PEECOM

2025

FYP EXTENDED ABSTRACT

ELECTRICAL ENGINEERING DEPARTMENT (EED)
POLITEKNIK TUANKU SULTANAH BAHIYAH

EDITOR'S NOTE

CHIEF EDITOR

Dr. Rahimah binti Abdul Rahman

Alhamdulillah to Allah SWT for His grace and mercy. It is with great pleasure that we present the latest edition of PEECOM - FYP Extended Abstract. This publication highlights the exceptional research and innovation produced by the final year students of our esteemed department. The Extended Abstracts included in this edition cover a wide range of topics, from cutting-edge technology to creative solutions for real-world problems.

We hope that this edition of PEECOM - FYP Extended Abstract serves as a testament to the hard work, dedication, and creativity of our students and faculty.

We believe that the research and innovation highlighted in this publication will make a significant contribution to the advancement of knowledge in their respective fields.

Thank you for your continued support, and we hope you enjoy reading this edition.

What's inside...

ABOUT PEECOM

PEECOM is the abbreviated name for Electrical Power, Electronic, Communication, and Computer Engineering. PEECOM is an annual newsletter published by the Electrical Engineering Department (EED), Politeknik Tuanku Sultanah Bahiyah.

PEECOM shares program information and technical articles produced by lecturers and students.

HIGHLIGHT

1. Course Information
2. Final Year Project (FYP) Extended Abstract

HEAD OF DEPARTMENT'S NOTE

PN. IDA SAFINAR BINTI AZIZ

Head of EED Department

Alhamdulillah to Allah SWT for His grace and mercy. I am pleased to introduce the latest edition of the PEECOM - FYP Extended Abstract, which features the outstanding work of our final year students in the Department of Electrical Engineering (EED). This publication is a testament to the dedication and hard work of our students, as well as the guidance and mentorship of our esteemed EED members.

In this edition, you will find a diverse range of topics, from innovative IOT systems in agriculture to cutting-edge research in renewable energy. These extended abstracts provide a glimpse into the breadth and depth of the work being carried out by our students, and serve as a testament to the quality of education and training that our department provides.

I would like to extend my heartfelt congratulations to all the students who have contributed to this publication. Your hard work and dedication have paid off in producing innovative and impactful research that has the potential to shape the future of our industry.

I would also like to express my gratitude to the lecturers who have supported and guided our students throughout their academic journey. Your unwavering commitment to education and research has inspired our students to achieve great heights of excellence.

I hope that this publication will serve as a source of inspiration and motivation for all of our readers, and that it will continue to highlight the incredible work being done by our students and EED members.

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ELECTRICAL ENGINEERING DEPARTMENT

COURSE INFORMATION

Your Career in Engineering: EED at Politeknik Tuanku Sultanah Bahiyah (PTSB)

Department Overview & Mission

Excellence in Technical Education

Providing quality education and professional services through broad-based electrical and electronic engineering knowledge.

Graduate Excellence

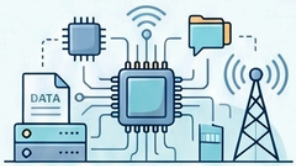
Aiming to produce graduates who are potential, competent, competitive, and highly skilled.

Professional Resources

Staffed by dedicated professional trainers supported by sufficient technical infrastructure.

Diploma Programs Offered

Electrical Engineering Focus



Electronic Systems Specialization

Electrical Engineering (DET)

Electrical and Electronic Engineering (DEE)

Electronic (Communication) Engineering (DEP)

Electronic (Computer) Engineering (DTK)

Engineering Your Future: Choosing the Right Diploma Path

Four distinct diploma pathways sharing a foundation in electronics, each diverging into specialized engineering fields.

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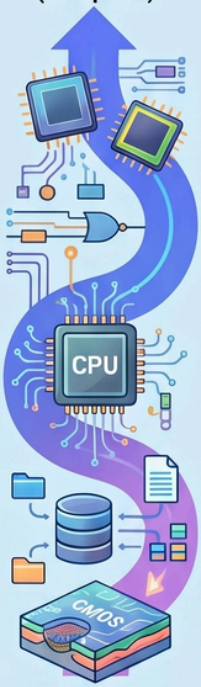
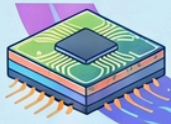


Focuses on **computers, computer architecture, OS, database systems,** and **CMOS IC design and fabrication.**



SPECIALIZATION SUBJECTS: Microprocessors, CMOS IC Design, Computer Diagnosis

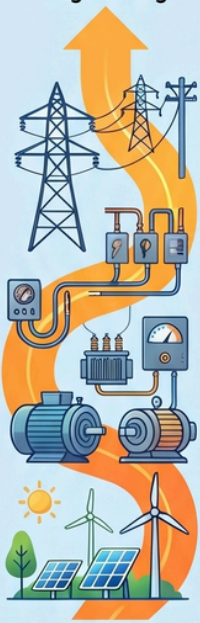
Electronic Engineering (Communication)

Specializes in **telecommunication networks, fiber optics, wireless communication,** and **microwave devices.**

SPECIALIZATION SUBJECTS: Fiber Optics, Wireless Tech, Telecommunication Networks

Electrical & Power Systems

Electrical Engineering



Emphasizes **wiring installation, power systems, electrical machines,** and **sustainable green technology awareness.**

SPECIALIZATION SUBJECTS: Power Systems, Wiring, Green Tech, PLC

Electrical and Electronic Engineering

A hybrid program covering **communication systems** alongside **power systems** and **programmable logic controllers.**

SPECIALIZATION SUBJECTS: Power Systems, Wiring, Green Tech, PLC

SHARED ELECTRONICS FOUNDATION

LIST OF FYP 2024

SMART IOT MONITORING FOR VERTICAL FARMING SYSTEM

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Abstract – This project aims to explore using a vertical farming system based on the Internet of Things (IoT) to overcome the challenges of space constraints for agriculture in limited areas. Vertical farming allows crops to be grown in a tiered arrangement, maximizing efficient use of space. With IoT, the system can automatically monitor and control parameters such as temperature, humidity, and soil moisture in real-time. As a result, this project promises to increase crop yields, save resources, and provide a difficult agricultural solution for urban areas and limited space.
Keywords: ESP32, IoT, Vertical Farming, sensor

INTRODUCTION

Agricultural activities around residential areas are currently almost hopeless due to the constraints of suitable areas for growing crops. The existence of a hydroponic growing system that does not require soil as a plant medium according to the factors of the area. The application of IoT in this project aims to implement the 4.0 industrial revolution in agriculture to improve deficiencies that humans fail to detect with plants.

METHODOLOGY

ESP32 has been used in this project as a main controller. Developing a vertical hydroponic system is the innovative concept of this project, which allows for space optimization without using much soil. A sophisticated intelligence component and monitoring accompanied by the Internet of Things (IoT) used in this project have been added. The aim is to use several sensors to monitor and control plant growth, sensors for the solution of temperature, humidity, and pH. The data collected by these sensors can be accessed directly via the internet network, allowing for precise control and response to the environmental conditions of the plants.

RESULTS AND DISCUSSION

Table 1 shows the temperature, humidity, and moisture level readings for 3 consecutive days where the trend we can see is the temperature at 1 pm recorded a high temperature and then decreased at 6 pm which shows that the movement of the sun affects the temperature and this coincides with the temperature range of Malaysia as a tropical climate country with a temperature range of 21℃ to 32℃. The trend for humidity also shows a high value at 8 am in the range of 80% to 85% due to the cooler temperature in the morning where the air contains higher humidity.

Table 1: The temperature, humidity, and moisture level readings for 3 days

Day	Time	Temperature (*C)	Humidity (%)	Soil moisture (%)
1	8 am	24	85	60
	1 pm	32	70	55
	6 pm	27	75	58
2	8 am	23	82	59
	1 pm	31	68	54
	6 pm	26	77	57
3	8 am	25	84	61
	1 pm	30	69	53
	6 pm	28	76	56

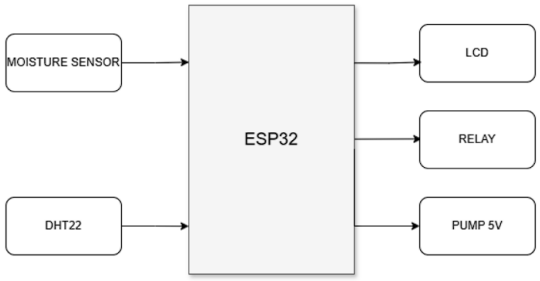

Figure 1: The Block Diagram of Inputs and Outputs

CONCLUSIONS

This project helps everyone who is using a vertical farming system. The trend for humidity will depend on the temperature where high temperature will reduce the humidity level as can be seen at 1 pm. Furthermore, soil moisture also shows a high rate in the morning and decreases slowly in proportion to the rising environmental temperature.

ACKNOWLEDGEMENTS

The researchers would like to thank their parents and supervisors for financial and guidance support. The researchers would also like to thank friends and Polytechnic Lectures for helping in various ways to complete this project.

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[2] Bomford, M., More bytes per acre: do vertical farming's land-sparing promises stand on solid ground? *Agriculture and Human Values*, *40*(3), 879-895, 2023

SMART FIRE ALERT SYSTEM WITH IOT

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Abstract – The Smart Fire Alert System with IoT project aims to focus on the public living in residential areas. This project aims to detect fires in homes, whether they are small or large. With technological advancements, fire detectors are now more sophisticated and feature smart capabilities, such as the ability to connect with remote control systems and smartphone applications. This allows monitoring and fire alarm notifications to be done in real-time, even when the occupants are far from the location. Innovation in this fire detection system ensures that we can be better prepared to face any fire threats.

Keywords: ESP32, IoT, fire sensor, smoke sensor

INTRODUCTION

The Smart Fire Alert System with IoT aims to focus on the public living in residential areas. This project can help provide an early warning to people living in the house to save themselves from unwanted incidents before waiting for the arrival of rescue personnel such as firefighters and others. Fire detectors are now more sophisticated and feature smart capabilities, such as the ability to connect with remote control systems and smartphone applications. This allows monitoring and fire alarm notifications to be done in real-time, even when the occupants are far from the location.

METHODOLOGY

The Smart Fire Alert System with IoT utilizes advanced fire sensors to detect fires, whether small or large and immediately sends real-time alerts to homeowners via smartphone applications or remote-control systems. Integrated with the Internet of Things (IoT), the system allows for remote monitoring, enabling users to keep track of fire hazards even when away from the property. In addition to fire detection, the system can automate actions like triggering alarms, unlocking doors for easier escape, or notifying local fire services, ensuring rapid responses and enhanced safety. This combination of methods ensures comprehensive fire protection and preparation for emergencies.

RESULTS AND DISCUSSION

Table 1 shows the fire detector readings for five consecutive distances. Table 1 observes that 35 cm is the maximum distance for the sensor to detect. Table 2 shows the smoke detector readings five consecutive times. Table 2 observes that the minimum time for the sensor to detect is 8 seconds.

Table 1: Fire detector data reading

Distance Sensor Detected	Led/ Buzzer	LCD Display
20 cm	ON	"Fire Detected"
25 cm	ON	"Fire Detected"
30 cm	ON	"Fire Detected"
35 cm	ON	"Fire Detected"
40 cm	OFF	"Fire Not Detected"

Table 2: Smoke detector data reading

Time Sensor Detected	Led /Buzzer	LCD Display
2 sec	OFF	"Smoke Not Detected"
4 sec	OFF	"Smoke Not Detected"
6 sec	OFF	"Smoke Not Detected"
8 sec	ON	"Smoke Detected"
10 sec	ON	"Smoke Detected"

CONCLUSIONS

In conclusion, the Smart Fire Alert System with IoT offers a significant advancement in fire safety by providing early detection and real-time alerts, ensuring timely responses to fire emergencies. This system enhances the protection of lives and property in residential areas, as well as other environments like offices and factories, by allowing remote monitoring and instant notifications.

ACKNOWLEDGEMENTS

The researchers would like to thank their parents and supervisors for financial and guidance support. The researchers would also like to thank friends and Polytechnic Lectures for helping in various ways to complete this project.

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HYDROPONIC FARMING MONITORING SYSTEM

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Abstract – This research focuses on developing an ESP32-based automated exhaust fan system to enhance air quality, safety, and energy efficiency. The system integrates a temperature sensor, gas sensor, and Wi-Fi module. The temperature sensor activates the fan when ambient temperatures exceed a set threshold, preventing overheating and ensuring comfort. The gas sensor detects harmful gases like carbon monoxide or methane, triggering the fan to expel contaminated air and reduce health risks. Controlled remotely via a mobile app, the system adjusts fan speed based on conditions, ensuring efficient operation. Ideal for kitchens, garages, and industrial spaces, it improves safety and energy efficiency.

Keywords – automated exhaust fan system, temperature sensor, gas sensor, air quality.

INTRODUCTION

The development of an automated temperature-controlled exhaust fan with gas detection marks a significant step forward in ventilation technology. This system offers a safer, more efficient, and sustainable solution for improving indoor air quality [1]. By automatically adjusting fan speed based on ambient temperature, it reduces energy consumption while enhancing user comfort. Equipped with temperature sensors, the fan activates only when temperatures exceed a set threshold, ensuring reliable operation. Additionally, the integration of a solar panel as an alternative power source further minimizes electricity use, promoting sustainability. This innovative design sets a new standard for ventilation across various industries [2].

METHODOLOGY

The development of the project divided into several part such as Solar Panel, Solar Controller, Battery, 12V, 5V Regulator, AC Sensor (ZMT101), Gas Sensor (MQ2), Temperature Sensor (DHT11), Blynk, Optocoupler, Relay, Exhaust Fan, LED Light and Buzzer. The main functions of components which the temperature sensor measures ambient temperature to trigger actions like turning on an exhaust fan [3]. While, the humidity sensor detects moisture levels for ventilation or humidity control. On the other hand, the AC sensor monitors voltage stability to protect the system. Lastly, a relay controls high-power components, while the fan motor circulates air, and fan speed adjusts airflow

RESULTS AND DISCUSSION

Figure 1 shows the result of the component in the blynk dashboard. Ambient Temp at 31 Celcius, Humidity at 71%, Gas Level at 190 was the safe level.

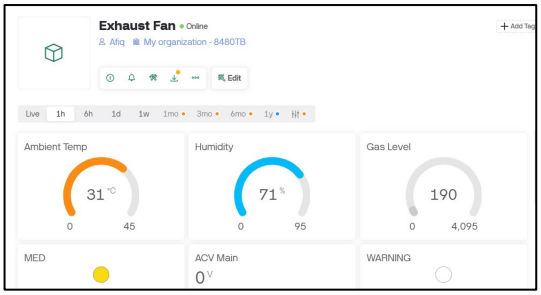

Figure 1: Blynk analysis

Table 1: Function of sensors

Name	Symbol	Function
Temperature	Celcius, °C	Measure the degree of hotness or coolness of serounding.
Humidity	Percentage, %	Measure both moisture and temperature in the atmosphere and express relative humidity.
Gas Sensor	Percentage % (g)	gas sensor detects the presence and concentration of gases in the air, converting this data into an electrical signal for monitoring and safety purposes.

Table 1 outlines the functions of key environmental sensors. The Temperature sensor (°C) measures the degree of hotness or coolness of the surrounding environment. The Humidity sensor (%) measures both moisture and temperature in the atmosphere, expressing the relative humidity. The Gas sensor (%) detects the presence and concentration of gases in the air, converting this data into an electrical signal for monitoring and safety purposes, ensuring a safe and controlled environment..

CONCLUSIONS

This project develops an automated, temperature-controlled exhaust fan system using the ESP32 microcontroller. It integrates temperature, humidity, and gas sensors to dynamically adjust ventilation based on real-time environmental data. This smart system optimizes air circulation, enhances comfort, conserves energy, and offers IoT-enabled convenience and efficiency over traditional ventilation methods.

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KEYTRACER'S APPLICATION: KEY LOCATION SYSTEM

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Abstract – This paper presents KeyTracer's Key Location System, an advanced solution for managing and tracking keys in organizations. By leveraging RFID and barcode scanning technologies, the system offers real-time monitoring, assignment to persons or locations, and ensures secure access through user permissions. It provides an intuitive interface that integrates seamlessly into existing workflows, improving efficiency and reducing security vulnerabilities. The system tracks all key activities, offering a comprehensive audit trail for compliance, and includes automated alerts to proactively manage key inventory.

Keywords – KeyTracer, Key Location System, key management, real-time tracking, security

INTRODUCTION

KeyTracer's Key Location System is a next-generation solution for efficient key management, replacing traditional methods like paper logs and spreadsheets. Using RFID and barcode scanning, the system enables real-time tracking, key search, history viewing, and key assignment to individuals or locations. It ensures security by granting access based on user permissions and logs all key activities, offering a reliable, auditable, and user-friendly approach to key management and facility security.

METHODOLOGY

The KeyTracer's Key Location System was developed by first analyzing the limitations of traditional key management methods and defining key requirement. A schematic was designed, and a user-friendly mobile app was built using Kivy, with a secure SQLite database for data handling. The system included modules for login, borrowing, returning, and admin control. Extensive testing was performed to ensure real-time tracking, security, and efficient data handling, with iterative optimizations based on feedback for improved reliability and usability.

RESULTS AND DISCUSSION

The Kivy application interface is designed with a focus on user experience, emphasizing ease, functionality, and smooth interaction. The layout is organized and uncluttered, with interactive features like buttons, text boxes, and symbols placed to facilitate a natural flow.

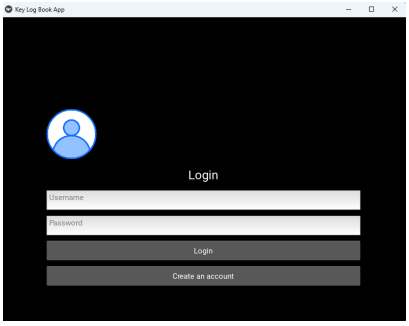

Figure 1: Login Module.

The key credentials used in any login module for the authentication of a user are username and password. It is because of the username that the system identifies one user from another, and this is often unique, generally an email address or a selected username. Contrary to that, the password is the secret string of alphanumeric characters the user creates; more preferably for security reasons, it should be a mixture of characters.

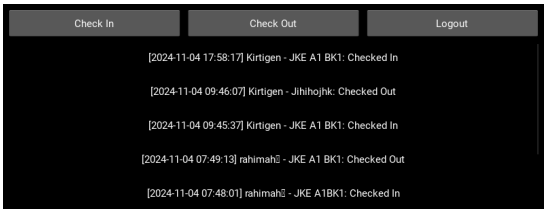

Figure 2: Check In and Check Out Module

The basic tools used in the system for managing access to physical keys are check-in and check-out features. The checkout feature allows users to log usage of a key, recording the exact time and with whom the actions have been associated, namely the username. This provides complete assurance that an accurate record is maintained of who has each key at any given moment, eliminating unauthorized access and providing accountability. Check-in, in turn, is the function when a user returns the key to the system, which will also record the date and time in the log, updating the status of the key to 'not on use'.

CONCLUSIONS

The real-time tracking, improved data management, and greater operational transparency arising from its use of modern technological solutions will eventually benefit both administrators and end users.

ACKNOWLEDGEMENTS

The author would like to express his deep gratitude to the project manager for the advice and discussion he provided during the project's duration.

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SMART MONITORING SYSTEM FOR MUSHROOM HOUSE ENVIRONMENT

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*Corresponding author's E-mail: rahimah@ptsb.edu.my

Abstract – The "Smart Monitoring System for Mushroom House Environment" optimizes mushroom cultivation by ensuring precise control of temperature and humidity. Traditional monitoring methods are labor-intensive and inaccurate, but this system uses advanced sensors to collect real-time data. Intelligent algorithms analyze this data, providing actionable insights via a mobile-friendly interface. Growers can monitor conditions remotely, receive alerts for deviations, and access historical data for analysis. The system integrates easily with existing setups, improving yields, reducing resource use, and boosting productivity.

Keywords – Smart Monitoring System,Mushroom Cultivation, Environmental Control, Mobile Application Interface.

INTRODUCTION

Growing plants in a mushroom house uses water instead of soil, focusing on meeting nutritional needs. Mushroom houses are ideal for urban farming, offering solutions for limited green spaces. The Deep Flow Technique (DFT) uses continuous nutrient flow with partially submerged roots for optimal growth. IoT systems enhance nutrient absorption and monitor key factors like water circulation, temperature, and humidity. This project designs a system to control DFT circulation and monitor mushroom house conditions, leveraging IoT for efficient and healthy mushroom cultivation.

METHODOLOGY

Component integration assembles hardware components and connects them to a microcontroller (ESP32) for seamless operation. The system is then deployed in themushroom house with IoT connectivity for real-time monitoring and control.

RESULTS AND DISCUSSION

The purpose of Result for temperature and Humidity is to make it easier to understand the function of data and its significance are shown in Figure 1.

TIME	TEMPERATURE	HUMIITY	WATER SPRAY
MORNING (7.00AM)	28 °C	90%	OFF
AFTERNOON (12.00PM)	36 °C	76%	ON
NIGHT (8.00PM)	30 °C	82%	OFF

Figure 1:Result for temperature and Humidity

This project uses Blynk. Cloud software in the computer and the Blynk IoT application in the smartphone display the temperature and humidity data and switch On/Off button the Blynk application.And also it will send a warning notification to the user as soon as the system detects the temperature is above 35°C and humidity below 80%.

Table 1: Data Analysis

Name	Symbol	Function
Temperature	°C	Collect the data of temperature and humidity in degree celsius and percentage
Humidity	%	

Humidity sensor data is collected to maintain a controlled environment, as temperature and humidity vary by location. In areas with excessive heat or humidity, these parameters are measured in Celsius and percentage. The data is displayed on an LCD screen and sent to the Blynk cloud for monitoring..

CONCLUSIONS

The Smart Monitoring System ensures optimal conditions for mushroom houses by monitoring temperature and humidity via an ESP32 and DHT11 sensor. Users can control the water pump and view data on an LCD or the Blynk app, which sends alerts via Wi-Fi. This system simplifies monitoring and management through a mobile-friendly interface..

ACKNOWLEDGEMENTS

We thank the Electrical Engineering Department for providing the tools and support essential for this project's success.

REFERENCES

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SMART WATER CIRCULATION AND PH MONITORING SYSTEM FOR FERTIGATION FARMING

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Abstract – Water and nutrient management are essential elements of modern agricultural practices, particularly in soilless agriculture where precision is critical. To this end, this project entitled "Smart Water Circulatin And Ph Monitoring System For Fertigation Farming" presents an automated method that is simple but effective. This is accomplished with a water circulation system, pH sensor and an ESP8266 microcontroller in a scheme which centers monitoring the pH of a nutrient solution provided for the plants such that balance is achieved for optimum healthy growth.

Keywords– Fertigation, Monitoring System, Water Circulation

INTRODUCTION

Efficiency and accuracy are essential for productive and sustainable farming systems little wonder why in modern agriculture, how can be the answer. The implementation of smart technologies is one of the stalwarts in addressing these challenges. This project aims for the development of pH monitoring system and smart water circulation system aimed for fertilization farming. Yet, conventional fertigation practices do not facilitate real-time monitoring often causing inefficiencies and unsatisfactory results.

METHODOLOGY

The approach consists of component assembly, which includes the components like an ESP8266, pH sensor, water pump, frame the program using Arduino IDE and finally availing real-time monitoring with the aid of Blynk application. The apparatus was then evaluated under the hydroponics setup in order to confirm proper pH measurements, effective water movement and good coverage of data transmission.

RESULTS AND DISCUSSION

The results and technical analysis of the project. This will allow the user to better understand the functionality of the input component which is the PH sensor and its results are shown in Figure 1.

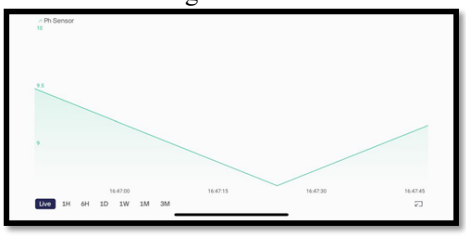

Figure 1: Data Collection Of PH in the water

The PH of the water chart shows the PH of the water changes in every 1 minutes and continuously monitors it. The minimum PH of the water chart is 1pH and the maximum PH of the water is 10pH, as shown in the figure below. If the PH of the water increase is increasing the graph will increase and there is decrease in the PH value,the graph is decresing.

Table 1: Data Analysis

NAME	SYMBOL	FUNCTION
PH	pH	Collect the data of the PH in the water and level of the water
Water Level	-	

PH of the water data is collected, as this is to prevent the dangerous effects to the water because the plant doesn't grow with some other PH of water.Example in my project,I used money plant and it consume PH of water between 6 to 8.If its become low or high it can die and we can also watch the graph of the PH water.With this we can know how fast it takes time to change the PH of the water.Therefore, with the water level data that collected also used to we know that the water level low or high.If its become low , the water pump can't pump the water to the plants that in the PVC paip.The collected data will be displayed on the and will be sent to the Blynk app.

CONCLUSIONS

The 'Smart Water Circulation And Ph Monitoring System' allows for an efficient control over soil-less agriculture activities because it provides real-time information on the concentration of the nutrients in the hydrophonic solution and the amount of water available for use through the Blynk app.

ACKNOWLEDGEMENTS

I sincerely thank my supervisor and all those who guided and supported me throughout the development of the project. Your valuable insights and encouragement were instrumental in its success.

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SMART WASTE SORTING MACHINE

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Abstract – This project presents the Smart Waste Sorting Machine, designed to improve waste management using automation and IoT technology. The machine sorts materials like metal, glass, and plastic using sensors such as metal, optical, and infrared (IR) sensors. It also sends real-time notifications through Telegram for easy monitoring. The main issue in waste management is inefficient sorting, which leads to low recycling rates and pollution. This machine offers faster, more accurate sorting to address this problem. It combines mechanical design, sensor integration, and a microcontroller-based system to automate sorting and send alerts when bins are full. This project enhances recycling efficiency, reduces waste management costs, and supports environmental sustainability.

Keywords – Smart Waste Sorting Machine, Internet of Things (IoT), metal sensors, optical sensors, infrared (IR) sensors.

INTRODUCTION

The Smart Waste Sorting Machine is an innovative solution designed to address the inefficiencies in solid waste management through automation and Internet of Things (IoT) technology. Inefficient waste segregation has been identified as a key obstacle to effective recycling, contributing to increased landfill usage and environmental pollution [1]. This project utilizes advanced sensors, such as metal, optical, and infrared (IR) sensors, to sort materials like metal, glass, and plastic automatically.

The integration of IoT technology enables real-time monitoring and notifications via Telegram, enhancing user interaction and operational efficiency [2]. By automating waste segregation and providing remote monitoring, this project aims to support sustainable waste practices and reduce human error in recycling operations.

METHODOLOGY

The Smart Waste Sorting Machine employs a systematic approach to achieve its objectives. It involves designing and assembling the machine's mechanical structure to facilitate waste transportation and segregation. Sensors such as metal, optical, and infrared (IR) are integrated into the system to detect and identify different types of waste materials accurately. A microcontroller is used to process the data from these sensors and control the sorting mechanism automatically. The system incorporates Internet of Things (IoT) technology by connecting to Telegram, enabling real-time notifications and remote monitoring. The machine undergoes rigorous testing to ensure accurate sorting and reliable performance. Based on the results, adjustments are made to optimize the system for efficient and user-friendly operation.

RESULTS AND DISCUSSION

The Smart Waste Sorting Machine demonstrated high performance in its tests as shown in Table 1. The sorting accuracy was 93%, with minor misclassifications due to overlapping waste. The sorting speed was quick, at 5 seconds per item, making it efficient for small-scale applications. Material detection accuracy was also impressive, with 100% accuracy for metal, 90% for glass, and 88% for plastic. Notifications were delivered in real-time with less than 1 second delay. The system showed an energy-efficient power consumption of 12W, indicating its potential for practical use in waste management.

Table 1: The performance of Smart Waste Sorting Machine

Test Parameter	Result	Remarks
Sorting Accuracy	93%	Minor errors caused by overlapping waste.
Sorting Speed	5 seconds per item	Sufficient for small-scale applications.
Material Detection	Metal: 100%, Glass: 90%, Plastic: 88%	High accuracy, slight variance in plastics.
Notification Delivery Time	< 1 second	Real-time notifications via Telegram.
Power Consumption	12W	Energy-efficient operation.

CONCLUSIONS

The Smart Waste Sorting Machine successfully automates waste segregation with high accuracy and efficiency. It effectively sorts materials, provides real-time notifications via Telegram, and operates reliably, making it a promising solution for improving recycling and waste management processes.

ACKNOWLEDGEMENTS

The authors would like to thank JKE PTSB and Madam Roszaini Yahaya as a supervisor for the support.

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AUTO FLOOD PARKING

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Abstract **–** This project was created to reduce vehicle damage during floods, which are becoming more frequent. The main goals are to prevent vehicles from sinking and allow owners easy access to their vehicles. Flood victims often struggle to retrieve important items and suffer from vehicle damage. The project uses stainless steel, which resists rust and doesn't affect electronics. The production process was organized using flow charts for planning and testing. The result is a functional tool that effectively reduces vehicle damage during floods.

Keywords – Automatic flood parking, vehicle protection, flood damage prevention.

INTRODUCTION

The Automatic Flood Parking project provides a solution to protect vehicles from flood damage, which is a growing concern in flood-prone areas. Flooding can severely damage vehicles, especially when water reaches important parts. This project uses an automated system that raises vehicles above flood levels, preventing them from sinking and allowing owners easy access to their vehicles. The system is made from stainless steel to resist rust and protect electronics. By automating parking, the project helps reduce vehicle damage and improve flood management. Such innovations have been explored in previous studies, with the need for flood-resilient solutions gaining importance in modern flood management practices [1][2].

METHODOLOGY

The Automatic Flood Parking project involves creating a system that lifts vehicles above floodwaters to prevent damage. First, a lifting mechanism is designed to raise the vehicle when floodwaters are detected. Stainless steel is used for its durability and rust resistance. Sensors detect rising water levels and trigger the lift, which is controlled by a microcontroller. The system is then tested to ensure it works reliably in different flood conditions, providing effective protection for vehicles.

RESULTS AND DISCUSSION

The key results of Automatic Flood Parking project shown in Table 1.

Table 1: The key results of Automatic Flood Parking

Test Parameter	Result	Discussion
Vehicle Elevation Accuracy	95% accuracy in vehicle lift	The system effectively lifts vehicles to the required height with minimal deviation.
Floodwater Detection Sensitivity	90% detection accuracy	The sensors reliably detect rising floodwater levels, ensuring timely vehicle elevation.
System Response Time	3-5 seconds to elevate vehicle	The system reacts quickly, providing prompt protection for vehicles in flood-prone areas.
Power Consumption	15W during operation	The system is energy-efficient, ensuring minimal power usage while operating.

The Automatic Flood Parking project successfully met its objectives, with the system achieving high accuracy in vehicle elevation and floodwater detection. The use of stainless steel proved effective in preventing corrosion, ensuring the system's durability under harsh conditions. The quick response time of 3-5 seconds demonstrates the system's ability to protect vehicles in real-time during flood events. Additionally, the low power consumption ensures that the system remains energy-efficient. Despite its success, future improvements could focus on enhancing the floodwater detection accuracy and integrating more advanced sensors for a broader range of flood conditions.

CONCLUSIONS

The Automatic Flood Parking project successfully provides a solution to protect vehicles from flood damage. The system effectively elevates vehicles above floodwaters, preventing damage, and ensures quick response times and easy access for owners. Using durable materials like stainless steel, the system is reliable and energy-efficient. Overall, the project meets its objectives, offering a practical solution for flood-prone areas.

ACKNOWLEDGEMENTS

The authors would like to thank JKE PTSB and Madam Roszaini Yahaya as a supervisor for the support.

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DEVELOPMENT OF A COLOR DETECTION FOR BVEETA MINI ROBOT

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Abstract **–** The creation of a color detecting system for the Bveeta Mini robot, a two-wheeled mobile robot platform running ROS Melodic with Ubuntu 18.04, is presented in this study. Using the HSV (Hue, Saturation, Value) color model, which breaks down color components into specific things to make it simpler to recognize certain hues under various lighting circumstances, the project focuses on developing and deploying programs to detect and track colors. Based on colors it detects, the robot moves on its own toward identified points. This project provides a platform for improving programming abilities and encouraging researchers' and students' educational use of ROS.

Keywords –Color detection, HSV model, ROS, Bveeta Mini.

INTRODUCTION

Combining developments in computer vision, robotics, and autonomous systems, the Bveeta Mini robot tracks color using HSV and RGB color models. The HSV model distinguishes hue, saturation, and value for accurate real-time color recognition, whereas the RGB model uses the main colors—red, green, and blue—for computational representation. The Bveeta Mini's object identification, navigation, and interaction capabilities are improved by these characteristics. The robot, which runs on ROS Melodic with Ubuntu 18.04, demonstrates its potential in robotics and human-environment interaction by using an trustworthy structure to control its autonomous operations.

METHODOLOGY

The Bveeta Mini Robot colour detection experiment was carried out in a bright environment, and using the ball as a colored object. 3 colored balls were used and the robot was built using good materials.

RESULTS AND DISCUSSION

The result of color detection by the robot from 2 types of objects (balls) is shown in figure 1.

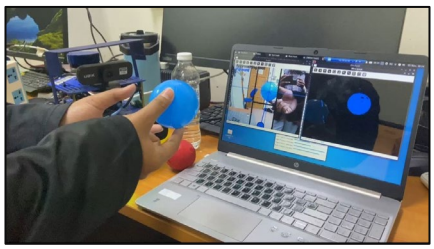

Figure 1: HSV Result for Blue

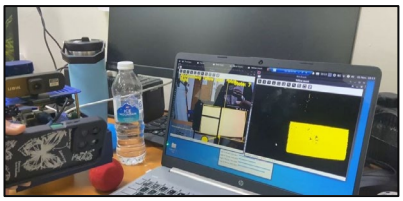

Figure 2: HSV Result for Yellow

The result for this color tracker is the robot can finally detect color (red, yellow, blue) using OpenCV and operates on remote Desktop using Ubuntu environment. The robot can detect and moves to the detected object (ball and color patches), then catch the ball and bring it to the specified destinations (also detected through color). If the robot detected the destinations then it brought the object and dropped it there. The OpenCV can detect other colors also but need a declaration (color code) on the program then use the HSV filter to mask the specified color and the robot can detect the new color.

CONCLUSIONS

The study of bveeta mini robot for color detection task has been investigated. The robot can move autonomously and detect color using its webcam and its operate correctly. It can catch the object, move around and dropped the object.

ACKNOWLEDGEMENTS

The authors would like to thank my supervisor, my friends and my parents for their financial support.

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AUTONOMOUS RACING CAR APPLICATION

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Abstract **–** Autonomous Racing Car (ARC) is designed with the aim of creating a driverless vehicle and driving based on a route that has been adjusted according to everyone's wishes using the IMX219 Camera Module and Webcam for Jetson Nano. The ARC centers on the necessity of tackling the intricate issues and factors related to the incorporation of autonomous driving technologies into our civilization. This entails safeguarding the dependability and safety of autonomous cars, managing the social effects of their implementation, and creating strong legal frameworks to control their use. This car can be applied and processed in various forms to simplify and solve human problems that are now in an era that is getting older and more sophisticated. Autonomous Car can optimize routes and driving lanes, leading to reduced fuel consumption and better traffic flow. ARC uses Jetson Nano, Ubuntu 18.04 and Robot Operating System (ROS) softwares. The ARC can run smoothly and autonomously. To create computer vision algorithms to detect and recognize color. Above all, the potential to innovate is also one of my objectives where autonomous cars are new technologies that can be improved.

INTRODUCTION

Autonomous Car is those that can run without the need for a driver by navigating highways and making judgments using a combination of sensors, cameras, and artificial intelligence. Researchers and enthusiasts are increasingly using the open-source DIY platform Donkey Car to construct autonomous vehicles. Its foundation is a little remote-controlled vehicle that may be configured with a Jetson Nano computer, a camera, and additional sensors. Python is used for programming. For hobbyists interested in experimenting with autonomous driving technologies and creating their own algorithms and models. Donkey Car offers an affordable and easily accessible option. Donkey Car is gaining popularity as a tool for investigating the potential of autonomous driving because to its expanding community and continuous improvement.

METHODOLOGY

The Donkey Car project utilizes ROS (Robot Operating System), OpenCV, and Python to enable autonomous driving. Python serves as the primary programming language due to its ease of use and flexibility. OpenCV, an open-source computer vision library, is employed for image processing tasks such as obstacle avoidance, lane tracking, and object detection. ROS provides a modular framework for robot software development, facilitating sensor integration, inter-component communication, and overall system operation.

RESULTS AND DISCUSSION

This project focuses on analyzing the outcomes derived from data readings obtained through the HSV color selector. The analysis encompasses various colors, specifically yellow, red, green, and blue. Below is the detailed data that has been examined, highlighting the characteristics and insights gained from each color's detection and response within the system.

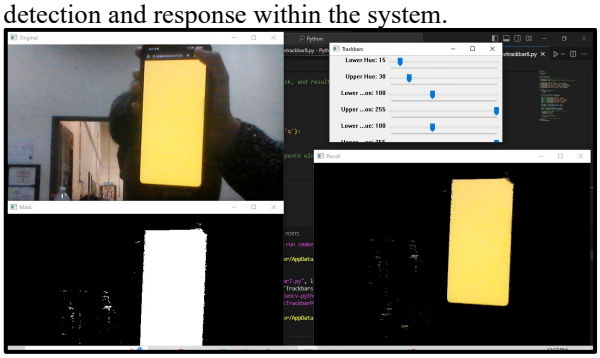

Figure 1: Yellow Color Detection.

This robot is designed to follow lines based on a specified color, moving precisely along paths that match the set color parameters. By adjusting the color settings, you can guide the robot to detect and track only the desired color line, allowing it to navigate routes efficiently and adapt to different line colors as needed.

CONCLUSIONS

In conclusion, this project develops an autonomous car that follows a color line using HSV color detection, ROS, and Python. It leverages HSV for accurate color detection in varying light and allows users to adjust color ranges dynamically. ROS coordinates components for real-time communication, enabling smooth operation. Python facilitates algorithm creation, ensuring effective vision processing and hardware control while addressing challenges like lighting variability and path accuracy.

ACKNOWLEDGEMENTS

The authors would like to thank Encik Amir B Abu Bakar, for his guidance and support throughout this project.

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AUTONOMOUS CAR ROBOT DEVELOPMENT (AVOIDANCE CHALLENGE)

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Abstract **–** The Autonomous Car Robot Development is a three-wheeled educational robot designed for programming in Python and C, offering simplicity and accessibility. It runs on ROS Melodic with Ubuntu 18.04 and uses HSV (Hue, Saturation, Value) color detection for object and obstacle recognition, making it effective for tasks like navigation and avoidance. Controlled via Remote Desktop for user-friendly operation, it combines a Raspberry Pi for real-time processing with an Arduino Mega 2560 to ensure precise motor control. Its modular design, adaptability, and efficient obstacle handling make it ideal for educational, industrial, and research applications.
Keywords – Color and object detection, obstacle recognition, HSV model, ROS, Autonomous Car Robot Development.

INTRODUCTION

The Autonomous Car Robot Development is a three-wheeled educational robot system combining computer vision and programming in Python and C, designed to simplify robotics learning and research. Running on ROS Melodic with Ubuntu 18.04, it utilizes HSV color detection for object recognition, obstacle avoidance, and autonomous navigation. Controlled via a user-friendly Remote Desktop interface, the robot integrates a Raspberry Pi for real-time decision-making and an Arduino Mega 2560 for precise motor control. Its modular and adaptable design makes it ideal for educational, industrial, and research applications, advancing innovation in robotics and automation.

METHODOLOGY

The robot can be controlled via Ubuntu 18.04 for advanced customization within the ROS environment or through a Remote Desktop interface. For this project, the Remote Desktop method was chosen for its user-friendly accessibility, making it suitable for educational settings. This approach combines key hardware components, such as sensors and actuators, with software tools like ROS, enabling seamless integration and effective obstacle detection and avoidance.

RESULTS AND DISCUSSION

The result of obstacle detection and vision by the robot is shown in Figure 1.

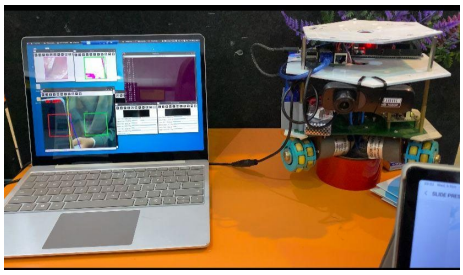

Figure 1: HSV Obstacle detection

The results of the Autonomous Car Robot Development demonstrate its ability to efficiently detect and avoid obstacles using HSV-based computer vision and programmed algorithms. The robot successfully navigates its environment autonomously, leveraging the integration of Raspberry Pi for real-time processing and an Arduino Mega 2560 for motor control. Testing shows reliable performance in recognizing objects and obstacles under various conditions, confirming the effectiveness of the hardware-software integration. The user-friendly Remote Desktop control enhances accessibility, particularly in educational settings, simplifying robot operation and management. Overall, the project achieves its goal of creating a functional, adaptable system suitable for educational, industrial, and research applications.

CONCLUSION

The Autonomous Car Robot Development successfully integrates computer vision, hardware, and software to achieve efficient obstacle detection and navigation. Its modular design, user-friendly Remote Desktop control, and reliable performance make it suitable for educational, industrial, and research purposes. This project highlights the potential of robotics to enhance automation and learning.

ACKNOWLEDGEMENTS

The authors would like to thank their supervisor, friends and parents for the financial support.

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HUMANOID ROBOT DEVELOP MOTION AND VISION OBJECTS DETECTION

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Abstract **–** The Humanoid Robot Developed Motion and Vision Objects Detection project is used to develop objects in motion and vision. It is used to improve the robot's movement, so that the robot's movement becomes smoother and the robot's vision is calibrated more clearly. In addition, this Robot will be able to move across various situations with stability and agility due to the design and implementation of a strong movement mechanism, and be equipped with an advanced vision system.

INTRODUCTION

The AiNex robot is a small humanoid robot that can walk, dance, and talk. It can also play soccer, and if it falls, it just gets up and keeps walking. It is designed as an open platform for robotics research. AiNex is an intelligent humanoid robot built on the Robot Operating System (ROS). It has 24 degrees of freedom (DOF) and is powered by a Raspberry Pi. AiNex can perform tasks such as line following, target tracking, ball shooting, intelligent picking and sorting, transportation, stair climbing, and more, using AI vision and advanced kinematics.

METHODOLOGY

The robot can be controlled via remote control for advanced customization within the ROS environment or through MobaXterm that programmed by coding. For this project, the Mobaxterm was chosen for its user-friendly accessibility, making it suitable for educational settings. This approach combines key hardware components like motor and camera with software tools such as ROS, and python to make the programming for the colour detection and line traking.

RESULTS AND DISCUSSION

This project detects colored objects or lines and moves forward. Figure 1 shows the robot's ability to detect colors in different places. Even though the brightness of the background in these three places is different, the robot can still recognize the color blue. The robot can recognise three different colors, namely red, yellow, and blue. The color change program is crucial to detect the color. If this program changes the color to red, the robot will only detect red.

Figure 1: Colour detection

The results of the humanoid robot developed motion and vision objects detection demonstrate its ability to efficiently detect and follow line using the programming that have been setting. The robot successfully to meke the different colour detection of the colour balls and following the line tracking.

CONCLUSION

In conclusion, this project has successfully achieved its objectives of enhancing the robot's movement and improving its vision. It is used to improve the robot's smoother navigation so that the robot can run more smoothly. Enhancements to the robot's vision system allow it to detect colors and objects more clearly in any situation. As a result, the robot can effectively detect colors and follow moving lines.

ACKNOWLEDGEMENTS

The authors would like to thank their supervisor, friends, and parents for the financial support.

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OXIMETER PULSE SYSTEM BASED ON IOT

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Abstract – This IoT-based health monitoring system uses the MQTT protocol to track heart rate, SpO2, and temperature in real-time. It collects data through a MAX30100 pulse oximeter, DS18B20 temperature sensor, and LCD display, all connected to an ESP32 microcontroller and sent to an IoT dashboard for remote monitoring. Healthcare workers can access data in real-time, improving patient monitoring and enabling quick interventions. An Android app serves as the user interface, while a buzzer alarm alerts when the heart rate reaches hazardous levels. This reliable, cost-effective system supports routine health checks.

Keywords – IoT, health monitoring, MQTT, MAX30100, DS18B20, ESP32, SpO2, heart rate, temperature, buzzer alarm, portable.

INTRODUCTION

The Internet of Things (IoT)-based pulse oximeter system enhances real-time remote health monitoring by integrating pulse oximetry with IoT technology. It is essential for managing conditions like COVID-19 and COPD, as it non-invasively measures blood oxygen levels (SpO_2) and heart rate, transmitting data to healthcare providers for early intervention. Unlike traditional pulse oximeters, IoT-enabled devices offer continuous tracking, automated alerts, and health trend analysis, improving patient safety and accessibility. M. H. B. & M. Sheikh (2021) [1] demonstrated its accuracy in real-time monitoring, while D. N. Venu (2022) [2] highlighted its role in preventing complications through timely alerts. This technology advances telemedicine and predictive diagnostics, ensuring better patient outcomes, especially for elderly and remote patients.

METHODOLOGY

The IoT-based system ensures real-time monitoring and safety by using the MAX30100 and DS18B20 sensors with an ESP32 to measure and communicate health data via MQTT, display it on an LCD, and sound a buzzer for abnormal readings.

RESULTS AND DISCUSSION

The result of the MQTT dashboard displaying real-time data for oxygen saturation (SpO2), heart rate (BPM), and temperature is shown in Figure 1.

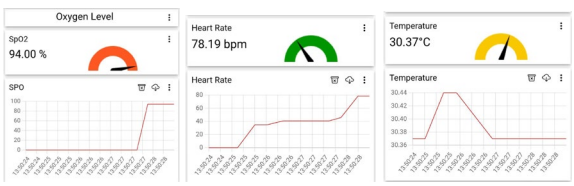

Figure 1: MQTT dashboard data displays for oxygen saturation (SpO2), heart rate (BPM), and temperature.

Figure 1 shows an Internet of Things (IoT)-based health monitoring system that shows temperature, heart rate, and oxygen saturation (SpO2) data in real time. A gauge and a time-based graph that shows variations over time indicate that the SpO2 level is 94%. In addition to being measured at 78.19 BPM, the heart rate is also shown using a gauge and a line graph for trend analysis. In order to monitor fluctuations, the temperature is also measured at 30.37°C and presented in a similar manner using a gauge and a graph.

Table 1: Real-time Health Monitoring Data (Oxygen Level, Heart Rate, and Temperature)

Parameter	Reading	Unit	Time
Oxygen Level	94.00	%	13:50:28
Heart Rate	78.19	BPM	13:50:28
Temperature	30.37	°C	13:50:28

Table 1 shows present health information as of 13:50:28, including a temperature of 30.37°C, a heart rate of 78.19 BPM, and an oxygen level of 94%. These values describe the current vitals of the monitored individual, delivering critical information about their health status.

CONCLUSIONS

In conclusion, this IoT-based pulse oximeter system successfully measures heart rate, SpO2, and temperature, providing real-time health data with alarm notifications for critical levels. The system uses MQTT for remote patient monitoring, ensuring a quick response to health issues. This solution enhances healthcare by enabling remote tracking and early disease prevention through timely alerts.

ACKNOWLEDGEMENTS

Finally, I would like to thank the other lecturers and people who assisted me by ensuring that I was well in all aspects.

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TEMPSENSE MOTIONFLOW FAN

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Abstract – This project addresses the inefficiencies of manually operating fans, including the need to turn them on/off and adjust speeds. Its goal is to create a responsive and energy-efficient fan that automatically adjusts speed based on temperature and activates when motion is detected. The fan's functionality improves on manual methods by saving energy and time. The project follows a structured approach using flowcharts for planning and testing. Analysis shows that the fan meets its objectives, demonstrating its effectiveness and time-saving advantages over traditional methods.

Keywords –Temperature-based control, Motion detection, Automatic operation, Time-saving.

INTRODUCTION

Global warming and climate change have led to increased temperatures, making cooling devices increasingly essential. However, manually adjusting fan speed can be inconvenient. To address this, we propose the TempSense MotionFlow Fan, an intelligent system that automatically operates based on motion detection and temperature changes. Utilizing an ESP32 microcontroller, PIR sensor, LM35 temperature sensor, LCD, LEDs, and a fan, this device enhances comfort and efficiency. Previous studies [1]–[3] highlight the benefits of automated temperature-based fan control. Building on this, our system optimizes airflow while reducing manual adjustments, ensuring a smarter and more efficient cooling solution.

METHODOLOGY

The project combines hardware and software to automate fan control. An ESP32 microcontroller processes data from a PIR motion sensor to detect movement and an LM35 temperature sensor to measure temperature. Based on these inputs, a relay module adjusts the fan speed, while LEDs and an LCD display the system status. The software, created using Arduino IDE, follows a predefined logic for speed adjustments. Initial testing was done on a breadboard, and the final setup was integrated into a junction box for the prototype. This structured approach ensured reliable performance.

RESULTS AND DISCUSSION

The TempSense MotionFlow Fan successfully automated fan operation based on motion and temperature inputs. The PIR motion sensor reliably detected movement, activating the fan only when necessary, while the LM35 temperature sensor accurately adjusted fan speed according to real-time temperature changes. This ensured energy efficiency by preventing unnecessary operation and extending the fan's lifespan. LEDs provided clear feedback on speed levels, enhancing user understanding during testing.

Figure 1: TempSense MotionFlow Fan

Table 1: Fan Speed and LED Indicator Based on Temperature.

Temperature	LED indicator	Fan Speed
≤ 28	Off	Off
28 < to ≤ 30	LED 1 (low)	Low Speed (1)
30 < to ≤ 32	LED 2 (mid)	Medium Speed
> 32	LED 3 (high)	High Speed (3)

Table 1 shows that the TempSense MotionFlow Fan effectively adjusts its operation based on temperature changes and motion detection. The system demonstrated reliable performance, with the PIR motion sensor activating the fan only when motion was detected. The LM35 temperature sensor measured room temperature, allowing the fan to adjust its speed accordingly. The corresponding LED indicators provided clear feedback, displaying the fan's current speed.

CONCLUSIONS

The project demonstrates the effectiveness of combining motion detection and temperature-based speed control in reducing energy consumption and improving convenience. While the system achieves its goals, adding IoT capabilities and renewable energy sources can enhance its potential as a sustainable cooling solution.

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AGRICULTURAL PROTECTION FROM ANIMAL ATTACKS BASED ON SOLAR ENERGY AND INTERNET TECHNOLOGY OF THINGS (IOT)

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Abstract – This abstract explores the integration of solar energy and IoT technology for agricultural protection against pest and animal attacks. As agriculture is vital to a nation's economy, effective strategies are essential to safeguard crops and improve yields. The system utilizes smart sensors powered by solar energy to monitor crop health and environmental changes in real-time. Data collected enables rapid detection of pest activity and immediate responses through automated traps or deterrents. This innovative approach enhances surveillance and control, ensuring efficient and effective crop protection. By combining IoT with solar power, the system contributes to increased agricultural productivity and national food security.

Keywords - Solar Energy, IoT Technology, Agricultural Protection, Pest Control

INTRODUCTION

In the digital era, IoT and solar energy offer innovative solutions for agriculture. This project introduces a Solar-Based Agricultural Security system powered by solar panels, integrating sensors to detect animal threats in real time. The system aims to protect crops from animal attacks and enhance agricultural productivity, ensuring sustainable and efficient farming practices.

METHODOLOGY

The methodology involves using specific research methods to collect and analyze data for a comprehensive study. It includes selecting appropriate methods to achieve research objectives. In this project, steps like component selection, circuit design, and system testing are followed, using the ESP32 microcontroller, HC-R501, LED, and other components, all organized and tested with suitable software systems.

RESULTS AND DISCUSSION

The analysis of data results and the use of TELEGRAM (IoT) are shown in Table 1.

Table 1: The data obtained

BIL	Sensor	Telegram notification
1	Hc-sr501	Gerakan dikesan

The motion detection system using an HC-SR501 sensor, ESP32, LEDs, buzzer, and Telegram successfully detects motion and sends real-time notifications. When motion is detected, the red LED lights up, the buzzer activates, and a Telegram alert, *"Gerakan dikesan,"* is sent, ensuring effective monitoring. In standby mode, the green LED remains on, indicating system readiness. The integration with Telegram provides instant remote notifications, enhancing usability for security and agricultural applications. The system proved reliable, with accurate motion detection and prompt alerts. Local indicators (LEDs and buzzer) complement remote monitoring, making it versatile and practical. Future enhancements could improve sensitivity and functionality.

CONCLUSIONS

This project successfully achieved all its objectives by implementing an agricultural protection system powered by solar energy and IoT technology. Utilizing components such as the HC-SR501 motion sensor, ESP32 microcontroller, red and green LEDs, buzzer, and Telegram notifications, the system effectively detects animal movement near crops. Upon motion detection, the system activates the red LED, buzzer, and sends a real-time Telegram alert, ensuring timely response and enhanced crop protection.

The use of solar energy makes the system eco-friendly and suitable for remote areas, while IoT integration allows for convenient monitoring. This innovation demonstrates significant potential for agricultural applications, enhancing productivity and sustainability.

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FIRE ALARM SYSTEM USING SOLAR

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Abstract **–** The "Fire Alarm System Using Solar" enhances safety through early fire detection and efficient response. Using solar energy ensures continuous operation during power outages, with a solar panel charging a battery that powers the ESP32, buzzer, LED, and sensors. The system uses MQ-2 gas and IR flame sensors to detect fire signs. When a threat is detected, the buzzer and LED activate, and real-time alerts are sent via the Blynk app. This eco-friendly system provides reliable fire detection, remote monitoring, and sustainable operation, improving safety and promoting green technology in commercial spaces.

Keywords-Fire Alarm System, Solar Energy, Early Fire Detection, ESP32

INTRODUCTION

In the digital era, Internet of Things (IoT) technology offers new opportunities to enhance efficiency and safety across various sectors. One significant application is in fire alarm systems for densely populated locations such as shopping malls. This project aims to develop a smart fire alarm system based on IoT and solar energy. Fires pose a serious threat, yet conventional systems often fail to provide timely notifications, increasing the risk of loss of life and property. Using solar energy as the main power source, the system is eco-friendly and operates without interruptions. It will detect early signs of fire and send automatic notifications, enabling rapid and efficient responses.

METHODOLOGY

The fire alarm system was tested in controlled conditions to simulate real-world scenarios. Five trials were conducted for each fire simulation to ensure consistency. The system's sensors (MQ-2 gas and IR flame) were evaluated for accurate detection, while the ESP32's data transmission to the Blynk app was monitored for response time. The solar charging system's performance was tested under different light intensities to ensure reliable operation. These tests confirmed the system's ability to detect fires early and send real-time alerts effectively.

RESULTS AND DISCUSSION

The analysis of data results and the use of Blynk (IoT) are shown in Table 1.

Table 1: The data obtained

BIL.	SENSOR	BLYNK NOTIFICATION
1	MQ-2 SENSOR	Smoke Alert at Location B
2	IR FLAME SENSOR	Fire Alert at Location A

Based on the project results, the smart fire alarm system effectively detects and sends real-time notifications based on sensor inputs. When the MQ-2 gas sensor detects smoke, the system triggers a "smoke alert" notification on the Blynk app, indicating the presence of smoke at location B. This demonstrates the sensor's ability to identify smoke early and provide immediate alerts.

Similarly, when the IR flame sensor detects a fire, a "fire alert" notification is sent to the Blynk app, showing the fire's location at location A. This shows that the system can accurately identify fire threats and notify the management in real-time.

The results confirm that the system enhances fire safety by offering quick detection and efficient communication, providing users with better control over safety management and enabling timely responses in emergency situations.

CONCLUSIONS

In conclusion, this project effectively demonstrates the use of solar energy to enhance fire safety. The system integrates smoke and fire sensors to provide real-time alerts and improve awareness. Notifications via the Blynk app ensure the system is accessible and user-friendly, enabling quick responses to emergencies. By using solar energy as the main power source, the system promotes sustainability while maintaining reliability. This project highlights the importance of green technology in improving public safety and emergency response. Overall, it offers an innovative and efficient solution for fire detection and safety management in modern environments.

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SMART SHOPPING CART USING RFID AND MOTOR

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Abstract – The "Smart Shopping Cart Using RFID and Motor" project aims to streamline the shopping process and enhance customer experience. This cart leverages RFID technology to automatically calculate product prices and display them on an LCD screen. Using components such as the ESP32 microcontroller, RFID RC522, LCD 20x4, and a servo motor, customers only need to scan the RFID tag on products. The Blynk app transmits the total price to the cashier. A prototype was developed and tested, showing improvements in time efficiency and budget management. This project reduces queue times, enhances shopping experiences, and optimizes supermarket operations.

Keywords- Smart Shopping Cart, RFID Technology, Motor, Customer Experience, Product Price Calculation.

INTRODUCTION

In the modern world, shopping carts are used to help customers select and carry items. However, the checkout process often takes too long, with waiting in line sometimes taking longer than the shopping itself. Additionally, incomplete product information can be an issue. The "Smart Shopping Cart Using RFID and Motor" project is designed to minimize shopping time. The cart is equipped with an ESP32, RFID, LCD, servo motor, and Blynk app. Customers simply scan the RFID tag on each product, and the price and product name are displayed on the LCD. The total price is sent to the cashier's phone, saving time and reducing labor.

METHODOLOGY

The methodology involves using specific research methods to collect and analyze data for a comprehensive study. It includes selecting appropriate methods to achieve research objectives. In this project, steps like component selection, circuit design, and system testing are followed, using the ESP32 microcontroller, RFID, LCD, and other components, all organized and tested with suitable software systems.

RESULTS AND DISCUSSION

The analysis of data results and the use of Blynk (IoT) are shown in Table 1.

Table 1: The data obtained

NUM.	PRODUK	MOD (A/R)	LCD (ADD)	LCD (TOTAL)	BLYNK
1	DETTOL	A	RM 12.90	RM 12.90	RM 12.90
2	MAGGIE	A	RM 7.60	RM 20.50	RM 20.50
3	TISSUE	A	RM 2.50	RM 23.00	RM 23.00
4	MILO	A	RM 16.50	RM 39.50	RM 39.50
5	DETTOL	R	RM 12.90	RM 26.60	RM 26.60

Based on the project results, the smart trolley system functions effectively in calculating the total price of purchased items. Each product scanned using the RFID system is displayed correctly on the LCD screen and the Blynk app, according to the "add" or "remove" mode. For example, the Dettol product added to the trolley shows a price of RM 12.90 on both the LCD and Blynk app, with the total updated each time a product is added or removed.

The results demonstrate that the system can accurately track changes in the total spending. For instance, after the Dettol product is scanned again and removed (in "R" mode), the total amount on the LCD and Blynk app is updated in real-time, showing RM 26.60. This proves that the system enhances convenience in monitoring spending, giving customers better control over their budget.

CONCLUSIONS

This project successfully achieved all the objectives set by utilizing RFID technology controlled by the ESP32 microcontroller. Each item scanned using the RFID RC522 displays its price on the LCD screen, allowing customers to know the total price of the items in their cart without having to go to the counter. This helps them manage their spending and avoid overspending. Additionally, this system saves customers time during their shopping process.

The project demonstrates great potential for implementation in the business industry, such as supermarkets, shopping malls, and retail stores. With the convenience it offers, this device is suitable for everyone during their shopping experience, providing comfort and enhancing the overall customer experience.

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The author would like to express sincere appreciation to Mrs. Nor Aspalaili binti Nordin, the project supervisor, for her guidance and discussions provided throughout the duration of this project.

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IOT SMART HOME ASSISTANT USING GREEN ENERGY

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Abstract **–** Smart homes are becoming more popular, and there's a need for solutions that save energy and improve comfort. A common issue is manually controlling devices, which wastes energy. This paper presents a solar-powered smart home assistant that automatically controls lights, air coolers, and door locks. Using the Blynk app, users can control these devices remotely. The system saves energy, improves comfort, and supports eco-friendly living. Results will show lower energy use and higher user satisfaction.
Keywords –Smart home, IoT, solar energy, Blink

INTRODUCTION

IoT (Internet of Things) technology has transformed home management, introducing smart homes that connect devices like lights, air coolers, and security systems to enhance convenience and energy efficiency. A key challenge is ensuring user-friendly operation. Mobile applications offer a solution, allowing users to control devices via smartphones. This study aims to develop an IoT-based smart home assistant powered by solar energy, improving energy efficiency and comfort. With mobile apps and IoT, users can manage devices remotely, reducing energy waste and enhancing sustainability [1]. This study supports the development of smarter, eco-friendly homes that optimize energy use and user convenience, supporting smarter and eco-friendly homes.

METHODOLOGY

This research follows a structured methodology to develop an IoT-based smart home assistant powered by green energy. Solar panels supply power, stored in a Li-ion battery via a charge controller. An ESP32 microcontroller manages sensor inputs and automation, with IoT connectivity enabling remote control via Blink and Wi-Fi. Voice integration with Google Assistant allows hands-free operation. Firmware is developed using Arduino IDE. Initial testing is conducted on a breadboard before final PCB assembly. Real-world testing evaluates energy efficiency and response time, while predictive maintenance via Telegram alerts ensures system reliability and optimal performance [2].

RESULTS AND DISCUSSION

The Smart Home Assistant, powered by solar energy and controlled via the Blynk app, efficiently managed devices like LED lamps, air coolers, and locks. Photovoltaic (PV) solar panels converted sunlight into electricity, stored in a Li-ion battery for continuous operation. This system reduced reliance on traditional electricity, promoting energy efficiency and sustainability.

Figure 1:Control the smart home via Blink

Figure 1 illustrates the successful control of the smart home using the Blynk app.

Table1: Output Testing

Sensor	Detect	Output
Blynk Control	LED Lamp 1 (12V)	Turn ON/OFF
Blynk Control	LED Lamp 2 (12V)	Turn ON/OFF
Blynk Control	Air Cooler (12V)	Turn ON/OFF
Blynk Control	Lock Solenoid (12V)	Turn ON/OFF
Solar Panel	Power Supply	Energy supply

Table 1 shows the Blynk app allows users to remotely control lighting, cooling, and security devices, while solar panels ensure a renewable and sustainable power source, reducing energy costs and environmental impact.

CONCLUSIONS

This project enhances convenience, efficiency, and sustainability. By harnessing renewable solar power, the system reduces reliance on fossil fuels, lowering carbon emissions and electricity costs. With Blynk app control, users can manage devices remotely, demonstrating the potential of smart homes in promoting sustainable and green energy solutions.

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SMART STREET LIGHT

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Abstract – This project develops a Smart Street Light prototype that utilizes solar energy and IoT technology to enhance energy efficiency and reliability. Using an ESP32 microcontroller, the system integrates IR sensors for motion detection, LDR sensors for light level assessment, and Telegram alerts for fault notifications. Controlled by Arduino IDE, the prototype adjusts lighting based on movement, reducing energy consumption while ensuring safety. Testing demonstrates the system's effectiveness in saving energy and quickly detecting faults. Future improvements include data analytics for optimization, increased solar energy storage capacity, and a more user-friendly remote monitoring interface.

INTRODUCTION

The increasing demand for energy-efficient and cost-effective urban infrastructure has driven the adoption of renewable energy and IoT technology. One innovative solution is solar-powered smart streetlights, which optimize energy use while reducing operational costs. These systems incorporate infrared (IR) sensors to detect movement, allowing lights to automatically adjust brightness or turn off when no activity is detected, significantly saving electricity consumption. Additionally, by harnessing solar energy with high conversion efficiency and advanced energy storage, these lights minimize reliance on non-renewable sources, ensuring sustainable operation. Furthermore, IoT integration facilitates predictive maintenance via Telegram notifications, reducing maintenance costs and improving system reliability.

METHODOLOGY

This research adopts a structured methodology to develop an IoT-based solar-powered smart street lighting system. The hardware consists of photovoltaic panels, a charge controller, a Li-ion battery, an ESP32 microcontroller, IR sensors, and LEDs. The system is programmed using Arduino IDE, enabling automated brightness control based on movement detection. IoT integration allows remote monitoring via a Telegram-based notification system for predictive maintenance [1]. Initial testing is conducted on a breadboard before transferring to a PCB layout for final assembly. The system is evaluated under various conditions to assess energy efficiency, sensor accuracy, and cost-effectiveness, ensuring sustainable urban lighting solutions.

RESULTS AND DISCUSSION

The smart street light system efficiently controlled LED lighting using LDRs for daylight detection, with motion-activated IR sensors conserving energy. Telegram alerts notified of issues.

Figure 1. Notification for telegram

The smart street light system effectively detects day and night with LDRs, turning off LEDs during the day and activating motion detection at night. It monitors LED brightness and sends messages to Telegram for maintenance. IR sensors detect motion, activating lights when needed and conserving energy when idle. The system is energy-efficient, with future improvements including remote monitoring and real-time data analytics for smarter urban environments.

Table 1: Sensor Condition

Sensor	Condition	Output
LDR (sun)	Value<200	Daytime led off
LDR (LED)	Value>200	Nighttime check motion
	Value>3000	Detect led error send message to telegram
IR sensor	Motion detected IR low	Turn on
	No motion detected IR high	Turn off

CONCLUSIONS

The smart street light project enhances energy efficiency, cost savings, and sustainability through motion detection, solar energy, and IoT integration. It reduces electricity use, lowers operational costs, and enables remote monitoring for predictive maintenance, extending system lifespan.

ACKNOWLEDGEMENTS

The authors would like to thank supervisor MRS. Noor Indon

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SAFETY HOME NOTIFICATION USING MAGNETIC SENSOR DETECTION AND ESP32 CAM WITH REALTIME IMAGE CAPTURE AND NOTIFY TO USER BY SENDING NOTIFICATION USING TELEGRAM APP

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Abstract **–** This project introduces a Safety Home Notification System to address home invasions and burglaries using magnetic sensors and an ESP32 camera. Powered by the Wi-Fi-enabled ESP32 microprocessor and Internet of Things (IoT) technology, the system captures real-time images and sends alerts via Telegram when unauthorized access is detected. The IoT integration allows for remote monitoring, enhancing security, and providing flexibility. The captured images also serve as evidence in legal matters, helping to deter crime and ensure greater safety, ultimately giving homeowners peace of mind.

Keywords – Internet of Things (IoT), ESP32 Camera, Home Notification System, Telegram.

INTRODUCTION

Home invasions are a major issue in Malaysia that harm the public and cause property damage. Using magnetic sensors and an ESP32 camera that takes real-time pictures and swiftly delivers alerts via the Telegram app, this work aims for an advanced safety alerting system. The system boosts security by including Internet of Things (IoT) technology, allowing for remote access and device control in the home. Through Wi-Fi connectivity, it grants homeowners peace of mind and improves home security with instant notifications and helpful proofs.

METHODOLOGY

A magnetic sensor and an ESP32 camera were used to evaluate the safety home notification system in typical home settings. Unauthorized entry simulations resulted in picture capture and Telegram notification transmission. Reliability was tested using multiple runs in stable Wi-Fi conditions.

RESULTS AND DISCUSSION

Figure 1 shows the detection results of the magnetic sensor and ESP32 camera system, which successfully identified unauthorized entries and sent real-time alerts through Telegram. When the magnetic sensor detects uninvited entry, the system takes pictures and instantly sends them to the user through Telegram. This enables clients to safely keep an eye on their home security and get instant notice of any unusual activity.

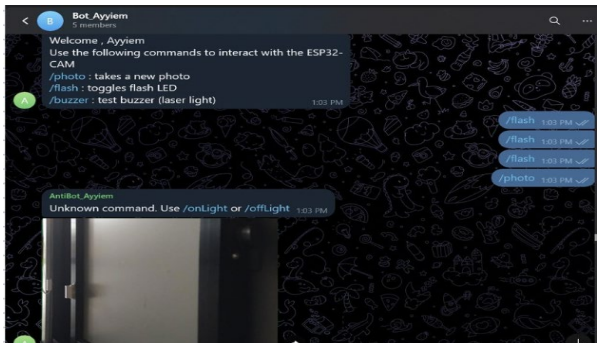

Figure 1: Available Command and Image Captured after the Sensor Triggered.

CONCLUSIONS

The Safety Home Notification System demonstrated effective performance in detecting unauthorized entries and sending real-time alerts with images to users via Telegram. The integration of magnetic sensors with the ESP32 camera, powered by Wi-Fi connectivity, offers a seamless and reliable solution for remote monitoring, improving home security. The system not only provides homeowners with immediate notification of intrusions but also ensures valuable photographic evidence that can be used in legal proceedings. The reliability and flexibility of the system contribute to increased safety and peace of mind for users, while the use of IoT technology reinforces its effectiveness in modern home security applications.

ACKNOWLEDGEMENTS

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ANTI-THEFT MOTORCYCLE HELMET SECURITY USING ESP32 WITH ALARM BUZZER AND VIBRATE SENSOR TO DETECT VIBRATION ON HELMET AND NOTIFY USER BY SENDING NOTIFICATION VIA TELEGRAM

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Abstract – This project aims to prevent motorcycle helmet theft nowadays. Thus, this project will reduce the possibility of theft in Malaysia. The concept that states that nowadays motorcycle helmets are easily taken by thieves. The objective of this project is to make it easier for users to monitor the helmet and get notifications. The methodology used in the development of this project involves several components such as ESP32, SW-420 vibration sensor, HC-SR04 & sonar sensor.

INTRODUCTION

Motorcycle safety and security have become paramount in an era marked by swift technical progress and a growing dependence on motorcycles as the major mode of transportation and means of lifestyle. Because of their ease of use, portability, and sense of independence, motorcycles have ingrained themselves into our everyday existence. But the pleasure and convenience of owning a motorcycle have been overshadowed by the growing number of motorcycle helmet thefts that occur nationwide.

METHODOLOGY

One part, the Ultrasonic Sensor HC-SR04, will be utilized on the input side. Also, SW-420 Vibrate Sensor, Vibrations or motions are detected by the vibrate sensor. If the helmet is moved or stolen, the sensor will detect these disturbances. The ESP32 receives the signal from the sensor when it detects vibrations above a predetermined threshold, and sounds the buzzer. A telegram bot-based notification distribution mechanism is present on the output side.

RESULTS AND DISCUSSION

The goal of data analysis for your motorcycle helmet security system is to assess how well the system detects theft attempts. The table below shows how quickly it responds and how efficiently it uses power.

Table 1:Time taken to deliver to the alert user by telegram

Times Repeated	Time taken (s)	Remarks
1	4	Quick response
2	3	Quick response
3	3	Quick response
4	3	Quick response

Based on this project, there are many problems faced and addressed to get the best results. There are problems encountered in terms of circuit testing, programming, and components. There were many difficulties in creating the motorcycle helmet security system, especially with regard to power management, sensor sensitivity, and hardware integration. Careful synchronization was necessary to integrate the motion, vibration, and ESP32 microcontroller sensors with the IoT platform for real-time warnings.

Figure 2: Telegram notification of the helmet movement

CONCLUSIONS

The motorcycle helmet security system solves the rising problem of helmet theft and is a major improvement in motorcycle riders' personal safety. The system provides an efficient and user-friendly solution by utilizing IoT technology, which includes real-time monitoring and event-based alerts via Telegram.

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The author would like to express sincere appreciation to Mr Muhammad Bin Jamaluddin, the project supervisor, for his guidance and discussions provided throughout the duration of this project.

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SOLAR-POWERED PARCEL DELIVERY STORAGE BOX USING ESP32 WITH AUTOMATION SYSTEM AT HOME ASSISTED BY TELEGRAM NOTIFICATIONS

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Abstract **–** This project addresses the increasing issues of package theft, failed deliveries, and related inefficiencies in online shopping logistics. A solar-powered, automated parcel storage box was developed to securely store delivered packages at homes. The system uses an ESP32 microcontroller to control components such as an ultrasonic sensor, solenoid door lock, and OLED display, integrating with the Telegram app for notifications. The storage box is remotely operable, ensuring ease of use and enhanced security. Testing showed the system reduces theft risks and saves time compared to traditional methods.

Keywords – ESP32, Telegram Notification, Home Automation.

INTRODUCTION

Online shopping is becoming increasingly popular due to busy lifestyles, offering convenience without the need to wait in long queues (Esa & Basri, 2018). This project introduces a smart parcel storage system with enhanced security features, designed for residential installations. Studies show that notifications via Telegram are highly effective due to its chatbot features, which simplify user interaction (Azrin et al., 2022). In addition to benefiting households, this system has the potential to be adopted by real estate developers to enhance smart city projects in Malaysia (Mokhsin et al., 2021).

METHODOLOGY

The storage box is powered by a 10W 18V solar panel, connected to a rechargeable battery via a solar charge controller. The system uses two ultrasonic sensors—one to detect delivery personnel and another to detect package placement. Notifications are sent to users via Telegram upon parcel detection. A solenoid door lock secures the box, controlled by a relay, while an OLED display provides real-time status updates. A flowchart-based design process ensured seamless integration of hardware and software components.

RESULTS AND DISCUSSION

The results of the Solar-Powered Parcel Delivery Storage Box project demonstrate its effectiveness in addressing package security and delivery inefficiencies. Testing was conducted on key components, as outlined in the table 1.

Table 1: Results of the Solar-Powered Parcel Delivery Storage Box

Test Component	Test Parameters	Outcome
Ultrasonic Sensor 1	Detecting delivery personnel (30-50cm)	Detected personnel accurately within 30-50cm.
Ultrasonic Sensor 2	Detecting parcel placement (distance)	Successfully detected parcels at all tested distances.
OLED Display	Displaying status messages	Displayed correct messages, but less visible in bright light.
Solenoid Door Lock	Response to opening and locking commands	Operated efficiently, required sufficient current for optimal performance.
Telegram Notifications	Sending alerts for parcel delivery	Notifications are delivered promptly with no delays under stable internet.

CONCLUSIONS

The solar-powered parcel storage box achieved its objective of enhancing parcel security and reducing delivery inefficiencies. The system successfully integrates IoT-based control, secure locking mechanisms, and sustainable energy solutions. Future improvements could include incorporating camera-based facial recognition for added security and enhancing solar efficiency under varying weather conditions.

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The author would like to express sincere appreciation to Mr Muhammad bin Jamaluddin, the project supervisor, for his guidance and discussions provided throughout this project.

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SMART DEVICE FOR MANAGING ELECTRICITY WITH IOT AND SOLAR INTEGRATION

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Abstract- Solar energy systems can cause power issues like voltage changes and grid instability. To solve this, we propose a smart system that uses the Internet of Things (IoT) to monitor and manage solar panels remotely. With this system, data like temperature, current, voltage, power, and energy from solar panels is sent to a smartphone app via the internet. Users can view this information and control connected devices from anywhere. This makes it easier to manage solar panels, especially in remote locations, and improves power quality for both on-grid and off-grid systems. The system also works as a smart meter for smart grids and is useful for future energy systems with more solar power.

Keywords - Internet of Things (IoT), Solar Power, Smart Grids

INTRODUCTION

This project develops a smart device for managing electricity using IoT and solar power, built around the ESP32 microcontroller. The goal is to optimize energy use by managing devices based on real-time data and user preferences while promoting sustainable energy practices. The system includes an ESP32 for processing, a solar panel with a charge controller for energy harvesting, a battery bank for storage, and an IoT platform for remote monitoring and control. Users can track energy consumption, solar power generation, and device operations in real timeThe system helps reduce electricity waste and costs while supporting environmental sustainability through renewable energy and efficient management.

METHODOLOGY

The project involves designing and integrating an ESP32-based system with a solar panel, charge controller, and battery bank for energy storage and IoT connectivity. The ESP32 collects data from sensors to monitor energy consumption and solar power generation while controlling connected devices automatically or via a user-friendly IoT platform. After setting up hardware connections and programming the ESP32, the system is tested and optimized for efficient energy use, seamless data transmission, and reliable remote control.

RESULT AND DISCUSSION

INPUT	DESCRIPTION	RESULT
DHT11 /TEMPERATURE	Temperature detecting	32 c
DHT11 / HUMIDITY	Humidity detecting	68 %
CURRENT SENSOR	Current detecting	16 mA
VOLTAGE CURRENT	Voltage detecting	0 v

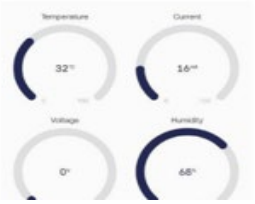

Figure 1 Result table

An ACS712 current sensor and voltage divider circuit accurately monitor electrical parameters, while a DHT sensor tracks environmental conditions. This setup allows users to remotely control the motor, optimize energy use, and ensure reliable performance.

CONCLUSION

Ultimately, this system represents a well-thought-out combination of renewable energy and intelligent motor control that can be applied in various energy-conscious applications.

ACKNOWLEDGEMENT

We express our gratitude to our supervisors and my parents for their guidance and resources in realizing this project.

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DOOR LOCK SECURITY SYSTEM WITH IOT

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Abstract **–** This paper presents The Door Lock Security System uses IoT technology to allow remote monitoring and control of doors via a smartphone and fingerprint biometrics. The smartphone acts as a smart controller through an IoT system built with Arduino Wemos D1 and ESP32, monitored through the MQTT app. Fingerprint biometrics provide a backup security option if the smartphone fails. This system offers quick and easy access, enhancing security against threats like theft or cyberattacks. The IoT-based door lock can be monitored anytime and anywhere, ensuring greater effectiveness and durability for residential security.

Keywords – Door Lock Security, fingerprint biometrics, IoT

INTRODUCTION

Door lock security systems serve as the primary barrier between the outside and inside environments, protecting homes, offices, and unauthorized access from security threats. With the advancement of technology, door lock systems now offer advanced features such as keyless entry, remote access control using smartphones, and integration with home security systems to increase efficiency and comfort.

METHODOLOGY

Methodology involves methods for designing, collecting, and analyzing data to support the study. The door lock system is activated by a signal from a smartphone and a circuit. A second input is also sent to activate the system. Microcontrollers are used to keep the project running smoothly, with applications receiving simple messages and acting as object detectors. This chapter summarizes the information gathered to overcome problems during the project.

RESULTS AND DISCUSSION

The result of accessing the door are shown in Figure 1.

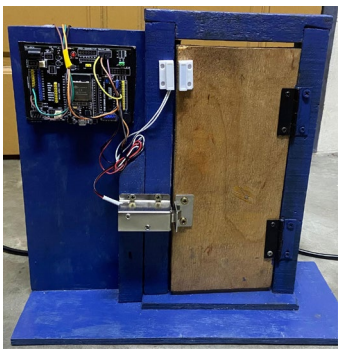

Figure 1: Connection of Solenoid

Figure 2 : Accessing Door using Fingerprint

The result shows that this Door Lock System with IoT combines solenoids, fingerprints, and MQTT to improve security and convenience. The solenoid acts as a physical lock mechanism that is only activated by a valid input such as a registered user's fingerprint. Fingerprints are used as unique biometrics that are difficult to forge, ensuring access only to legitimate individuals. Through MQTT, users can control and monitor door locks in real time using smartphones or other devices connected to the internet. This system facilitates access management, provides data on entry and exit activities, and offers smart, secure, and efficient solutions for modern homes and buildings.

CONCLUSIONS

IoT Door Lock System offers high security with fingerprint sensor and remote control via smartphone. It ensures access only to registered users, monitors in-and-out activity in real-time, and eliminates the need for physical keys. The system is safe, easy to operate, and suitable for smart homes and modern buildings.

ACKNOWLEDGEMENTS

The authors would like to thank my supervisor, my friends and my parents for the financial support.

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ORCHESTRATING IOT DEFENSE AGAINST AVIAN PREDATION USING ESP32 (SMART SCARECROW)

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Abstract **–** This project presents the design and implementation of a Smart Scarecrow system aimed at protecting crops from birds. Utilizing an ESP32 microcontroller, the system integrates ultrasonic and PIR sensors to detect intrusions. Upon detection, a servo motor activates to scare away intruders, and a notification is sent to the user's smartphone via the Blynk application. This innovative solution offers an automated and efficient way to safeguard crops, ensuring minimal human intervention and continuous monitoring.

Keywords – Smart Scarecrow, ESP32, Ultrasonic Sensor, PIR Sensor, Blynk, Agriculture Protection

INTRODUCTION

Crop protection is one of the major concerns for farmers. The birds and animals damage the crops to a large extent. Scarecrow techniques traditionally used are not very effective. This project, Smart Scarecrow, deals with modern technology in the form of detecting and keeping these threats away with much efficiency. The system makes use of an ESP32 microcontroller in association with ultrasonic and PIR sensors to trace the presence of birds. Upon detection, a servo motor will go into action to scare away the intruders, sending a notification to the user's smartphone via a Blynk application for real-time monitoring and response.

METHODOLOGY

The system involves the interfacing of an ESP32 microcontroller with ultrasonic and PIR sensors for detecting motion and proximity. The servo motor will be programmed to act when the sensors detect intrusion. It also connects the ESP32 to the Blynk platform for sending instant notifications to the smartphone in real time. The software involves programming of ESP32 for interpreting sensor data and controlling servo motor, along with interfacing the Blynk app for notifications.

RESULTS AND DISCUSSION

The Smart Scarecrow system was tested in some outdoor conditions. The sensors accurately detected birds, and the servo motor effectively deterred them. Notifications were reliably sent to the user's smartphone, ensuring real-time monitoring.

Figure 1 : Smart Scarecrow Prototype

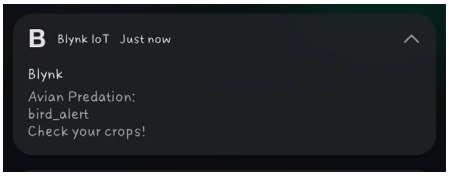

Figure 2 : Blynk app notification in smartphone

Table 1: Sensor detection and notification response time

Sensor Type	Distance Detected (cm)	Response Time (ms)	Notification Sent
Ultrasonic Sensor	10 – 100	150	Yes
PIR Sensor	10-100	100	Yes

The table demonstrates the performance of the Smart Scarecrow system's sensors in detecting intrusions and the response time required to activate the servo motor and send a notification to the user's smartphone via the Blynk application. Both the ultrasonic and PIR sensors effectively detect movement and send notifications promptly, ensuring efficient crop protection.

CONCLUSIONS

The Smart Scarecrow project successfully integrates modern technology to address the issue of crop protection. The system's automated detection and deterrent mechanism, together with real-time notifications, provide an efficient and reliable solution for farmers. Future improvements could involve expanding sensor capabilities and incorporating additional features for enhanced protection.

ACKNOWLEDGEMENTS

The authors would like to thank PTSB and parents for the resources provided for this project.

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AGRICULTURAL PROTECTION FROM ANIMAL ATTACKS BASED ON SOLAR ENERGY AND INTERNET TECHNOLOGY OF THINGS (IOT)

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Abstract – This abstract explores the integration of solar energy and IoT technology for agricultural protection against pest and animal attacks. As agriculture is vital to a nation's economy, effective strategies are essential to safeguard crops and improve yields. The system utilizes smart sensors powered by solar energy to monitor crop health and environmental changes in real-time. Data collected enables rapid detection of pest activity and immediate responses through automated traps or deterrents. This innovative approach enhances surveillance and control, ensuring efficient and effective crop protection. By combining IoT with solar power, the system contributes to increased agricultural productivity and national food security.

Keywords - Solar Energy, IoT Technology, Agricultural Protection, Pest Control

INTRODUCTION

In the digital era, IoT and solar energy offer innovative solutions for agriculture. This project introduces a Solar-Based Agricultural Security system powered by solar panels, integrating sensors to detect animal threats in real time. The system aims to protect crops from animal attacks and enhance agricultural productivity, ensuring sustainable and efficient farming practices.

METHODOLOGY

The methodology involves using specific research methods to collect and analyze data for a comprehensive study. It includes selecting appropriate methods to achieve research objectives. In this project, steps like component selection, circuit design, and system testing are followed, using the ESP32 microcontroller, HC-R501, LED, and other components, all organized and tested with suitable software systems.

RESULTS AND DISCUSSION

The analysis of data results and the use of TELEGRAM (IoT) are shown in Table 1.

Table 1: The data obtained

BIL	Sensor	Telegram notification
1	Hc-sr501	Gerakan dikesan

The motion detection system using an HC-SR501 sensor, ESP32, LEDs, buzzer, and Telegram successfully detects motion and sends real-time notifications. When motion is detected, the red LED lights up, the buzzer activates, and a Telegram alert, *"Gerakan dikesan,"* is sent, ensuring effective monitoring. In standby mode, the green LED remains on, indicating system readiness. The integration with Telegram provides instant remote notifications, enhancing usability for security and agricultural applications. The system proved reliable, with accurate motion detection and prompt alerts. Local indicators (LEDs and buzzer) complement remote monitoring, making it versatile and practical. Future enhancements could improve sensitivity and functionality.

CONCLUSIONS

This project successfully achieved all its objectives by implementing an agricultural protection system powered by solar energy and IoT technology. Utilizing components such as the HC-SR501 motion sensor, ESP32 microcontroller, red and green LEDs, buzzer, and Telegram notifications, the system effectively detects animal movement near crops. Upon motion detection, the system activates the red LED, buzzer, and sends a real-time Telegram alert, ensuring timely response and enhanced crop protection.

The use of solar energy makes the system eco-friendly and suitable for remote areas, while IoT integration allows for convenient monitoring. This innovation demonstrates significant potential for agricultural applications, enhancing productivity and sustainability.

ACKNOWLEDGEMENTS

The author would like to express sincere appreciation to Mrs. Nor Aspalaili Binti Nordin, the project supervisor, for her invaluable guidance, support, and constructive discussions throughout this project. Her expertise and encouragement were instrumental in the successful completion of this work.

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FIRE ALARM SYSTEM USING SOLAR

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Abstract **–** The "Fire Alarm System Using Solar" enhances safety through early fire detection and efficient response. Using solar energy ensures continuous operation during power outages, with a solar panel charging a battery that powers the ESP32, buzzer, LED, and sensors. The system uses MQ-2 gas and IR flame sensors to detect fire signs. When a threat is detected, the buzzer and LED activate, and real-time alerts are sent via the Blynk app. This eco-friendly system provides reliable fire detection, remote monitoring, and sustainable operation, improving safety and promoting green technology in commercial spaces.

Keywords-Fire Alarm System, Solar Energy, Early Fire Detection, ESP32

INTRODUCTION

In the digital era, Internet of Things (IoT) technology offers new opportunities to enhance efficiency and safety across various sectors. One significant application is in fire alarm systems for densely populated locations such as shopping malls. This project aims to develop a smart fire alarm system based on IoT and solar energy. Fires pose a serious threat, yet conventional systems often fail to provide timely notifications, increasing the risk of loss of life and property. Using solar energy as the main power source, the system is eco-friendly and operates without interruptions. It will detect early signs of fire and send automatic notifications, enabling rapid and efficient responses.

METHODOLOGY

The fire alarm system was tested in controlled conditions to simulate real-world scenarios. Five trials were conducted for each fire simulation to ensure consistency. The system's sensors (MQ-2 gas and IR flame) were evaluated for accurate detection, while the ESP32's data transmission to the Blynk app was monitored for response time. The solar charging system's performance was tested under different light intensities to ensure reliable operation. These tests confirmed the system's ability to detect fires early and send real-time alerts effectively.

RESULTS AND DISCUSSION

The analysis of data results and the use of Blynk (IoT) are shown in Table 1.

Table 1: The data obtained

BIL.	SENSOR	BLYNK NOTIFICATION
1	MQ-2 SENSOR	Smoke Alert at Location B
2	IR FLAME SENSOR	Fire Alert at Location A

Based on the project results, the smart fire alarm system effectively detects and sends real-time notifications based on sensor inputs. When the MQ-2 gas sensor detects smoke, the system triggers a "smoke alert" notification on the Blynk app, indicating the presence of smoke at location B. This demonstrates the sensor's ability to identify smoke early and provide immediate alerts.

Similarly, when the IR flame sensor detects a fire, a "fire alert" notification is sent to the Blynk app, showing the fire's location at location A. This shows that the system can accurately identify fire threats and notify the management in real-time.

The results confirm that the system enhances fire safety by offering quick detection and efficient communication, providing users with better control over safety management and enabling timely responses in emergency situations.

CONCLUSIONS

In conclusion, this project effectively demonstrates the use of solar energy to enhance fire safety. The system integrates smoke and fire sensors to provide real-time alerts and improve awareness. Notifications via the Blynk app ensure the system is accessible and user-friendly, enabling quick responses to emergencies. By using solar energy as the main power source, the system promotes sustainability while maintaining reliability. This project highlights the importance of green technology in improving public safety and emergency response. Overall, it offers an innovative and efficient solution for fire detection and safety management in modern environments.

ACKNOWLEDGEMENTS

The author would like to express sincere appreciation to Mrs. Nor Aspalaili Binti Nordin, the project supervisor, for her guidance and discussions provided throughout the duration of this project.

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SMART SHOPPING CART USING RFID AND MOTOR

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Abstract – The "Smart Shopping Cart Using RFID and Motor" project aims to streamline the shopping process and enhance customer experience. This cart leverages RFID technology to automatically calculate product prices and display them on an LCD screen. Using components such as the ESP32 microcontroller, RFID RC522, LCD 20x4, and a servo motor, customers only need to scan the RFID tag on products. The Blynk app transmits the total price to the cashier. A prototype was developed and tested, showing improvements in time efficiency and budget management. This project reduces queue times, enhances shopping experiences, and optimizes supermarket operations.

Keywords- Smart Shopping Cart, RFID Technology, Motor, Customer Experience, Product Price Calculation.

INTRODUCTION

In the modern world, shopping carts are used to help customers select and carry items. However, the checkout process often takes too long, with waiting in line sometimes taking longer than the shopping itself. Additionally, incomplete product information can be an issue. The "Smart Shopping Cart Using RFID and Motor" project is designed to minimize shopping time. The cart is equipped with an ESP32, RFID, LCD, servo motor, and Blynk app. Customers simply scan the RFID tag on each product, and the price and product name are displayed on the LCD. The total price is sent to the cashier's phone, saving time and reducing labor.

METHODOLOGY

The methodology involves using specific research methods to collect and analyze data for a comprehensive study. It includes selecting appropriate methods to achieve research objectives. In this project, steps like component selection, circuit design, and system testing are followed, using the ESP32 microcontroller, RFID, LCD, and other components, all organized and tested with suitable software systems.

RESULTS AND DISCUSSION

The analysis of data results and the use of Blynk (IoT) are shown in Table 1.

Table 1: The data obtained

NUM.	PRODUK	MOD (A/R)	LCD (ADD)	LCD (TOTAL)	BLYNK
1	DETTOL	A	RM 12.90	RM 12.90	RM 12.90
2	MAGGIE	A	RM 7.60	RM 20.50	RM 20.50
3	TISSUE	A	RM 2.50	RM 23.00	RM 23.00
4	MILO	A	RM 16.50	RM 39.50	RM 39.50
5	DETTOL	R	RM 12.90	RM 26.60	RM 26.60

Based on the project results, the smart trolley system functions effectively in calculating the total price of purchased items. Each product scanned using the RFID system is displayed correctly on the LCD screen and the Blynk app, according to the "add" or "remove" mode. For example, the Dettol product added to the trolley shows a price of RM 12.90 on both the LCD and Blynk app, with the total updated each time a product is added or removed.

The results demonstrate that the system can accurately track changes in the total spending. For instance, after the Dettol product is scanned again and removed (in "R" mode), the total amount on the LCD and Blynk app is updated in real-time, showing RM 26.60. This proves that the system enhances convenience in monitoring spending, giving customers better control over their budget.

CONCLUSIONS

This project successfully achieved all the objectives set by utilizing RFID technology controlled by the ESP32 microcontroller. Each item scanned using the RFID RC522 displays its price on the LCD screen, allowing customers to know the total price of the items in their cart without having to go to the counter. This helps them manage their spending and avoid overspending. Additionally, this system saves customers time during their shopping process.

The project demonstrates great potential for implementation in the business industry, such as supermarkets, shopping malls, and retail stores. With the convenience it offers, this device is suitable for everyone during their shopping experience, providing comfort and enhancing the overall customer experience.

ACKNOWLEDGEMENTS

The author would like to express sincere appreciation to Mrs. Nor Aspalaili binti Nordin, the project supervisor, for her guidance and discussions provided throughout the duration of this project.

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RFID ATTENDACE SYSTEM WITH TELEGRAM NOTIFICATION

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Abstract – The 'RFID Attendance System with Telegram Notification' addresses challenges in manual attendance management, such as delays and inaccuracies, which increase administrative workload and risk of errors in educational institutions. This project develops an automated system integrating RFID for attendance tracking and Telegram for real-time notifications, ensuring faster, more reliable verification. Key components include a microcontroller, RFID tags, an RFID reader, and Telegram software. RFID is used for efficient user identification, while Telegram offers a simple platform for instant notifications. Experiments tested parameters like RFID range and internet stability, ensuring functionality under various conditions. The system achieved over 95% accuracy in attendance recording with an average response time of under 2 seconds, proving its effectiveness in reducing processing time and enhancing attendance management. This solution minimizes administrative burden and ensures higher accuracy, making it a practical alternative for educational institutions. The project suggests wider implementation of RFID-based systems to optimize management and improve attendance data quality.

Keywords - RFID Attendance System, Telegram Notification, Manual Attendance Management, Automated System

INTRODUCTION

In Malaysia, many childcare centers cater to children aged 7 to 15, often serving as transit points for students returning from school. However, parents face challenges tracking their children's whereabouts due to school policies prohibiting mobile phones, leading to communication gaps and misunderstandings with the centers. To address this, implementing an efficient system like the 'RFID Attendance System with Telegram Notification' is crucial. This system enables real-time attendance monitoring, providing parents with peace of mind and simplifying processes for childcare centers. Future enhancements could include facial recognition technology for added security, complementing RFID to verify students' identities.

METHODOLOGY

The system begins with the user scanning their RFID card, followed by verification of the card's validity. If the card is invalid, a buzzer is triggered, and a red LED light is activated to alert the user. For valid cards, a green LED light turns on, and a notification is sent via Telegram to inform the parents or guardians. The process ends once verification and notification are completed, ensuring accurate and timely updates.

RESULTS AND DISCUSSION

Figure 1: Analysis Data Result

When the RFID card is scanned, the system identifies the ID on the card and matches it with the records stored in the database. If the card is authorized, a green LED light will turn on, and once the identity is verified, the system activates the programmed Telegram bot to automatically send a notification to the parents or guardians. If the card is unauthorized, a red LED light will turn on, and a buzzer will trigger to alert the user. The Telegram notification will appear in real-time, informing the parents or guardians that the child has arrived safely. Through this process, parents or guardians receive information directly without delay, making the system more effective and facilitating monitoring of the children's safety.

CONCLUSIONS

In conclusion, the 'RFID Attendance System with Telegram Notification' offers an efficient and reliable solution for tracking attendance and ensuring the safety of children. By integrating RFID technology for quick identification and Telegram for real-time notifications, the system provides instant updates to parents or guardians. It reduces administrative workload, improves accuracy, and enhances security, making it a practical solution for educational institutions and childcare centers.

ACKNOWLEDGEMENTS

I sincerely thank Mrs. Hasrimin for her guidance and support throughout this project.

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HANDICAPPED PARKING USING ESP32

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Abstract – This project aims to develop a dedicated parking model for persons with disabilities (PWD) using IoT technology to address the increasing misuse of PWD parking spaces due to population growth and limited parking availability. The system integrates RFID technology to grant access to registered PWD users via card scanning for entry into designated parking spaces. To ensure that only authorized vehicles use these spaces, ultrasonic sensors will detect the presence of a vehicle and verify its registration status. If an unauthorized vehicle attempts to use the space, the system will send a notification to security personnel and activate a buzzer as a warning, thereby helping to reduce parking misuse and improve the management of PWD parking.

Keywords–IoT technology, Security notification, Parking management, Parking misuse.

INTRODUCTION

Parking can be a challenging task for many people, but it poses even greater difficulties for individuals with disabilities. Ensuring that designated parking spaces for disabled users are appropriately utilized and remain available when needed is crucial to fostering inclusivity and accessibility. In response to this need, we present the Disabled Parking System using the ESP32 microcontroller—a solution designed to improve the management and efficiency of parking spaces for disabled individuals.

METHODOLOGY

This handicapped parking project using ESP32 involves several key steps. First, a vehicle detection system is set up using sensors to detect the presence of a vehicle within a 20cm range. When a vehicle is detected, a red LED lights up and a sound is emitted. Second, an RFID-based user verification system is implemented, where authorized users can scan their RFID cards to stop the sound and change the LED to green. Lastly, if the RFID card is not scanned within 1 minute, a security notification is sent through the Blynk app to alert the security guard. The ESP32 microcontroller is used to manage sensor data, control the LED indicators, and handle communication with the Blynk app.

RESULTS AND DISCUSSION

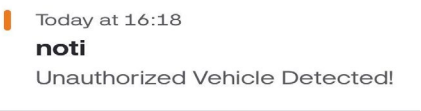

Figure 1: Notification on the Blynk app

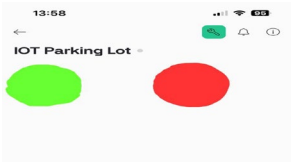

Figure 2: Red and green LED display on the Blynk app

The system incorporates several key features to ensure efficient and secure parking management. *Vehicle Detection* alerts users whenever a vehicle is detected within a 20cm range by emitting a sound and lighting up a red LED, signaling the presence of an unauthorized vehicle. *Authorized User Verification* ensures that only disabled parking users with a valid RFID card can deactivate the sound and change the red LED to a green one, indicating authorized use of the parking spot. Additionally, if the RFID card is not scanned within 1 minute, a *Security Notification* is triggered, automatically sending an alert to the security guard via the Blynk app to prompt further action and ensure timely resolution of the situation.

CONCLUSIONS

In conclusion, this project leverages the ESP32 to create an efficient handicapped parking management system. By integrating vehicle detection, authorized user verification via RFID, and real-time security notifications through the Blynk app, the system ensures only authorized users can access disabled parking spots. The use of red and green LED indicators provides clear visual cues, enhancing both security and convenience for users. This smart solution optimizes parking space usage while improving accessibility and enforcement**.**

ACKNOWLEDGEMENTS

The authors would like to thank the supervisor and everyone that show support throughout the project.

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AUTOMATIC ENERGY MONITORING AND OPTIMAZATION SYSTEM FOR BUILDINGS

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Abstract – This study focuses on implementing smart energy monitoring and optimization systems for buildings to improve energy efficiency. By using IoT sensors, including ESP-32 microcontrollers, voltage and current sensors, and integrating data with Google Sheets for analysis, the research identifies energy consumption patterns and promotes energy-saving behavior. Results show significant energy reduction in buildings after simulation deployment.
Keywords-Sensor , ESP32, ZMPT-101B, SCT-013, LCD and Google Sheets

INTRODUCTION

The convergence of innovation and framework has birthed a transformative solution: automatic energy monitoring and optimization systems for buildings. The integration of Internet of Things (IoT) sensors, advanced data analytics, and automation technologies shapes the spine of these systems a comprehensive understanding of when and where energy is being consumed most intensively, laying the basis for strategic intercessions to improve efficiency.

METHODOLOGY

The system uses a ZMPT101B voltage sensor and SCT-013 current sensor to capture AC voltage. An ESP32 microcontroller processes the input, calculates power metrics, and displays the data on a 16x2 LCD in real time. Additionally, the system integrates with Google Sheets via Google Forms for automated data collection and analysis. Google Apps Script enhances functionality by enabling custom functions and task automation.

RESULTS AND DISCUSSION

The tracking time result of total voltage, current, power and energy used are shown in Figure 1.

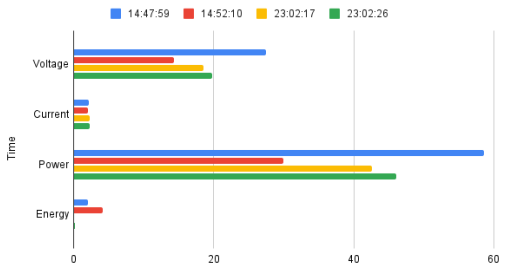

Figure 1: Tracking time result of total voltage, current, power and energy.

At 14:47:59, the system demonstrated its peak performance, recording the highest values across multiple parameters, including voltage, power, and energy. The voltage and power consumption was at its maximum, aligning with the increased voltage, while energy output was noticeably higher.

In contrast, subsequent intervals (14:52:10, 23:02:17, and 23:02:26) showed a decline in voltage, power, and energy values, stabilizing at lower levels. After the peak activity at 14:47:59. The system's performance at 14:47:59 stands out as a peak event, followed by more consistent but reduced activity in the later intervals.

Table 1: The table presents data recorded at four different time intervals for voltage, current, power, and energy

Date	Time	Voltage	Current	Power	Energy
05/11/2024	14:47:59	27.44	2.14	58.6	2.03
05/11/2024	14:52:10	14.31	2.09	29.88	4.09
05/11/2024	23:02:17	18.54	2.3	42.57	0.04
05/11/2024	23:02:26	19.73	2.33	46.01	0.18

The result show on 05/11/2024, at 14:47:59, the system recorded the highest voltage (27.44 V) and power (58.6 W), with moderate energy (2.03 Wh). At 14:52:10, voltage dropped to 14.31 V, power halved to 29.88 W, but energy peaked at 4.09 Wh. By 23:02:17 and 23:02:26, voltage (18.54–19.73 V) and power (42.57–46.01 W) stabilized, while energy remained low (0.04–0.18 Wh).

CONCLUSIONS

In conclusion, this project uses IoT, mobile apps, and cloud computing to create a real-time energy monitoring system that tracks usage, identifies inefficiencies, and promotes energy-saving behaviors. By optimizing energy use, it reduces costs and supports environmental sustainability.

ACKNOWLEDGEMENTS

The authors would like to thank the supervisor and everyone that show support throughout the project.

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SOLAR-POWERED SMART TRASH BINS USING ESP32

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Abstract **–** This project presents the development of Solar-Powered Smart Trash Bins Using an ESP32 system designed to enhance waste management efficiency and user convenience through the integration of Internet of Things technology IoT. The system includes an ultrasonic sensor for detecting users, a servo motor for automatic lid opening, and LED lighting for visibility. Powered by solar energy, the bin can be controlled remotely via the Blynk app, making waste disposal easier, more hygienic, and eco-friendly. Initial tests show effective operation, remote control capabilities, and energy efficiency, making it suitable for both residential and public use.

Keywords – Smart Trash Bin, ESP32, IoT, Solar Power, Waste Management, Blynk

INTRODUCTION

In a world increasingly focused on technology and sustainability, this project introduces a Solar-Powered Smart Trash Bin designed to modernize waste management through automation and renewable energy. Using the ESP32 microcontroller, the bin integrates an ultrasonic sensor for automatic lid opening, a servo motor, and LED lighting for user convenience and hygiene. Controlled remotely via the Blynk IoT app and powered by a solar panel, this smart bin offers an eco-friendly solution that reduces physical contact, promotes cleanliness, and enhances user experience in both residential and public settings.

METHODOLOGY

The methodology involves integrating an ESP32 microcontroller, ultrasonic sensor, servo motor, and LED lights powered by a solar panel to automate the trash bin's functions. The system uses the Blynk app for remote control, allowing users to manage bin operations via smartphone. Testing was conducted to ensure efficient lid opening, energy use, and remote-control functionality.

RESULTS AND DISCUSSION

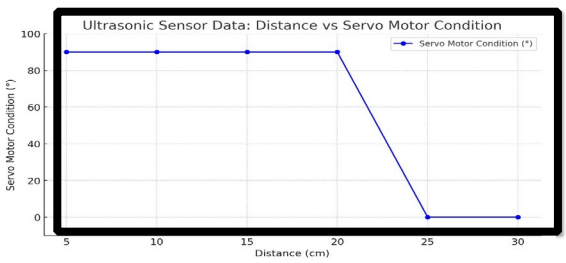

Figure 1: Ultrasonic data graph

The graph shows the decrease in the angle of the servo motor at 25 cm, and beyond which is in line with the data in the table. This provides a clear visual of how the servo motor responds to the distance measured by the sensor.

Table 1: Data analysis

Data Of Ultrasonic Sensor						
Distance (cm)	5	10	15	20	25	30
Servo Motor Condition	ON 90°	ON 90°	ON 90°	ON 90°	OFF 0°	OFF 0°

From 0 cm to 20 cm, the servo motor will be in the "ON" state at an angle of 90° which indicates that the trash bin lid is open. When the distance exceeds 20 cm, the servo motor returns to the "OFF" state at an angle of 0° which indicates the trash bin lid is closed.

CONCLUSIONS

The Solar-Powered Smart Trash Bin Using ESP32 effectively combines solar power and IoT for sustainable waste management. With ESP32 and ESP8266 working together, the bin allows hands-free operation and remote control via the Blynk app, making disposal more hygienic and accessible while reducing environmental impact. This project offers a practical, eco-friendly solution for modern waste disposal needs.

ACKNOWLEDGEMENTS

The researcher would like to thank Puan Sharipah for helping a lot in making this project a success.

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HOME WATER PUMP USING IOT

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Abstract - This project investigates the deployment of an Internet of Things (IoT)-enabled smart household water pump system. The system's objectives are to increase the effectiveness of water management, encourage conservation efforts, and give homeowners remote monitoring and control capabilities. The system monitors several water characteristics and water level, using an ESP32 microcontroller as the central control unit. These sensors make it possible to collect data in realtime, which gives the system the ability to identify abnormalities, enhance pump performance, and reveal patterns in water usage. Through IoT connectivity, users can remotely access the system via smartphone apps or web interfaces to monitor water status, adjust pump settings, and receive alerts for potential issues.

INTRODUCTION

Domestic water pumps are frequently used to supply water for different home requirements, move water from one place to another, and increase water pressure. A dependable and effective water supply is necessary for everyday tasks like cooking, drinking, taking baths, and caring for lush plants in today's modern homes. Many homeowners employ automatic water pumps made especially for household usage to meet these demands and provide a steady, pressured water flow. People may want water pumps in their homes for simple reasons like low water pressure, using well water, living in high-elevation areas, being far from the water source, ensuring water purity, or for tasks like watering plants.

METHODOLOGY

Many pieces of information regarding IoT-enabled smart home water pumps can be uncovered after examining the research approach. The references for design concepts, measurements, and cost estimates that will be employed in the project's production are provided by this material. Additionally helpful as a guide, this information makes the process of creating and even developing prototypes easier

RESULTS AND DISCUSSION

Table 1: Sampling Method

Distance Measurement:	Distance measurements are taken from the ultrasonic sensor at various water levels, including the minimum 2cm and maximum 11cm levels set.
Pump Control:	water level drops below 25%, the system activates the pump through the relay module. This process is monitored to ensure that the pump operates correctly and fills the tank until a safe level is reached.

The testing is carried out by starting the system and monitoring the response from the ultrasonic sensor as the water level in the tank changes. The ultrasonic sensor measures the distance to the water surface, and this measurement is processed to determine the percentage of the water level.

CONCLUSIONS

The IoT-based home water supply system developed in this project successfully addresses the need for efficient water management in residential settings. By integrating an ESP32 microcontroller, ultrasonic sensor, relay module, and LCD display, the system can monitor and control water levels in real time. The ultrasonic sensor accurately measures the water level in the storage tank, and the relay module controls the water pump based on pre-set threshold levels. The LCD display provides immediate feedback on water levels and pump status, making it easy for users to monitor the system.

ACKNOWLEDGEMENTS

I take this opportunity to say thank you very much to those who have helped and provided invaluable cooperation for me complete this HOME WATER PUMP USING IOT Project. I would like to thank my Supervisor, MR ENCIK SYAHRIL IZWAN BIN ABDUL YAMIN. He has given guidance, guidance and invaluable advice as I carried out this project.

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HEADWATER DETECTION AND ALERT SYSTEM

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Abstract – Headwaters are one of the important components in river systems because they provide the first sources of freshwater, which influences hydrology, ecology, and water quality. However, these places are the main subject which cause to natural calamities like as floods, and landslides, which can have a significant influence on both the headwaters and downstream ecosystems. Flooding in headwater areas can cause more habitat damage and property damage which can cost a lot of money, whereas landslides can disrupt water flow and bring pollutants. My project is related to the headwater detection system that occurs in the waterfall area and so on. The ESP32 microcontroller is equipped with ultrasonic sensor which enabling it to gather certain environmental data.

INTRODUCTION

In following the current of modernity, there are various technologies that have been upgraded according to this advanced age. The project I am working on is related to water heads. This project can find out the water head by detecting the water level and give warnings so that we can avoid it. In this project, I used a sensors namely the ultrasonic sensor. If the water level exceeds the set level, it will notify us by phone in the application I developed.

METHODOLOGY

The electrical surface tracking experiment was carried out at room temperature in accordance with IEC 60587 standard. An average of five specimens were measured on each loading concentration.

RESULTS AND DISCUSSION

The result of water level as shown in Figure 1.

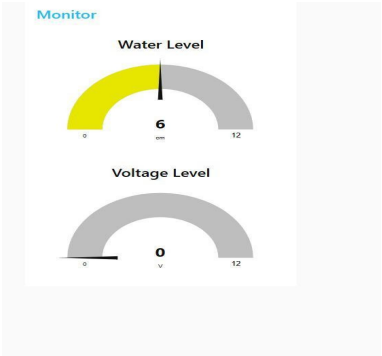

Figure 1: Dashboard result of water level of the tank via MQTT

CONCLUSIONS

In conclusion, the development of a headwater detection and alert system represents a crucial advancement in flood management and water resource monitoring. By utilizing real-time data from sensors, remote sensing technologies, and predictive analytics, such a system can effectively identify rising water levels in headwater regions, providing early warning signals for downstream communities. This proactive approach enhances public safety, reduces flood- related damages, and allows for more efficient management of water resources.

ACKNOWLEDGEMENTS

I want to start by sincerely thanking Mr. Syahril Izwan, my supervisor, for his crucial advice, tolerance, and support. His knowledge and perceptions made my job much better.

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IOT BASED MINI HYDRO SYSTEM

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Abstract – The goal of this project is to create a sustainable 10V–12V DC power source for an ESP32 that does not require external adapters or traditional batteries by using hydropower from a turbine-driven generator. To ensure stability and spot inefficiencies, the system combines sensors and microcontrollers to continuously monitor voltage, current, and power output. The design seeks to provide a reliable and environmentally friendly energy source for microcontroller operations by utilizing the water's natural flow. Throughout the production process, flowcharts are used to expedite planning, testing, and improvements. The project's goals have been effectively met based on analysis and observations, proving that an IoT-driven mini hydro system is feasible.[1]

INTRODUCTION

Water management technologies are among the many systems that have been updated to meet contemporary demands in the age of technological advancements. In order to provide early warnings and avert possible hazards, this project focuses on monitoring water heads by using an ultrasonic sensor to detect water levels. The system uses a specially designed phone application to alert users if the water level rises above a predetermined threshold. The project also intends to give an ESP32 microcontroller a steady 10V–12V DC power supply so that it operates consistently. The system emphasizes efficiency and dependability by using sensors and microcontrollers to monitor the DC power supply unit and identify, record, and handle any anomalies.

METHODOLOGY

A specially designed phone application is used to notify users when thresholds are surpassed, and an ultrasonic sensor is integrated to detect water levels. In order to guarantee dependability and efficiency, the system is also made to provide the ESP32 with a steady 10V–12V DC power source. Sensors and microcontrollers are used to monitor the power supply's voltage and current.

RESULTS AND DISCUSSION

The result of water level and voltage value of the DC generator as shown in Figure 1.

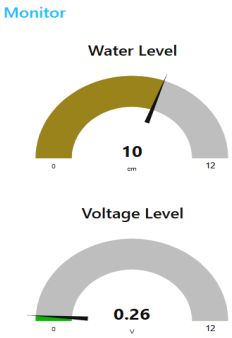

Figure 1: Dashboard result of MQTT

CONCLUSIONS

To sum up, the IoT-based mini hydro system successfully integrates intelligent monitoring and renewable energy to guarantee dependable power and effective operation. It permits early detection of fluctuations and proactive adjustments by providing the ESP32 with steady 10V–12V DC power and real-time voltage monitoring. The system promotes sustainable energy solutions and improves safety by automatically alerting users to high voltage levels. This project promotes the management of renewable energy and demonstrates the usefulness of IoT in environmentally friendly systems.

ACKNOWLEDGEMENTS

I want to start by sincerely thanking Mr. Syahril Izwan, my supervisor, for his crucial advice, tolerance, and support. His knowledge and perceptions made my project much better.

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SMARTPHONE CHARGING KIOSK WITH SOLAR SYSTEM

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Abstract **–** Smartphones are sophisticated mobile devices with touchscreens, internet connections, and the ability to run apps. It describes RFID technology, which enables remote data reading from tags in contrast to bar-codes that need to be aligned with scanners, and emphasises the appeal of gadgets like the Apple iPhone. The Automatic Identification and Data Capture (AIDC) technology, which includes RFID, automates data entry and item recognition. The project to create a safe smartphone charging station is also covered in the passage. By controlling access with RFID cards, this kiosk ensures that users' devices are securely secured and shielded from theft.

Keywords – Smartphone charging station, RFID technology, The Automatic Identification and Data Capture (AIDC)

INTRODUCTION

A smartphone is a personal object for each user. Every day, work is made easier by using smartphones. When a smartphone is heavily used, the battery power drops or nearly falls to zero. For the battery's power to rise, it must be recharged. These days, the most popular charging option is using an electrical power supply from Tenaga Nasional Berhad (TNB), an alternating current (AC) of 240V. Depending on each smartphone battery's capacity and maximum voltage limit, this high voltage is reduced to 5V to 8V. Thus, the ESP32-based RFID security system smartphone charging kiosk can facilitate phone charging for users.

METHODOLOGY

The project uses an ESP32 microcontroller and an RFID security system to construct a safe smartphone charging station. It is designed to guarantee secure and dependable charging, with features that prevent theft and limit access to authorised users.

RESULTS AND DISCUSSION

Figure 1 shows the output of the Liquid Crystal Display (LCD) after three distinct RFID cards have been read.

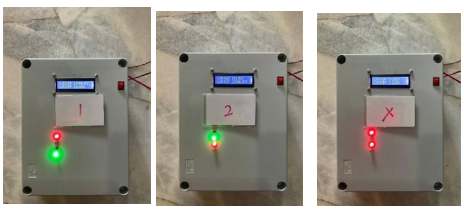

Figure 1: LCD's output

The result of the Smartphone Charging Kiosk is that it efficiently provides secure access through RFID technology. Three RFID cards—Card 1, Card 2, and an Access Denied Card—are used in the system. The red light-emitting diode (LED) indicates restricted access when the door is locked. The green LED illuminates to indicate that entry has been given when the door is unlocked by scanning either Card 1 or Card 2 (authorised cards). The door stays shut and the red LED remains on if an unauthorised card is scanned, ensuring security. Thanks to this design, only authorised users can access the kiosk.

Table 1: Difference in solar times for charging according to time

Time	Voltage Reading
10 am	5.7 Volts
11 am	7.7 Volts
12 pm	8.0 Volts
1 pm	14.4 Volts
2 pm	10.1 Volts

The result shows that the difference in solar time charging times according to time in Table 2 exhibits a small voltage reading, which is 5.7V at 10 am, when compared with other times. The highest voltage reading is 14.4V at 1 pm because of maximum sunlight.

CONCLUSION

The Smartphone Charging Kiosk with a solar-powered RFID system offers a secure and sustainable solution for public charging. It combines renewable energy with advanced security to ensure safe and eco-friendly smartphone charging.

ACKNOWLEDGEMENT

The author would like to thank the project supervisor and parents for their support.

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GENERATING CLEAN ELECTRICITY WITH PIEZOELECTRIC FLOOR PLATES

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Abstract – In today's globalized world, there is an urgent need to reduce dependency on non-renewable energy sources like fossil fuels, coal, and natural gas. This has led to the exploration and development of various types of renewable energy, such as solar, wind, geothermal, and hydroelectric power. These renewable sources have proven capable of generating substantial amounts of electrical energy for daily use, as the demand for electricity increases.

Keywords – fossil fuels, non-renewable energy, renewable energy, electrical energy.

INTRODUCTION

This project explores piezoelectric floor plates that turn the mechanical energy from footsteps into electricity. Piezoelectric materials generate power when stressed, making them perfect for capturing energy from people walking in public areas. By improving the materials, plate designs, and storage systems, the project aims to maximise the electrical output. These floor plates can power low-energy devices and support sustainable energy practices in smart cities. Integrating them into public spaces turns everyday walking into a source of clean energy, helping meet the growing electricity demand.

METHODOLOGY

This project involves creating and testing piezoelectric floor plates that convert footsteps into electricity. High-efficiency piezoelectric materials are chosen for their ability to generate energy when stressed. These materials are built into floor plate prototypes designed to handle pedestrian traffic. The plates are installed in busy areas, and energy is stored using efficient storage systems. Different designs are tested to find the most effective setup. Energy output and durability data are collected to improve the designs, aiming to provide a sustainable energy solution for urban areas.

RESULTS AND DISCUSSION

Table 1: Output produced for 93 kg person

Capacitor value	Voltage produces (one footstep)	Current produces (one footstep)	Power output Produce (P = IV)
1uF	4.27V	29μA	0.123mW
10uF	1.56V	25μA	0.038mW
47uF	0.98V	24μA	0.023mW

The result shows that a person weighing 93kg produces voltage and power for three different capacitor values: 1uF, 10uF, and 47uF. For 1uF, the voltage produced is 4.27V and the current 29uA. For 10uF, the voltage produced is 1.56V and the current 25uA. For 47uF, the voltage produced is 0.98V and the current is 24uA.

Table 2: Output produced for 67 kg person.

Capacitor value	Voltage produces (one footstep)	Current produces (one footstep)	Power output Produce (P = IV)
1uF	4.48V	25μA	0.112mW
10uF	2.01V	16μA	0.032mW
47uF	0.98V	14μA	0.013mW

The result shows that a person weighing 67 kg produces voltage and power for three different capacitor values: 1uF, 10uF, and 47uF. For 1uF, the voltage produced is 4.48V, and the current is 25uA. For 10uF, the voltage produced is 2.01V, and the current is 16uA. For 47uF, the voltage produced is 0.98V, and the current is 14uA.

CONCLUSION

Creating a smooth and functional circuit is crucial for this project. First, the PCB circuit was designed and assembled carefully to ensure proper soldering and functionality. Once the PCB was flawless, components were correctly installed according to a detailed list. The energy generated from the piezoelectric floor plates successfully charged a 6V battery, providing enough power for phone charging and DC lighting. The project met its goal, showing that piezoelectric energy can be practically used for everyday needs.

ACKNOWLEDGEMENT

The author would like to thank Mr Amer Faizal bin Hussin, the advisor, for his guidance and support. I also thank the faculty and staff of the electrical engineering department for providing resources and facilities. I am grateful to my peers and colleagues for their feedback and assistance.

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SOLAR TRACKING SYSTEM

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Abstract **–**An ESP32-powered solar tracker is a device that aligns solar panels with the sun's position throughout the day to optimise solar panel efficiency. As the central controller, the ESP32 microcontroller processes data from light sensors, including light-dependent resistors (LDRs), which measure the amount of sunshine. Through regulated servomotors, the ESP32 modifies the solar panel's orientation in response to the data from these sensors, lining it up with the sun's path to maximise solar energy. This solar tracker is a dependable and simple way to improve solar energy capture without relying on a network since it only concentrates on the operation of effective solar alignment. This method promotes sustainable energy practices through better panel placement while providing an economical and energy-efficient way to maximise solar panel performance.

Keywords–ESP32, LDR Sensor, Maximise solar energy

INTRODUCTION

Due to its sustainability and environmental advantages, solar energy use is growing in popularity. Effective solar tracking devices are necessary, though they present difficulty in optimising solar energy use. Thanks to solar tracking devices, solar panels may align themselves with the sun to maximise energy capture throughout the day. This plan describes implementing a solar tracking system to increase our solar energy infrastructure's output and efficiency.

METHODOLOGY

The LDRs read light intensity in 4 directions. The Arduino reads these values and compares them. The servo motors adjust the solar panel to face the direction with the highest light intensity.

RESULTS AND DISCUSSION

The solar tracker project utilises Light Dep (LDRs) to detect ambient light levels, with two LDRs providing directional information for east/west orientation. Servo motors adjust the solar panel's orientation—tilt or azimuth—based on inputs from the LDRs to track the sun's position throughout the day. A Real-Time Clock (RTC) ensures precise timekeeping and manages day-night detection. It enables the servos to operate only during daylight hours by turning them off at night and restarting them in the morning. This integration optimises solar panel efficiency by maximising sunlight exposure, making the system both efficient.

Feature	Static Solar	Solar Tracker
Sunlight Capture	Captures about 70-85% of sunlight.	Captures about 90-95% of sunlight.
Energy Efficiency	Less efficient due to fixed orientation.	More efficient by following the sun's movement.
Sustainability Impact	Lower impact, less energy produced.	Higher impact means more energy is generated, reducing emissions.
Operational Costs	Lower costs, simpler system.	Higher costs, more complex system.
Energy Output	Less energy during certain hours.	More energy throughout the day.

Table 1: Results between static and non-static solar

CONCLUSION

This project's Solar Tracker System emphasises how crucial it is to use solar energy efficiently by orienting panels dynamically. Compared to fixed installations, the technology greatly increases energy generation by optimising solar panel alignment by actively detecting the sun's movement. This strategy improves energy efficiency and advances sustainability by lowering dependency on non-renewable energy sources. Our data analysis and trials confirm that solar tracking systems are efficient at optimising solar energy output, which promotes the use of renewable energy technology and aids in environmental conservation. A cleaner and more sustainable energy future may be possible in the future.

ACKNOWLEDGEMENT

The author would like to thank Amer Faizal Bin Hussin, the project supervisor, for the guidance and support. Thanks to the Electrical Engineering department faculty, staff, peers, and colleagues for their feedback.

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APPLICATION OF VOICE COMMAND CONTROL IN ROBOT OPERATING SYSTEM (ROS) USING BVEETA MINI R1007 IN REMOTE DESKTOP

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Abstract **–** The Bveeta Mini, created in 2021, is a two-wheeled, ROS-based educational mobile robot designed to teach users about ROS and programming in languages like Python and C. Equipped with voice command features, it moves according to given instructions and navigates environments using SLAM to avoid obstacles dynamically. This technology demonstrates the potential of high-tech aids, particularly for elderly individuals needing assistance at home, by enabling easy, voice-controlled navigation to support daily tasks safely. This project serves as a practical demonstration for understanding and developing voice command technology, making learning accessible and enhancing productivity.

Keywords – Bveeta Mini, ROS, educational mobile robot, voice command control, SLAM, obstacle avoidance,

INTRODUCTION

The Bveeta Mini, a ROS-based educational mobile robot created in 2021, is developed by Bizbot Technology.Designed to teach users ROS and programming in Python and C, it comes in three versions: the original Bveeta Mini,the Bveeta R007 model, combined with a Raspberry Pi 4, will be used to implement voice command functionality. This open source platform supports researchers by accelerating product design, offering a ready-to-deploy example of mobile robotics.

METHODOLOGY

The Bveeta Mini R1007 robot was integrated with a Raspberry Pi 4 using ROS for voice command control. LiDAR and teleoperation features were tested, and data on voice command accuracy were analyzed.

RESULTS AND DISCUSSION

The tracking time result of voice command towards different volume, pronounciation and its interpretation

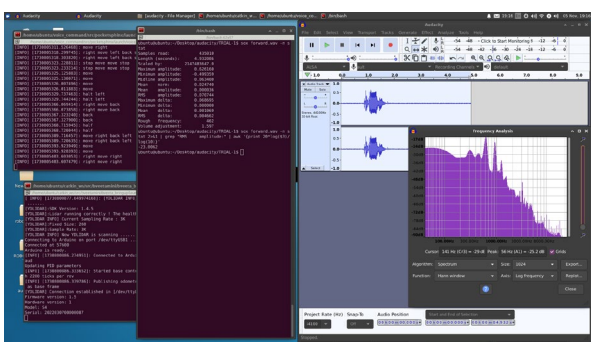

Figure 1: move right commands

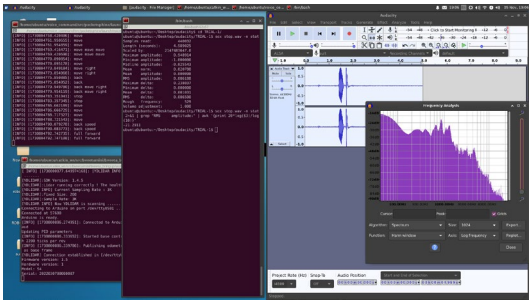

Figure 2: forward command

The result for this is where to in order to make sure to voice command works well, it can be tested on audacity where it is installed on ubuntu, remote desktop. Have to make sure that the sound volume should be over 50 Db in order to make sure the robot to intepret the command, The robot's response was affected by voice pronunciation and frequency, with optimal performance achieved within 2-3 cm

CONCLUSIONS

The project successfully implemented a voice-controlled robot with basic functionality, despite challenges in responsiveness and obstacle detection. Future work should focus on improving voice recognition and LiDAR accuracy for better performance in dynamic environments

ACKNOWLEDGEMENTS

The authors would like to thank my supervisor, my friends and my parents for the financial support.

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InfinitiGrip – Robotic Arm

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Abstract – This project introduces an RC Car Mounted Robotic Arm to address the limitations of fixed robotic arms by adding mobility. Unlike stationary systems restricted to specific areas, this design allows the robotic arm to move freely on an RC car, controlled via Bluetooth through a mobile app. It is ideal for applications like warehouse automation, where it can navigate aisles, pick items from shelves, and manage inventory efficiently, reducing the need for multiple stationary units. In home assistance, it offers convenience by helping users with tasks like retrieving objects or operating switches, especially benefiting individuals with limited mobility. By combining mobility and real-time control, this solution is versatile for both industrial and everyday use. ***Keywords – Arduino UNO, Servo Motor, Bluetooth Sensor, IoT***

INTRODUCTION

The integration of robotic arms with RC cars represents a significant advancement in robotics, combining mobility and precision to create versatile systems capable of operating in diverse environments. These robotic platforms can perform tasks such as warehouse logistics, search and rescue, and remote handling with improved efficiency. IoT technology further enhances their functionality by enabling real-time remote control and monitoring over networks. Brock and Khatib (2002) [1] explored motion generation frameworks in human environments, while Kumar and Michael (2012) [2] discussed challenges and opportunities in autonomous mobile systems. Building on these studies, this innovation has broad applications in manufacturing, construction, and healthcare, where automation and remote operation are increasingly essential.

METHODOLOGY

The robotic arm RC car uses sensors and a Bluetooth module to receive commands and data for movement, arm control, and obstacle detection. The Arduino UNO processes this information, controlling the motors and servos for smooth navigation and precise actions like picking and placing objects. It also provides real-time feedback to the mobile app for efficient operation.

RESULTS AND DISCUSSION

The motor speed and functions with PWM is shown in Table 1.

Table 1: Motor Speed and Functions with PWM

RC car	D2	D5(PWM)	D4	D6(PWM)
Forward	HIGH	0-255	LOW	0-255
Backward	LOW	0-255	HIGH	0-255
Rotate to left	LOW	0-255	LOW	0-255
Rotate to right	HIGH	0-255	HIGH	0-255
Stop	/	0	/	0

The PWM value is in the range of 0-255. The greater the value, the faster the motors turn. When PWM=0, it means stop, when PWM=255 it means maximum speed.

The angle calibration method of the servo motor is shown in Table 2. This will make us easier to install the swing arm into the gear of the servo and prevent servo heating issue.

Table 2: The Angle Calibration Method of the Servo Motor

Claw	Servo 1	D9	90 degree
Arm	Servo 2	D10	135 degree
Base	Servo 3	D11	90 degree

The result shows that the robotic arm RC car operates in a loop of input, processing, and output. It receives commands from a Bluetooth-connected app for movement, arm control, and advanced features like gravity control and auto pick-and-place. Sensors like the ultrasonic module detect obstacles, while the line-tracing module helps navigate paths, and accelerometer data assists with balance. The Arduino UNO processes these inputs, controlling motors for movement and servos for arm actions. The system performs tasks like moving, following lines, and handling objects, providing real-time feedback to the app for smooth and responsive operation.

CONCLUSIONS

The "InfinitiGrip – Robotic Arm" combines a robotic arm with an RC car for flexible, user-friendly operation in various environments. Using Bluetooth control and sensors, it offers stability and adaptability. While future upgrades are possible, it sets a solid foundation for advancing mobile robotics and task automation.

ACKNOWLEDGEMENTS

The authors would like to thank Politeknik Tuanku Sultanah Bahiyah and their parents for their support throughout this project.

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WIRELESS GRASSCUTTER USING SOLAR AND IOT

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Abstract – This project proposes a solar-powered, IoT-enabled wireless lawnmower, offering an eco-friendly and efficient solution for lawn maintenance. Powered by solar energy, it reduces reliance on traditional energy sources and minimizes the carbon footprint. IoT integration enables remote control via a mobile app or web interface, allowing users to schedule cutting sessions, receive updates, and adjust settings. Equipped with obstacle-detection sensors, the system ensures safety and efficiency. By combining renewable energy, IoT, and advanced technology, this lawnmower provides a sustainable and convenient approach to lawn care.

Keywords – IoT, Solar energy

INTRODUCTION

In today's age of technological and environmental awareness, traditional grass-cutting methods relying on fossil fuels contribute to pollution and harm. This project introduces a solar-powered, IoT-enabled lawn mower as a sustainable alternative, utilizing renewable energy to reduce carbon emissions and enhance efficiency. IoT integration enables remote monitoring and control, providing convenience and customization. By merging renewable energy, IoT, and advanced lawn-cutting technology, this initiative promotes greener, smarter, and more sustainable landscape practices.

METHODOLOGY

The project plan integrates hardware and software to ensure efficient lawnmower operation. An ultrasonic sensor detects obstacles or boundaries, sending signals to the ESP32 control system to adjust direction for safe operation. Solar panels power the mower by converting sunlight into electricity to charge the battery. A central Gateway connects to the Blynk IoT Cloud, enabling remote monitoring and control via the Blynk app on a smartphone or laptop. The motor driver controls power to the blades, which perform cutting actions based on commands from the control system.

RESULTS AND DISCUSSION

The ESP32 serves as the main controller, managing sensors, relays, and motor drivers. Ultrasonic sensors measure object distance, with Trigger and Echo pins sending and receiving signals to calculate distance. A Relay Module controls high-power devices like 12V cutters, with the ESP32 toggling the relay via a control pin. The L298 Motor Driver operates four DC motors, controlling their speed and direction based on ESP32 commands. These motors enable movement for the tool or vehicle. The ESP32 processes distance data, activates the cutter via the relay when needed, and drives the motors, making it ideal for robotics and automation applications.

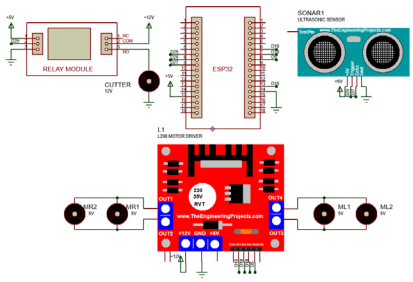

Figure 1: Connection circuit

The circuit uses an ESP32 as the main controller, connected to an ultrasonic sensor, a relay module, and an L298 motor driver. The ultrasonic sensor detects obstacles and sends data to the ESP32. The relay module, controlled by the ESP32, powers a 12V cutter motor. The L298 motor driver operates four DC motors for movement, with the ESP32 managing their speed and direction. A 12V power supply powers the system, with 5V components likely regulated. This setup enables autonomous lawnmower operation with obstacle detection, navigation, and cutting functionality.

CONCLUSIONS

This wireless lawnmower project successfully combines green technology with IoT, showcasing the potential of solar energy for efficient and eco-friendly landscape maintenance. The integration of ESP32 and ultrasonic sensors enhances control and monitoring for effective grass-cutting operations. Overall, the project met its objectives and lays a foundation for future innovations in landscape automation and sustainable technology, inspiring the development of more advanced solutions.

ACKNOWLEDGEMENTS

The authors would like to thank PTSB and parents for the resources provided for this project.

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INFERNO MATERMIND – IoT BASED FIRE ALERTING SYSTEM

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Abstract – This paper presents the Inferno Mastermind, an IoT-based fire alerting system designed to enhance fire detection and emergency response. Addressing limitations in traditional fire safety systems, this project integrates fire, temperature, and motion sensors with the ESP32 microcontroller. Real-time data from these sensors is transmitted to a monitoring platform through WiFi, enabling prompt alerts to users and emergency services. This system is developed using Arduino IDE and Blynk, which together provide an accessible interface for users to monitor and manage fire risks remotely. Initial results show that the system successfully delivers timely alerts, thereby supporting early intervention and minimizing damage.

Keywords –IoT, fire detection, ESP32, real-time monitoring, emergency response.

INTRODUCTION

With increasing fire hazards and a need for effective fire management systems, the Inferno Mastermind project was developed to create a responsive, IoT-based fire alerting system. Traditional systems often lack real-time data processing and seamless integration with emergency services, increasing response times. This project leverages IoT technology, aiming to provide a comprehensive solution for residential, commercial, and industrial fire safety.

METHODOLOGY

The system integrates fire, temperature, and PIR sensors with the ESP32 microcontroller to detect fire hazards. Data from sensors are processed in real time and transmitted via WiFi to a cloud server. The system design includes a web interface using Arduino IDE and the Blynk platform, where users receive alerts and monitor environmental conditions. The methodology involved prototype development, testing for sensor accuracy, and calibration to ensure reliable alerts.

RESULTS AND DISCUSSION

Testing showed that the system effectively detects temperature changes, smoke presence, and flame. The ESP32's WiFi connectivity facilitated seamless transmission of sensor data to the monitoring platform, with alerts successfully reaching users via the Blynk app. Some challenges were encountered with sensor calibration, particularly under fluctuating network conditions, but adjustments improved data accuracy. The system's real-time alerts help minimize potential fire damage and provide a scalable solution for fire safety.

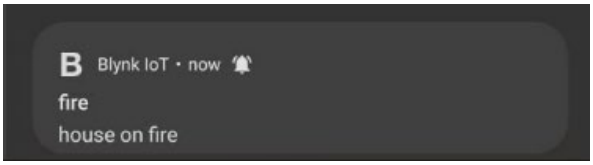

Figure 1 : Blynk app notification in smartphone

Table 1: Sensor detection amd notofication response time

Sensor Type	Response Time (ms)	Notification Sent
PIR Sensor	150	Yes
Flame Sensor	100	Yes
DHT 11 Sensor	150	Yes
MQ-2 Smoke Sensor	100	Yes

The table demonstrates the performance of Inferno Mastermind's sensors in detecting intrusion and the response time required to activated the buzzer and send a notofication to the user's smartphone via the Blynk application. All 4 sensors effectively detect surrounding and send notifications promptly, ensuring efficient fire detection.

CONCLUSIONS

The IoT-based Inferno Mastermind system has proven effective in enhancing fire alert capabilities through timely detection and communication. The project highlights IoT's potential in improving fire safety, especially in settings where early intervention is critical. Future work could integrate machine learning for predictive analytics, alternative connectivity options for remote areas, and battery backup for uninterrupted operation.

ACKNOWLEDGEMENTS

The authors would like to thank PTSB and parents for the resources provided for this project.

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SMART FISHPOND SAFETY

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Abstract **–** In the era of smart technology and related ecosystems, the Smart Fishpond Safety project is designed to explores the integration of RFID technology, temperature sensors, and water pumps to improve safety and monitoring of freshwater fishponds. The use of RFID in the pond area ensures that only registered individuals can access the pond, reducing the risk of threats such as wild animals and fish theft, an increasingly serious problem in fish farming. In addition, the DS18B20 temperature sensor constantly monitors the water temperature, ensuring optimal conditions for the fish. When the water temperature is outside the safe range, the temperature control light will turn on especially when the low temperature works to help raise the pool temperature to a suitable level for the fish. The water pump controls circulation, pool temperature and water oxygenation to prevent stagnant water and reduces the risk of lack of oxygen. With this combination of technologies, farmers can remotely monitor ponds, proactively detect abnormalities, and implement timely actions, ensuring the well-being of aquatic life and optimizing fish farm productivity.
Keywords –ESP32, RFID, Monitoring.DS18B20.

INTRODUCTION

Smart Fishpond Safety is a project created to further improve the fishpond safety system. The specialty of this project is the combination of functions which are RFID, temperature monitoring and water pump. This project is very suitable for use on all types of freshwater fishponds. This project is designed using a temperature sensor to detect the temperature of the pool. Then, RFID to keep the fishpond safe from the threat of wild animals and fish theft. The pool also has a water pump that works to control water circulation and oxygenation, reducing the risk of stagnant water and running out of oxygen.

METHODOLOGY

In the course of preparing for the project setup various devices were to be installed and these included an RFID reader for access control, a temperature sensor for water, and a water pump. These components are interfaced to a microcontroller that transmits real-time information to a remote system.

RESULTS AND DISCUSSION

The enrolment of temperature is shown in Figure 1.

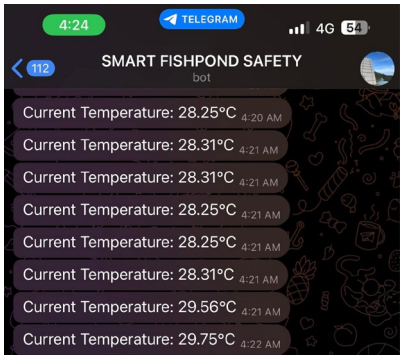

Figure 1: Telegram update temperature every second.

The Smart Fishpond Safety bot is configured to send updates about the current water temperature in the fish pond every 30 seconds. The frequent updates suggest the system's focus on real-time monitoring, helping fish farmers maintain optimal water conditions remotely and ensuring a safe environment for the fish.

Table 1: The RFID door access table

Entry	Register	Access	Door
RFID Card	Yes	Access granted	Open
RFID Card	No	Access denied	Close

The fishpond is secured through the service of RFID. If the RFID card is registered the door opens. If not registered, then the door remains locked. This makes the surrounding area secure since only those people who have access can get inside.

CONCLUSIONS

The Smart Fishpond Safety System improves pond security and monitoring by using RFID technology, temperature sensors, and a water pump. RFID ensures controlled access, the temperature sensor maintains ideal conditions, and the water pump prevents stagnation. These features work together to create a reliable system that helps fish farmers manage the pond more efficiently and keep the fish healthy.

ACKNOWLEDGEMENTS

The authors would like to thank PTSB and parents for their financial support.

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Smart Parking System with LCD Display Using ESP32 & IoT

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Abstract – An intelligent parking system with an LCD that uses ESP32 and IoT helps to reduce parking space issues by allowing users to see parking availability directly through the LCD. With ESP32 as the main microcontroller, parking space data is collected and displayed to determine the status. The components used are ESP32, LED, Servo motor, Infrared sensor, and LCD. Users can interact with the system through the user interface on the LCD to find empty parking spaces or obtain additional information. This advanced technology allows users to find empty parking spaces easily, improve parking management efficiency, and reduce time spent searching for parking spaces. This system provides an innovative solution to the common parking space problem, aiming to enhance user experience and benefit society.

Keywords: Smart parking, LCD, ESP32

INTRODUCTION

This project, titled "Parking System with LCD Display Using ESP32 and IoT," aims to address the problem of parking space congestion by utilising Internet of Things (IoT) technology. The system allows users to view the availability of parking spaces in real time via an LCD connected to an IoT network to collect data automatically. This enables users to make smarter decisions regarding which parking space is suitable for them to use.

METHODOLOGY

The intelligent parking system with an LCD using ESP32 and IoT in this methodology and materials section uses the required components such as ESP32, LCD, ultrasonic sensor, and infrared sensor. A schematic diagram of the system is provided to understand the relationships between the necessary components better. Software development involves writing code for the ESP32 to handle the sensor readings and display the information on the LCD. The ESP32 is the system's primary controller, while the LCD the parking status. Parking sensors, such as ultrasonic and infrared sensors, are used to detect vehicles. Finally, basic electronic components, including wires, solder, and other components required for the circuit, are included.

RESULTS AND DISCUSSION

This chapter presents the results and design of the innovative parking system project using ESP32 and IoT technology with an LCD. The system design consists of the ESP32 module, which acts as the brain of the system, infrared sensors to detect the presence of vehicles, and an LCD that provides clear information about the parking space status. The results demonstrate the effectiveness of data collection, with the system able to accurately detect and display the status of spaces. Additionally, the IoT integration allows the data to be accessed online to monitor vehicle entries and exits. Overall, this project demonstrates the potential of technology in enhancing parking management, offering a practical and efficient solution for users.

Figure 1: LCD

In the project "Smart Parking System with LCD" (Figure 1), ESP32 and IoT are used. Telegram is used to send notifications to users on their phones. Through this integration, the system can send real-time alerts regarding the status of parking spaces, such as detecting vehicles entering or leaving the parking area.

CONCLUSION

The conclusion of the project "Smart Parking System with LCD Display Using ESP32 and IoT" highlights its potential to improve parking management efficiency. Using ESP32 as the core, the system utilises IoT technology to provide real-time parking availability through an LCD. The project successfully addressed technical challenges like component integration and internet connectivity. Key benefits include reduced traffic congestion, better user experience, and easy access to information. Overall, it offers a practical solution to parking issues and paves the way for future improvements in more intelligent, integrated transportation systems.

ACKNOWLEDGEMENT

The authors would like to thank PTSB and parents for the resources provided for this project.

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AUTOMATIC FLOOD PARKING AND NOTIFICATION MONITORING

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Abstract **–** The Automatic Flood Parking and Notification Monitoring System is designed to assist residents in flood-prone areas by providing early warnings and preventing vehicle submersion. The system consists of three main sections: an input section with water sensors and an ESP32-CAM for real-time flood detection, a processing section featuring an ESP32 microcontroller to analyse data and trigger responses, and an output section that includes a DC motor, buzzer, LED lights, an additional ESP32-CAM, and integration with the Telegram application for instant notifications. This project enhances preparedness and minimises potential damage during flooding by automating flood monitoring and vehicle protection.

Keywords – Water Sensor, ESP32-Cam, Automatic parking, Telegram

INTRODUCTION

The rainy season often occurs in Malaysia, and in places where vehicles can't be saved during floods, the author has created a project that can. I named this project Automatic Flood Parking and Notification Monitoring. Automatic Flood Parking is a project that can save current vehicles from flooding instead of sinking and causing damage to the car.

METHODOLOGY

Several steps have been taken while developing this project. The following description will explain the methodological steps. The microcontroller used is ESP32 and ESP32-CAM. ESP32 is connected and will control the buzzer, LED (Light Emitting Diode), water sensor and motor. ESP32 will control software and hardware. Thus, the ESP32 is a programmable microcontroller chip. ESP32-CAM is only made for CCTV. On the output side, a motor will lift the car, the buzzer will sound, the LED will light up, the picture will be sent to Telegram, and users will receive notifications in the event of a flood.

RESULTS AND DISCUSSION

The data presented in the table and graph demonstrate the behaviour of the water sensor and auto parking in response to varying floods by the water sensor. If the detector detects lamp water, the LED red will light up. If LED lights detect no water, green will light up.

Figure 1: Water Sensor data graph

Table 1: Data analysis

Data of Water sensor		
Parking	UP	DOWN
Water sensor	Water detected	No water detected

The water sensor detects water and activates the DC motor to turn up the parking; if it does not detect water, it activates the DC motor to turn down the parking.

CONCLUSION

The analysis and results demonstrate the effectiveness of this project in achieving its objectives. While some challenges were encountered, they can be addressed and resolved. The system successfully activates the DC motor in response to water sensor detection, fulfilling its intended purpose. This project meets the established criteria by providing a reliable and user-friendly flood monitoring and vehicle protection solution.

ACKNOWLEDGEMENT

The author would like to thank USM and TNBR (Tenaga Nasional Berhad Research) for the financial support.

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SMART METER ENERGY USING IOT

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Abstract **–** The **Smart Meter Energy using IoT** project offers an efficient solution for real-time monitoring and managing energy consumption. It utilises an ESP32 microcontroller to process data from voltage sensors, displaying energy usage on an LCD screen for easy tracking. With Wi-Fi connectivity, users can remotely access the system via a smartphone app, monitor consumption, control settings, and receive alerts for abnormal usage. Powered by a 9V supply, the system ensures stable performance and reliability. This project particularly benefits Kulim Hi-Tech Park Phase 2 residents, enabling them to optimise energy efficiency and take proactive steps to reduce consumption.
Keywords – Smart Meter Energy, Internet of Things

INTRODUCTION

Smart Meter Energy, powered by IoT, improves energy management using smart meters that track and control energy use in real time. These meters enable remote communication between energy providers and consumers, ensuring accurate billing and identifying inefficiencies quickly. They help consumers make smarter, more sustainable energy choices and provide energy providers with data to improve the grid. Overall, IoT-based smart meters create a more efficient and sustainable energy system.

METHODOLOGY

The Smart Meter Energy experiment used a voltage sensor, which was tested using batteries with voltage variations of 3V, 5V, and 9V. These three tests, conducted consecutively, provide a clear picture of the performance and accuracy of energy consumption measurement in various voltage conditions.

RESULTS AND DISCUSSION

Figure 1 shows that BLYNK works when receiving voltage readings detected by the voltage sensor.

Figure 1: Blynk working when receiving voltage

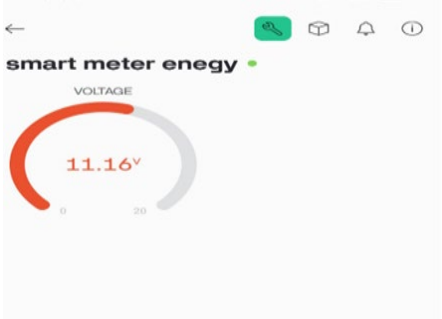

Table 1: Comparison for Smart Meter Energy

EXPERIMENT	SUPPLY	VOLTAGE
1	3V	2.60V
2	5V	4.76V
3	9V	8.78V

This analysis shows several important points. First, there is a slight voltage drop relative to the supply voltage in each experiment, possibly due to the internal resistance of components such as wires or connections. Second, the slight difference between the supply voltage and the measured voltage may reflect the accuracy or calibration limits of the measuring instrument. Third, the measured voltage is almost identical to the supply voltage, indicating good compatibility between the supply and the load. Finally, the increased measured voltage in parallel with the supply voltage indicates that the system can handle higher voltages efficiently without significant power loss.

CONCLUSION

The Smart Meter Using IoT project has successfully improved energy consumption monitoring. Users can track their electricity usage in real time by using voltage sensors and connecting to platforms like Blynk. This helps them make better decisions about their energy use, leading to more efficient resource consumption. The ESP32 microcontroller ensures fast and accurate data processing, while the LCD makes it easy for users to read the information. The project is designed to meet user needs and provide reliable results. It helps save costs and encourages a more sustainable lifestyle by informing users of their energy consumption. With future upgrades, like adding solar panels, the project could offer even more benefits for users and the environment.

ACKNOWLEDGEMENT

The author would like to thank his supervisor and friends for their support and the knowledge they shared.

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Kesum Leaf Growth Monitoring System Using IoT and Relay-based Hydroponic Method

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Abstract **–** Kesum leaves are vegetables often found in supermarkets and used in various dishes, and they are one of the important crops for farmers. However, the increased consumer demand makes cultivating kesum leaves less efficient. So, the Kesum Leaf Growth Monitoring System on IoT and Relay-based Hydroponic Methods was implemented to design a kesum leaf growth monitoring system using IoT and relay-based hydroponic methods. In addition, an ultrasonic sensor can be used as a water level gauge in the kesum leaf hydroponic container. This remote monitoring is not impossible for the farmers to monitor the kesum leaf plant. All that needs to be done is to wait for the notification to be sent to the user's smartphone. After that, the farmer needs to select the add water function in the Blynk application and send a signal using a relay to add water to prevent the kesum leaves from withering or dying. Farmers can also monitor water levels and temperatures.

INTRODUCTION

In Malaysia, the weather is generally hot due to its location near the equator. This climate poses unique challenges for plant cultivation, especially for crops that require consistent water levels to thrive. Hydroponics, a modern method of growing plants without soil as a growth medium, relies entirely on water to support plant growth. The Kesum Leaf Growth Monitoring System Using Hydroponic Method Based on IoT and Relay was developed to address this issue. This innovative system is designed to help gardeners overcome water management challenges by providing real-time monitoring and control of the hydroponic environment. The system offers several key features, including the ability to display vital information such as water temperature, air temperature, humidity, and water levels. It also integrates IoT technology, enabling farmers to monitor and control their plants using smartphones remotely.

METHODOLOGY

This chapter covers aspects of project design, including system block diagrams and Gantt charts. It also includes software and hardware, such as schematic circuits, PCB layout, and etching steps. Next, it consists of developing software systems, such as the application used to develop this project. Flow charts and social responsibility are also important aspects.

RESULTS AND DISCUSSION

Table 1: Days against the water level.

Masa(Hari)	Pam air	Paras air(cm)	Ultrasonik sensor (%)
1	OFF	17	85
2	OFF	15	75
3	OFF	14	70
4	OFF	11	55
5	OFF	9	45

The table shows the data recorded for five days. During those five days, the water pump did not turn on. This is because the day was cloudy and the weather was not hot, causing the water in the hydroponic container to be less than 20% hydrated. In addition, the water level decreased from 85% % to 45% for five days. This is because the weather and air humidity are typical and not hot, causing the water level not to decrease by 20% and the water pump not to operate.

CONCLUSION

In conclusion, this project took longer than expected due to delays in selecting components and equipment, which affected the programming and overall timeline. To avoid such delays in the future, detailed planning, including schematic diagrams and GPIO connections, should be done early. After completing the model, a final test was conducted before data collection. Overall, the project involved complex processes requiring careful planning and execution.

ACKNOWLEDGEMENT

The author would like to thank PTSB for the financial support.

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PORTABLE FIRE DETECTOR

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Abstract – A portable fire detector was developed to emit a warning sound when the temperature exceeds a set level. This design was created because it is cheaper than other fire detectors, uses batteries, and can be charged from the main AC power supply. The system combines a thermistor and a programmable ESP32 microcontroller. The circuit is designed and simulated, with simulation results showing that the system can meet its objectives.

INTRODUCTION

A fire detection system is designed to detect fires in their early stages, ensuring occupants can evacuate safely and emergency responders can act before significant damage occurs. Early detection is crucial for saving lives and property. Some systems rely on occupants manually triggering alarms, which can cause delays. Rapid detection is vital, especially in residential areas or hospitals where occupants cannot evacuate themselves. Residential fires can occur anytime, from smouldering, producing heavy smoke and carbon monoxide with little heat, or flaming, which burns rapidly with high heat but less smoke. Fire alarms are classified into three main types: photoelectric, ionisation, and dual-sensor alarms, each suited for different fire types. Heat detectors are the most basic and cost-effective, but slower to respond. This project aims to develop a portable fire alarm system using heat detection principles and integrate it with an ESP32 microcontroller.

METHODOLOGY

Research methodology involves designing, collecting, and analysing data to create a complete study framework. It explains how a problem is studied, why specific methods are used, and the techniques applied. Its goal is to provide a detailed understanding of research processes, including methods, principles, styles, and patterns used in a field or discipline. Research methodology identifies the most suitable approach and effective procedures to address research problems and achieve specific objectives.

RESULTS AND DISCUSSION

This gas detection system successfully triggers an alarm when gas is detected at a hazardous level. When the sensor detects high gas levels, the code activates a buzzer connected to a specific pin (ALARM_PIN), providing a danger warning at the location. This alarm activation helps deliver early warnings to users.

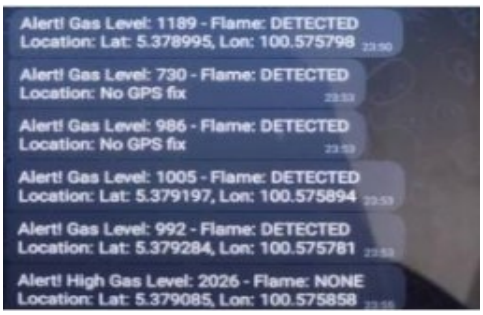

Figure 1: Detect fire, gas and location.

This system uses IoT through a Telegram bot. When a fire is detected, the notification will display "detected" along with the coordinates of the fire's location. Similarly, it will send the exact location coordinates when gas is detected.

Table 1: The result

Gas (unit ppm)	Fire	Buzzer
Less than 2000	no	Off
More than 2000	Yes	On

The result shows that when the gas level exceeds 2000 ppm, an alarm will sound, and a notification will be sent to a mobile phone about the hazardous location. If the flame sensor detects a flame, the phone will receive a notification about the fire and location.

CONCLUSION

In conclusion, the developed gas detection system provides effective safety with two key features: a physical alarm and mobile notifications. The gas detection system ensures safety with a buzzer alarm and mobile alerts, including GPS location, for quick emergency response.

ACKNOWLEDGEMENT

The author would like to thank Puan Raihana Binti Sam Hun for her guidance and support throughout this project.

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AUTOMATIC FLOOD PARKING AND NOTIFICATION MONITORING

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Abstract **–** The Automatic Flood Parking and Notification Monitoring System is designed to assist residents in flood-prone areas by providing early warnings and preventing vehicle submersion. The system consists of three main sections: an input section with water sensors and an ESP32-CAM for real-time flood detection, a processing section featuring an ESP32 microcontroller to analyse data and trigger responses, and an output section that includes a DC motor, buzzer, LED lights, an additional ESP32-CAM, and integration with the Telegram application for instant notifications. This project enhances preparedness and minimises potential damage during flooding by automating flood monitoring and vehicle protection.

Keywords – Water Sensor, ESP32-Cam, Automatic parking, Telegram

INTRODUCTION

Rainy season often occurs in Malaysia, and there are places where vehicles cannot be saved during floods. Therefore, the author created an Automatic Flood Parking and Notification Monitoring project that can save vehicles during floods. Automatic Flood Parking is a project that can save current vehicles from flooding instead of sinking and causing damage to the car.

METHODOLOGY

In doing this project, several steps have been taken. The following description explains the methodological steps. The microcontroller used was ESP32 and ESP32-CAM. ESP32 was connected to and controlled by the buzzer, LED (Light Emitting Diode), water sensor, and motor. ESP32 controlled software and hardware. Thus, the ESP32 is a programmable microcontroller chip. ESP32-CAM is only made for CCTV. On the output side, a motor will lift the car, the buzzer will sound, the LED will light up, the picture will be sent to Telegram, and users will receive notifications in the event of a flood.

RESULTS AND DISCUSSION

The data presented in the table and graph demonstrate the behaviour of the water sensor and auto parking in response to varying floods by the water sensor. If the detector detects lamp water, the LED will light up red. If no water is detected by LED lights (Light Emitting Diode), green will light up.

Figure 1: Water Sensor data graph

Table 1: Data analysis

Data of Water sensor		
Parking	UP	DOWN
Water sensor	Water detected	No water detected

The Water sensor detects water and activates the DC motor to turn up the parking, whereas if it does not detect water, it activates the DC motor to turn down the parking.

CONCLUSION

The analysis and results demonstrate the effectiveness of this project in achieving its objectives. While some challenges were encountered, they can be addressed and resolved. The system successfully activates the DC motor in response to water sensor detection, fulfilling its intended purpose. This project meets the established criteria by providing a reliable and user-friendly flood monitoring and vehicle protection solution.

ACKNOWLEDGEMENT

The author would like to thank USM and TNBR (Tenaga Nasional Berhad Research) for the financial support.

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Hydroelectric Model for Renewable Energy Education

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Abstract—To study renewable energy, a hydroelectric model using an ESP32 microcontroller with water flow and voltage sensors has been developed. The system measures water flow and electrical output, processing the data for real-time display on an LCD. This model enhances understanding of hydroelectric efficiency and serves as an educational tool for renewable energy experiments and innovation.

Keywords: LCD, ESP32, hydroelectric, renewable energy

INTRODUCTION

Hydropower, or hydroelectric power, is a renewable energy source that harnesses the energy of flowing or falling water to generate electricity. It is one of the oldest and most widely used forms of renewable energy, with a history dating back thousands of years. The basic principle behind hydropower is quite simple: water is channelled through a turbine connected to a generator. As water flows through the turbine, it causes the turbine to spin, converting the kinetic energy of the moving water into mechanical energy. This mechanical energy is then converted into electrical energy by the generator, producing electricity that can be used to power homes, businesses, and industries.

METHODOLOGY

The methodology used in this project follows a structured and systematic approach to achieving the set objectives. Several steps and processes were incorporated, which have proven effective in similar projects. This approach provides clear guidelines for planning, implementing, and evaluating the project's results.

RESULTS AND DISCUSSION

Figures 1 and 2 show the user interface for displaying results from the hydroelectric model. Parameters like voltage and water flow rate are clearly shown on the LCD for easy monitoring.

Figure 1: Full valve opening

Figure 2: 50% valve opening

Table 1 compares the voltage and water flow under different valve opening conditions. As the valve opens wider, the voltage and water flow increase, showing a direct relationship. A larger valve opening allows more water to flow, increasing turbine speed and electrical output. This highlights the importance of valve control in optimising hydroelectric generation.

Table 1: Generated Voltage and Water Flow Results

Valve opening	Voltage	Water flow
100%	11.60V	93.00 L/min
50%	10.44V	40.00 L/min
0%	0V	0.00 L/min

The results show a direct relationship between valve opening, water flow, and voltage. At 100% valve opening, the system generates 11.60V with 93.00 L/min of water flow. At 50% opening, the voltage drops to 10.44V with 40.00 L/min flow. At 0% opening, no water flows, resulting in 0V. These results confirm that more water flow leads to higher voltage output.

CONCLUSION

In conclusion, this model will succeed if the LCD accurately displays voltage and water flow, and the solar energy system performs as expected, with faster turbine rotation producing higher output. This study aims to support educators and students in learning about solar energy systems.

ACKNOWLEDGEMENT

Thanks to my supervisor, colleagues, and family for their support and encouragement throughout this project.

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GLASS, ALUMINIUM, AND PLASTIC WASTE ISOLATION FOR ENVIRONMENTAL SUSTAINABILITY

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Abstract **–** This paper explores an automated waste isolation system for glass, aluminium, and plastic, addressing the need for sustainable waste management. The system utilizes an Arduino Nano as the microcontroller, alongside capacitive, inductive, and infrared proximity sensors to identify and separate waste. The design integrates a servo motor for material sorting and an LCD display for user interaction. Results demonstrate that this approach simplifies waste segregation, encourages recycling, and significantly contributes to environmental sustainability.
Keywords: Automated waste sorting, Arduino Nano, sustainability, recycling, sensor technology

INTRODUCTION

Improper disposal of solid waste presents severe environmental challenges, including ecosystem degradation and pollution. This project introduces a household waste segregation system tailored for glass, aluminium, and plastic materials. The design leverages advanced sensing and microcontroller technologies to streamline waste sorting, reduce human effort, and enhance recycling efficiency. By integrating sustainability into household practices, this project aligns with global environmental goals.

METHODOLOGY

The project follows a systematic approach to hardware and software integration, using Arduino Nano and various sensors. A prototype was developed, involving flowchart-guided planning, design, and testing. The segregation process is automated, requiring minimal user input, and results were validated through surveys and prototype analysis.

RESULTS AND DISCUSSION

The system achieved accurate sorting of glass, aluminium, and plastic waste. User surveys indicated a satisfaction rate of 91.7%, highlighting the practicality and reliability of the design. Furthermore, the use of sustainable materials for the prototype reinforced the environmental benefits of the project.

CONCLUSIONS

This project successfully demonstrates an automated solution for waste segregation, suitable for household implementation. By promoting recycling and reducing manual labor, it fosters sustainable waste management practices. Future enhancements include IoT integration and AI-based sorting for broader applicability.

ACKNOWLEDGEMENTS

The author expresses gratitude to the supervisor, Puan Siti Mariam Binti Hussain, and all contributors for their support and guidance throughout the project.

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RECYCLE VENDING MACHINE

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Abstract – This project proposes an automated recycling bin using Reverse Vending Machine with a reward system to address the challenges of manual recycling. Equipped with sensors and a microcontroller, the bin identifies user information, weighs waste, and converts it into reward points. The system, tested in a small-scale trial, aims to motivate Malaysians to recycle more and could potentially help address urban poverty by turning waste into wealth.
Keywords – Reverse Vending Machine

INTRODUCTION

With the increasing amount of waste being generated and limited landfill space for disposal, recycling has become one of the key approaches to managing waste effectively. The current manual recycling practice, where users are required to transport bulk waste to recycling centers, can be inconvenient and may discourage people from recycling. To address this issue, this project proposes an automated recycling bin based on the concept of a Reverse Vending Machine (RVM). Essentially, the system is implemented within a standard recycling bin provided by local municipalities, equipped with a microcontroller and a collection of sensors.

METHODOLOGY

The methodology for the Reverse Vending Machine (RVM) begins with users depositing recyclable items into the machine. Sensors identify the type of waste and the user's details. The waste is then weighed to determine its weight. ESP 32 processes the data and controls the machine's operations.

RESULTS AND DISCUSSION

For this project, I analysed the data based on environmental impact.

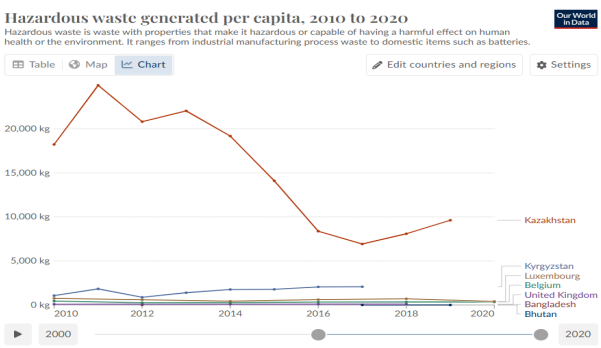

Figure 1: Chart of hazardous waste in the world

As we can see in Figure 1, hazardous waste was reduced over time because a lot of countries used RVM to improve the world's environment.

RVM contribute significantly to environmental sustainability by:

- Reducing CO_2 emissions through the recycling of plastics, metals, and glass.
- Diverting waste from landfills, thereby conserving space and reducing the impact of landfill emissions.
- Reducing litter in public spaces and minimizing the environmental consequences of littering.
- Supporting a circular economy and resource conservation by promoting the recycling of valuable materials.

When materials like plastics, aluminum, glass, and paper are recycled through an RVM, they contribute to significant energy savings compared to producing new materials from raw resources. These energy savings lead to a reduction in CO_2 emissions.

CONCLUSION

RVM project demonstrates significant potential in promoting environmental sustainability by encouraging recycling, reducing waste, and lowering carbon emissions. The prototype successfully achieved its primary goals of improving recycling rates and providing an accessible, incentivized system for users. By diverting waste from landfills and supporting a circular economy, RVM contributes to the conservation of resources and helps mitigate environmental pollution.

ACKNOWLEDGEMENTS

Thank you to the supervisors who helped a lot to make this project a success.

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PROXICAM SECURITY DOORBELL

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Abstract - The Proxy-Cam Security Doorbell project is a new design to facilitate homeowners and make them feel secure. Using advanced technology, the system is incorporated with motion detection and a remote access system for smooth and secure access to homes. By using smart programming and teaching apps data through machine learning, the app automatically unlocks your door, warning homeowners of a potential thief. Also, the system is touch-free in nature which encourages less physical touch which is good for hygiene, especially in the time of crisis. The project will help in tackling the ever-growing demand for smart home solutions and contribute to the advancement of home security technology. The Proxy-Cam Security Doorbell will give homeowners peace of mind and convenience through its outstanding features and usability without compromising safety.

Keywords – Proxy-Cam Security Doorbell, Motion Detection, Remote Access System, Smart Home Solutions

INTRODUCTION

This project creates a smart, contactless security doorbell using ESP-WROOM-32 and ESP-32 CAM. It features a photoelectric sensor to detect visitors, triggering the ESP-32 CAM to capture and send images via Telegram. The system allows homeowners to control the automatic door lock and display messages on an outdoor LCD remotely or manually. It includes an alarm for break-in attempts, enhancing home security and providing convenient, contactless access management.

METHODOLOGY

Develop circuit simulations, create project schematics, and produce PCB, including ESP32 controller, camera, IR Proximity sensor, LCD, and buzzer. Develop firmware for ESP32 and a mobile app for remote access and real-time monitoring. Integrate with smartphone and voice assistants for enhanced functionality.

RESULTS AND DISCUSSION

Once the project has been fully functional, the data obtained will be displayed as proof that this project has worked and achieved the project objectives that have been set. Among the data obtained through this project is that the LCD will display the words "WELCOME" when the lock is opened by using a phone, “DOOR UNLOCK” when the lock is opened manually, "NO ENTRY" when the request is denied and "PROXY CAM" when the camera as shown the following figures

Figure 1: Result when the lock is opened by using the phone

Figure 2: Result when the lock is opened by manual

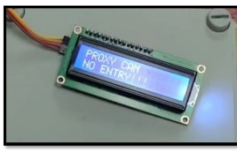

Figure 3: when the request was denied

Figure 4.4: when the camera is in a ready state

CONCLUSIONS

This smart contactless security doorbell uses IoT and remote control to enhance modern home security. Combining ESP-WROOM-32 and ESP-32 CAM, it enables smartphone access, visitor tracking, remote unlocking, photo capture, LCD messages, and security alerts. While dependent on internet connectivity and regular maintenance, it meets key security needs. The project showcases a practical, user-friendly, and energy-efficient system, demonstrating how smart technology can evolve to meet future security demands.

ACKNOWLEDGEMENTS

Grateful to God, my supervisor Puan Syajaratul, my lecturers, and my parents for their guidance, support, and motivation in completing my Proxy-Cam Security Doorbell project.

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HYDROPOWER CHARGER USING ESP32 FOR OUTDOOR ACTIVITIES

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Abstract - The Hydro Power Charger with ESP32 for Outdoor Activities utilizes a 12V DC turbine generator to charge electronic devices using hydropower. An ESP32 microcontroller manages the charging process, integrating water flow, voltage, and current sensors to monitor power generation. It optimizes energy use while tracking the device's battery status. The system features an LCD, a TP4056 charging module, LEDs, a relay, and a 12V water pump for user interaction. This portable and sustainable solution reduces reliance on conventional power sources, promoting environmental sustainability for outdoor enthusiasts.

Keywords – Hydro Power Charger, Outdoor Activities, Water Flow Sensor, ESP32

INTRODUCTION

Innovation in hydropower chargers using ESP32 for outdoor activities focuses on developing a portable and lightweight system that converts water current into electricity through a 12V DC turbine generator. Controlled and monitored by an ESP32 microcontroller, it uses voltage, current and water flow sensors for accurate energy production and charging efficiency measurement. The main components include a 20x4 LCD, TP4056 battery charging module, LED, relay and 12V DC water pump for user interaction. The project explores renewable energy by emphasizing efficient energy conversion, system interactivity and sustainability through compact design.

METHODOLOGY

The Hydro Energy Charger uses Esp32 for outdoor activities that are carried out using tap water. The average flow rate reaches 3400 L/m, there is a voltage and also a current that we can use.

RESULTS AND DISCUSSION

The flow rate of flowing water required to produce electricity is shown in Figure 1.

Table 1: Data Sampling From the Test

Tests	Flow rate(L/m)	LED Blue	LED red	Voltage (v)	Current (A)
1	000.0 L/m	ON	OFF	0 V	0 A
2	3400 L/m	OFF	ON	5 V	3.3 A
3	6400 L/m	OFF	ON	12 V	5 A
4	2100 L/m	ON	OFF	2.5V	0.8 A

From Table 1, We can see that when there is no flow rate from flowing water, there will be no electricity. LED blue will turn ON when there is no electricity or not enough voltage and current. On the other hand, when there is flowing water, the red LED will turn ON and the blue LED will turn OFF. As you can see from the table, when the flow rate of the flowing water reaches 3400 L/m, LED Blue turns OFF and LED RED turns On, and voltage and current also increase. When the flow rate of the flowing water reaches 6400 L/m, it does the same thing, but the voltage and current increase more. For the 4th test of the project, I used low pressure of the flowing water, it reads the flow rate value until 2100 L/m only, LED Blue turns On and LED red will not trigger because there is not enough flow rate, voltage and current.

CONCLUSIONS

During the completion of this project, all planning was done carefully and neatly and according to the procedures that were set. This project is also 80% complete due to my hard work. The project meets the objectives or criteria that were set when the blue LED and red LED lights up according to what has been set. It also manages to display Turbine voltage readings, Current, voltage and flow rate suitable for charging other devices. In conclusion, the faster the water flows to rotate the Turbine Generator and Water flow sensor, the higher the voltage and current created.

ACKNOWLEDGEMENTS

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STUDY THE INTELLIGENT SMOKE DETECTION AND ALARM SYSTEM

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***Abstract*—**This paper presents an Intelligent Smoke Detection and Alarm System that uses IoT and machine learning to enhance safety. It provides real-time monitoring, alerts users via mobile apps, emails, or SMS, and reduces false alarms by distinguishing real hazards. The remote-controlled system has been tested for reliable smoke detection with minimal false alarms.

Keywords – Intelligent Smoke Detection, Alarm System, IoT Technology, Machine Learning, Real-time Monitoring, False Alarms, Remote Control, Smoke Detection, Safety Systems, Mobile Alerts

INTRODUCTION

Fire protection systems have been a cornerstone of safety in modern buildings, with traditional smoke alarms playing a crucial role in preventing fire-related incidents. However, these alarms come with reliability, connectivity, and adaptability limitations, highlighting the need for more advanced solutions. Enter the Smart System Detector Alarm—an innovative step forward in fire safety. By leveraging artificial intelligence, Internet of Things (IoT) connectivity, and cutting-edge sensor technology, this system offers a new level of fire detection and prevention. Unlike conventional alarms, often prone to false warnings or limited in their detection capabilities, the Smart System Detector Alarm stands out with its precision, fast response times, and user-friendly design, setting a new benchmark in comprehensive fire protection.

METHODOLOGY

Methodology is a structured approach to executing a project. It combines theoretical models and practical techniques to ensure organisation and timely completion. Methodology enhances transparency by detailing each step, though its thoroughness may sometimes extend the timeline.

RESULTS AND DISCUSSION

The system effectively displays real-time smoke and heat values on the LCD, showcasing its capability for fire detection.

Figure 1: Result in Smoke and Heat Displayed

Based on the image, the data analysis shows the system's ability to monitor smoke and heat levels in real time, displaying corresponding values on the LCD for easy tracking and efficient fire condition monitoring.

Table 1: Data Analysis for Smoke and Heat Detection Exceeding Limits

Condition	Smoke Concentration (PPM)	Temperature (°C)	Exceeds Limit (Yes/No)
1	165	152	Yes
2	145	158	Yes
3	170	149	Yes
4	155	145	No

This analysis highlights the importance of monitoring smoke and temperature levels for fire safety. The system detects when these levels exceed safe thresholds, enabling early fire hazard identification and timely action to prevent damage.

CONCLUSION

Intelligent Smoke Detection and Alarm System take fire safety to the next level by combining IoT and machine learning for accurate, real-time monitoring. It minimizes false alarms, provides reliable detection, and sends timely alerts through mobile or remote control, ensuring users can respond quickly to potential fire hazards. This system offers peace of mind by enabling early detection and improving safety in homes and businesses.

ACKNOWLEDGEMENT

The authors would like to thank to supervisor Pn. Syajaratul Dur and all the lecturers for the guidances.

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Wind Turbine-Powered Streetlight

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ABSTRACT – This project involves wind turbines installed along highways to generate electricity for street lighting. It uses the ESP32 microcontroller, which allows for the measurement of voltage, current, speed, and light detection. Speed is monitored using a speed sensor, while current is measured with a current sensor module that detects the output from the generator or direct current (DC) motor. Light detection is managed by an LDR (light-dependent resistor), ensuring the streetlights turn on when it gets dark. All of these parameters can be accessed and controlled through a mobile application (Blynk) programmed into the ESP32.

Keywords:-ESP32 , LDR , wind turbine, DC motor

INTRODUCTION

Small wind turbines can be used to generate energy for street lighting in specific areas. By utilizing wind energy, its provide the necessary power for streetlights without relying entirely on the main electrical supply.d turbines for street lighting helps reduce electricity costs and supports renewable energy initiatives, making it more environmentally friendly and efficient.

METHODOLOGY

The Smart Wind Turbine project uses an ESP32 to connect environmental sensors that monitor the surroundings. The ESP32 collects data and sends it via Wi-Fi to a cloud platform for analysis. The turbine's operations are automatically adjusted based on the sensor data to improve energy efficiency. A user interface makes it easy to monitor and control the system, and data security is ensured through encryption. Overall, the project allows for smarter and more efficient wind turbine management.

RESULTS AND DISCUSSION

The data readings for this project aim to determine the values for power flow (W), voltage (V), and current (A) that can be generated through the electricity generation from the wind turbine. Table 1 are the readings for power flow, voltage, and current that have been recorded from the project prototype.

Table 1: Data Reading Analysis Results.

REKOD BACAAN	KUASA (W)	VOLTAN (V)	ARUS (mA)	KELAJUAN TURBIN	CAHAYA	LED
OFF	0mW	0V	0mA	0RPM	Cerah	off
1	1622mW	7.53V	243mA	1680RPM	Gelap	on
2	1780mW	7.54V	237mA	1440RPM	Cerah	off
3	1828mW	7.53V	243mA	1560RPM	Gelap	on
4	1626mW	7.55V	216mA	1320RPM	Cerah	off
5	1826mW	7.52V	243mA	1380RPM	Gelap	on

From observation, the parameters produced by the wind turbine-powered streetlight model fully follow the principles of wind turbine power generation. In other words, as wind speed increases, the voltage generated by the model also increases proportionally. These results consistently reflect a positive relationship between wind flow and voltage in the context of wind turbine power, emphasizing the model's reliability in predicting and optimizing wind power performance based on changes in wind speed.

Table 2: IoT Application Usage Analysis

OPERASI BLYNK	SUIS	NILAI BACAAN PADA BLYNK DAN LCD
1	OFF	TIADA
2	ON	ADA

The Blynk operation with a switch functions to control the device's status. Referring Table 2, when the switch is OFF no readings or data are displayed on the Blynk app and LCD. Conversely, when the switch is ON, the Blynk app and LCD will display the relevant readings or status, such as "ACTIVE," indicating an active activity or connection.

CONCLUSION

The wind turbine-powered streetlight project successfully achieved its objectives by displaying values for voltage, current, power, and wind speed on both the LCD and Blynk. It is hoped that this project will spark interest among students in renewable energy. Additionally, the project enhances understanding of microcontrollers and IoT applications.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to Politeknik Tuanku Sultanah Bahiyah for the financial support provided.

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SMART SOLAR TRASHBOT

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Abstract **–** The SMART SOLAR TRASHBOT is an innovative robot designed for efficient waste management in smart cities. It automatically collects and sorts trash at home using ultrasonic, IR, soil moisture, and proximity sensors. The TrashBot identifies and separates different types of waste, such as paper, organic matter, and metals, and is operated via Wi-Fi on a mobile phone for easy access. Users receive notifications when bins are full, ensuring timely disposal. Powered by solar energy, this affordable and clean solution contributes to enhanced sustainability, reduces pollution, and lowers the costs of mitigating global warming.

Keywords –ultrasonic sensor, IR sensor, soil moisture sensor, proximity sensor, via Bluetooth

INTRODUCTION

The Smart Solar Trashbot is a new waste disposal system that helps automatically sort recyclable and non-recyclable materials, making recycling easier and better for the environment. It uses an ESP32 microcontroller with sensors to detect organic waste moisture, differentiate materials like plastic and paper, and detect and sort metal waste. The system opens the right compartments based on what it detects. By improving traditional waste management methods, the Trashbot reduces costs and environmental harm while increasing environmental awareness among the community. Overall, the Smart Solar Trashbot is an important step towards a cleaner, greener future.

METHODOLOGY

The SMART SOLAR TRASHBOT uses an ultrasonic sensor to detect objects and start a conveyor belt. It uses a metal sensor for metal, a moisture sensor for wet waste, and an infrared sensor for plastic to automatically sort waste into appropriate bins. This system improves recycling and helps keep the city clean.

RESULTS AND DISCUSSION

An expected result is that when the trash moves forward, the ultrasonic sensors will detect if it is within a range of 10cm. The trash will be sorted into organic waste, metal, paper, etc. On its motion path, the bin rotates based on the type of waste. A notification will be sent when the specified level of waste is reached, and the person concerned will be notified for waste removal. Figure 1 and Figure 2 show the result.

Table 1.1 Data Analysis

Sensor	Detect	Output	Range
Ultrasonic sensor conveyor	All waste	Move the conveyor	10 cm
Ultrasonic sensor monitors metal waste	Distance	Notification	10 cm
Ultrasonic sensor monitors wet waste	Distance	Notification	8 cm
Ultrasonic sensor monitors paper and other waste	Distance	Notification	10 cm
Infrared sensor	Paper and other waste	Bin turn to paper and other waste	10 cm
Proximity sensor	Metal waste	Bin turn into metal waste	8 mm
Soil moisture sensor	Wet waste	Bin turn to wet waste	10%

CONCLUSION

SMART SOLAR TRASHBOT automates dry waste sorting, improving efficiency and reducing labour. It aids recycling, protects wildlife, and supports eco-friendly practices by segregating waste at the source for better waste management.

ACKNOWLEDGEMENT

The author would like to thank lecturesrs in Tuanku Sultanah Bahiyah Polytechnic and Puan Zunainah binti Hamid for their support and encouragement.

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KINETIC POWER GENERATOR WITH BUCK BOOST

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Abstract – This project develops a kinetic power generation system using wheels to convert motion into electrical energy. It highlights the importance of renewable energy while addressing the challenge of efficiently converting kinetic energy into usable electricity. The system employs a boost converter to increase the generated voltage, making it suitable for applications such as device charging and energy storage.

Keywords – Kinetic power, renewable energy

INTRODUCTION

The use of alternative energy and green technology is increasingly important, driven by the demand for renewable sources like kinetic energy. This project developed a kinetic power generator with a boost converter to convert mechanical energy into electrical energy, suitable for charging mobile devices or supporting small power systems. The boost converter ensures a stable and usable voltage, aligning with the current emphasis on green technology and clean energy.

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METHODOLOGY

Methodology involves the use of specific research methods to collect and analyze data for a comprehensive study. It includes choosing the appropriate method to achieve the research objectives. In this project, steps such as component selection, circuit design, and system testing are followed, using a Direct Current motor as a generator, components to make a boost converter and other components. Everything is arranged and tested with practical and simulation.

RESULTS AND DISCUSSION

Analysis of the input and output data results of the boost converter is shown in Table 1.

Table 1: The data obtained

Voltan Input(V)	Voltan Output(V)	Arus Input(A)	Arus Output(A)	Kuasa(W) (V×I = W)
5 V	54.6 V	6.40 A	0.59 A	32.21 W
9 V	54.9 V	162 A	26.56 A	1458.12 W
12 V	57.7 V	311 A	64.68 A	3732.04 W

The table presents data on a system's performance, likely a boost converter, showing how it handles different input voltages and outputs. The input voltage varies between 5V, 9V, and 12V, while the output voltage remains relatively high and consistent at 54.6V, 54.9V, and 57.7V, respectively, indicating the system effectively boosts the voltage. The input current increases with the input voltage, which is typical for such systems, while the output current is lower, as expected due to the conservation of power. The power output, calculated as the product of voltage and current (P = V x I), shows a significant increase with higher input voltages, reflecting the system's ability to scale up energy production. This suggests that the system is designed to efficiently convert mechanical energy into electrical energy at varying input levels, providing stable power output for different applications.

CONCLUSION

In conclusion, a kinetic power generator with a boost converter is an innovative and efficient technology to convert mechanical energy into electrical energy. These systems harness kinetic energy, such as the movement of objects, to generate electricity that can be used for a variety of applications, including charging mobile devices and supporting small power systems.

The main advantage of this system is its ability to increase and stabilize the low voltage produced, making it suitable for practical applications in today's world, which is increasingly demanding green technology and renewable energy. In addition, the system reduces dependence on primary energy sources, promotes clean and sustainable energy generation, and supports the development of environmentally friendly alternative energy solutions. In the current context, where the need to reduce the carbon footprint and increase the use of clean energy becomes more urgent, this system makes a significant contribution towards more sustainable and efficient energy solutions.

ACKNOWLEDGEMENTS

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AUROOF RAIN

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Abstract – This project was created to design a device that is able to protect clothes from rain for public use. In addition, there are several research scopes that have been set in this project, namely, users will receive notifications through the Telegram application, and this project will also emit a sound to inform users that the roof is being activated. Next, the methodology of this project has three parts, namely, on the input side, there is a rain sensor and a light sensor, while on the process side, there is a microcontroller component, which is ESP32. In addition, on the output side, there are several electronic components such as a Buzzer, a DC motor, an LED, a Motor Driver (L298N), and a Telegram application.

Keywords – Rain Sensor, Ldr Sensor, ESP32, Protect clothes, Telegram

INTRODUCTION

The rainy season that often occurs in Malaysia and the places where clothes are hung are not able to protect clothes from rain. I have planned to design a roof that can open and close automatically using a rain sensor and a light sensor. I named this project “Auroof Rain”. With this Auroof Rain, users don't have to worry about their clothes hanging outside even if the weather conditions are unpredictable.

METHODOLOGY

In producing this project, several steps have been taken. The following description will explain the methodological steps. The microcontroller component used is an ESP32 that will be connected to the Telegram application. ESP32 is also connected and will control the DC motor, rain sensor, light sensor, LED, and buzzer. ESP32 will control hardware and software. Therefore, the ESP32 is a programmable microcontroller chip.

RESULTS AND DISCUSSION

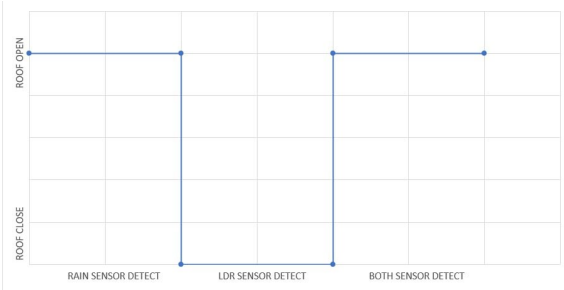

Figure 1: Rain Sensor data graph

The data presented in the table and graph demonstrates the behaviour of the rain sensor and roof in response to varying rain levels by the rain sensor and LDR sensor. If it rains, the rain sensor will move the DC motor clockwise to open the roof. If the rain sensor does not detect rain, the light sensor will detect light to drive the DC motor counterclockwise to close the roof

Table 1: Data analysis

Data of Rain sensor and Ldr sensor		
Roof	OPEN	CLOSE
Rain sensor	Detect Rain	
Ldr sensor		Detect Light

The rain sensor, which works to detect rain, will activate the DC motor to open the roof, whereas if the rain sensor does not detect rain, the light sensor will detect the light and will activate the DC motor to close the roof.

CONCLUSIONS

The analysis and results obtained provide a clear overview of this project. Although there are problems, they can be dealt with and overcome. This project meets the objectives set when the rain sensor and the light sensor can move the DC motor. Overall, this project has met the criteria and objectives of the project because it can make it easier for users.

ACKNOWLEDGEMENTS

The authors would like to thank USM and TNBR for the financial support.

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KEY MONITORING SYSTEM

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Abstract **–** The Key Monitoring System (KMS) provides a secure and efficient hardware-based solution for managing key access. The system utilizes an ESP32 microcontroller integrated with an AS608 fingerprint sensor, IR sensors, and a solenoid lock to ensure authorized access and key placement detection. Real-time notifications and data tracking are supported by software, but the core functionality lies in its robust hardware implementation. Powered by an AC adapter, the system operates continuously, ensuring reliable performance for secure environments.

Keywords –ESP32, Fingerprint Sensor, Solenoid Lock, IR Sensor, IoT

INTRODUCTION

The Key Monitoring System is primarily a hardware-driven project designed to replace traditional key management methods. By integrating fingerprint authentication and real-time monitoring, the system ensures secure access to keys stored in a solenoid-controlled locker. The project focuses on enhancing physical security and automating access, making it ideal for organizations requiring strict access control.

METHODOLOGY

The data logging process was executed with stable internet connectivity and reliable system performance, in line with the ESP32 microcontroller standards. Events of key removal and placement were recorded in real-time and automatically logged in Google Sheets to ensure precise tracking and monitoring of key usage.

RESULTS AND DISCUSSION

The data logging of key removal and placement events is shown in Figure 1.

2	16DTK22F1012	Lakshana	Key 1	Removed	11/6/2024 8:19:38
2	16DTK22F1012	Lakshana	Key 6	Removed	11/6/2024 8:19:35
2	16DTK22F1012	Lakshana	Key 3	Removed	11/6/2024 8:23:02
2	16DTK22F1012	Lakshana	Key 4	Removed	11/6/2024 8:23:07
2	16DTK22F1012	Lakshana	Key 1	Placed	11/6/2024 8:24:14
2	16DTK22F1012	Lakshana	Key 3	Placed	11/6/2024 8:24:19
2	16DTK22F1012	Lakshana	Key 2	Removed	11/6/2024 8:44:11
2	16DTK22F1012	Lakshana	Key 1	Removed	11/6/2024 8:45:06
2	16DTK22F1012	Lakshana	Key 5	Removed	11/6/2024 8:45:11
2	16DTK22F1012	Lakshana	Key 3	Removed	11/6/2024 8:46:23
2	16DTK22F1012	Lakshana	Key 1	Placed	11/6/2024 8:57:48
2	16DTK22F1012	Lakshana	Key 2	Placed	11/6/2024 8:57:53
2	16DTK22F1012	Lakshana	Key 3	Placed	11/6/2024 8:57:58
2	16DTK22F1012	Lakshana	Key 4	Placed	11/6/2024 8:58:02
2	16DTK22F1012	Lakshana	Key 5	Placed	11/6/2024 8:58:07
2	16DTK22F1012	Lakshana	Key 6	Placed	11/6/2024 8:58:12
2	16DTK22F1012	Lakshana	Key 5	Removed	11/6/2024 9:08:27
2	16DTK22F1012	Lakshana	Key 6	Removed	11/6/2024 9:08:32
2	16DTK22F1012	Lakshana	Key 5	Placed	11/6/2024 9:53:07
2	16DTK22F1012	Lakshana	Key 1	Removed	11/6/2024 9:53:52

Figure 1: Real-time logging of key usage events in Google Sheets.

By enabling real-time data logging through Google Sheets, the system tracks key removal and placement events directly. The logging process records each event with a timestamp and user details, ensuring accurate tracking of key usage as specified in the project's code (as shown in the figure above). This step demonstrates the system's ability to monitor and record key actions efficiently, providing reliable data for administrative oversight.

Table 1: The performance table

Performance	Measurement	Description
Detection Accuracy	95% Accuracy	Percentage of accurate key removal/placement events logged.
System Latency	2-5 Seconds	Time taken for key event detection and system response.
Internet Stability	99% Connection Rate	Reliability of the internet connection for data transmission.
Data Sync Rate	Real-time Sync	Speed of data transmission between the hardware components and the system.
Logging Accuracy	100% Success Rate	Percentage of successfully recorded key events.

The result shows that the Key Monitoring System performs efficiently in tracking key usage, with 95% detection accuracy and 100% success in logging key events. The 2-5 seconds latency and real-time data synchronization ensure timely system responses.
The high internet connection reliability demonstrates stable system performance, though further improvements in latency could optimize the system.

CONCLUSIONS

The Key Monitoring System project enhances key tracking and security by integrating an ESP32 microcontroller, IR sensors, a solenoid lock, and a fingerprint sensor. Focused on reliable hardware operation and real-time monitoring, the system tracks key usage and provides secure access control with automated data logging. While future improvements could enhance system latency and battery efficiency, the Key Monitoring System establishes a robust foundation for broader applications in asset management and security, offering a secure and efficient solution for monitoring and controlling key usage in various environments.

ACKNOWLEDGEMENTS

The authors would like to thank Politeknik Tuanku Sultanah Bahiyah and their parents for their support throughout this project.

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KEY MANAGEMENT SYSTEM

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Abstract **–** The Key Management System offers a secure and efficient IoT-based solution for managing key access within controlled environments. This system utilizes an ESP32 microcontroller integrated with a fingerprint scanner, IR sensors, and AppSheet software for user-friendly real-time tracking. Key access is authenticated through biometric scanning, with data automatically logged into Google Sheets. This streamlined hardware and software integration ensures accurate tracking, secure access, and enhanced administrative oversight, making the KMS an ideal solution for modern asset management.

Keywords – ESP32, Fingerprint Sensor, IR Sensor, IoT, AppSheet, Google Sheets, Telegram Bot

INTRODUCTION

The Key Management System replaces traditional methods with a secure, automated, and environmentally friendly solution. By incorporating biometric authentication and real-time monitoring, this system ensures that only authorized personnel can access keys. With its focus on security, efficiency, and sustainability, the system is particularly suited for institutions managing critical assets like laboratory or classroom keys.

METHODOLOGY

The data logging process used AppSheet Locker Studio with stable internet and ESP32 microcontroller reliability. Key removal and placement events were recorded in real-time and automatically logged in Google Sheets for accurate tracking. The dynamic dashboard enabled real-time data analysis, while a Telegram bot sent instant notifications for administrative oversight.

RESULTS AND DISCUSSION

The data logging of key removal and placement events is demonstrated in the AppSheet Locker Studio dashboard, as shown in Figure 1.

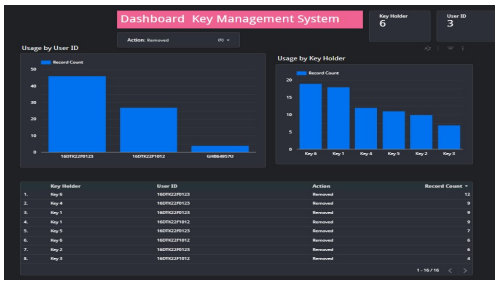

Figure 1: Dashboard displaying key usage events and real-time analytics.

The AppSheet Locker Studio dashboard (Figure 1) demonstrates real-time tracking of key removal and placement with timestamps and user details logged in Google Sheets. The dashboard offers clear visuals of key usage, ensuring accurate monitoring and efficient administrative oversight.

Table 1: The performance table

Performance	Measurement	Description
Authentication Accuracy	95% Accuracy	Percentage of accurate user verification events.
Response Time	2-5 Seconds	Time taken for system response to key actions.
System Reliability	99% Uptime	Stability of hardware and software integration.
Data Synchronization	Real-time Sync	Speed of data updates between the dashboard and Google Sheets.
Event Logging	100% Success Rate	Percentage of key activities successfully recorded.

The results indicate that the Key Management System performs reliably, with 95% authentication accuracy and 100% event logging success. The 2-5 seconds response time and real-time data sync ensure efficient key management, while the high system reliability supports uninterrupted performance. Further optimization of response time could enhance overall system efficiency.

CONCLUSIONS

The Key Management System improves key tracking and security by integrating AppSheet Locker Studio, Google Sheets, and automated event logging. With real-time data synchronization and efficient key usage monitoring, the system provides secure access control and streamlined asset management. Future enhancements in system latency and performance could further optimize its efficiency.

ACKNOWLEDGEMENTS

The authors would like to thank the lecturers at Politeknik Tuanku Sultanah Bahiyah for their continuous support throughout this project.

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ADVANCED OBSTACLE DETECTION AND WARNING SYSTEM IN HOME BY USING ESP32

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Abstract – This project aims to increase safety in residential areas by developing an advanced obstacle detection and warning system. The system's core is the ESP32 microcontroller, which integrates several sensors, such as an ultrasonic sensor for obstacle detection and a KY-038 sound sensor for ambient noise monitoring. It is observed that these sensors can identify any threats and send out instant alerts. Both visible and auditory alerts are provided via an LED display and a buzzer, guaranteeing timely awareness of any threats.

Keywords – Obstacle detection, ESP32, IoT, safety, Home device, Blynk

INTRODUCTION

A state-of-the-art project called Obstacle Detection and Warning aims to improve safety and navigation, especially for those who are visually impaired or deaf. The initiative makes use of a number of technologies, such as sound and ultrasonic sensors, to identify obstructions and issue alerts in a home. This system is crucial in providing the user with enough time to know about their safety.

METHODOLOGY

The components utilized for each form of validation and work activities, as well as the methodologies used to construct this project, will be detailed in this section. The techniques or processes utilized to carry out the project in detail are referred to as methodology. These actions are crucial to the project's implementation to guarantee its timely and effective completion. Furthermore, there are methods for testing circuits that have already been constructed.

RESULTS AND DISCUSSION

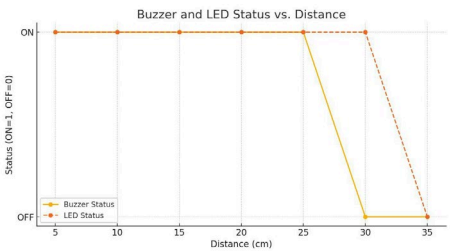

Figure 1: Ultrasonic data graph

The data presented in the table and graph demonstrate the behaviour of the buzzer and LED in response to varying distances measured by an ultrasonic sensor. Warnings are triggered when objects are within a 25 cm range or closer, enhancing safety by providing immediate alerts for nearby obstacles.

Table 1: Data analysis

Data of Ultrasonic sensor							
Distance (cm)	5	10	15	20	25	30	35
Buzzer	ON	ON	ON	ON	ON	ON	OFF
LED	ON	ON	ON	ON	ON	ON	OFF

The environmental distance and sound analysis for the obstacle detection system involves monitoring the proximity of obstacles and the sounds. By setting a specific threshold, we can track how often obstacles or loud noises are detected within these limits.

CONCLUSIONS

The analysis and results provide a clear overview of this project, which has been tested in various ways. Firstly, testing the obstacle detection and warning system using the ESP32 demonstrated effective detection and response capabilities. When the ESP32 is connected to the power supply, it activates the sensors, enabling them to monitor environmental distance and sound levels.

ACKNOWLEDGEMENTS

The authors would like to thank the supervisor and lecturers for the support.

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FIRE SYSTEM ALARM USING IOT

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Abstract **–** This study aims to build an IoT-based, portable, reliable fire alarm system that can give users early warnings, emergency guidance, and fire notification. An MQ2 sensor detects smoke and a fire sensor detects fire in the system. When there is no fire, the 12x2 LCD display shows the emergency route. When a fire is detected, it changes to the command "Please use this route." A buzzer serves as a signal, and a battery serves as a backup for the system in the event of power outages. To display smoke level in percentages, the system is linked to the Blynk application. The percentages are then sent to the user as an emergency notification. Remote monitoring and notification features enable this project to improve building security and enable immediate response in emergency situations.

Keywords – IoT-based, MQ2 sensor, BLYNK

INTRODUCTION

Fire is one of the most common disasters that cause death and property damage. To facilitate prompt response, both the owner of the scene and the fire department must be immediately notified of the fire. Advanced technology can't avoid the situation, but it can reduce its effect. Every second can save many lives in such situations. The goal of this project is to decrease the number of deaths and make it easier for firefighters to quickly locate a fire outbreak.

METHODOLOGY

Generally, these projects involve using sensors, such as smoke sensors or temperature sensors, to detect the occurrence of a fire and then using an Arduino to start a system that alerts people with buzzers and SMS messages. Additionally, studies have built fire alarm systems using Arduino boards. The Arduino-based device used in this study records temperature readings and helps understand smoke and temperature values when a fire occurs. This data can be used to create more effective methods of finding smoke or fires and alerting people to them.

RESULTS AND DISCUSSION

IoT-enabled fire detection device that improves safety and monitoring capabilities. It shows how the system behaves both before and after a fire is detected. At first, there is no warning message displayed on the LCD, suggesting that there is no imminent threat. However, the LCD transforms to show a warning message when a fire is detected, telling people to evacuate using the emergency exit. In a similar situation, the buzzer doesn't ring when there isn't a fire or other threat, but it does so loudly when the system detects a fire, excessive heat, or gas concentrations above a safe level. The Blynk app, which tracks gas levels in real time, is also linked to the system. The software notifies a linked smartphone immediately if the gas levels rise above 80% or if the sensors pick up unusual heat or gas. Simultaneously, the LCD gives clear instructions for safety precautions and the buzzer sounds. A thorough and efficient approach to fire detection and safety management is ensured by this mix of real-time detection, visual alerts, aural warnings, and remote notifications.

CONCLUSIONS

Without depending on human supervision, this approach can cut down on the time and effort needed to locate and provide early warning of fires. Because it employs effective sensors for smaller-scale monitoring, it also conserves energy. The goal of this project is to automate the fire detection system, which will increase building occupant safety. This method optimizes energy utilization and makes sure that alarms and emergency notifications are only triggered when necessary by controlling operation modes using MQ2 smoke, fire, and ESP32 sensors. To sum up, this study demonstrates how mobile fire detection using IoT technology may significantly improve safety and energy efficiency in small buildings or enclosed places.

ACKNOWLEDGEMENTS

The authors would like to thank to supervisor and lecturers for their guidance and financial support.

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SMART PET HOUSE CONTROLLED BY ESP32 & SOLAR

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Abstract – The Smart Pet House controlled by ESP32 and solar is an innovation that aims to improve the well-being of pets in the home environment. The main objective of this project is to provide convenience to owners in taking care of their pets by using the latest technology. Among the features included in this Smart Pet House include a food supply system, a notification system for the arrival of pets in the house, as well as a light and fan control system. Owners can control all of this remotely through a mobile app, allowing them to pay better attention to their pets even when they are away from home. The effectiveness and reliability of this system will be compared with manual methods in solving problems such as providing enough food for pets and controlling lights and fans when the owner is not at home. It is hoped that the results of this study can provide a clearer view of the effectiveness of the use of technology in improving the well-being of pets.

Keywords – Solar, ESP32, LDR Sensor, PIR Sensor, IR sensor, Blynk

INTRODUCTION

In this era of advancing technology, not only do humans benefit from its progress, but pets as well. One of the latest innovations capturing attention is the smart pet house, a concept of a smart home designed specifically for the welfare and comfort of pets. The smart pet house combines sophisticated, innovative design with the latest technology, enabling pet owners to remotely monitor and control their pets' living environment.

The smart pet house is not only a practical solution for busy pet owners but also helps improve the quality of life for pets by providing a healthy, safe, and comfortable environment. With this technology, the bond between humans and their pets becomes closer and more harmonious.

METHODOLOGY

The methodology for studying a smart pet house utilizing IoT and ESP32 begins with gathering information about IoT technology and the features of the ESP32, as well as examining the needs and preferences of pet owners. The objective of the proposed system is to enhance pet management by providing three main functions.

First, a notification system that automatically sends a message to the owner when the pet is near the PIR sensor. Second, a control system that allows the owner to remotely operate functions such as the fan and food supply via a smartphone application. Third, the use of an LDR sensor to detect lighting levels within the pet house area, where the light will automatically turn on if the illumination falls below the predetermined threshold. In this way, the system aims to provide comfort to the owner and streamline pet management more efficiently.

RESULTS AND DISCUSSION

The Smart Pet House uses notifications to inform about the food status and the presence of the pet, as well as a switch in the Blynk application to manually control the fan.

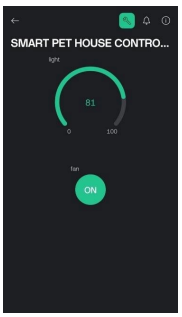

Figure 1: Blynk app notification on smartphone

The solar panel converts sunlight to electricity, the battery stores it, and the charge controller manages charging and prevents overcharging.

Figure 2: Solar, Battery, Solar Charge Controller

CONCLUSIONS

In conclusion, this smart pet house project provides an innovative and eco-friendly solution for pet care. Using ESP32, solar power, and smart sensors, it can monitor pet movement, lighting, and food status automatically while reducing electricity use. The Blynk app allows remote control, making it convenient for busy owners. With affordable components, this system is practical, efficient, and sustainable.

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PORTABLE INSTANT DRINK COOLER

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Abstract – This instant portable drink cooler was created because all other products on the market were heavy, expensive and all use electricity from a wall plug. Likewise, refrigerators usually take a long time to cool drinks properly. Therefore, it was decided to make a cooler portable drink cooler that can keep drinks cool during outdoor activities such as picnics, hiking, jogging and other outdoor activities. Moreover, because it is portable, it will be minimalist and affordable. The main target group for this product is people who are interested in outdoor activities, such as picnics, camping, festivals, cyclists and others. This product can also be used by people who work in offices or places without refrigerators such as warehouse jobs. Since a regular refrigerator takes more than half an hour to cool drinks from room temperature, this product should be able to cool cans in less than 5-10 minutes. The net weight ofthis product without the drink container should weight less than 5kg and still be able to. The purpose of this project is to make a product that can help people in their daily lives by cooling drinks quickly and instantly.

INTRODUCTION

The "Portable Instant Drink Cooler" is a compact device designed to quickly cool beverages without the need for a refrigerator. Using a Peltier module controlled by an ESP32, the system is portable, efficient, and easy to use. It features a 3-way rocker switch with three modes: a 5-minute cooling session, continuous cooling, and an off mode. Additional features include an ultrasonic sensor for proximity detection and a buzzer for notifications.

METHODOLOGY

The system uses a Peltier module (TEC1-12706) powered by a 12V USB Type-C input. An ESP32 microcontroller manages the cooling, fan, and buzzer. The 3-way rocker switch allows users to select their preferred mode, and the ultrasonic sensor ensures precise operation. Tests were conducted to evaluate performance and reliability.

RESULTS AND DISCUSSION

The cooler efficiently reduced beverage temperature in a short time. The ultrasonic sensor worked effectively for activation, and the buzzer provided clear user notifications. The device consumed minimal power and could be integrated with renewable energy sources. Future improvements could include better insulation and battery-powered operation.

Table 1.1: Temperature data reading of glass type beverage containers

DATE / TIME	VALUE
2024-10-29 05:43:55	28.3 C
2024-10-29 05:48:58	26.6 C
2024-10-29 06:03:10	22.9 C

Table 1.2: Temperature data reading of aluminum beverage containers

DATE / TIME	VALUE
2024-10-29 06:17:05	22.1 C
2024-10-29 06:22:12	19.6 C
2024-10-29 06:27:36	10.2 C

Table 1.3: Temperature data reading of plastic beverage containers

DATE / TIME	VALUE
2024-10-29 06:41:25	30.2 C
2024-10-29 06:46:36	28.7 C
2024-10-29 06:51:55	25.9 C

CONCLUSIONS

The "Portable Instant Drink Cooler" offers a practical, energy-efficient solution for quick beverage cooling. With further refinements, it has potential for wider use, emphasizing convenience and sustainability.

ACKNOWLEDGEMENTS

The team expresses sincere gratitude to our project advisor, lecturers, and peers at Politeknik Tuanku Sultanah Bahiyah for their guidance and support throughout the development of this project. Special thanks also go to our families and friends for their encouragement, and to everyone who contributed feedback and ideas, which greatly improved the project.

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IOT-BASED PLANT IRRIGATION SYSTEM USING ESP32

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Abstract **–** This project developed an IoT-based automatic irrigation system for plants using the ESP32. The system aims to optimize water usage while ensuring adequate hydration for plants. By integrating various sensors, including soil moisture, temperature, and water level sensors, data is processed via the Node-RED platform for remote control and automation. The system is designed to address issues such as forgetting to water plants and water wastage. Users can operate it automatically or manually through a mobile application. Results demonstrate accurate sensing, stable Wi-Fi connectivity, and effective automated irrigation. This system holds significant potential for water conservation and sustainable agriculture.

Keywords: smart irrigation, Internet of Things (IoT), ESP32

INTRODUCTION

Efficient irrigation is critical in agriculture, particularly for maintaining optimal soil moisture to support plant growth. Traditional methods often result in water and energy wastage. This smart irrigation system leverages ESP32 and multiple sensors to overcome these challenges. It is designed to monitor soil moisture, temperature, humidity, and water levels automatically, minimizing human intervention. The primary objective is to develop an efficient IoT-based automatic irrigation system that can be remotely controlled and monitored, providing convenience and sustainability.

METHODOLOGY

This system uses an ESP32 microcontroller to manage soil moisture, temperature, humidity, and water level sensors. Data is transmitted to the Node-RED platform for real-time monitoring and control. A 12V DC water pump, activated by a relay, irrigates plants when soil moisture drops below a threshold. The system is housed in a PVC enclosure for durability and tested under various conditions to ensure reliability.

RESULTS AND DISCUSSION

The system effectively automates irrigation, with sensors accurately detecting environmental conditions. Wi-Fi connectivity remained stable. and the mobile app enabled flexible manual control as in Figure 1.

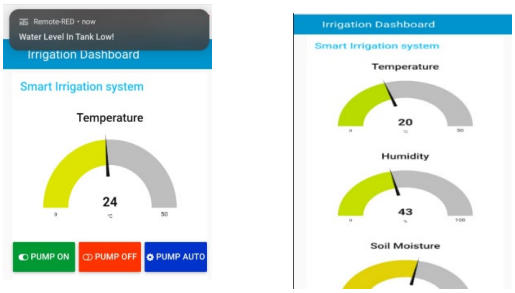

Figure 1: Blynk Application

Automated irrigation activated promptly when needed and stopped once optimal moisture levels were reached. The result summarized as in Table 1.1.

Table 1.1 Data Analysis

SENSOR	OBSERVED VALUE CHANGE	CONDITION TRIGGER	SYSTEM RESPONSE	OBSERVATION
TEMPERATURE SENSOR	20°C - 40°C	-	Displayed on LCD & published to MQTT	High accuracy within indoor/outdoor ranges
HUMIDITY SENSOR	30%-80%	-	Displayed on LCD & published to MQTT	Responsive to environmental humidity changes
SOIL MOISTURE SENSOR	0% - 100%	Below 30%	Turns on water pump	Effective auto-watering for dry soil
WATER LEVEL SENSOR	0% - 100%	0%	Sends low water notification via MQTT	Notification received promptly on 0%

CONCLUSIONS

This system demonstrates the potential of IoT for sustainable irrigation, offering water savings, remote monitoring, and reduced manual effort. Future improvements could include solar power integration and additional sensors for enhanced functionality.

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NOTES

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