his friends encounter several such creatures in their life at Hogwarts, the Forbidden Forest, or other parts of the Wizarding World throughout the seven main books in the Harry Potter series. Hogwarts' studies of Magical Creatures in the wizardry world course also teaches students how to care for monsters and dead evils, such as Acromantula, ghosts, dementors, and the good magical creatures of animals, such as hippogriffs and unicorns of wizardry world of Harry Potter.

Keywords : Acromantula, Boggart, Dementors, Ghosts, Dark wizard

INTRODUCTION

J.K. Rowling discusses the animal characters of the wizarding world in the novel. Acromantula, a giant spider that can speak like a human, exists in the Harry Potter universe. Borneo, where it now lives, is where it first appeared. Thick black skin covers its body, its length of up to fifteen feet, and pincers that make a clicking noise. When Acromantula is upset or angry, the poisonous ooze is spit from the mouth. The carnivorous Acromantula prefers huge prey. It spins webs in the form of vaults on the ground to catch the prey. The female can produce up to 100 to 110 eggs at a time and is larger than the male species in the wizardry world. They are the size of large balls and soft to the touch and white in color. The eggs hatch in six to eight weeks to complete form an acromantula baby.

According to popular belief in the wizardry world, this animal was created by sorcerers to save and guard homes and forests from evil creatures. Acromantula is a dead creature animal harmful to every people in Hogwarts. Acromantula or Aragog, thought by the

Hogwarts teachers to be a creature of the Chamber of Secrets, was the reason Hagrid was expelled from school in his third year. Aragog forbade his children from attacking Hagrid save their children from the past, showing that Acromantula is capable of love respect, or loyalty. Aragog was the only thing stopping them from being dangerous, so Hagrid's protection was gone when he died.

The next important monster is basilisk in the Harry Potter books. In the Harry Potter universe lives an ugly squirming beast known as a basilisk. This basilisk is bigger than the basil from mythology, live for hundreds of years and it grows for 60 meters. Only parselmouths (language of snake) can control basilisks from evil deeds, and Herpes the Impure, a Greek dark wizard and Parselmouth, is believed to have invented the first basilisk. Herpe spotted it under the beast while incubating an egg to birth their babies. The basilisk's powerful venom and a purple spot can be seen on the head of the male basilisk and its enormous yellow eyes - which instantly kill any creature that looks directly into them - attack the enemy and causes the death. It

encourages a state of deep fossilization similar to Medusa viewing when viewed indirectly, such as through a camera or reflection.

Ghosts looking directly or indirectly at it only experience petrification, as they cannot die twice. The antidote only touches on the deadly effects of basilisk poison liquid and is a cure for Phoenix Tear. Spiders are the lifelong enemy of the Basilisks, so they can run away from spiders. The next enemy for the basilisk is the crowing of a rooster because the sounds kill the basilisk and the weasel, whose scent also kills the basilisk.

The next important wild character in the Harry Potter wizardry world is Boggart. Boggart is an immortal shape-shifting non-being character and the worst horror of a target victim in the Harry Potter wizardry world in the universe. While British tradition evil creatures live in bogs or isolated places with wet surfaces. Rowling's bogs are more than magical creatures of characters of Scottish origin to define the dark world. Boggart can appear in different forms and enter into the animal's soul with can change it into a more terrifying creature. Boggarts prefer to hide in enclosed dark spaces such as cupboards and closets. It is not known what form the bastard takes. In Harry Potter and the Order of the Phoenix, Mad-Eye Moody uses his magic eye to discover that there is a swamp on the table in the living room.

In Harry Potter and the Prisoner of Azkaban, Remus Lupine in his Defense Against the Dark Arts class instructs students to approach the swamps in groups of different deadly creatures. In the Harry Potter wizardry world, the dementors played a vital role to scare the muggles and safeguard the school; from the death eaters. Dementors play good and safeguard the Hogwarts School of witchcraft and wizardry. The "Dementor's Kiss" is the pinnacle of their power to where the Dementor grabs the victim's lips and swallows their soul or psyche, presumably to render them permanently unconscious and without memories and emotions. Muggles cannot see Dementors but they still suffer due to the dark world.

Dementors attack the trouble distinguishing between humans, despite their connection to emotions. For example, Barty Crouch Jr. escaped from Azkaban, where they were unable to emotionally separate from the younger Crouch and his mother from the wizardry world. Their sensitivity to understanding the feelings

and less acute. The Animagus Sirius Black transforms into a dog and escapes from Azkaban from the eyes of dementors. When the Dementors are used to protect Hogwarts from Sirius Black, who is considered a criminal in the wizardry world. Harry first meets Sirius Black in his third year of schooling. They are a constant reminder that Harry's parents were murdered by Voldemort, with the help of Sirius Black. In The Order of the Phoenix, two Dementors are sent to kill Harry, but Harry chases them with a patron when they almost kill Harry's cousin Dudley Dursley. It is later revealed by the minister that the evil action made by Fudge's corrupt secretary, Dolores Umbridge, may have been a Death Eater. Towards the end of the book, the dementors of Azkaban revolt against their masters to become monsters and join forces with dark lord Voldemort, who gives them almost unlimited access to their victims.

In Deathly Hallows, dark lord Voldemort's Ministry sends dementors to punish muggle-borns to keep away from the wizardry world. The Dementors were also on the side of Voldemort to create problems for muggles in the Battle of Hogwarts. The Dementors are sent out from Azkaban after Kingsley Shacklebolt is appointed Minister of Magic and the Ministry manages to contain them by limiting their population. After an episode in which Rowling, in her own words, "was clinically sad," she invented the Dementors as both positive and negative characters.

The ghosts play a significant supporting role in the school and mostly act as advisors to the heroic characters. These ghosts are not as scary or terrifying as the spirits of a traditional ghost story. In novels, ghosts are silver, transparent, and support good hearted people. They magical power to affect the living world and can fly and pass through walls, tables, and other solid objects to see everyone in the magical world. For example, Moaning Myrtle tends to spray water in the toilet. The ghosts enhance the taste and smell of decaying food. Therefore their banquet tables are full of rotten food. When you touch or walk through a ghost, it feels "like walking through an ice shower." Magic and curses can affect ghosts, but not to the same extent as living creatures.

CONCLUSION

Only witches and wizards have the ability to become ghosts in the Harry Potter universe. "The reins can leave their mark on the earth, walk pale where their living

selves once went”. Many ghosts complain that they cannot eat despite choosing this afterlife, and many are characterized as depressing. In addition, they attract dark and unhealthy images. Happiness and sanity, are described as “soulless creatures” and “among the filthiest things on earth.

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LOW POWER VLSI DESIGN AND FPGA IMPLEMENTATION OF VARIOUS MULTIPLIERS

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ABSTRACT

The vital role that function multipliers play in many different applications, including digital signal processing. The architecture of arithmetic multipliers must constantly change to achieve better performance. Technology development has led to the creation of a number of high-speed, low-power, and compact multipliers. The Array, Wallace Tree, and Booth multipliers, in addition to Binary and Vedic multipliers, are all compared in this work. Moreover, we created various VLSI architecture of multipliers in Verilog on the Vivado 2022.2 with the purpose of introducing novices working on VLSI architecture design about these technologies. The Artix-7 XC7A200T-2FBG676C FPGA board, which has the relevant multipliers, was used to evaluate our design. Overall, the implemented multiplier designs obtain better result than existing designs in terms of power and device utilization. Simulation and RTL synthesis results are clearly shown in this paper which could be helpful for researchers to perform the critical analysis of the related designs.

Keywords : Wallace Tree, Binary, Array, Vedic, Power, Delay, Unsigned, Booth

INTRODUCTION

Low power VLSI circuit design and optimisation have become crucial because to the demand for high performance, mobility, and prolonged battery life. When more computations are needed, the action of multiplication is widely utilised in signal and video processing applications. On the other hand, multiplication processes frequently take longer to complete and demand more space and hardware. Hence, minimising critical route delays is essential. Furthermore, with the adders employed in the multiplier design, the propagation delay of the data inputs strongly relies on the travel delay of the carry signal. To accomplish their objectives, designers must pay particular attention to these elements. These factors generally have an impact on the cost and performance of digital signal processors [6,7].

CHARACTERISTICS OF USING MULTIPLIERS

Modern processors contain arithmetic logic units (ALUs) with multipliers constructed using adders. To perform multiplication, shift and add operations are employed in multiplier circuits such as those depicted in Figure 1.1. The approach involves generating partially multiplied products for each bit of the multiplier, starting from the least significant bit. The first partial product is created by the least significant bit of the multiplier, and subsequent bits follow in order. Partial products generated when the multiplier bit is set to one often contain an exact copy of the multiplicand, while partial products generated when it is set to zero contain only zeros. After creation, bit [9] is left-shifted on each partial product.

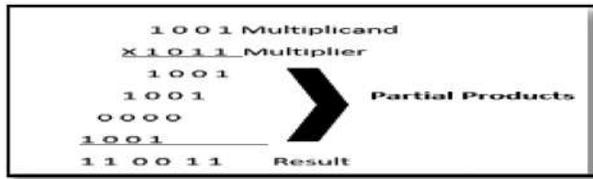


Fig. 1. Algorithm of shift and addition

High-performance computing fundamentally has to be able to add and multiply binary values. According to reports in the literature, multiplication and addition-required instructions are frequently used by DSP-based algorithms and other processors, which causes slow calculation times. High performance multipliers are therefore more in demand right now. Once more, low power multipliers constitute a design problem. Hence, dynamic power must be decreased for any circuit to have low power consumption since it has the greatest impact on overall power. This may be decreased by reducing the number of processes through circuit optimization. A good multiplier should be able to deliver a unit with high speed and low power consumption while being tightly packed [1].

DIFFERENT TYPES OF MULTIPLIERS

Here, five distinct multipliers are explained and contrasted: -

- A. Wallace Tree Multiplier.
- B. Booth Multiplier.
- C. 3.Vedic Multiplier
- D. Array Multiplier.
- E. Binary Multiplier

Wallace Tree Multiplier

An effective hardware implementation of a digital circuit that multiplies two integers is a Wallace tree multiplier.

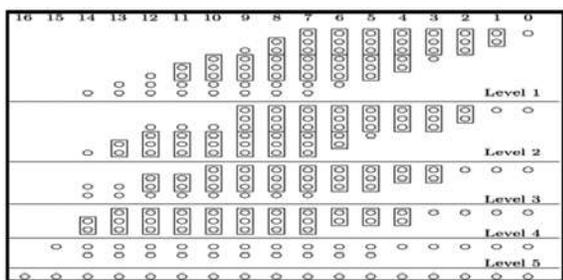


Fig. 2. Method of Wallace Tree Multiplier Multiplication

Three steps are taken by Wallace tree:-

1. We multiply each and every bit of the multiplier by the bits of the multiplicand in the exact same order. It is also known that the weights of the resulting partial products vary depending on the location of the multiplier bits.
2. We cut the number of partial products by two utilising layers of full and half adders. In this instance, we see that we receive two rows of sum and carry.

Then, using standard adders, the rows are appended.

Here is an explanation of the second step: - A subsequent layer is created if there are three or more rows of the same weight:

1. We use any one of the three rows with a comparable weight as input for a complete adder. A row of output with the same weight, or the total, and a row of output with a greater weight value for each of the three carries are the outcomes.
2. If there are two rows with the same weight, a half adder uses them as input.

If there is only one row left, it is linked to the following tier [8].

The Wallace tree is advantageous since there are only $O(\log n)$ reduction layers (levels) and each layer has an O propagation delay (1). While constructing partial products, the propagation delay of addition is $O(1)$, and when adding everything together, it is $O(\log n)$. There is simply an O delay in the multiplication ($\log n$). To add the partial products, regular adders with a propagation delay of $O(\log n^2)$ are required [4].

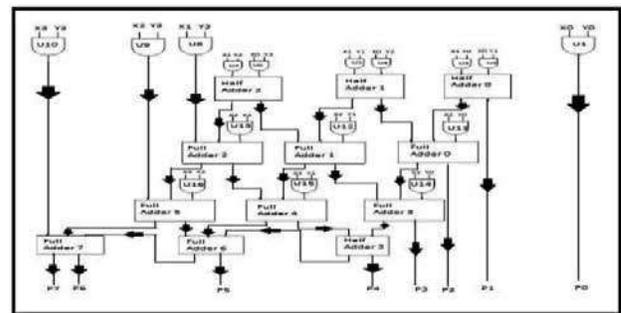


Fig. 3. Architecture of Wallace Tree Multiplier [4]

The following describes how Wallace Tree Multiplier is implemented in Vivado ML 2022.2: -

RTL View

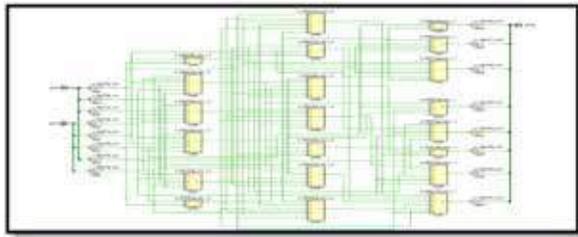


Fig. 4. RTL Schematic for the Wallace Tree Multiplier

Simulation Result



Fig. 5. Simulation of Wallace Tree multiplier

Utilization Summary of Device

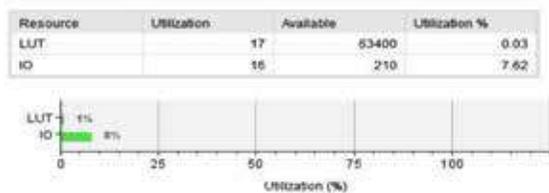


Fig. 6. Device Utilization Summary of Wallace Tree multiplier

Booth Multiplier

The Booth multiplication method is used to multiply binary numbers in signed 2's complement form. Let's say there are two binary integers, X and Y, with p and q bits each (p and q are the same) [7].

Step 1 Building a booth table In the booth table, there are four columns: one for the multiplier, one for the previous first LSB of the multiplier, and two more (U and V) for the accumulator of the partial product (P).

1. The two values are used as the multiplicand (Y) and multiplier (X). The multiplicand (Y complement)'s 2, is finished.

2. The table is loaded with the value of X. The value 0 is loaded for X-1.0 is fed into U and V, which will, at the conclusion of the process, have the result of X & Y. When the p and q bits numbers are multiplied, "q" rows are created for each cycle.

Booth algorithm, Step 2: For the Booth method, the multiplier bits must be examined, and the partial product

must be shifted (P). The multiplicand is either added to P before shifting, removed from P before shifting, or left unchanged: -

X_i	X_{i-1}	
0	0	Shift only
1	1	Shift only
0	1	Add Y to U and shift
1	0	Minus Y from U and shift

Fig. 7. Booth Procedure

ii) U and V are combined and shifted using the arithmetic right shift method, which keeps the sign bit of the 2's complement integer intact.

iii) X is right-circularly shifted since doing otherwise would require utilising two registers to store the X value. The same actions are repeated until n cycles have been completed. We ultimately arrive at the result of X and Y [6].

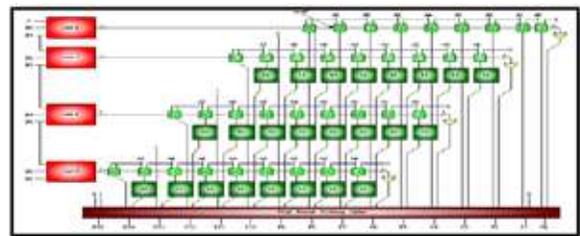


Fig. 8. Booth Multiplier Circuit Diagram

The following describes how Booth Multiplier is implemented in Vivado ML 2022.2: -

RTL View

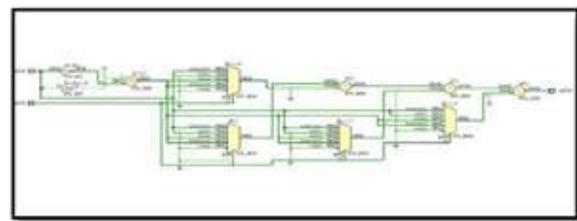


Fig. 9. RTL View of Booth Multiplier

Simulation Result



Fig. 10. Simulation of Booth Multiplier

Device Utilization Summary

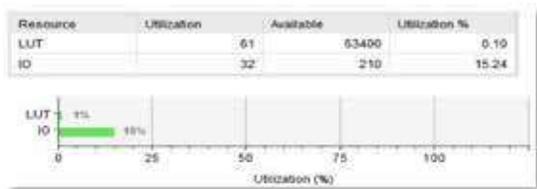


Fig. 11. Device Utilization Summary of Booth Multiplier Vedic Multiplier

A Vedic multiplier is commonly implemented in VLSI design as a combinational logic circuit that accepts two n -bit binary values as inputs and generates an output of $(n \times 2)$ bits. Its fundamental operation entails employing crosswise and vertical multiplication to divide the multiplication into simpler operations. The transverse approach entails multiplying pairs of digits and taking their sums to get partial products, whereas the vertical method entails multiplying each digit of one number with all the digits of the other number.

The procedures for creating a Vedic multiplier in VLSI are as follows:

1. Use the Vedic mathematics methods of vertical and transverse multiplication to divide the two input integers into smaller sub-numbers. Each digit of one input number should be multiplied by all the digits of the second input number using the vertical approach, and the resulting partial products should be saved in an array.
2. To create more partial products, multiply two digit pairs using the crosswise approach, add the resulting sums, and then add the new partial products to the array's already-existing partial products. To create the whole product, put the array's component products together using a tree of adders.. Use combinational logic, such as AND gates and adders, to implement the Vedic multiplier circuit.
3. Use strategies like pipelining, parallel processing, and a decrease in the quantity of produced incomplete products to optimise the design of the Vedic multiplier. To confirm that the Vedic multiplier circuit yields accurate outputs for a range of input values, test it using simulation or other testing techniques.
4. Improve the performance and power consumption of the Vedic multiplier circuit. Hardware testing and validation should be used to confirm the Vedic multiplier

circuit's operation. If necessary, include the Vedic multiplier into larger digital systems, such as circuits for digital signal processing or picture processing.

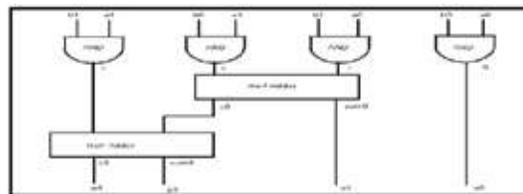


Fig. 12. Vedic Multiplier

The following describes how Vedic Multiplier is implemented in Vivado ML 2022.2 :-

RTL View

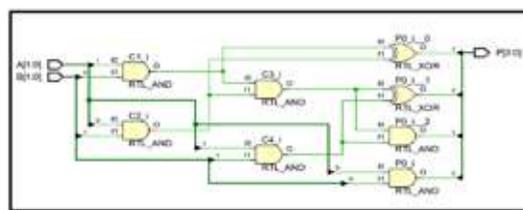


Fig. 13. RTL Diagram of Vedic Multiplier

Simulation Result



Fig.14. Simulation of Vedic Multiplier

Device Utilization Summary

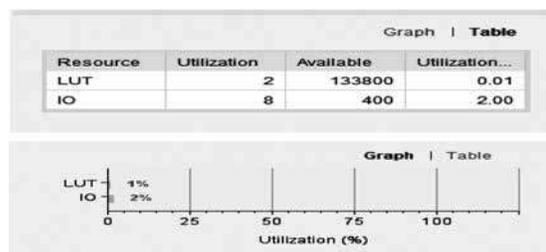


Fig. 15. Device Utilization Summary of Vedic Multiplier Array Multiplier

Fig. 1.12 depicts the construction of an array multiplier. The architecture's component building parts are eerily similar to the multiplication process used with paper and pencil. $N \times M$ two-bit AND gates and $N - 1$ M -bit adders are needed for a $N \times M$ array. The vast bulk of the space is needed for this partial product creation. By routing the entire design using wire, the partial products shifting is accomplished [3].

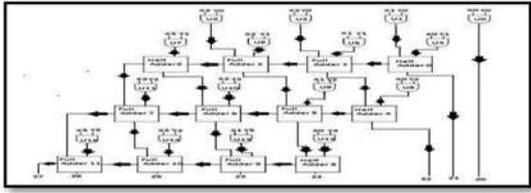


Fig.16. Array Multiplier

The following describes how Array Multiplier is implemented in Vivado ML 2022.2 : -

RTL View

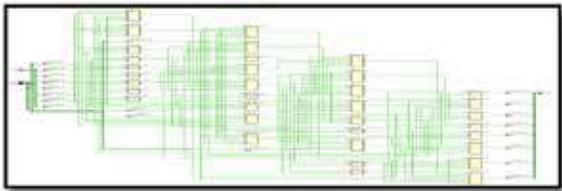


Fig. 17. RTL View of Array Multiplier

Simulation Result



Fig.18. Testbench Waveform of Array Multiplier

Device Utilization Summary



Fig. 19. Device Utilization Summary of Array Multiplier

Binary Multiplier

A digital circuit known as a binary multiplier multiplies two binary values. A binary multiplier is commonly implemented as a combinational logic circuit in VLSI design, taking two n-bit binary integers as inputs and producing an output that is (n*2) bits long. Each bit of one number is multiplied by all the bits of the other number in a binary multiplier's fundamental operation, and the resulting partial products are then added. The bits may be multiplied in this way using AND gates, and the partial products can be added using complete adders. The procedures for creating a binary multiplier in VLSI are as follows: -

1. Create the circuit for the single full-adder that will combine the partial products. Design a multiplier module that accepts two n-bit values as inputs and outputs a (n*2)-bit product.

Resource	Utilization	Available	Utilization...
LUT	2	133800	0.01
IO	8	400	2.00

Fig. 20. Binary Multiplier

2. Create n copies of the second input number and divide the first input number into its component bits. Use multiplexers or selectors to connect the first input bits to the proper inputs of the second input copy.
3. Using AND gates, multiply each bit from the first input by all the copies of the bits from the second input. Use shift registers or shift left operations to apply the necessary number of bits of left shift to each partial product. Beginning with the rightmost piece, combine all of the partial products using the full-adders. Join the multiplier's output to the output of the full-adders.
4. To guarantee that the multiplier circuit gives accurate results for a range of input values, test it using simulation or other testing techniques. Depending on the situation, optimise the circuit design to increase performance, decrease power consumption, or satisfy other design criteria.

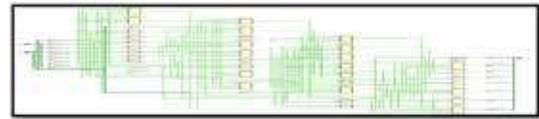


Fig. 21. RTL View of Binary Multiplier

The following describes how Binary Multiplier is implemented in Vivado ML 2022.2 : -

RTL View

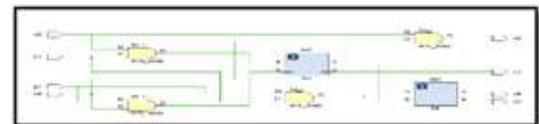


Fig. 22. Simulation of Binary Multiplier

Simulation Result

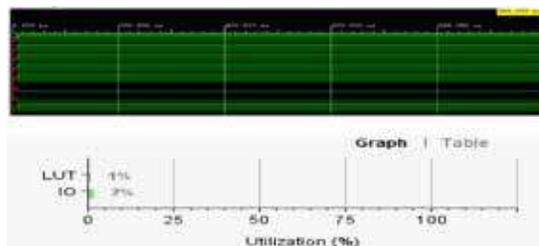


Fig. 23. Device Utilization Summary of Binary Multiplier

Device Utilization Summary

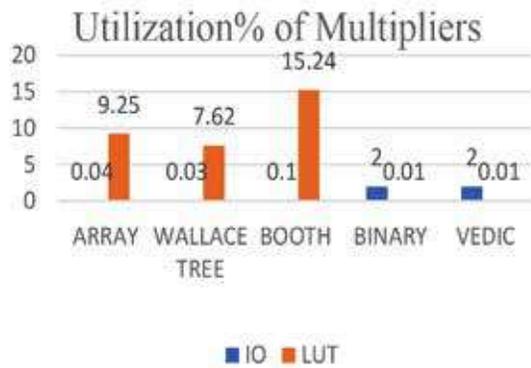


Fig. 24. Usage % Comparison of Several Multipliers

COMPARATIVE ANALYSIS OF VARIOUS MULTIPLIERS

The comparison shows that the static power of the array multiplier, which only enables unsigned binary multiplication, is 0.122 W, whereas the dynamic power is 5.458 W. Binary numbers can be multiplied in two different ways: unsigned and signed, respectively, using the Wallace-Tree and Booth multipliers. The Wallace-Tree multiplier's dynamic power consumption is 3.898 W, compared to its static power consumption of 0.109 W. The Booth multiplier, on the other hand, uses 0.296 W of static power while using 13.722 W of dynamic power.

The Vedic multiplier, which can also multiply signed binary integers, uses 0.133 W of static power and 0.975 W of dynamic power. The Vedic multiplier's static and dynamic power consumption is matched by the binary multiplier, another multiplier that can multiply signed binary values.

Table 1. Comparison of Different Multipliers

Multipliers	Static Power Consumption (in watt)	Dynamic Power Consumption (in watt)	Delay (in ns)
Array	0.122	5.458	7.888
Vedic	0.133	14.975	12.89
Wallace-Tree	0.109	3.898	7.02
Booth	0.296	13.722	9.118
Binary	0.133	0.975	-

Table 2. Total Power Consumption of Multipliers

Multipliers	Power Consumption (in watt)	Proposed Design Power Consumption (in watt)
Array	5.980 [10]	5.580
Vedic	18.627 [22]	15.108
Wallace- Tree	4.987 [13]	4.007
Booth	16.021 [25]	14.018
Binary	-	1.108

CONCLUSION

From the above observation, the Binary and Wallace-Tree multiplier uses less power and is quicker than the Array multiplier for unsigned binary multiplication. Binary and Wallace- Tree hence occupies less space than an array multiplier in the microprocessor's ALU. The signed binary multiplication is performed for the Booth multiplier, and we can compare it to other publications on the Booth multiplier and find that it is a quicker multiplier.

An alternative approach to the Array Wallace- Tree multiplier is the Vedic or Booth multiplier. Wallace-Tree multiplier has fewer adders than Array multiplier [9, 10], as comparison to Array multiplier. For the binary multiplication 4X4, the Booth multiplier generated four partial products, but the Array and Wallace-Tree multipliers produced sixteen (16).

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EXTRACTION OF CELLULOSE FROM HYBRID BIOMASS AND DEVELOPMENT OF BIOCOMPOSITE FILM WITH IMPROVED PROPERTIES

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ABSTRACT

The growing concern regarding the use of petroleum based composites due to their non-biodegradability and non-renewability can suitably be addressed by Biopolymer based composites and blends. But, biopolymer-based materials have relatively poor mechanical and barrier properties which can be overcome by the addition of two or more polymers. In this regard, chitosan-based film by solvent casting method with incorporation of MCCs derived from the hybrid biomass and the AgNps from guava leaves are extensively explored for their improved mechanical, barrier and antimicrobial activities. After including 5% MCCs, their tensile strength increased by 30% and their water vapour permeability increased by 44%. AgNps were revealed to be responsible for a 14 mm and 13 mm inhibitory zone against *E. coli* and *Bacillus cereus*, respectively. The inclusion of MCCs and AgNps increased the mechanical characteristics and antibacterial activity of the biocomposite films.

Keywords : Biocomposite film; Hybrid Biomass; Improved Tensile Strength; MCC

INTRODUCTION

Carbon-based polymers generated from petroleum, like plastics, are widely used for packaging across the world due to their versatility and flexibility. Because of their low production costs and resistance to environmental degradation, plastics have replaced more expensive materials like metals, woods, and glasses. This petrochemical-based product is currently being utilized in almost every conceivable setting due to the rapid expansion of plastics-based industries.

Much of the daily garbage load may be attributed to food packaging. Some of the components of this trash aren't biodegradable and won't be metabolized for hundreds or thousands of years. 2016, Pan et al. In addition, petroleum is a non renewable fossil fuel from

which most polymers are first generated. We need to find replacements for fossil fuels since their supply is limited and their use is raising mounting environmental concerns.

Much work has gone into producing sustainable degradable materials for use in a variety of industrial applications because to their renewability, biodegradability, low cost, nonpetroleum based source, low carbon dioxide emission, and ecologically acceptable packaging. Agricultural wastes have been proposed as a low-cost and sustainable substrate option that might help overcome these limitations. A lot of people are interested in using natural fibers made from agricultural wastes as reinforcements for polymers and composites since they are inexpensive and easy to get. The functional properties of chitosan-based composites

were improved when reinforced with crystalline cellulose, as reported by HPS et al., 2016. The goal of this study is to create a green manufacturing process for a nano bio composite film including silver nanoparticles. The mechanical properties and antimicrobial activity of chitosan films may be improved by the addition of fillers such as crystalline cellulose from hybrid biomass and green generated silver nanoparticles.

MATERIALS AND METHODS

Materials

The young *Pisidium guajava* (Guava) leaves used here were harvested at the Anna University campus garden in Chennai-25, Tamil Nadu, India. Hybrid biomass has been utilized to produce microcrystalline cellulose (MCC) (Kalpana and Perarasu, 2020). Powdered bacterial growth media such as Mueller Hinton and Agar-Agar. High-purity AgNO_3 (99.5%) for use in silver nanoparticle production. The chitosan used in the bio composite film was purchased from SRL Chemicals in Mumbai, India (high molecular weight, 310000-375000 Da, 75-85% deacetylated). Chitosan's solubility and film-forming capabilities are affected by its deacetylation grade and molecular weight. All of the experiments were conducted using distilled water. All supplied reagents were of the purer analytical grade and were utilized directly without additional purification.

Methods

Synthesis of Silver Nanoparticles: Due to their cheap cost, availability, and potential medicinal utility, silver nanoparticles were synthesized from guava leaves (Geetha, 2017). The clean leaves were collected, washed thoroughly under running water to remove any leftover dirt or debris, and then air-dried. The leaves were shade-dried, ground into a powder, and then sieved using a 120-mesh mechanical sieve to eliminate any bigger particles. For the Soxhlet extraction, 10 grams of guava leaf powder (120 mesh) were placed in a thimble along with 500 ml of distilled water. The extraction process was carried out at temperatures between 70 and 800 degrees Celsius. The solvent in the thimble was extracted many times until it was colorless. After filtering, the extract went through a 10-minute centrifuge run at 25 °C and 10,000 rpm.

The collected supernatant serves as a reducing agent and capping agent during nanoparticle production. An Erlenmeyer flask containing 100 ml of distilled

water was used to make a stock solution of 0.1 M silver nitrate from 1.7 kilos of silver nitrate. To create silver nanoparticles, a (0.1M) stock solution was mixed with an extract of *Pisidium guajava* leaves at a volume ratio of 1:1. To wit: Sougandhi et al. (2018). The *Pisidium guajava* leaf extract was added to 10 ml of stock solution in a beaker using a micropipette, and the beaker's opening was covered with aluminum foil to prevent the extract from evaporating too quickly. To prevent photo-activation and encourage bio-reduction of silver nitrate at ambient temperature, this setup was incubated in a dark chamber. The transformation of the colorless solution into a brownish hue proved that Ag^+ had been reduced to Ag. In 2018, Basumatary et al. Fine powdered silver nanoparticles were produced by centrifuging the resulting dispersion, washing it many times with distilled water and ethanol, and drying it at room temperature. Fortuitously, Fortunati et al. After synthesis, further characterization was performed on the nano particles.

Biocomposite Film Preparation: The chitosan solution was prepared by slightly modifying the procedure given by Ronget. al., 2017. A solution of 2% acetic acid was prepared in a beaker with a volume of 100 mL. Using a magnetic stirrer/hot plate, we combined the acetic acid solution with 2 grams of chitosan powder. After the chitosan solution was stirred for 24 hours at room temperature, the residual particles were centrifuged for 10 minutes and filtered. The chitosan solution was kept in a refrigerator until it was time to use it.

At first, 80 ml of a previously produced chitosan solution was used in the solvent casting procedure to make a pure chitosan film. In contrast, silver nanoparticles (3% w/v) were dissolved in 10 mL of distilled water and agitated ultrasonically for 30 minutes to create a uniform solution. Then, we mixed up solutions of Micro Crystalline Cellulose (MCC) in distilled water at strengths of 1, 3, 5, and 7 percent. Microcrystalline cellulose (MCC) solutions were prepared using a conventional procedure, as reported by El Achabyet al. (2017). The MCC was derived from a hybrid biomass consisting of sugarcane bagasse and maize cob. The required volume of chitosan solution (20 ml) was transferred to a beaker.

The chitosan solution was then mixed with 20 ml of a silver nanoparticle solution containing 3 percent silver. The mixture was then whisked using a magnetic

stirrer. Finally, the MCC solution (1wt.%) was added while stirring constantly. When the biopolymers and nanoparticles were stirred together for 60 minutes at room temperature, they were well combined. Ashrafi et al. (2018) report that the solvents were allowed to evaporate over the course of 48 hours at room temperature after the bubble-free liquid was poured onto petri plates. Soaking the dry film sample in a sodium hydroxide solution of 1 weight percent for 1 hour neutralized the acetic acid. Nano bio composite films were formed after repeated washings in distilled water and air drying. 2019 A. et al. By altering the concentration of the MCC solution, a wide range of nano bio composite films was manufactured. The peeled films were kept in a container at room temperature and 75% relative humidity for 48 hours before being employed in the tests.

Characterization

UV-visible Spectroscopy Analysis: The manufactured silver nano particles were first characterized and verified using UV-Visible spectroscopic analysis. A high resolution spectrophotometer was used to scan it at 200 nm/min for processing.

Fourier Transform- infrared spectroscopy analysis: This method uses the frequency absorptions of infrared light to determine how well a sample material is able to transmit or reflect that energy. PerkinElmer's Spectrum Two infrared absorption spectrometer was used for vibration and structural testing of molecular bands. Spectra were taken from 4000-5000 cm⁻¹ with a 4 cm⁻¹ resolution and 64 scans per sample.

Scanning Electron Microscopy Analysis: We employed a 500x objective, a working distance of 11700 m, and an emission current of 70,000 nA to see gold-sputtered samples at an acceleration voltage of 5 kV.

Film Thickness: We used a slide clipper to estimate the thickness of the films by taking precise readings from several locations on the slides and averaging the results.

Film Transparency: Transparency was determined by inserting rectangular pieces of film in a cuvette and measuring their color at 550 nm using a colorimeter. The formula for determining film transparency was

$$T(\%) = \frac{T_r}{T_o} \times 100$$

To denote the light intensity without the film specimen and T_r to indicate the light intensity with it. Triplicate readings are taken for every parameter.

Water Absorption Test: The film was measured and weighed after being cut into 2 cm by 2 cm squares. For 24 hours, we submerged every composite sample in room temperature distilled water. After removing the samples, they are left out for an hour to dry in the air before being weighed. The overall mass was referred to as the "final weight." The ensuing calculation was based on the mean of the weights from those five sets. The equilibrium swelling property of the films due to moisture absorption (Me) was calculated as a percentage increase in weight using the following equation: $Me = \frac{W_f - W_i}{W_i} \times 100$

Where, W_i is the initial dry weight and W_f is the final weight of film.

Water Vapour Permeability: Permeability to water vapor was determined using a custom-made permeability cell and a gravimetric technique based on the "cup method" described in ASTM E96. Distilled water was placed in a wide-mouthed cup with a top enabling an area of 5•10³ m². The cup's opening was covered with film, and the whole thing was stored in a silica gel-filled desiccator at 20 degrees Celsius. For 5 days, weight was recorded every 24 hours. Linear regression was used to determine the incline of the weight vs time del plot ($r^2 > 0.99$). The WVTR was determined by dividing the slope (in g/s) by the area of the test (in m²). The water vapor permeability (WVP) was determined using Equation (1), which is based on the combined Fick and Henry equations for gas diffusion through films. $WVP = WVTR \times \frac{x}{\Delta P}$

Where x (m) is the film thickness and P (Pa) is the water vapor 166 pressure difference across the film. The water vapour pressure difference was set at 2339 Pa as the driving power. Each experiment was done three times.

Mechanical Properties of the Film: Using a Universal Testing Machine (model H5KT, with a 1KN load cell, Tiniusolsen, Horsham, USA), we determined the films' tensile strength (TS) and elongation at break (E_b). The thickness of the film was measured in five different locations using Mitutoyo Digimatic Indicators (Type ID-110E; Mitutoyo Manufacturing Co. Ltd., Tokyo, Japan). The samples were sliced using the ASTM D 638-99 standard procedure.

Antibacterial Assay: The film's antibacterial properties were evaluated utilizing the agar well diffusion technique. After the agar-agar (0.2 g) and Muller Hinton

agar (3.8 g) combination was prepared, it was incubated. *Bacillus cereus* and *Escherichia coli* were seeded onto incubation plates with the use of a sterile cotton swab, and the plates were covered with film. After that, the plates were sealed and incubated at 37 degrees Celsius for a full day. The “zone of inhibition” of the film of discs was checked after incubation on the plates. Zones of inhibition against *Escherichia coli* and *Bacillus cereus* were determined by measuring their size relative to the film disc and reporting the difference.

RESULTS AND DISCUSSION

UV-Vis Spectrum of Silver Nanoparticle

The optical absorbance spectra of silver nanoparticles produced at room temperature is shown in Fig.1. A sharp absorption peak at 407 nm was observed for the silver nanoparticle. The spectral absorption was in good agreement with published data, In the words of Sharmila et al.

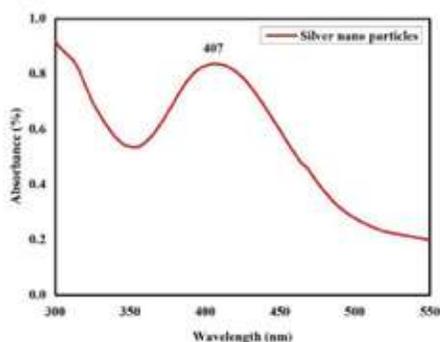


Fig. 1. UV-Vis spectrum of Silver nanoparticle

Fourier Transform-Infrared Spectroscopy Analysis

FTIR examination of silver nanoparticles corroborated the presence of functional groups and the dual action of plant extract as a capping and reducing agent, as shown in Fig. 2.

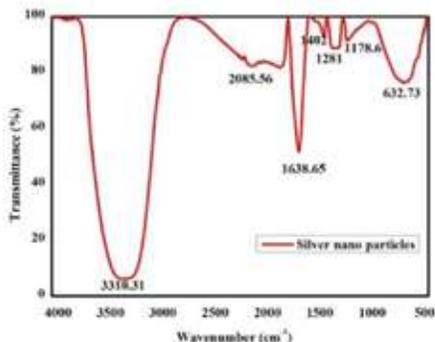


Fig.2. FTIR spectra of AgNPs

The O-H stretch can be seen at 3310.31 cm^{-1} , the -C=O stretch at 1638.65 cm^{-1} , the C-H alkenes stretch at 1402 cm^{-1} , the C-OC-linkages or CO bond stretch at 1281 cm^{-1} , the C-N amines stretch at 1178.6 cm^{-1} , and the C-H alkenes stretch at 632.73 cm^{-1} in the broad-band spectrum. The findings are consistent with those of Krithigaet.al. (2015). FTIR analysis confirmed that Ag^+ was reduced to Ag, indicating that organic compounds in the plant extract acted as a reducing/capping layer.

Scanning Electron Microscopy Analysis

Fig. 3 displays the results of scanning electron microscopy analysis of a dried and powdered sample of AgNPs.

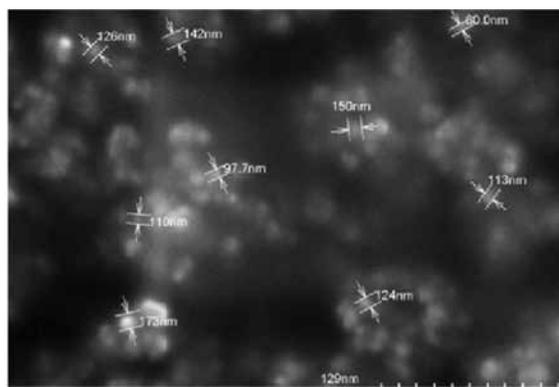


Fig. 3. Surface morphology of AgNPs

Figure 3 demonstrates the formation and aggregation of silver nanoparticles. According to the SEM examination, the particles are likewise nanosized, and their sizes are uneven and somewhat round, which is consistent with what was found in the literature.

Film thickness: Using a slide clipper, we measured the thickness of films made at several concentrations. Table 1 displays the measured thickness.

Table.1. Thickness of the Biocomposite film

Chitosan (2 grams) and AgNPs (3%)	
MCC (%)	Thickness (mm)
0	0.05
1	0.07
3	0.11
5	0.19
7	0.25
9	0.36

Film Transparency

Transparency of the film is crucial since it impacts the visual appeal of the packaged food. The colorimeter readings at 550 nm revealed that the pure chitosan film had a transparency of 85%, whereas the addition of AgNps and an increase in MCC concentration decreased this value, as shown in Fig. 4.

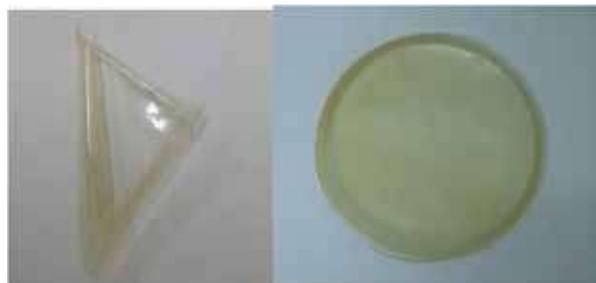


Fig. 4. Film Transparency (a) Pure Chitosan film; (b) MCC and AgNps incorporated film

Water Absorption Test

Antimicrobial films' sensitivity to water is a crucial factor in their widespread use. Figure 5 shows the relative water uptake of pure chitosan film and biocomposite films (doped with cellulose and Ag nanoparticles). Due to the partial dissolution of chitosan, the water uptake capacity of pure chitosan films and biocomposite films was determined (by immersion in water).

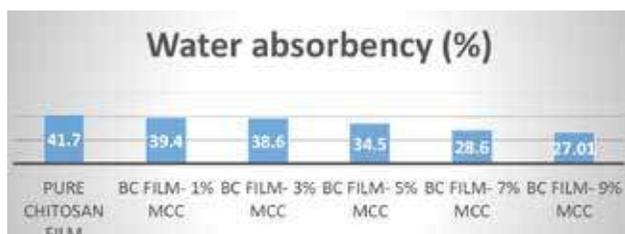


Fig. 5. Water absorbency (%)

The films' moisture absorption rates were measured. A pure chitosan film was found to have a water absorption capacity of 41.7%, according to the literature. Using chitosan films to reinforce MCC and AgNps led to a significant reduction in water absorption, down to 27.01%. Chitosan films were used to strengthen micro crystalline cellulose (MCC) of varying concentrations, and the films' decreased water absorbency showed that the MCCs improved the chitosan's resistance to moisture. The addition of chitosan and micro crystalline cellulose to the film has made it more water resistant, since both substances have been shown to form

hydrogen bonds with cellulose molecules, decreasing the latter's water absorbency (Romainet al., 2014). This research was published in 2011 by Bhuvaneshwarie et al. Therefore, it was concluded that including MCC into the chitosan film would be the most effective technique for enhancing water absorption.

Water Vapour Permeability

Permeability to water vapor was measured and shown in Fig. 6. Both the WVP of a biocomposite film and a pure chitosan film were determined.

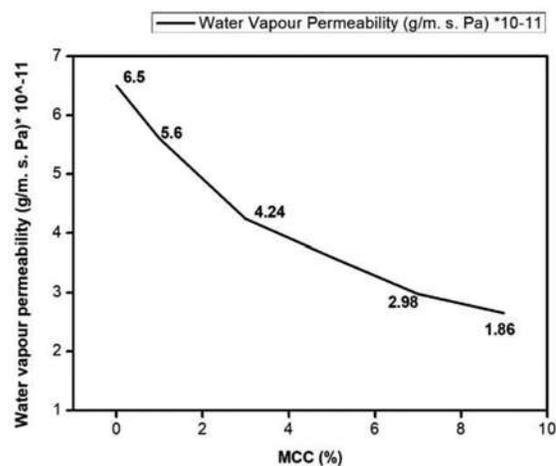


Fig.6. Water Vapour Permeability

It shows how MCCs may affect the WVP speed of chitosan films by providing an example using a film made entirely of the material. According to water absorbency data (Bhuvaneshwarie et al., 2011), it was discovered that the rate of WVP was reduced when the MCCs with increasing concentrations were added into the chitosan films. At 5% MCC, the WVP value is lowered to 44%, and the largest drop occurs between 3% and 7% MCC incorporation. This shows that MCCs' hydrophobic qualities provide some resistance to water vapor.

The permeability qualities of the cellulose were the primary driver of the WVP values found in the composite films. Pure chitosan has a higher WVP value than cellulose because its hydrophilic components are more permeable. Cellulose's permeability is determined by its degree of crystallinity; areas with a high degree of crystallinity are impenetrable to water molecules. A para-crystalline component (amorphous region) of cellulose makes it hydrophilic because it is easily accessible to water molecules. According to Cazonet. al.

(2018), the degree of crystallinity is also essential in the permeability behavior of films because water molecules prefer to diffuse via amorphous portions of the polymer matrix. As more and more MCC was inserted, a barrier was created against the passage of water vapor.

Mechanical Properties

Tensile Strength: Increasing the MCC loading from 1% to 9% w/w of the final dry weight of the film was demonstrated to enhance the tensile strength of chitosan-based films (Fig. 7). Films reinforced with 1, 3, 5, 7, and 9% MCC had tensile strengths (TS) of 87 MPa, 94 MPa, 99 MPa, and 98 MPa, respectively, compared to the 75 MPa shown by unreinforced chitosan films. These increases in TS percentage points are equivalent to a 16.25%, 32.25%, and 30.6% increase in TS above the normative sample, respectively. It finds determined that between 3% and 7% MCC loading is optimal for maximizing TS value before TS value levels out. The enhanced TS values in the biocomposite films may be attributed to two factors: the positive interactions between chitosan and MCC, and the reinforcing effect caused by effective stress transmission at the MCC-chitosan interface. High-TS biocomposite films might emerge from this process. Using the work of Khan et al., 2014.

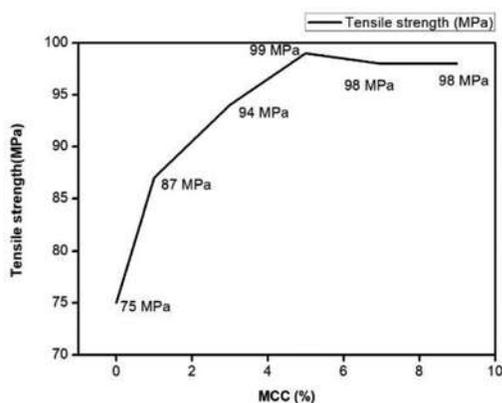


Fig.7. Tensile strength of the biocomposite film

The TS readings seem to plateau at about 7% MCC, indicating that adding additional MCC beyond this concentration has little effect on the TS. As the concentration of MCC particles reaches a certain point, they may start to aggregate, preventing any further enhancement of mechanical qualities. According to Yashaswini et al. (2019), the effects of this dryness on the quality of the films were not significant.

Elongation at Break: Figure 8 shows the percentage of Eb in biocomposite films as a function of the MCC content. The findings revealed that the Eb value changed from 8.58 percent for the pure chitosan film to 6.28 percent after adding 1, 3, 5, 7, and 9 percent MCC. The Eb levels tend to stabilize once 7% MCC is applied. When MCC was inserted into the chitosan film recipe, the Eb values dropped.

This decrease in Eb showed that the incorporation of MCC into the chitosan matrix would lead to strong interactions between the filler and the matrix, hence restricting the mobility of the matrix and lowering Eb. Using the work of Khan et al., 2014.

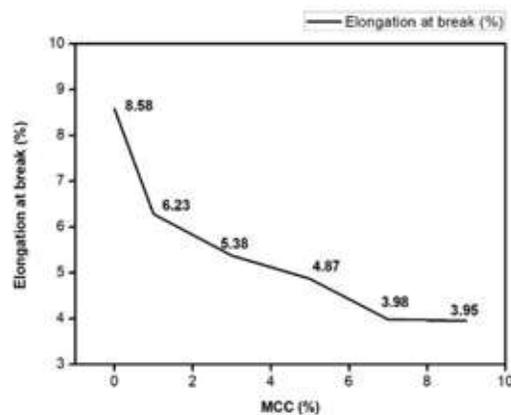


Fig. 8. Elongation at break (%)

Antibacterial Assay

The growth of *Escherichia coli* and *Bacillus cereus* was tested against the film samples. To compare the efficacy of pure chitosan film, purified water, and the biocomposite film to which AgNPs have been added, see Fig. 9.

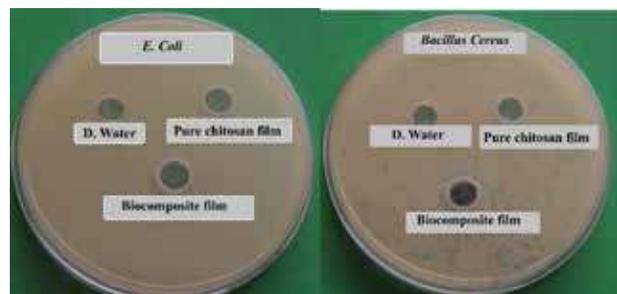


Fig. 9. Antibacterial assay of the films (a) on *E. Coli*; (b) on *Bacillus Cereus*

Antimicrobial activity against *E. coli* and *Bacillus cereus* is graphically shown in Fig. 9. In both situations, the biocomposite film's zone of clearance is maximized

by the addition of green-synthesised AgNps to the mix of chitosan and cellulose. Ahmed et al. (2016) found that biocomposite films had a larger clearing zone than films made entirely of chitosan. However, in the case of distilled water, there is no such clearing zone. This proves that AgNps inclusion has a major impact on bacterial growth invasion.

Table 2. Inhibition zone of biocomposite film

Bacteria Species	Distilled water	Pure chitosan film	Biocomposite film
E.Coli	Nil	10	14
Bacillus cereus	Nil	09	13

Thus, Table 2 shows the clear picture of the inhibition zone is maximum in presence of silver nanoparticle.

CONCLUSION

Micro crystalline cellulose (MCC) has been produced using a hybrid source derived from widely accessible agricultural wastes including sugarcane bagasse and maize cob. The usual approach was optimized for this purpose, and MCC was produced. After cellulose and AgNps were synthesized from guava leaves and put into chitosan film, the biocomposite film's properties were found to have improved using a number of different characterisation methods. Inhibition zones of 14 and 13 mm were seen against E. coli and Bacillus cereus, respectively, for AgNps produced by green synthesis, making them the most efficient antibacterial agent. Using just 3-7% MCC loading, the greatest results were achieved when reinforcing chitosan with MCC derived from hybrid biomass.

Due to the high crystalline structure of the MCC, its integration at a 5% level increases its tensile strength and decreases its WVP by 30% and 44%, respectively, as compared to pure chitosan film. When compared to pure chitosan film, MCC reinforcement significantly decreased Eb% and water absorbency. This demonstrates that pure chitosan film has significantly enhanced barrier characteristics and tensile strength.

Overall, owing to their high tensile strength, barrier, and antibacterial capabilities, MCC reinforced bio composite films are a promising contender in several industries, including the medical, textile, and food packaging sectors.

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A PROSPECTIVE NATURAL FOOD PRESERVATIVE FROM PISIDIUM GUAJAVA LEAF EXTRACT

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ABSTRACT

With the goal of finding alternatives to synthetic chemical additions in food, this research focused on using extracts from *Psidiumguajava* leaves as an antibacterial agent. The goal of this research is to see whether the leaf extract may be used to stop the spread of certain rotting bacteria in packaged foods. Several organic solvents were used to isolate the antibacterial compound. In comparison to the other solvents tested, the diethyl ether extract performed best against the microorganisms. The extract of *psidiumguajava* leaves demonstrated inhibitory effects, suggesting the plants might be used profitably in the manufacturing of natural food preservatives.

Keywords : Food preservative, Antibacterial agent, Chemical additives, P guajava leaves

INTRODUCTION

Globalization of the food economy poses serious risks to food safety and quality. Food poisoning and other unforeseen effects are common results of microbial contamination of food products. A universally accepted criterion for food quality requires that all foods (whether processed or raw) be safe to eat and devoid of harmful substances. Studies by Rennamohanka and colleagues. After health risks were brought to light, many people's opinions on foods preserved with synthetic preservatives changed. Therefore, powerful but safe natural preservatives are desperately needed. There is evidence of extensive research on naturally occurring antibacterial chemicals. Herbs and spices may be the best sources of antimicrobial agents. The 2011 Omaret al. The ideal food preservative would stop food from going bad due to bacteria without altering the taste, smell, or appearance of the meal. Because of its ability to delay decay, *Psidiumguajava* leaves are widely used across much of Asia for wrapping perishable produce.

Plants with relatively high levels of antibacterial activity may therefore provide a source for compounds that might be used to control the spread of food-borne illnesses. According to K. D. Sharma et al., the guava (*Psidiumguajava*) is considered a phytotherapeutic plant containing active components that help cure and manage a wide variety of illnesses in traditional medicine. Traditional medicine has employed the plants and their many components to cure a wide range of ailments, including but not limited to diabetes, hypertension, obesity, malaria, vomiting, diarrhoea, dysentery, wounds, ulcers, and toothache.

It was hypothesized in this research that the leaf extract would have antibacterial properties, therefore it might be used as a natural food preservative. Daniels et al. (2013) tested the efficacy of a complete extract of *P. guajava* leaves against the development of bacteria that might cause food poisoning and spoilage, including *Bacillus cereus*, *Pseudomonas*, *Staphylococcus aureus*, and *Escherichia coli*.

MATERIALS AND METHODS

Preparation of Plant Extract

The guava trees used for the samples were found in a garden in close proximity to Erode. To prepare for extraction in the lab, random samples of leaves were gathered and placed in labeled plastic zip lock bags.

The extraction method used on guava

- After washing the leaf samples in running water and letting them dry in the shade, they were crushed into a powder in a blender.
- Diethyl ether (>95%), methanol (>95%), ethanol (>99.55%), and distilled water (the least polar) were employed in a soxhlet extraction to get the leaves.



Fig.1. Soxhlet extraction of guava leaves

- A medium temperature of 40°C to 50°C was maintained throughout the extraction process, and the leaf powder was added to each of the solvents to produce a 50% concentration.
- To prevent evaporation and light damage, the extracts were packaged in aluminum foil and kept in a conical flask.



Fig. 2. Various solvents extracted from guava leaves

Phytochemical Analysis

In order to discover and screen for bioactive chemical components in the guava, Fredrick et al. (2013) conducted chemical assays on the extracts.

Test for Saponins

The extract was placed in a test tube and forcefully shaken. The existence of stable foam was taken to be evidence of the presence of saponins.



Fig. 3. Test for saponins

Test for phenols and Tannins

Two milliliters of FeCl₃ 2% solution was added to the extract. The presence of phenols and tannins was indicated by a blue-green or black hue.



Fig. 4. Test for phenols and tannins

Test for Terpenoids

The extract was diluted with 2 cc of chloroform. A total of 2 cc of concentrated sulfuric acid was added before the mixture was gently shaken. The interphase became a promising shade of reddish-brown, suggesting the presence of terpenoids.



Fig. 5. Test for Terpenoids

Test for Flavonoids

Magnesium ribbon pieces were added to the extract, and then powerful hydrochloric acid was added drop by drop. The presence of flavonoids is indicated by an orange, red, pink, or purple hue.



Fig. 6. Test for Flavonoids

Antibacterial Activity

The well-diffusion technique was used to determine antimicrobial susceptibility, as recommended by the National Committee for Clinical Laboratory Standards. It's Mueller, Hinton To examine the antibacterial properties of the plant extracts, agar and Agar-Agar were used as the substrate in petri dishes. A sterile borer (five millimeters in diameter, per Conte et al., 2007) was used to punch wells into the media before the bacteria were plated. Extra inoculums were extracted by dipping a sterile cotton swab into the solution, rotating it several times, and then pressing it firmly against the inner wall of the tube above the fluid level. The inoculum was distributed uniformly by first swabbing the outside edge of the agar plate and then turning it such that the streaks covered the whole surface. For three to five minutes, the dishes are dried in the open air. Writers: Anand yadav and co. We used three plates with the same extract to select for bacteria. After being labelled, the plates are warmed in an incubator at 37 degrees Celsius. We looked for inhibitory zones after incubating the plates for 24 hours. Distances between inhibitors were measured in millimeters.



Fig. 7. Antimicrobial activity of leaf extract

RESULTS AND DISCUSSION

A qualitative Phytochemical screening of the chemical components of guava extracts is shown in the following table. All four extracts were shown to possess functional substances in the lab testing. Table 1 reveals that methanol, ethanol, and diethyl ether were able to extract tannins, phenols, flavonoids, and terpenoids, but not saponins. The full range of phytochemicals was only found in distilled water.

Phytochemical Analysis

Table 1. Phytochemical constituents of *Pisidiumguajava* extracts

Extracts	saponins	phenols and tannins	terpenoids	flavonoids
Diethyl ether-	+	+	+	
Methanol	-	+	+	+
Ethanol	-	+	+	+
Distilled water	+	+	+	+

(+) positive: presence of constituent

(-) negative: absence of constituent

Plant extracts included phytochemicals, which have been demonstrated to have medicinal and physiological benefits.

Protein production in bacteria is stymied when polyphenolic tannins are present.

Plants generate flavonoids, hydroxylated polyphenolic compounds with antibacterial effect against a broad range of pathogens, in response to microbial infections.

The antimicrobial and fragrant characteristics of terpenoids have led to their widespread usage.

Saponins are a kind of glycoside that inhibit gram-positive bacteria growth.

Therefore, the findings obtained from antibacterial analysis may be at least partially attributable to the chemical components discovered in the methanol, ethanol, diethyl ether, and distilled water extracts, as shown by the phytochemical study.

Antibacterial Activity

For *Pisidiumguajava* leaves, the inhibitory zone width (in millimeters) varied from zero to nine and a quarter millimeters when extracted with various solvents (methanol, ethanol, diethyl ether, and distilled water). The average bactericidal activity of diethyl ether and

methanol extracts was 9.17 mm, whereas that of water extract was 0.00 mm.

Table 2. Zone of inhibition* (mm)

Plant extracts	B. cereus	Pseudomonas	S. aureus	E. coli	Mean
Diethyl ether	6.4 ± 0.5	14.2 ± 0.2	12.0 ± 0.2	4.1 ± 0.39.17	
Ethanol	6.1 ± 0.6	11.3 ± 0.4	13.2 ± 0.1	-7.65	
Methanol	8.27 ± 0.4	9.2 ± 0.5	12.3 ± 0.7	2.4 ± 0.1	8.04
Water	-	-	-	-	-

Inhibition zones are the mean including borer (5mm) diameter ± deviation.

(-) :no inhibitory activity

CONCLUSION

The identification of new, naturally generated antibacterial compounds has been made possible by the increased study of bio-preservation techniques for food systems. Extracts made using diethyl ether and methanol performed the best against bacteria. It has been suggested that the plant utilized in the study might provide a natural preservative that could be added to processed goods. Additional research on the toxicity of plant extracts in relation to standardization of dose is required before they may be promoted as nutraceutical foods.

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COMPARATIVE ANALYSIS OF NATURAL DYEING BY USING POLYESTER FABRIC WITH TWO DIFFERENT MORDANTS

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ABSTRACT

Due to people's eco-friendly mindset, the use of natural dyes has multiplied during the last few years. The purification of natural colouring materials obtained from the widely occurring plants "Punica Granatum" or pomegranate and the "Tagetes" or marigold flower is the focus of this endeavour. Granatonine, an alkaloid derived from N-methyl Granatonine, is the primary colour ingredient in pomegranate peel. Furthermore, the yellow to orange-red Marigold Flowers are a rich source of the carotenoid component lutein. In this research, the colours will be compared after being dyed in polyester fabric with various mordants, including alum and ferrous sulphate. Following tests for colour fastness and colour rubbing, we arrived at a conclusion.

Keywords : Natural dyes, Mordant, Polyester fabric

INTRODUCTION

Natural dyes have been used to colour textiles for thousands of years, dating back to the 12th to 11th millennia BC. They are derived from a variety of sources, including plant roots, insects, and marine snail secretions (Melo, 2009). Humanity was able to wear colour for centuries before synthetic dyes were developed, as evidenced by the artefacts that are on exhibit in museums throughout the world. Some natural dyes were still utilised in textile design today and even into the 20th century. The usage of natural colours did, however, drastically decrease with the invention of synthetic dyes in the middle of the 19th century. One of the plants' most significant uses is the production of dyes. Due to strict environmental regulations put in place by many nations in response to the harmful and allergic reactions linked to synthetic dyes, interest in the use of natural dyes has recently been developing quickly.

At the start of the twentieth century, natural dyes were essentially useless due to a noticeable decrease in the price of synthetic dyestuff. In most nations today, natural dyeing is only done as a handcraft and all commercial

dyeing is done using synthetic colours. The use of natural dyes has, however, once again attracted interest due to the widespread concern over the usage of eco-friendly and biodegradable products. A neutral bath, an acidic bath, or an alkaline bath can all be used for dyeing. There are numerous reports on the mordanting techniques used on various fibres, including cellulosic, protenic, and synthetic fibres, for natural dyeing. By using different mordants, one can create several shades of shads, such as black to brown, green to yellow to orange, etc. There are reports of henna, indigo, marigold, and other dyes being used to dye cotton and silk. Natural dyes are now again being used to colour textiles, which is generating interest. Contrarily, natural dyes are more compatible with the environment than synthetic dyes, show superior biodegradability, and are generally more environmentally benign.

Because the cost of manufacturing is extremely low and the cost of the raw materials is low, the method is economically viable. Regarding marigold, china rose, and bixa flowers, similar results were obtained. Natural dyes and colours originating from flora and wildlife are thought to be harmless due to their nontoxic, non-

carcinogenic, and biodegradable makeup. This plant species has long been used traditionally by several tribes in Arunachal Pradesh for the manufacture and extraction of colours using homegrown methods. It is often combined with other plants. In addition to the textile business, natural dyes are now sought after in the cosmetics, leather, food, and pharmaceutical industries. There are lots of raw resources available to us thanks to the abundant biodiversity in our land, but there must be a sustainable connection established between their cultivation, gathering, and applications. Natural dyes are used in the textile industry for a variety of tasks, including dyeing yarns that are later woven into cloth, carpet, or any other usable form; dyeing previously woven fabrics; block printing, in which the textile materials are printed using printing blocks; and Kalamkari, in which beautiful designs are created on the fabric using the “Kalam” or pen. Though it is improbable that all dyestuffs will one day be made exclusively from plants, the idea that some of our everyday colours may one day come from nature is intriguing and thrilling. The plant has a variety of therapeutic qualities. The most efficient fermentation agent utilised in Ayurvedic medications is flowers. Numerous studies showed that using a combination of mordants in varied ratios produces distinct colours and variable colour fastness results. The flowers are used extensively in India for dyeing silk and other fabrics on a big scale since they produce a lot of red, pink, brown, or flame-colored dye (depending on the fabric used) and have a high tannin content. Numerous natural dyes have weak to moderate light fastness, especially those made from flower components.

When several synthetic dyes and intermediates were no longer allowed to be produced in Western nations due to pollution issues, India was a significant supplier of herbal colours. Natural dyes can be obtained principally from four sources. DNA-based biotechnology for tissue or cell culturing - Anthraquinone derivatives are secondary metabolites produced by several fungus, including *Drechslera* and *Trichoderma*. The majority of natural dyes have little to no effect on cellulose or other textile fibres when used without a mordant. To establish an affinity between the fibre and the dye or the pigment molecules of natural colourant, the majority of natural dyes require a mordanting chemical (ideally metal salt or sufficiently coordinating complex building agents). These metallic salts combine with the fibres and dyes

to generate metal complexes as a mordant. Following mordanting, the metal salts tethered to the fibres draw the dye/organic pigment molecules to be anchored to the fibres and then form coordinating bonds to connect the dye molecules and the fibre complexes. Aluminium sulphate or other metallic mordants attached to any fibre react chemically with specific functional groups that are mordantable in natural dyes and bound by coordinated/covalent bonds, hydrogen bonds, and other interactional forces.

DYEING

In order to get a desired colour with appropriate colour fastness, dyes or pigments are applied to textile materials such as fibres, yarns, and fabrics during the dyeing process. A special solution combining colours and a specific chemical substance is typically used during dyeing. A dyeing process is the interaction of a dye with a fibre and the migration of the dye into the fiber’s interior. A dyeing procedure typically entails two steps: adsorption (where colours are transferred from an aqueous solution to the surface of the fibre), and diffusion (where colours are absorbed by the fibre).

TYPES OF FABRIC DYE USED IN INDUSTRY

- ❖ Fibre Reactive Dyes.
- ❖ Direct Dyes.
- ❖ Acid Dyes.
- ❖ All-Purpose Dyes.
- ❖ Natural Dyes.
- ❖ VAT Dyes.
- ❖ Disperse Dyes.
- ❖ Azoic Dyes.

FIRST COLOUR OF DYE

The first synthetic dye, mauve, was discovered serendipitously by William Henry Perkin in 1856. The discovery of mauveine started a surge in synthetic dyes and in organic chemistry in general.

pH OF DYE

The values range from 0-14. 7 means neutral, below 7 means more acidic, and above 7 means more alkaline. Every chemical reaction has an optimum pH in which they work best. As dyeing’s are types of chemical reactions, different dyeing requires different specific

pH.

METHODS OF DYEING BALE DYEING:

This is a low-cost method to dye cotton cloth.

- ❖ Batik Dyeing: This is one of the oldest forms known to man.
- ❖ Beam Dyeing: In this method the warp is dyed prior to weaving.
- ❖ Burl or speck Dyeing.
- ❖ Chain Dyeing.
- ❖ Cross Dyeing.
- ❖ Jig Dyeing.
- ❖ Piece Dyeing.

MORDANTS

The word “mordant” is derived from the present tense of the verb “mordre” (to bite) in French. Colours that are mordant ‘bite’ into the cloth. Another significant issue with natural dyeing is the requirement for mordant. The fact that most natural dyes’ molecular structures are not optimal for interacting with fibres gives rise to this necessity. Of course, they were not intended for this use by nature. Natural dyes frequently contain eight tiny molecules that are only a little soluble in water and resemble disperse pigments suited for dyeing synthetic fibres. Those with longer molecular chains resemble direct dyes somewhat.

Usually, hydrogen bonds and other weak interactions are used to link them to the fibres. In any case, natural dye sorption on fibres is often minimal and is thus associated with poor fastness. Sometimes, their sorption can be boosted by adding a neutral electrolyte to the bath, such as sodium chloride (NaCl) or Glauber’s salt Na₂SO₄, and notably by using mordants. In general, mordanting increases the dye-exhaustion to the fibres and produces a wide range of hues with wide shade variations and higher fastness qualities. Mordants are not the only metal salts, such as sulphates (magnesium, aluminium, zinc, copper, cobalt, nickel, manganese or stannous sulphate), chlorides (stannic, ferric, copper, zinc, aluminium chloride and even rhenium, neodymium or zirconium trichloride or oxychloride), nitrates (aluminium nitrate), but also various hydroxides (calcium hydroxide) and oxides (ferric or lanthanum oxide). Most commonly used mordants in natural dyeing are aluminium potassium. Mordants are

one of the reasons why we cannot say that dyeing with natural dyes is an eco-friendly technology; the improved stability and deeper colour of fabrics can be achieved mostly with their very high concentrations (up to 15 g/litre). Same as natural dyes, the mordanting salts do not have affinity to the fibres and therefore only a small part of them is bounded with fibres.

All the remnants are carried off by water after dyeing and final rinsing. In minute concentrations, several metals are essential micronutrients for the body, but in general, metals in soluble form (metal ions) act on the cell as 9 poisons. Depending on the dose, they inhibit enzyme activity, form deposits in the bones and tissues, form harmful structures by replacing some elements, such as lead replacing calcium in the bones, ions Cd⁺² displace Zn⁺² from native proteomic binding sites, resulting in the formation of a Cd-proteome, and an excess of iron, copper, or zinc has a prooxidant effect and increases oxidative stress via formation of harmful radicals or reactive oxygen species (ROS) molecules.

The hazardous form of free iron, which is primarily in the Fe⁺² state, combines with oxygen to create potent oxidants, which cause immediate damage to protein and DNA. When there is an iron overload, toxic free iron levels develop. Over time, iron exposure is linked to an increase in mortality, morbidity, diabetes risk, and cancer risk. Iron oxidation damage is mostly caused by the Fenton reaction, in which Fe⁺² reacts with H₂O₂ to form a hydroxyl radical. As a result, serious oxidative damage may develop when non-transferrin bound iron levels are high. A number of health issues, such as weariness, premenstrual syndrome, melancholy, anxiety, migraine headaches, allergies, childhood hyperactivity, and learning impairments are all attributed to copper ion poisoning. Because copper is a transition element like iron, it is poisonous when it is free.

This property has made copper and iron important players in a variety of enzyme reactions, including a number that produce high-energy molecules. The secret to life as we know it lies in this oxygen-hungry, high-energy, oxidative metabolism, but it has a price: the side-effect of ROS formation. These ROS have the potential to oxidise a wide variety of molecules, including proteins, lipids, DNA, and others, causing illnesses, inflammation, degeneration, and cancer as well as accelerating the ageing of cells and tissues. If ROS creation is too high, our ROS scavenging and

defence mechanisms may become overburdened. Let's review some of the factors that have contributed to the recent trend of reviving the art of natural dyeing: natural dyes should be non-toxic, safe, and environmentally beneficial. The advancement of natural textile dyeing must include modifications to conventional mordanting procedures and the choice of novel mordants to replace conventional heavy-metal ions.

PROPERTIES OF DYEING

A dye is a chemical substance that imparts colour when applied to a substrate.

The properties of dyes are based on the following factors:

- ❖ Shade (brightness or dullness) fastness requirements.
- ❖ Level dyeing properties.
- ❖ Ease of application.
- ❖ Dusting.
- ❖ Environmental concerns.

MATERIALS AND METHODS

The raw materials used in the natural process such as Pomegranate peels powdered and Marigolds flowers collected as shown in the figure. The methods employ the mordants alum and ferrous sulphate. The alum mordant solution can be made by taking 10 grams of alum, mixing it with 2 liters of water, and then combining the mixture. Similar to this, 10 grams of ferrous sulphate can be taken, combined with 2 liters of water, and used to create a mordant solution. Depending on the dye source, selected fibre, and desired outcomes, each mordant should be employed in the natural dyeing process. Alum and ferrous sulphate, a mordant used in natural dyes, enhances all natural dyes' light- and wash-fastness and maintains colour clarity.



Fig. 1. Pomegranate peels



Fig. 2. Marigold flower

Role of Dyeing in Alum

Alum is required to play its role as a chemical agent that permits a reaction to occur between the dye and the fabric when using natural dyes. It may be added to the dye source to influence it, but it does not serve as a colour source on its own. The fabric is impregnated with the mordant, and then during the dyeing process, the dye reacts with the mordants, forming a chemical bond and attaching it firmly to the fabric. The mordant and dye form a covalent chemical link involving a hydroxyl oxygen when it decides to accept the colour. Alum's involvement in textile dyeing can be added to the dye source to affect it, but it cannot produce colour on its own. After the fabric is impregnated with the mordant, the dye interacts with it during the dyeing process, creating a chemical bond that firmly attaches the mordant to the fabric. All-natural dyes perform better in terms of light and wash fastness and colour clarity when using an alum mordant.

Role of ferrous sulphate in the dyeing process

In this procedure, ferrous sulphate serves as a mordant and, when combined with other natural dyes, can intensify colour. Additionally, it serves as a reducing agent in some types of vats. It can be used as a variety of natural colours. Either by immersing the fabric in the mordant solution or adding it straight to the dye bath are options. When combined with other natural dyes, ferrous sulphate is used as a mordant, a colour changer, and to boost lightfastness. Additionally, it serves as a reducing agent in specific kinds of indigo vats.

METHODOLOGY

Extraction of Dye

Respective material was taken and poured into boiling water then kept in water and then kept in a water bath at the required temperature for about one hour to extract all

the color from them. The extracted process of different raw materials can be shown in the figure.



Fig. 3. Pomegranate peel and Marigold Flower Extraction



Fig. 4. Pomegranate peel And Marigold flower dye extract

Filtered

Soaking the Fabric with Mordants

The key step in getting materials ready for colour is mordanting. Soaking silk fabric in mordants for several hours or more. Without the addition of a fixative or mordant, natural colours will not stick to materials. In this method, the fabric is soaked in water that contains 10g of mordant and let to soak for more than 10 hours before being added to the extracted dye solution.

For Alum

“Fabric material can be taken and mixed with 10 grams of alum and immersed into a bowl or plastic bucket with tap water for a night. Stir until dissolved. After dissolving the bond formation takes between the mordant and fabric material. The sample was shown in the figure.



For Ferrous Sulphate

Similarly, the same fabric material was taken and mixed with ferrous sulphate and immersed into a bowl or plastic bucket with tap water for 3 hours. Stir until dissolved. After dissolving the bond formation takes between the mordant and fabric material. The sample was shown in the figure.



HEATING

After the soaking and mordanting process for 3 hours,

the fabric was taken out from the mordant solution. Then the fabric material was immersed in the dye-extracted solution. The dye-extracted solution with fabric material was heated for 1 hour at a moderate temperature with gentle stirring taking place every 1 minute.

WASHING

Cold Washing

Carefully remove the fabric from the dye and rinse in running water, starting with warm water and then making it cooler, until it runs clear.

Hot Washing

Set the water temperature to the hottest possible setting and a wash cycle of at least 30 minutes or longer. The longer the item is in the dye, the darker the color will be. Wearing rubber gloves, mix powder or well-shaken liquid dye with 4 cups of very hot water.

Detergent Washing

Detergent mixes with water to remove dirt from clothes. Water cannot remove dirt from the clothes. Detergent cleans by causing a chemical reaction with water to force dirt and debris out of clothing. Detergents work with water to loosen the dirt trapped in the material of clothing and clean them away. After washing, the sample was introduced to sunlight for drying.

MEASUREMENTS AND ANALYSIS TESTING

Fastness Property

Fastness qualities are the criterion for quality in dyeing. To determine colour fastness, many test procedures are presented. The fastness characteristics offer insight into the level of dyeing. The substrate type and mordant employed for dyestuff fixation have a significant impact on the fastness properties of natural dyes. In addition to the dye itself, a number of other elements, including water, chemicals, temperature, humidity, light, pre-treatments, post-treatments, dyestuff distribution in fibre, and dyestuff fixation, affect the fastness qualities. For the careful selection of materials and procedures in natural dyeing, special consideration must be given to the colour and fastness of natural dyes. Up to the turn of the twentieth century, natural dyes were still in use. Natural dyeing was at its height during the period, with exceptional fastness qualities; On the other hand, expertise in natural dyeing began to decline after the

development of synthetic dyes in the nineteenth century. The various fastness characteristics of dyes reveal the resistance of dyes to various external situations to which fabric containing dyes is subjected. The structure of the dyes, their exposure to the environment and fastness enhancers, as well as the kind of mordant used, all affect how fast the dyes are. To enhance the light and washing fastness, several natural post-treatment compounds need to be investigated.

Assessment of Color Fastness :

- Fastness to Washing
- Fastness to Rubbing

Fastness to Washing

The composite sample is treated in a water-shaking bath for 30 minutes at 50 or 52°C with a stock solution and required water. After testing for 30 minutes, the sample is taken away from the washing solution. The sample will be rinsed twice in cold distilled water and washed in running cold water for 10 minutes. Then the sample is squeezed carefully. Stitching is removed on two long sides and one short side. The sample is now dried at 60°C in a tumble dryer. The contrast between the treated and untreated sample is compared with the color change grey scale and the staining of adjacent fabric is compared with the staining scale in the color matching cabinet. Grey Scale Rating Change in Colour: 5-No change, 4-Slightly changed, 3-Noticeably changed, 2-Considerably changed, 1-Much changed Staining: 5-No staining, 4-Slightly stained, 3-Noticeably stained, 2-Considerably stained, 1-Much stained.

Fastness to Rubbing

The procedures for the determination of fastness to rubbing are specified in BS EN ISO 105-X12:2016. The tests involve rubbing the sample under the test with a dry rubbing cloth and a wet rubbing cloth. For this test an instrument called a crock meter is usually used, which rubs a finger, covered with cotton rubbing cloth, 10 times to and 10 times over the sample under test at a fixed pressure. Two fingers of different dimensions are used – for pile fabrics, a rectangular-shaped finger (19 × 25.4 mm) and a cylindrical-shaped finger 16 mm in diameter for other fabrics. The rubbing tests are carried out with dry and wet cotton rubbing cloths. The degree of staining of the two cotton rubbing cloths is assessed using the grey scale for staining.

There are two test methods for rubbing fastness:

1. ISO-105-X12
2. AATCC-08

In ISO-105-X12 the wet pickup of the rubbing cloth is 100%. While in AATCC-08 the wet Pickup of the rubbing cloth is 65%. We check to rub by Dry and Wet methods. In wet rubbing, we wet the rubbing cloth according to the test method and give a rating by comparing the Staining with the grayscale.

Similarly, for dry rubbing, we check the rubbing with a dry rubbing cloth and compare the staining with a gray scale for ratings. Colorfastness to rubbing is a main test that is always required for every colored fabric whether it is Printed or dyed.

Color fastness properties of natural dyeing:

Colorfastness is the resistance of a material to change in any of its color characteristics or extent of transfer of its colorants to adjacent white materials in touch or both for different environmental and use conditions or treatments like washing, dry cleaning, etc., or exposure to different agency heat, light, etc. Fading means changes in the color with or without loss of depth of shade for exposure to particular environment/agency/ treatments either by lightening or darkening the shades. Bleeding is the transfer of color to a secondary material in contact with accompanying white fiber material of similar/dissimilar nature. The color fastness is usually rated either by loss of depth of color/color change in the original sample or it is often expressed by staining scale meaning that the accompanying material gets tinted/ stained by the color of the original fabric when the accompanying white fabrics of similar/dissimilar nature are either in touch/ made to touch by some means of test procedure/protocol.



Pomegranate peels powder with ferrous sulphate.



Marigold flower with Alum



Marigold flower with Ferrous sulphate

The above samples are obtained from dyeing the Polyester fabrics.



Pomogranate peels powder with Alum.

Report For Colour Fastness

Colour Fastness To Washing: Test -1	Polyester Fabric - Pomegranate Peels Powder + Alum Mordant	Polyester Fabric – Pomegranate Peels Powder + Ferrous Sulphate Mordant
Change In Color	2-3	2
Staining On	.	.
Wool	4-5	4-5
Acrylic	4-5	4-5
Polyester	4-5	4-5
Nylon	4-5	4-5
Cotton	4-5	4-5
Acetate	4-5	4-5

Test Report For Rubbing

Colour Fastness To Rubbing	Polyester Fabric–Pomegranate Peels Powder + Alum Mordant	Polyester Fabric – Pomegranate Peels Powder + Ferrous Sulphate Mordant
Dry Rubbing (Staining)	4	4
Wet Rubbing (Staining)	3-4	3-4

Test Report For Colour Fastness

Colour Fastness To Washing Test - 2	Polyester Fabric – Marigold Flower + Alum Mordant	Polyester Fabric – Marigold Flower + Ferrous Sulphate Mordant
Change In Color	1-2	1-2
Staining On	.	.
Wool	4-5	4-5
Acrylic	4-5	4-5
Polyester	4-5	4-5
Nylon	4-5	4-5
Cotton	4-5	4-5
Acetate	4-5	4-5

Test Report For Rubbing

Colourfastness Rubbing	Polyester Fabric –Marigold Flower + Alum Mordant	Polyester Fabric – Marigold Flower + Ferrous Sulphate Mordant
DryRubbing (Staining)	4	4
Wet Rubbing (Staining)	3	3

CONCLUSION

Natural dyes offer a host of benefits for human use. Most significantly, they are better for the environment and our health. Natural dyes are biodegradable and disposing of them doesn't cause pollution. Renewable Natural dyes are obtained from renewable sources that can be harnessed without imposing harm to the environment. Natural dyes are non-toxic and eco-friendly. Attractive

colors can be obtained by mixing different dyestuff in the same dye bath. After the completion of one dye, the other can be mixed. Different dyestuff can be boiled separately and mixed in various proportions or they can be boiled together but mordanting is essential during or after dyeing. As the quality of the extract varies with the age, season, and other ecological conditions of the source, it is extremely difficult to standardize the

shades. When the Colour fastness to washing test was done Alum mordant was showing better results when compared to Ferrous sulfate mordant according to the grey scale rating report given by Sitra lab. And when the Colour fastness to rubbing test was done both of the mordants showed good results in both Dry Rubbing and Wet Rubbing. In conclusion, Alum mordant showed better results in both the test.

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MODELING AND SIMULATION OF SHUNT ACTIVE POWER FILTER FOR POWER QUALITY IMPROVEMENT IN MICROGRID

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ABSTRACT

Microgrids consist of various components including distributed energy resources like wind turbines, solar panels, and energy storage systems, as well as control systems and communication networks that let the microgrid run independently or in integration with the main grid. Numerous power quality problems might affect the reliability and effectiveness of microgrids as well as on the electrical equipment connected to them. Effective power quality monitoring and mitigation methods need to be employed to reduce the unfavorable effects of power quality issues in microgrids. Shunt Active Power Filter (SAPF) is one such measure. Effective mitigation of harmonics, Flexibility, and Real-time operation make SAPF a viable solution for power quality improvement in microgrids. In this study, power quality issues of the microgrid having a Photo Voltaic (PV) source and Wind turbine are examined and SAPF is applied to reduce the harmonics. Instantaneous Reactive Power theory and Hysteresis Current Controller are used to control SAPF. The proposed system is simulated in MATLAB Simulink and the attained results expressed the efficiency of the system.

Keywords : Shunt Active Power Filter, Microgrid, Power Quality, Instantaneous Reactive Power Theory

INTRODUCTION

In the near future, the electrical grid will be host to a huge number of micro-producers who use renewable energy sources to provide clean, environmentally friendly power. Utilizing renewable energy sources like solar, wind, biomass energy, etc. is important to meet the majority of the world's energy needs [1]. Photovoltaic energy and wind energy are significant sources in distributed energy sources. The group of distributed energy resources forms the Microgrid [2]. Microgrids are a new alternative source to develop

green energy scenarios and extending utility grid support [3]. Microgrids can function in an islanded or grid-connected mode, which allows them to connect or disconnect from the main power grid as necessary. This flexibility promotes the integration of renewable energy sources into the electrical grid and enables microgrids to deliver a reliable and stable power supply, particularly during emergencies or power outages. The ability to regulate and optimize the distribution of electricity dynamically makes microgrids often more efficient and robust than conventional power grids. As

a result, the cost of energy may be decreased, and the sustainability and reliability of the power grid will be enhanced. The purpose of power electronic devices is significant in integrating renewable energy sources with a grid. With the increasing usage of nonlinear loads in the industrial and residential sectors, harmonics are being injected into the grid [4]. Initially, passive filters are used for harmonics mitigation [5]. Because of the limitations of passive filters, Shunt Active Power Filters (SAPF) become the viable solution to mitigate the harmonics [6], [7]. The control strategy is important in SAPF as it decides its performance. The control strategy includes reference current generation which has a significant impact on the rating of the active filter and its compensation objectives. The Instantaneous Reactive Power theory plays an important role in the generation of the reference current for SAPF because it provides a framework for analyzing the instantaneous power flow in a power system and creating accurate reference current signals for compensating for harmonics and reactive power [8],[9]. This paper discusses the implementation of SAPF to improve power quality in microgrids having solar PV and wind energy as distributed resources. In this paper, Section 1 introduces this paper. Section 2, presents the modeling of Distributed Generation systems with wind and PV cells. Section 3, explains the shunt active power filter. Section 4 elaborates the simulation results and Section 5 concludes the obtained results.

SYSTEM ARCHITECTURE

Microgrid with solar PV and wind energy resources is connected with nonlinear loads as shown in Figure 1. The modeled PV cells are connected to a load through the DC to AC converter so that it supplies to AC load. To improve power quality, SAPF is connected to the grid at the point of common coupling (PCC).

Modelling of Wind Turbine

The wind generates kinetic energy as it passes through the rotor's blades. The energy obtained from the rotor is double that of the wind speed, so that the turbine must be designed to withstand storms [10],[11]. The output power produced by the wind turbine is given by Equation (1).

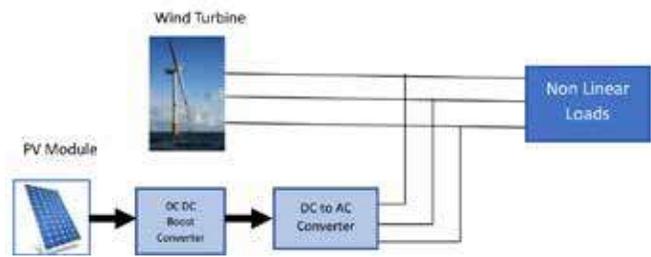


Fig. 1. Distributed generation system with nonlinear loads

$$P_0 = 0.5 P_c V_\omega^3 A \sigma \quad (1)$$

Where P_0 is the output power, V_ω gives the Velocity of the Wind, P_c denotes the Power coefficient, A is the rotor and σ is the density of air. Here, P_c is the kinetic energy obtained by the wind turbine.

The active power given in Equations (2) and (3) derives the electromagnetic torque developed in the wind turbine.

$$P_{em} = \frac{3}{2} \omega_e (\lambda_d i_q - \lambda_q i_d) \quad (2)$$

$$T_e = \frac{3P}{4} (\lambda_r i_q + (L_d - L_q) i_q i_d) \quad (3)$$

Modeling of Photo Voltaic Cell

An equivalent circuit model of a Photo Voltaic cell with a shunt connected diode to a constant current source and the shunt resistor is given in Figure 2 [12], [13]. Equation (4) presents output current of the Photo Voltaic cell (I_{pv}) and I_{lg} gives the light-generated current. Equation (5) represents the open circuit voltage (V_{oc}) of the Photo Voltaic cell having zero load current (I). I_d , diode current is given in Equation (6), and the shunt leakage current is given by I_{sh} .

$$I_{pv} = I_{lg} - I_d - I_{sh} \quad (4)$$

$$V_{OC} = V_t + IR_{se} \quad (5)$$

$$I_d = I_s \left(q \frac{V_{oc}}{\gamma_a \beta_z T} \right) - 1 \quad (6)$$

where V_t is the terminal voltage of the Photo Voltaic cell, R_{se} gives the series resistance, I_s represents the diode saturation current, γ_a is curve fitting constant, β_z is the Boltzmann constant, and T gives temperature in Kelvin.

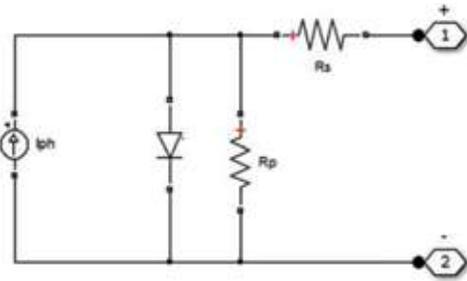


Fig. 2. Equivalent Circuit Model of PV Cell

SHUNT ACTIVE POWER FILTER

For compensating current harmonics, Shunt Active Power Filters are the preferred solution. Along with compensating for current harmonics, SAPF compensates for reactive power and balances unbalanced currents in the network [14]. SAPF is connected in parallel with the nonlinear loads. SAPF produces and injects current to compensate. The compensating current is equal but out of phase with the nonlinear loads' current harmonics. Because of the injected compensating current, the grid current becomes sinusoidal. Instantaneous Reactive Power Theory (IRP) [15], [16] is the preferred technique in the time domain for generating the reference current required for SAPF operation. Both in steady state and transient operation, it performs admirably. This theory also has the benefit of simple computations since only algebraic operations are needed. Figure 3. shows the calculations required for implementing Instantaneous Power Theory.

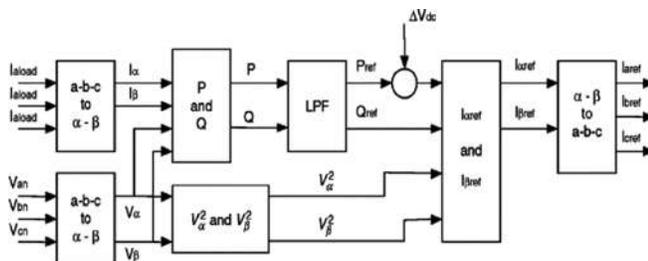


Figure 3. Instantaneous Power Theory calculations

Simulation Results

In MATLAB/Simulink, a microgrid is modeled utilizing PV cell and wind DG systems. System modeling, simulation, and analysis are done in the MATLAB/Simulink. The voltage and current waveforms are distorted when the system is coupled to non-linear loads. To reduce the current harmonics, the SAPF injects the compensating current. The current harmonics of the microgrid system having nonlinear loads without SAPF

and with SAPF are analyzed. The power factors are also compared. When the microgrid is linked to a nonlinear load, the Total Harmonics Distortion (THD) of current harmonics is 29.16%, which is significantly greater than the IEEE's mandated limit of harmonics. The power factor is less than 0.83. The current with harmonics and THD of the system when connected to nonlinear load is given in Figure 4. To compensate the current harmonics SAPF using Instantaneous Reactive Power Theory is implemented. The results show that current harmonics is reduced to 3.97% and is given in Figure 5. The power factor of the proposed system is improved to 0.97.

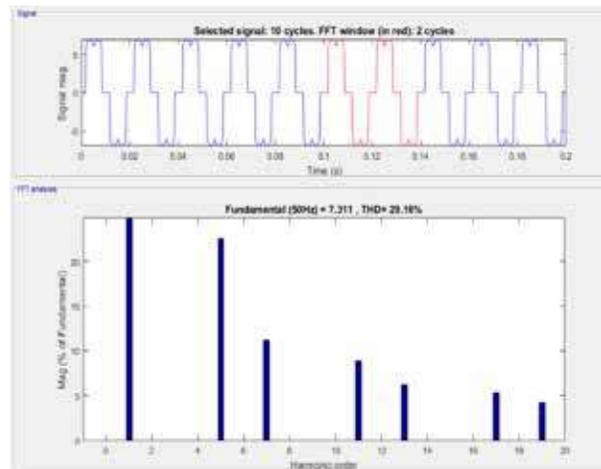


Fig. 4. Current with harmonics and THD without SAPF

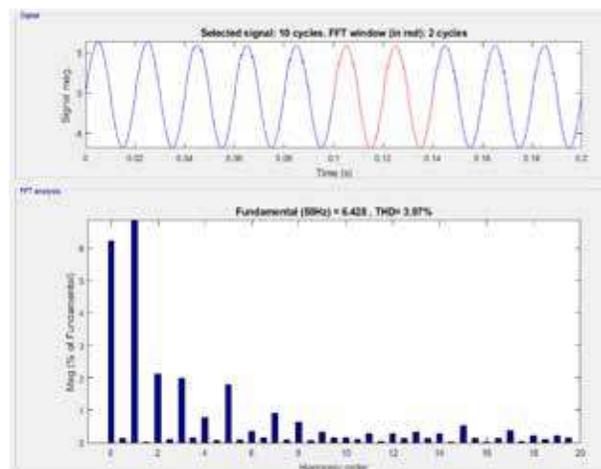


Fig. 5. Current with harmonics and THD with SAPF

CONCLUSION

In this paper, a simulation model for the microgrid system that includes PV Cells and wind turbines is presented. The results show that harmonic disturbances typically occur when nonlinear loads are connected,

and that compensation is necessary to ensure the system is reliable, efficient, and produces safe power. Shunt Active Power Filter with IRP theory is applied to compensate the current harmonics and thereby improving the power factor. The simulation is run in MATLAB/Simulink. From the results, it is observed that the proposed system reduces harmonics less than the prescribed limit and improves the power factor even when the nonlinear loads are connected.

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AUTOMATIC WATER DISTRIBUTION USING WIRELESS NETWORK

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ABSTRACT

The expansion of urban residential areas, which has an impact on the problems of water distribution, water conservation, water consumption, and interrupted water supply, water has become a severe concern as the population grows every day. In this paper, we present a design for water monitoring and control approach based on IOT that focuses on continuous and real-time monitoring of the water supply to enable proper and uniform distribution, unusual flow rates in the distribution line, and an account of the water that is currently in the tanks. The conceptual design for an automated water distribution system for urban areas is presented in this study. Since flow rate sensors have been installed in each area's intake, when the system is turned on the amount of water used by each area is continuously monitored and managed by using Arduino Uno. The maximum amount of water, or threshold value, will be determined for each location based on the amount of water in the reserve tank. The master node has the ability to turn on or off the valve to shut off the water supply when the flow rate exceeds a predetermined threshold. A computer is used in the system to track water usage by area in real time, and the administrator will also utilise it to simultaneously manage users in accordance with that data.

Keywords : IOT, Water distribution system, Flow rate sensor, Arduino UNO, Wi-Fi, Water level sensor, Solenoid valve

INTRODUCTION

Water is one of the most important natural resources for all living things on earth. In this, some people do not get enough water due to uneven distribution. So, it should be delivered properly and carefully and on time for daily activities. The main objective is to design and develop a low-cost, reliable, cost-effective and efficient technology to implement proper water distribution with continuous monitoring and also control from a central server to solve water-related complications. This article gives an idea by which we can offer water in the right order. Implement a purposeful channelized water distribution system for end users Each user control room must have a microcontroller that regulates and controls the required amount of water at the right time interval. The electrically operated solenoid valve automatically closes when the limit value reaches the set threshold value. A controlled flow of water is directed to the valve using a predetermined limit in the system. Wireless data

transmission is enabled by the Wi-Fi module, which allows messages to be sent to the system administrator in the central control room.

The water supply system offers:

- 1) Knowledge- how much water is being used.
- 2) Control- water delivery according to need.

EXISTING SYSTEM

The water system gives facilities an extraordinary ability to understand and manage water use. We believe that with this system, water will be efficiently managed and delivered according to demand, and real-time monitoring will achieve unnecessary water loss. In the current system, water is brought to the house with little work. The valve is opened by the person who has been given the responsibility. You have to wait a while and close the valve again. Time consumption is very high in this system. These types of operations require expertise

technicians. Also, if the operator does not perform the given task perfectly, the result of the task will not be good. In addition, people can remove excess water for their own use using a motor or other device. As a result, many people do not get enough water. They are self-contained devices and do not have water consumption management. So it works in an open loop system.

LIMITATIONS OF EXISTING SYSTEM

The current system has several limitations, such as:

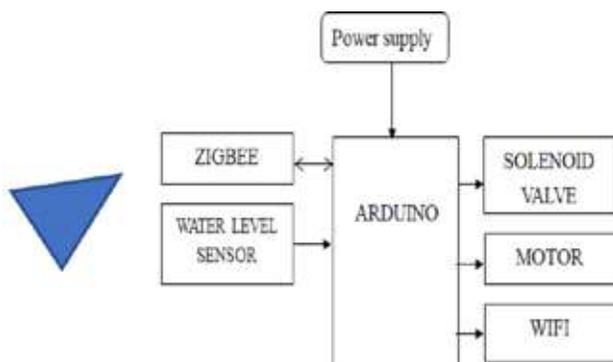
- Ineffective supervision
- The use of water by users is not monitored, which makes water management difficult during water shortages.
- Water demand is difficult to predict.
- Maintenance requires occasional human intervention, which makes it cumbersome and often the least effective

PROPOSED SYSTEM

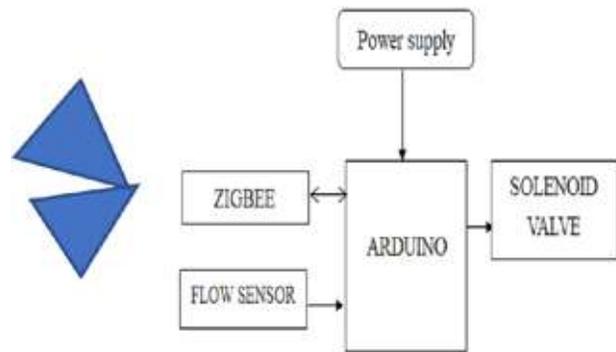
The suggested system has total automation. As a result, time and human labour are saved. This system can be implemented on water tanks for safe, efficient and waste less consumption. Water when supplied from the overhead tanks to each area, the tanks will be checked for its level using level sensors. This will be notified to the consumer i.e. nothing but the limit provided for usage of water.

The tank's fill line will be checked for every time. The admin server will be switched on for 24 hours daily. The admin will instruct the Arduino to open the valves for the particular area and supply water according to their requirement. The admin will be given control of a web based application consisting of:

Master Node:



Slave Node 1:



Slave Node 2:

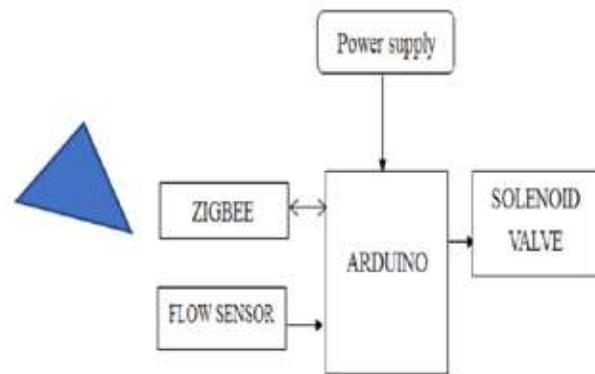


Fig. 1. Block chart of proposed system

- 1) The rate of flow measurement using a water flow sensor.
- 2) Information about when the next valves will open.

The flow sensors will keep the track of amount of water flowing through each pipeline of the requested user and will automatically shut off the valve when the threshold is reached. During distribution of water rate of flow is measured so that equal distribution is done. This whole data is sent from Wi-Fi to the Web page so that system can be accessed remotely from a computer. The flow of distribution and quantity of water both will be monitored from the web page which can be displayed anywhere using the internet. Hence, the proposed system helps in managing water supply efficiently according to the availability i.e. also under scarce conditions.

ADVANTAGES OF PROPOSED SYSTEM

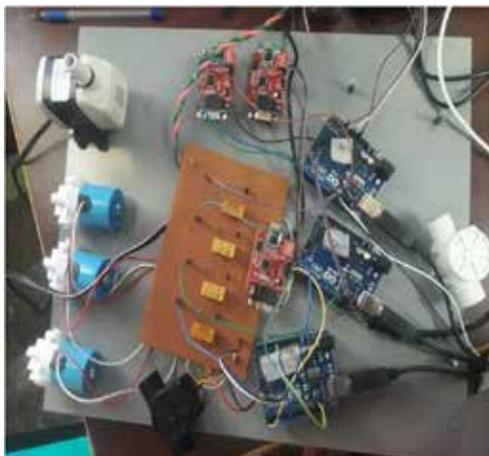
The proposed system overcomes all the difficulties of the existing system:

- Limits water consumption as per requirements.
- Real-time water supply regulation.
- Automated supply ensures that water is not wasted and hence promoting water conservation.
- System is provided with solenoid valve for proper water supply and hence no human intervention.

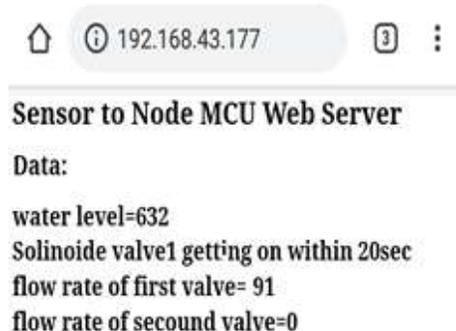
COMPARABLE STUDY OF THESE TWO TECHNOLOGIES

EXISTING SYSTEM	PROPOSED SYSTEM
Inefficient monitoring.	Efficient monitoring through making use of central server.
Water requirement prediction is difficult.	Each user receives a fixed amount of water.
Human intervention Needed for water supply.	Automated supply and Hence no manpower required.
Uneven water distribution	Water is distributed evenly.
Overconsumption of water	No water is wasted.

Kit Snapshot



Web Page Output



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LIFE-SAVING AUTOMATED VEHICLE COLLISION DETECTION WITH BAROMETRIC SENSOR

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ABSTRACT

The danger of accidents rises as there are more vehicles on the road for a variety of reasons, including poor weather, disregard for traffic laws, etc. The majority of deaths worldwide are caused by accidents. The majority of fatalities take place when there is no personal or public urgency or when they go unnoticed at the scene. The victim's fatality rate is based on how long it takes for someone to become aware of or locate the scene of the incident and get an ambulance to the hospital. Over time, the victim's morality score increases. There are numerous ways to quickly transport the injured to hospitals once an accident occurs, but there is no autonomous system to detect the event's occurrence. As a result, the barometric pressure sensor used in our system's "Vehicle crash detection" automatically detects when an accident occurs. Early detection of the incident after it happens is helpful. The Node MCU is used to deliver the alert message, which includes the position, to the guardian or a rescue team, preferably at a hospital, using the GSM module. The data is automatically transmitted to the nearby emergency centers, such as hospitals, police, and their family, with the aid of the RF transmitter and the IoT module. This autonomous system's improved safety and location-identifying features will be helpful in detecting car accidents and potentially saving lives.

Keywords : Node MCU, Arduino IDE, IoT, GPS, GSM, BMP180.

INTRODUCTION

The invention of a transportation system has given humans the ability to have the highest civilization above all other living things on the planet. Our daily lives are greatly impacted by automobiles. We use it to get to work, connect with friends and family, and transport our goods. But it can also do us harm and possibly result in our deaths from accidents. One of the most significant and fundamental danger factors when driving is speed. It influences a crash's intensity as well as the probability of getting into one. Accidents still happen sometimes despite the numerous efforts made by various governmental and non-governmental

organizations throughout the world through different initiatives to raise awareness against irresponsible driving. If the emergency services had been able to get the accident details at the time, many lives might have been saved. Therefore, effective automatic accident detection with automatic communication of the accident location to the rescue center is essential to saving a priceless human life.

In recent years, transport efficiency and associated issues have emerged as major worldwide concerns. According to a recent World Health Organisation (WHO) estimate, traffic accidents kill 1.35 million people and injure 50 million. The majority of accident deaths occur on

roadways such as motorways due to a lack of immediate medical treatment. According to research, nobody calls an ambulance 3 to 5 minutes after the accident because they are either frozen or shocked after watching the event.

Many accidents occur in a deserted location, and many of these mishaps go undiscovered. This report proposes an approach to lowering the country's accident rate.

The main objective of this project is to establish a scheme for recognizing an accident, identify the site of the accident, and notify the position to the emergency center, police, and their registered mobile number. In this proposed system, a barometric pressure sensor is employed to identify the accident, which serves as the system's main module. The GPS tracking technology can help locate the accident site. The NODE MCU is the heart of the system, sending messages to various devices across the system. The location can be supplied through a tracking system to cover all of the geographical coordinates in the area. This technology shortens the rescue process by quickly delivering the message to the nearest emergency center.

LITERATURE SURVEY

Nowadays, there are numerous innovative technologies available. To safeguard the vehicle and track it. In the past, information about an accident could be communicated, but the location of the accident could not be determined. Airbags are utilized for security and safety during travel in any vehicle [2]. The airbag system was first introduced in 1968.

To increase grip, navigate through challenging terrain, draw a heavy load out of an incline at a sluggish speed, and crawl out of soft dirt, TPMS is a system that controls the pressure within pneumatic tyres on vehicles. Pressure levels fluctuate between 15 and 45 PSI.

To identify the disaster's underlying cause, numerous alternate strategies have been put forth. In the current technology, two sensors are used: a MEMS sensor for angle detection and a vibration sensor for vehicle change detection.

Many other approaches to determining the cause of the accident have been proposed. The current method makes use of two sensors: a MEMS sensor for angle detection and a vibration sensor for sensing vehicle modifications.

The other existing solution takes advantage of IOT and cloud computing. SVM (support vehicle machine), an algorithm established by the Ant Colony Algorithm (ACA), is used for identifying vehicles. IoT will monitor the vehicles using magneto-resistive sensors in this case. The primary goal of this study is to distinguish between accidents that occurred in traffic and accidents that occurred in non-traffic areas.

Using an RF transmitter and receiver and an Atmega 328 microcontroller, the present system also provides the accident's location. The information is sent to the pre-stored mobile numbers [3].

In [8], the authors describe the process by which they created a programme for Android that just uses the smartphone's accelerometer sensors to detect accidents. When an accident happens, the programme instantly creates geographic data using GPS and delivers location details through a pre-recorded voice message to India's 108 ambulance emergency response service.

The primary concept of the programme is that the mobile phone shouldn't be carried by the driver of the car; alternatively, it should be docked within the car, and the accelerometer sensor's validity is checked by tilting the phone left or right or by letting it fall freely.

In [5], the authors created a system to identify and notify automobile accidents that integrates cellphones with automobiles using a second-generation On-Board-Unit (OBD-II) interface to develop smart vehicle design and provide the user with new emergency services. The researchers have created an Android application that, in the event of an accident being detected, automatically dials 911 and sends an SMS with important accident information to a pre-specified location. The car must comply with the OBD-II standard to allow this system to function.

Limitations of Existing Systems

- Finding the accident site and getting there without knowing the route took a very long time.
- In the old system, when an accident occurs, the message is delivered only via GSM, so it is impossible to pinpoint the exact location, and incorrect information could result.

PROPOSED METHODOLOGY

A crash detection mechanism makes up the suggested

system. If a vehicle is involved in an accident, an ambulance service is notified right away with the accident's location coordinates. Police, whose contact information is already entered in the database, will also be alerted by the system.

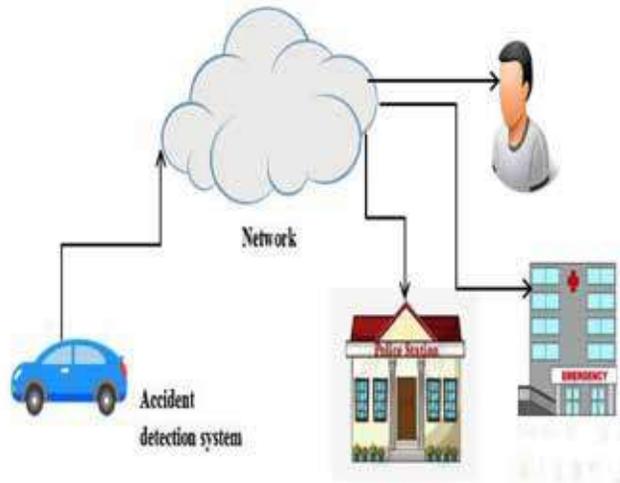


Fig 1. Proposed System

SYSTEM IMPLEMENTATION

This section logically demonstrates the suggested system structure's mechanisms as well as each module's role in creating the overall system architecture. In order to implement this system, both hardware and software components are used. The detection phase and the notification phase are the two components.

Two main modules make up the accident detection system. The first module uses a barometric pressure sensor to detect the accident. Once an accident is discovered, a second NODU MCU 12E module is used for IOT-based control and monitoring. IOT is used to transmit the sensor's reading to the local emergency centre. The effective and safe operation of vehicle crash detection can help save lives. One can track information like crash locations. To detect the collision, we'll employ an automobile crash sensor, which is frequently seen in airbag systems.

The GPS and BMP180 are connected to the microcontroller. The step-down transformer is connected to both a bridge rectifier and a filter. Then, a filter is connected to a regulator.

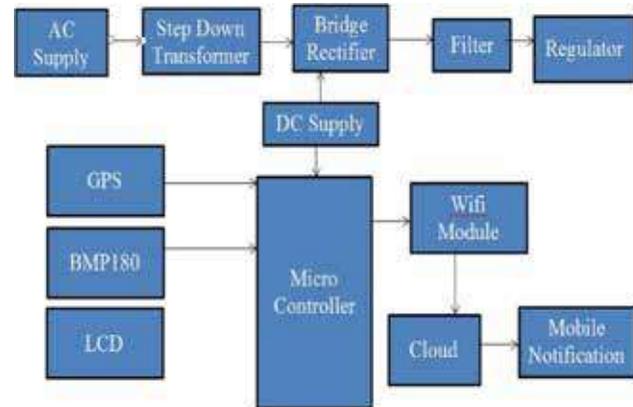


Fig.2 Block diagram of Proposed system

HARDWARE AND SOFTWARE OVERVIEW

Hardware Specifications

- ❖ Node MCU
- ❖ GPS.
- ❖ RF transmitter.
- ❖ LCD display.
- ❖ BMP180 (crash sensor)

SOFTWARE SPECIFICATIONS

- ❖ Arduino IDE.
- ❖ Embedded C.
- ❖ ESP 8266 NODE MCU12E.

Node MCU

The ESP8266-based Node MCU (Node Micro Controller Unit) is an open-source computer with a CPU, RAM, Wi-Fi networking, and even a contemporary operating system and SDK. The Expressive Systems-designed and produced ESP8266 has every essential component of the contemporary hardware development platform that is based on a very low System-on-a-Chip.

BMP 180

One of the BMP180 series' sensors. They are all made to gauge atmospheric or barometric pressure. The high-precision sensor BMP180 is designed for consumer applications.

The only thing that barometric pressure is the weight of air applied to everything.

The air has weight and wherever there is air its pressure is felt. BMP180 sensor senses that pressure and provides

that information in digital output. Also, the temperature affects the pressure and so we need temperature compensated pressure reading. To compensate, the BM180 also has good temperature sensor.

GPS

- ❖ Speed
- ❖ Bearing
- ❖ Track
- ❖ Trip distance
- ❖ Distance to destination and more

Proteus 8

- ❖ It is a software suite containing schematic, simulation as well as PCB designing.
- ❖ ARES is used for PCB designing. It has the feature.

RESULTS AND DISCUSSIONS

Working Module

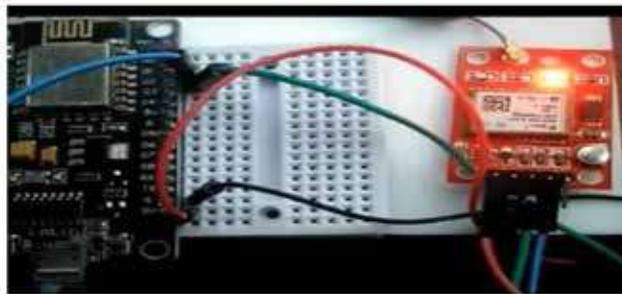


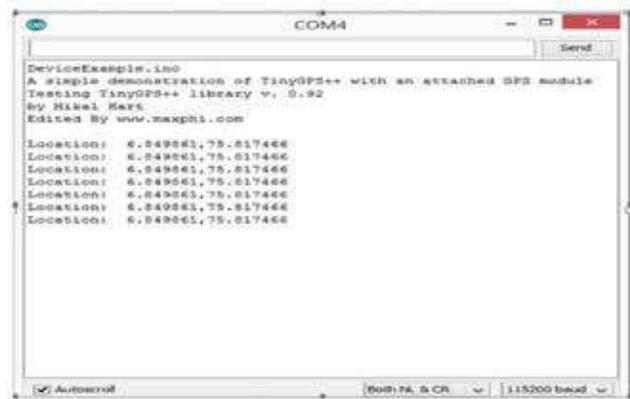
Fig. 3 NODE MCU with GPS

Once started up, the GPS module takes some time to collect location information. Node MCU runs the web server and waits for a client to establish a connection. When a client connects to a web server, Node MCU communicates the client's location information. The location information is presented on a straightforward HTML webpage.

Software Results

The result of the project is evoked by software simulation. The GPS values in serial monitor result are shown in figures Device value in cloud result is shown in figure below.

Communicating the Device



GPS values in Serial Monitor

Cloud

CONCLUSION

So in our system, "Automated Vehicle Collision Detection" the occurrence of accident is detected automatically by barometric pressure sensor. It helps to detect the occurrence as soon as the accident occurred. The RF transmitter and the IOT module help to transmit the data automatically to the nearby emergency center, police and to their family.

Thus, in this paper presents a system for automatically detecting the accident and send the message to the emergency center with accident location as well as police station and user's registered mobile number. Thus, if the system is implemented in an effective manner to save the victim.

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FORMULATION OF MILLET BASED ICE CREAM UTILIZING *ECHINOCHLOA ESCULENTA*

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ABSTRACT

Ice cream is a frozen dairy food made from cream, milk, sugar and flavouring. In this generation affected by diabetes and lactose intolerance people cannot consume the ice cream because it may affect our health, so in this all problem are rectify that in this barnyard millet ice cream. In this barnyard millet ice cream contains high amount of protein, which is highly digestible and is excellent source of dietary fiber with good amounts of soluble and insoluble fractions. In this extraction of barnyard millet milk was a great replacement of cow milk to prepare the barnyard millet ice cream. The different composition of barnyard millet ice cream was prepared for all age group of peoples, the samples are 100 % barnyard millet ice cream, 50 % barnyard millet ice cream, 30 % barnyard millet ice cream. Ice cream was prepared with formulations using barnyard millet milk and cow milk. The final product is found to have 78.50% moisture, 9.12% fat, 16.45% carbohydrate, 0.23% crude fiber, 3.83% protein and 0.52% total ash. Microbial load was found to be <10 CFU/g of yeast and mould, 15 CFU/g TPC and E. coli was absent.

Keywords : Millet Ice cream, Gluten free, Barnyard millet, Vanilla flavour, Lactose free

INTRODUCTION

Ice cream's origins for second century. Over a thousand years later, Marco Polo returned to Italy from the far source of recipe what is now called sherbet. Historians calculated that the recipe is evolved into the ice cream sometime in the 16th century. England seems to have discovered ice cream at the same time or perhaps even earlier than the Italians (Clark., 2012).

By definition "Ice Cream is a liquid mixture that turns into a paste after simultaneously shaking and freezing" (Clark., 2012). Although the meaning of the ice cream is various from country to country due to the differing regulations and composition (Goff & Hartel., 2013).

The liquid mixture turned into ice cream will present specific characteristic of taste, structure and texture, determined by quality of ingredients used to mix balance and manufacturing processing, the standard parameters of dairy based ice creams contain 64 % water, 18 %

sugars, 10 % non – fat milk solids particles and 8 % milk solids fat content, all these parameters, is expected to have a stable structure maintaining its characteristics in negative temperature with smooth texture, spreadable and stable at serving temperature (Goff H. D. 1997).

Millet is a collective term of referring a number of small seed crop annual grasses it is cultivated in a grain crop in some areas, primarily on marginal lands in dry areas in temperature, subtropical and tropical regions. They are cultivated in Asia more than 4,000 years ago and they were major grains in Europe during the Middle Ages. Today they are used chiefly for pasture or to produce a hay in the United States and Western Europe, they remain important food staples in less developed countries worldwide (Hardeep and Shilpa, 2020).

The millet ice cream has 59 percent less calories and 22 percent less carbohydrates at the same time regular ice cream contain 43 percent less fat compare to milk vanilla ice cream. Unlike other ice cream of the millet

ice cream contain omega – 3 fatty acids it is usually not available in vegetarian food.

Table 1. Experimental Plan

S. No	PARAMETERS	DESCRIPTION
1.	Product	Barnyard millet ice cream
2.	Ingredients	Barnyard millet milk, fresh cream, stabilizer, emulsifier, sugar, flavor, cow milk.
3.	Sample	S1, S2, S3

They are highly nutritious, non-glutinous and not acid forming foods. Hence, they are smoothing and easy to digest. They are considered to be the least allergenic and most digestible grains available. Compared to rice, especially polished rice, millets release lesser percentage of glucose and over a longer period of time (Son wane & Hem bade, 2014). Millets are known to contain the highest percentage of healthy dietary fibres among cereals and a higher mineral content than rice or wheat. Millets are a good source of other bioactive compounds like phytates, phenols and tannins, which can contribute to antioxidant activity important to health, aging and in preventing metabolic diseases (Pinto & Jana, 2013).

MATERIALS AND METHODOLOGY

Barnyard millet, stabilizer, emulsifier, sugar, fresh cream, flavour was purchased nearby the department store.

Preparation of 100% Barnyard Millet Ice Cream

Measure the 100 g of barnyard millet and soak 10 minutes. After soaking move to grinding process. The grinding process is only 30 seconds after completing this process extract the millet milk using 100 ml of hot water. Boil the millet milk and store it. The fresh cream was preparing for continuous milk cream beating process and measure 50 g of fresh cream. Take the millet milk and fresh cream for mixing process and add 50 g of sugar and mix it well using hand blender. Weigh the 2 g of stabilizer and 2 g of emulsifier add into the mixer and blend it. After that add 5 ml of vanilla essence, blend for 5 minutes in smooth consistency. Finally mention sample 1 and store the sample in 4 °C at overnight in the refrigeration.

Preparation of 50% Barnyard Millet Ice Cream

Measure the 50 g of barnyard millet and soak 10 minutes. After soaking move to grinding process. The

grinding process is only 30 seconds after completing this process extract the millet milk using 50 ml of hot water. Boil the millet milk and store it. Measure 50 ml of cow milk and boil it in high temperature. The fresh cream was preparing for continuous milk cream beating process and measure 50 g of fresh cream. Take the millet milk, cow milk and fresh cream for mixing process and add 50 g of sugar and mix it well using hand blender. Weigh the 2 g of stabilizer and 2 g of emulsifier add into the mixer and blend it. After that add 5 ml of vanilla essence, blend for 5 minutes in smooth consistency. Finally mention sample 2 and store the sample in 4 °C at overnight in the refrigeration.

Preparation of 30% Barnyard Millet Ice Cream

Measure the 30 g of barnyard millet and soak 10 minutes. After soaking move to grinding process. The grinding process is only 30 seconds after completing this process extract the millet milk using 30 ml of hot water. Boil the millet milk and store it. Measure 70 ml of cow milk and boil it in high temperature. The fresh cream was preparing for continuous milk cream beating process and measure 50 g of fresh cream. Take the millet milk, cow milk and fresh cream for mixing process and add 50 g of sugar and mix it well using hand blender. Weigh the 2 g of stabilizer and 2 g of emulsifier add into the mixer and blend it. After that add 5 ml of vanilla essence, blend for 5 minutes in smooth consistency. Finally mention sample 3 and store the sample in 4 °C at overnight in the refrigeration.

Table 2. Ingredients

S. No	INGREDIENTS	S1	S2	S3
1.	Barnyard Millet Milk (ml)	100	50	30
2.	Cow Milk (ml)	-	50	70
3.	Fresh Cream (g)	50	50	50
4.	Sugar (g)	50	50	50
5.	Stabilizer (g)	2	2	2
6.	Emulsifier (g)	2	2	2
7.	Vanilla Essence (ml)	5	5	5

Quality Analysis

The nutrient analysis is determined these 3 different types of barnyard millet ice cream.

Fat content

$$\text{Fat content (\%)} = \frac{W_4 - W_3}{W_2 - W_1} \times 100$$

Fiber content

$$\text{Crude fiber (\%)} = \frac{W_1 - W_2}{W} \times 100$$

Protein content

$$\frac{\text{TV} \times 0.014 \times 100 \times 0.01 \times 100 \times 6.25}{\text{Wt of the sample(g)} \times \text{Aliquot used for distillation(ml)}}$$

Carbohydrate

$$\text{Carbohydrate (\%)} = \frac{X}{0.1} \times 100$$

Microbial analysis

$$N = \sum c$$

$$V \times (N_1 + 0.1 N_2) \times D$$

Sensory Analysis

The sensory analysis is done by using 9-point hedonic scale and 5-point hedonic scale.

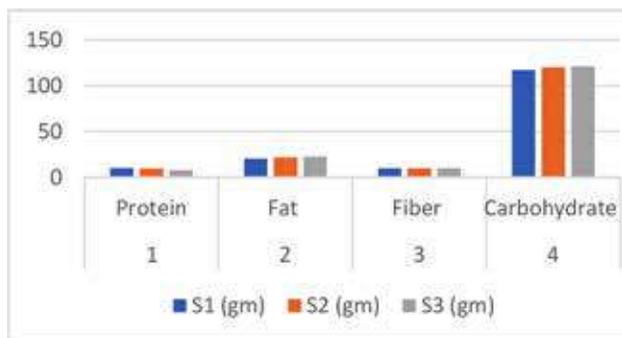
RESULTS AND DISCUSSION

Quality Analysis of Barnyard Millet Ice Cream

Table 3. Shows the result of chemical quality analysis of barnyard millet ice cream.

Table 3. Chemical quality analysis

S. No	Parameters	S1 (gm)	S2 (gm)	S3 (gm)
1.	Protein content	10.07	9.37	7.62
2.	Fat content	20.24	21.74	22.34
3.	Fiber Content	9.8	9.8	9.8
4.	Carbohydrate	117.27	120.02	121.12



Protein Content

The result exhibited that the protein content of the S1 is higher than the S2 and S3. The high protein content of ice cream S1 is due to high protein found in fully barnyard millet extract. P. Sheela et al., 2018 stated that

barnyard millet milk protein content is higher than the cow's milk.

Fat Content

The fat content of barnyard millet ice cream was found to be higher in S3. The fat content of the S1 is lower than the S2 and S3. The value of the S1 is similar to the fat content of ragi ice cream as reported by Patel, 2014.

Fiber Content

The equal amount of fiber content can be analyzed in the S1, S2 and S3. The barnyard millet milk contains high amount of dietary fiber so the samples contain equal amount of fiber content Amritha G et al., 2021.

Carbohydrate

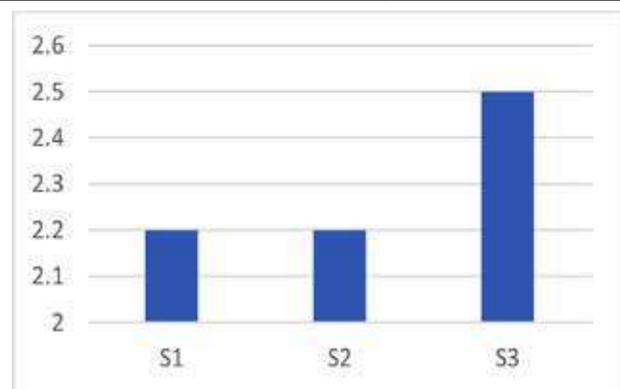
The carbohydrate content of the barnyard millet ice cream samples is analyzed. The lower amount of carbohydrate contains the S1 compared to S2 and S3. The obtained results conveys that the low carbohydrate content of ice cream makes it suitable for health Namrata sutar, 2009.

Microbial Analysis

The barnyard millet ice cream samples microbial plat count analysis can be done. The results given Table 4.

Table 4. Microbial analysis

S. No	Sample	Cfu/g×10 ⁵
1.	S1	2.2
2.	S2	2.2
3.	S3	2.5



Sensory Analysis

The sensory evaluation is done by using 5 – point hedonic scale and 9 – point hedonic scale the overall results is given below the Table 5 and Table 6.

Table 5. 5-point hedonic scale

S. No	Age Group	S1	S2	S3
1.	Above 50	Definitely will buy	Might or might not buy	Might or might not buy
2.	36 - 50	Probably will buy	Definitely will buy	Probably will buy
3.	18 - 35	Probably will buy	Probably will buy	Probably will buy
4.	Below 18	Might or might not buy	Definitely will buy	Definitely will buy

Table 6. 9-point hedonic scale

S. No	Sam-ple	Colour & Appearance	Aroma & Texture	Taste & Sweet-ness	Age group likes
1.	S1	Like very much	Like extremely	Like extremely	Above 50 & 36 – 50
2.	S2	Like extremely	Like very much	Like very much	36 – 50 & 18 – 35
3.	S3	Like moderately	Dislike slightly	Like very much	18 – 35 & Below 18

Overall suggestions & Comments

- ❖ Reduce the sweetness of the ice cream.
- ❖ Improve the texture and consistency of the ice cream.
- ❖ Improve colour and aroma.
- ❖ Sometimes sticky on teeth.
- ❖ Preparation is good, it seems to be healthy prepare more product like this appreciate to the effort.
- ❖ The overall comment is good.

CONCLUSION

The barnyard millet based ice cream was prepared and evaluated the proximate analysis of the formulated millet based ice cream, concludes that the ice cream possessed appreciable amount of protein, fat, fiber and carbohydrate and serial dilution. The result of the sensory of the evaluation showed the better

acceptability score when compared with the ice cream formulated with various of barnyard. The formulated millet based non – dairy ice cream can be consumed by person suffering from lactose intolerance. Consumers following vegetarian diet in future. Moreover, this ice cream also potential for commercialization in future. Thus, the findings of the study will aid to design and optimization of an acceptable millet based ice cream.

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BOREWELL RESCUE ROBOT USING ARDIUNO

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ABSTRACT

In recent times we have gone through many incidents of children falling into bore-wells. Usually the rescue team digs a big hole on same direction to the bore-well which takes almost 20-60hrs. Then trained army person will move inside the bore-well and rescue the child. In such cases, a small delay may reduce the chances of saving the child alive. To overcome the issues, we have proposed a system called “bore-well rescue robot”, in which the robot can move inside the bore-well and rescue the child safely. This project is easily portable and less expensive which can be used in any situation to rescue the child safely and also in less time.

Keywords : Bore well, Robot, Safely, Big hole

INTRODUCTION

During the time 2019 in March Nadim, an 18- month-old child, was safely saved after he fell into a 60- bottom deep borewell while playing near his house in Balsam and vill in Hisser quarter of Haryana. Nadim was saved after a 48- hour-long veritably hard to do by the army and NDRF labor force. In the month of February Six-time-old Ravi Panduit Bhili was stuck at a depth of 10 bases in a 200- bottom-deep borewell in Maharashtra’s Pune quarter beforehand this time. He was out latterly than eventually a 16- hour- Continuing for a long time after falling into the borewell. He was playing close to the borewell while his father, a workmen, was busy with road creation work. In January A 3- time-old boy was recovered after falling into a 30- bottom-deep borwell in Singrauli quarter. The child fell down the borewell at his father’s ranch. A platoon run to the spot and the sprat was saved after a three- hour long process.

Normal rescue plan of action involves digging a hole on same side to save the child and adjacent holes are made near to the walls of borewell. But these are

taking longer time and may cost life. A general purpose, reprogrammable and intelligent manipulator designed to perform a task is a robot.

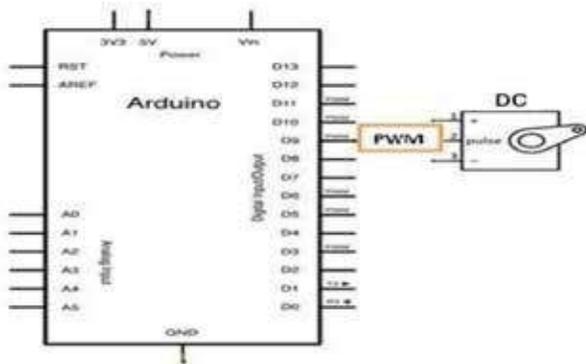
RELATED WORKS

Rescue a child trapped from a well is a very dangerous and difficult operation compared to other accidents. With exist methods, it takes longer a day to save a child. There are so many treatment, but most fail. Over the past few days, parallel holes have been dug to save fallen victims, a long process. Recently, portable robots have been developed to save children, but they also have some drawbacks. It cannot hold the whole body while lifting up.

In the existing system, if a child is stuck in a borewell the rescue operation involves digging a big hole adjacent to the borewell. It is dug up to the depth where the child is stuck. In this method there are many factors that affect the time take to rescue. If there is any problem in the digging process it will take more time to complete the rescue operation. Also, a correct person is needed to be sent into the hole to rescue the child.

PROPOSED SYSTEM

- a) The main thing of the current check is to expand a smart child deliverance robot using clarified system within a short span of time. It's achieved by controlling a robot which is managed by the person from outdoors. Now-a-days, different ideas were espoused for saving the held child from the borewell. Then we proposed a idea which is veritably unique in its structure and also lifting medium. This borewell deliverance robot is uses body and robot arm to deliver the child. Led light is fixed in this robot. Web camera is also fixed in this robot to see the child fluently. The robot is controlled by simple coding. Which is fitted into the Arduino board.
- b) Arduino is an open source tool for creating programs that are far superior to desktop computers. The physical world can be tasted and controlled by detectors programmed using Arduino programming. It can be powered by a USB string or an external 9 volt battery, but accepts a voltage of 7to 20 volts. This is open source platform is grounded on a simplemicro-controller board, and a development terrain for enforcing software on the board. The Arduino UNO's leg illustration is shown in below.

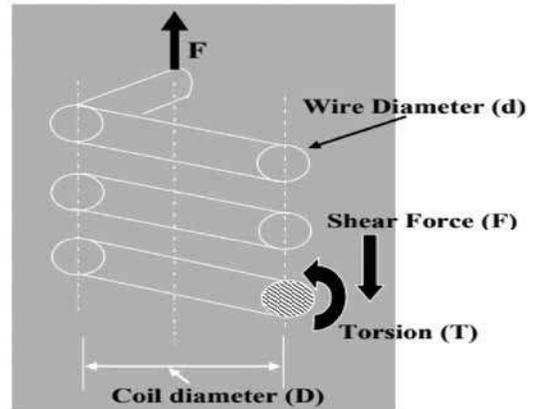


DESIGN AND INITIALIZATION

Design Helical Spring

It is defined as accommodating element that deflects under the work of load and returns to its native design when load is detached.

The spiral shape denote the random sample of the string. The cut section, it is from the whole coil somewhere we make a cut, is indicated as a circle with shade.



Curvature Effect

For springs where the wire is comparable with the coil diameter, in a given segment of the spring, the inside length of the spring segment is relatively shorter than the outside length. Spring is used to robot for flexibility. It will help the robot in to the pipe stable.

Translational Element

It joins the three frames of the link. It is used to compress and depress the spring.

Distance Between the Extreme Drilled Holes:

It is used to join all the links. It is used to connect all motors and tires.

Central Element

It is the central part of robot. Camera and robot arm is connected in the central part. All parts are connected to the central part.

Robot Arm

It is used to child rescue. It extends to 12 cm. This robot arm is control by dc motor.

ROBOT TELE OPERATION

Manually covering the child with the help of camera and controlling unit of system. The six bus in this robot three bus are sustained and the other three bus are associated in the motor. When operating the robot there are a aggregate of six bus of which there's a three wheelers motor will other three bus over and down moving when run the robot. The webcam of this robot is set up so that's can perceive the situation inside the deep well. The camera in this robot it's used to take the coming step after changing the problems. Under

the robot a robotic arm analogous to mortal fritters is placed.

RESCUE

Once the system has reached proximity of child, it is stopped right away and is given the commands by the controlling device to accomplish the closing of the systemic arms. Controlling a system to takeoff the child inside the bore well, which is jurisdiction by the person from beside. The human finger robot helps to retrieve objects and child that is stuck inside.

RESULT



Fig. 1. Robotic lifting the child from Bore well

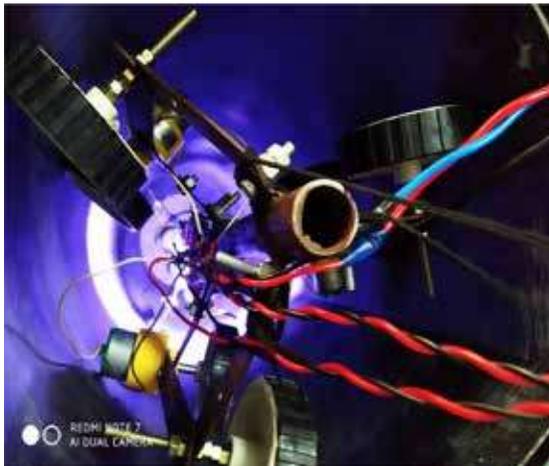


Fig. 2. Carrier Mounted Inside



Fig. 3. Borewell Rescue System



CONCLUSION

At present, instruments or devices to rescue the child who stuck in the borewell is not available in the fire stations because of lack of efficiency and possible of failures in existing instruments. So, we designed a robot which is of high efficiency in rescuing the robot and these is no possibility of failures while rescuing. Also, it is cost effective so that the needed persons could afford it easily. The device can be controlled easily. It have live camera feed which can be used to locate the child stuck in the borewell. Through this we can safe guard the child without any possibilities of failure and injury.

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DATA - DRIVEN ESTIMATION OF LITHIUM-ION BATTERY STATE OF HEALTH FOR ELECTRIC VEHICLE APPLICATIONS USING KNN AND RANDOM FOREST ALGORITHMS

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ABSTRACT

This project proposes a data-driven approach for estimating the State of Health (SOH) of Li-Ion batteries in hybrid electric vehicles. The approach utilizes a partial charge and discharge current sequence based on data analytics performed on battery aging data, and a KNN algorithm to extract a strong health indicator (HI) that measures the SOH. The impact of charging and discharging capacity on the estimation accuracy is evaluated, and the proposed method is tested with an open dataset, demonstrating its effectiveness. Additionally, the Random Forest algorithm is employed to compare the performance of the proposed method, showing that it outperforms the KNN algorithm in terms of accuracy, precision, and F1 score. This project provides a comprehensive examination of the primary methods for estimating battery SOH, highlighting their benefits and limitations in terms of real-time compatibility with automotive applications.

Keywords : KNN Algorithm, Random Forest, Electric Vehicle, Soh, Lithium Ion Battery, Arduino ATMEGA328P

INTRODUCTION

Accurately estimating the State of Health (SOH) of Li-Ion batteries is essential for effective battery management in hybrid electric vehicles. However, traditional methods, such as direct measurement and model-based approaches, have limitations in terms of complexity and real-time compatibility. Data-driven methods, on the other hand, offer a simple and flexible approach that is independent of battery models. This project proposes a data-driven approach that utilizes a partial charge and discharge current sequence, based on data analytics performed on battery aging data. The approach involves using a KNN algorithm to extract a strong health indicator (HI) that measures the SOH. The impact of charging and discharging capacity on the estimation accuracy is evaluated, and the proposed method is tested with an open dataset, demonstrating its effectiveness. To compare the performance of the proposed method, the Random Forest algorithm is also employed, showing that it outperforms the KNN algorithm in terms of accuracy, precision, and F1 score. This project provides a comprehensive examination of the primary methods for estimating battery SOH,

highlighting their benefits and limitations in terms of real-time compatibility with automotive applications.

LITERATURE SURVEY

1. Z. Chen, X. Zhang, J. Yang and J. Liu, "A new data driven approach for lithium-ion battery remaining useful life estimation based on support vector regression and particle swarm optimization," *Journal of Power Sources*, vol. 362, pp. 116-128, 2017.

This paper proposes a new data-driven approach based on support vector regression and particle swarm optimization for estimating the remaining useful life of lithium-ion batteries. The method is demonstrated on experimental data, and the results show that the proposed approach can accurately estimate the remaining useful life of lithium-ion batteries.

2. Y. Wang, Z. Chen, Y. Zhang, C. Chen and B. Liu, "Battery state of health estimation using a hybrid data-driven approach," *Journal of Power Sources*, vol. 317, pp. 47-58, 2016.

This paper presents a hybrid data-driven approach for estimating the state of health of batteries. The approach

combines a K-means clustering algorithm, a fuzzy C-means clustering algorithm, and a support vector regression algorithm. Experimental results demonstrate the effectiveness of the proposed method.

3. X. Li, J. Hu and H. Wang, "A new hybrid approach for lithium-ion battery state of health estimation," *Journal of Power Sources*, vol. 298, pp. 333-342, 2015.

This paper proposes a new hybrid approach for estimating the state of health of lithium-ion batteries. The method combines a particle filter algorithm and a support vector regression algorithm. The proposed method is evaluated on experimental data, and the results demonstrate its effectiveness for estimating the state of health of lithium-ion batteries.

4. H. Li, X. Zhang, J. Cao and Z. Wang, "A review of the estimation of lithium-ion battery state of charge and state of health," *Journal of Power Sources*, vol. 257, pp. 330-341, 2014.

This paper provides a comprehensive review of the estimation of the state of charge and state of health of lithium-ion batteries. The paper discusses various estimation methods, including model-based methods, data-driven methods, and hybrid methods. The advantages and limitations of each method are discussed, and future research directions are suggested.

ALGORITHM

KNN

KNN (k-Nearest Neighbors) is a popular machine learning algorithm used for classification and regression tasks. In KNN, the input data is represented by a set of points in a high-dimensional space, where each point represents an instance of the problem to be solved. To make a prediction for a new instance, KNN looks at the K closest points in the training data (i.e., the K nearest neighbors) and predicts the output based on the majority class or the average value of the K nearest neighbors.

The basic principles of KNN are relatively straightforward. Given a new instance, the algorithm identifies the K nearest neighbors in the training data based on some distance metric, such as Euclidean distance or Manhattan distance. The output for the new instance is then predicted based on the majority class or the average value of the K nearest neighbors.

One of the challenges of KNN is choosing an appropriate value of K. A smaller value of K may result

in overfitting to the training data, while a larger value of K may result in underfitting or poor generalization to new data. The choice of distance metric can also have a significant impact on the performance of the algorithm.

Various modifications and extensions to the basic KNN algorithm have been proposed in the literature, including weighted KNN, which gives more weight to the closer neighbors, and kernel density estimation, which estimates the probability density of the data based on the K nearest neighbors.

KNN has been applied to a wide range of problems in different domains, including image classification, text mining, and bioinformatics. One of the strengths of KNN is its ability to handle high-dimensional data and non-linear relationships between the input features and the output. However, KNN can also suffer from the curse of dimensionality, where the distance metric becomes less informative as the number of dimensions increases. In summary, KNN is a simple and effective algorithm for solving classification and regression problems.

Random Forest

Random forest is a popular machine learning algorithm used for classification and regression tasks. It is an ensemble method that combines multiple decision trees to improve the accuracy and robustness of the predictions. The basic principles of random forest are relatively straightforward. Given a set of training data, multiple decision trees are constructed by randomly selecting subsets of the input features and training each tree on a different subset of the data. The output for a new instance is then predicted based on the majority vote or the average value of the predictions from the individual trees.

One of the key advantages of random forest is its ability to handle high-dimensional data and complex relationships between the input features and the output. It is also less prone to overfitting than a single decision tree, since the individual trees are trained on different subsets of the data and input features.

Various modifications and extensions to the basic random forest algorithm have been proposed in the literature, including bootstrap aggregating (bagging), which randomly samples subsets of the data with replacement, and feature selection, which uses different criteria to select the most informative input features for each tree.

Random forest has been applied to a wide range of problems in different domains, including image classification, text mining, and bioinformatics. One of the strengths of random forest is its ability to handle missing or noisy data, since it can use the available features to make predictions even if some of the data is missing or corrupted.

METHODOLOGY

Data Preprocessing

In the data preprocessing step, the necessary libraries are imported and the dataset is read in as a pandas DataFrame. The predictor variables (X) and target variable (y) are separated for further analysis.

Exploratory Data Analysis

In the exploratory data analysis step, a count plot is generated using the seaborn library to visualize the distribution of cycles in the dataset. This plot helps to understand the balance of the dataset and whether any cycles are overrepresented or underrepresented. It is an important step in understanding the characteristics of the data before applying any machine learning algorithms.

Data Splitting

After splitting the data into training and testing sets, the next step is to train the K-Nearest Neighbors (KNN) classifier model using the training set. In this step, the KNN model is initialized with a specified number of neighbors, which in this case is 5

Model Training

a) KNN - The model is then fit to the training data, which means that it is trained on the input features (X_{train}) and their corresponding target values (y_{train}) to learn how to classify new data. The KNN model works by assigning a class to a new data point based on the classes of its k nearest neighbors in the training data. By fitting the model to the training data, it learns how to identify the relationships between the input features and the target variable, which can be used to make predictions on new data.

b) Random Forest - In the Model Training step, we initialize the Random Forest Classifier model and fit it to the training data. The Random Forest Classifier is a type of ensemble learning method that constructs a multitude of decision trees and outputs the class that is the mode of the classes of the individual trees. In

this case, we have set the number of trees in the forest to 100, which means that 100 decision trees will be constructed and used to make predictions. We have also chosen the hyperparameters of the model, such as the maximum depth of each tree, based on empirical evaluation and experimentation. The maximum depth of each tree determines the maximum number of levels that the tree can have, and can be adjusted to prevent overfitting or underfitting of the model. The choice of hyperparameters is important as it can significantly impact the performance of the model. Therefore, it is important to perform experimentation and evaluation to determine the optimal hyperparameters for the specific dataset and problem at hand

MODEL EVALUATION

After the model is trained and evaluated, it is saved using the pickle library so that it can be reused in the future without needing to train the model again. The filename "model1.sav" is used to save the model

BLOCK DIAGRAM

The lithium ion life estimation system is composed of various components, including an ATMEGA 328P microcontroller, an ESP8266 Wi-Fi module, an LCD display, and a Lithium Ion Battery. The main controller, ATMEGA 328P, is responsible for monitoring the battery's charging and discharging status. The battery's charging and discharging values are recorded and sent to the cloud via the ESP8266 Wi-Fi module. The current status of the battery is displayed through the LCD display, and the charging and discharging rate is stored in the form of ampere per hour.

In addition, the system uses a KNN (K-Nearest Neighbors) algorithm for battery life estimation. The KNN algorithm classifies the number of used cycles of the battery by comparing the hardware data from the cloud with the existing dataset. Using the number of used cycles, the remaining cycles, and the battery's life can be calculated.

DESIGN OF HARDWARE CIRCUIT

The overall circuit diagram of this project is shown in the fig 2 and it is designed using the Proteus software & Easy EDA software . The LCD display and all the type of sensor interfaced with the ATMEGA328 Microcontroller by connecting the pins as per the function. The sensors is interfaced with ATMEGA328

Microcontroller the by connecting the respective data transmission pin from the sensors to the data reception pin in the LPC2148 Microcontroller which are digital/ Analog inputs. The power supply circuit is as SMPS power supply which has as output of 5V DC to drive the ATMEGA328 Microcontroller as well as the relay circuit.

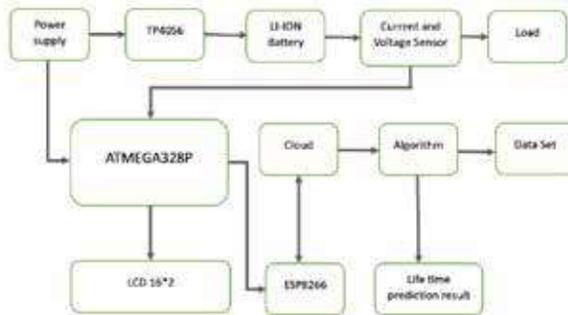


Fig 1 Block Diagram

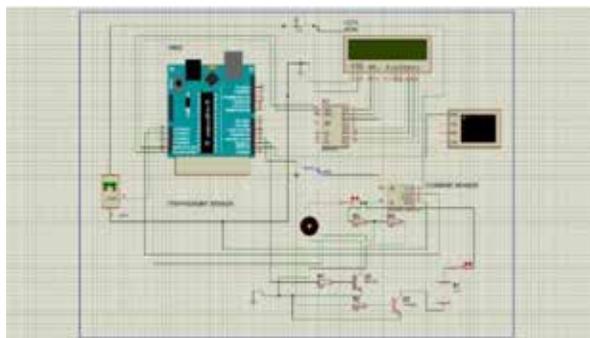


Fig. 2 Design of Hardware Circuit

The Wi-Fi module, data from all the sensors, and controls for the appliances are all interfaced by the microcontroller. Use the input and output ports on the Arduino microcontroller to connect all sensors to it. Because the microcontroller may be used to read the sensor's output anytime it becomes high. It features several input and output ports that allow it to read the motion sensor's high-logic output.

Voltage Sensor Circuit

The input voltage of the AC supply is read using the voltage sensor circuit. The ZMPT101B IC is the single component of this circuit. We obtain the equivalent variable DC in the output to the microcontroller when we provide the IC with an input AC supply. The controller's readings are then calibrated using software programming. The voltage circuit is depicted in below fig 3.

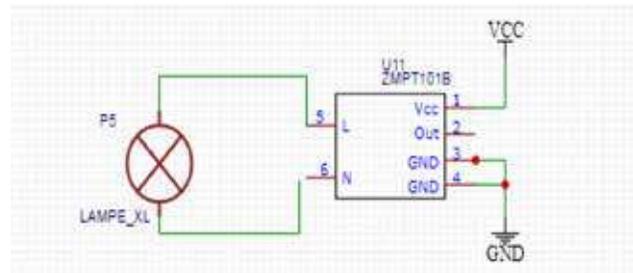


Fig. 3 Voltage Sensor Circuit Diagram

Current Sensor Circuit

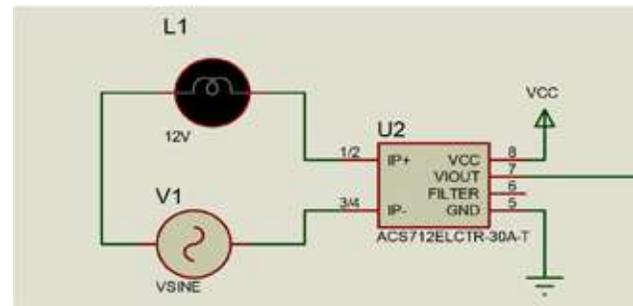


Fig. 4 Current Sensor Circuit

The Current sensor circuit is used to read the input current of the AC supply. This circuit only consists of a ACS713 IC. When we give an input AC supply to the IC, we get the corresponding varied DC in the output to the Microcontroller. Then the readings are calibrated in the controller using the software programming. The Current circuit is shown in the below fig 4.

DC Power Circuit

Electric current only travels in one direction in a DC circuit. In many low-voltage applications, particularly those that are battery-powered, DC is frequently seen. For the vast majority of electronic circuits, a DC power supply is required. The project's primary DC circuits are the current sensor, voltage sensor, temperature sensor, LCD display, and others. Fig. 5 displays the general block diagram of a DC power circuit.

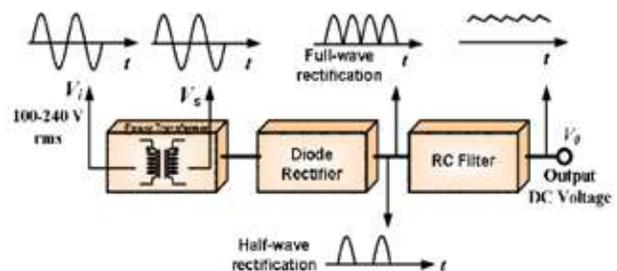


Fig. 5 DC Power Circuit Block Diagram

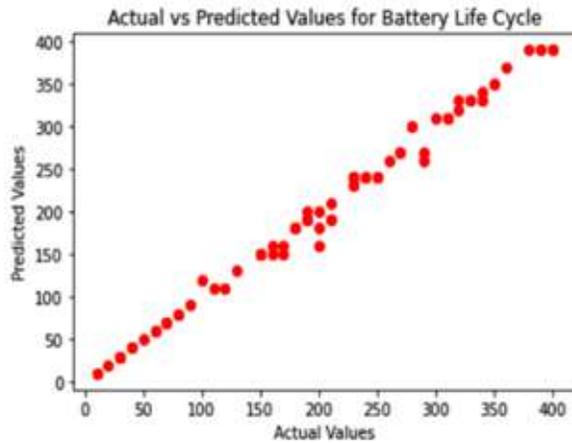


Fig 9 Battery Life Cycle Estimated by KNN Algorithm

The below graph of fig 10 shows the estimated life cycle of Li-ion battery to the actual values by Random Forest algorithm.

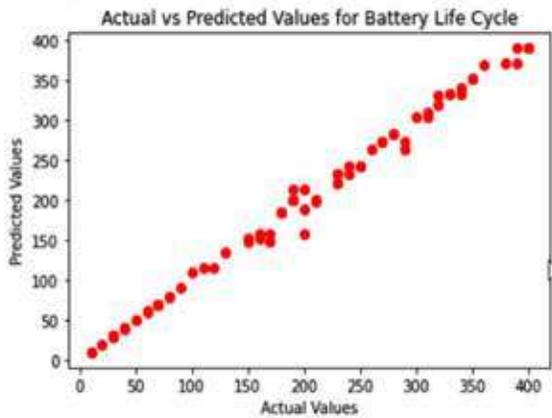


Fig 10. Battery Life Cycle Estimation by Random Forest Algorithm

The below graph shows the charge and discharge rate of the battery in fig 11 and fig 12 respectively.



Fig 11. Charging Rate of Li-ion Battery



Fig 12. Discharging Rate of Li-ion Battery

CONCLUSION

This project proposes a data-driven approach for estimating the State of Health (SOH) of Li-Ion batteries in hybrid electric vehicles. The approach utilizes a partial charge and discharge current sequence based on data analytics performed on battery aging data and employs a KNN algorithm to extract a strong health indicator (HI) that measures the SOH. The impact of charging and discharging capacity on the estimation accuracy is evaluated, and the proposed method is tested with an open dataset, demonstrating its effectiveness.

Furthermore, the Random Forest algorithm is utilized to compare the performance of the proposed method with KNN algorithm, and it is shown that the Random Forest algorithm outperforms KNN in terms of accuracy, precision, and F1 score. This project provides a comprehensive examination of the primary methods for estimating battery SOH, highlighting their benefits and limitations in terms of real-time compatibility with automotive applications.

In summary, the proposed data-driven approach provides a reliable and effective method for estimating the SOH of Li-Ion batteries, which is critical for the optimization of battery life and performance in hybrid electric vehicles. This approach can also be extended to other applications that require accurate battery health monitoring.

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