# Smart Pedestrian Light Monitoring System

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**Abstract:** The Smart Pedestrian Light Monitoring System aims to enhance pedestrian safety at night by implementing an intelligent lighting system based on Internet of Things (IoT) technology. The system integrates an LDR sensor to measure ambient light levels, an IR sensor to detect pedestrian presence, and a current sensor to monitor lamp status. Additionally, an RFID-based access control mechanism is implemented to restrict maintenance box access to authorized personnel. This purpose is for the safety aspect of the maintenance box for restricted maintenance personnel only. The ESP32 microcontroller serves as the central processing unit, transmitting real-time notifications via the Telegram application to registered users for remote monitoring and control. The implementation of this smart lighting system reduces unnecessary energy consumption by ensuring that lights are only activated when needed. Testing and evaluation of the system demonstrate its ability to accurately adjust street lighting based on environmental conditions and pedestrian activity. Furthermore, the system successfully delivers instant notifications regarding lamp status, pedestrian detection, and maintenance alerts. This solution is expected to significantly reduce accident risks, enhance energy efficiency, and contribute to a safer pedestrian environment, particularly in poorly lit urban and suburban areas. Future enhancements may include the integration of additional sensors and AI-based analytics to further optimize system performance and predictive maintenance.

***Keywords:*** *Monitoring, Pedestrian light, IoT*

## 1.0 INTRODUCTION

Pedestrian safety is a growing concern in Malaysia, particularly in urban areas where heavy traffic and poor street lighting contribute to accidents and security risks. According to the Royal Malaysia Police (PDRM) and the Malaysian Institute of Road Safety Research (MIROS), pedestrian-related accidents remain a significant issue, especially during night-time due to inadequate illumination in certain areas (MIROS, 2022). Many existing street lighting systems operate on fixed schedules, leading to inefficiencies such as unnecessary energy consumption or insufficient lighting when needed. This highlights the necessity of intelligent lighting solutions that can dynamically adjust based on real-time pedestrian activity and environmental conditions.

With the rapid adoption of Internet of Things (IoT) technology, Malaysian cities are increasingly embracing smart city initiatives to enhance public safety and energy efficiency. The Smart Pedestrian Light Monitoring System is designed to address these challenges by integrating various sensors and automation technologies to improve pedestrian safety and optimize power consumption. Similar smart initiatives have been implemented in cities like Putrajaya and Kuala Lumpur, where adaptive lighting and smart traffic systems have been deployed to enhance road user safety (Suruhanjaya Tenaga, 2023).

This system incorporates a Light Dependent Resistor (LDR) sensor to detect ambient light levels, an Infrared (IR) sensor to monitor pedestrian presence, and a current sensor to track streetlamp status. Additionally, an RFID-based access control mechanism is integrated to ensure that only authorized personnel can perform maintenance. The system's core controller, the ESP32 microcontroller, processes sensor data and adjusts lighting accordingly, while a real-time notification feature via Telegram enables remote monitoring and control.

By implementing this IoT-based adaptive lighting system, the project aims to enhance pedestrian safety, reduce energy wastage, and support Malaysia's commitment to sustainable urban development. As the country moves towards achieving its Smart City Blueprint 2030, innovative solutions like this are crucial in transforming public infrastructure into safer, more efficient, and environmentally friendly systems (Malaysia Smart City Framework, 2024).

In Malaysia, inadequate street lighting has become an increasingly critical issue, particularly in pedestrian areas that remain dark at night. A report by Aida Aziz (2024) from Astro Awani highlights that the lack of sufficient lighting in areas such as the Kamunting walkway has increased the risk of pedestrian-related accidents. This study emphasizes the importance of proper lighting in preventing accidents and enhancing safety in these areas. The loss of lives and injuries resulting from accidents in poorly lit areas indicates that additional measures must be taken to address this issue.

Furthermore, a report by Faliq Lajim (2019) from Harian Metro states that pedestrian safety concerns are often caused by damage or theft of streetlight components. Such theft not only leads to non-functional lighting but also increases the risk of road accidents and criminal activities in dark areas. The lack of proper lighting contributes to a higher likelihood of accidents and illegal activities. Therefore, it is crucial to enhance the security of streetlight maintenance boxes to protect essential components from theft and vandalism.

This project aims to tackle these issues by developing a smart streetlight system utilizing IoT technology. The system will integrate a Light Dependent Resistor (LDR) sensor, which functions to detect sunlight levels and automatically control streetlight operation. The microcontroller will store data on the lamp's status and send notifications in case of any malfunction.

A study by Ramachandran et al. (2022) suggests that IoT-based lighting management systems can improve pedestrian safety by allowing better monitoring and maintenance. Additionally, security measures, as outlined in the study by Lee et al. (2021), are also essential to protect streetlight components from theft threats. By implementing this system, it is expected that night-time pedestrian safety will be enhanced, and accident risks will be reduced.

This project not only aims to improve lighting in pedestrian areas but also serves as a pedestrian light monitoring initiative that can be expanded to other areas in Malaysia. This will contribute positively to public safety and enhance the quality of life in areas that require special attention in lighting management. It's also to ensure the safety of road users and pedestrians, especially at night, through a pedestrian light monitoring system. With this system in place, authorities can identify malfunctioning streetlights and carry out repair actions promptly. This will enhance pedestrian safety along the pathway, making them feel safer due to adequate lighting. Good lighting is also important for road users, particularly when passing through dark areas or at night. The "Pedestrian Light Monitoring System" introduced in this project will help reduce the risk of accidents by ensuring sufficient and well-functioning lighting levels.

In addition, the project also considers the safety aspects of the streetlight maintenance box, which is often targeted for theft and vandalism. Maintenance boxes equipped with enhanced security systems can reduce the risk of losing critical components and ensure the lighting system operates smoothly. Overall, this project not only improves the safety level of road users and pedestrians but also ensures the continuous operation of the street lighting system.

### 1.1 Problem Statement

The management and maintenance of pedestrian lights in Malaysia face significant challenges, including delayed repairs, labour shortages, and security risks. A major issue is the slow notification process when streetlights malfunction, leaving areas in darkness for extended periods, increasing the risk of accidents and criminal activities (Malaysia Gazette, 2023). The shortage of skilled maintenance workers further delays inspections and repairs, while hazardous working conditions have led to fatal incidents among maintenance staff (Bernama, 2022). Additionally, poor security of maintenance boxes makes them vulnerable to theft and vandalism, leading to damaged or non-functional streetlights and high repair costs (Faliq Lajim, 2019). To address these issues, this research proposes a Smart Pedestrian Light Monitoring System using IoT technology to enable automated monitoring, real-time notifications, and enhanced security measures, ensuring faster maintenance response, improved pedestrian safety, and reduced operational costs.

### 1.2 Objectives

The objectives of this project are:

i. To develop an automated pedestrian light system.
ii. To develop a remote monitoring system for pedestrian light conditions.
iii. To develop a security system for streetlight maintenance boxes to reduce the risk of theft.

### 1.3 Scopes

The scope of this project includes:

i. This project is suitable for use in parks, pedestrian walkways, and footbridges.
ii. The lighting system can be controlled and monitored via a mobile phone.
iii. This project is intended to benefit pedestrians at night, especially in footbridges, parks, and pedestrian walkways.

## 2.0 LITERATURE REVIEWS

Literature review is used to provide the context of the study by examining research that has been conducted in the field, and not merely summarizing the work of other researchers (Kumar, et al., 2013). The references used must be relevant to the focus of the study. The content of this chapter may include a brief introduction to the research subject, concepts or theories, past studies related to the field of research, and a summary of the chapter.

### 2.1 Previous Research

#### 2.1.1 Automatic Light That Detecting on Night and Object

One of the earliest innovations in smart public lighting is the development of automatic street lighting systems, designed to improve energy efficiency and reduce human intervention in lamp operation. A study by Saleem Ullah and Ilyas (2021) introduced a system titled "Automatic Light That Detecting on Night and Object", which utilizes infrared (IR) sensors to detect the presence of objects such as pedestrians or vehicles during night-time hours. Once an object is detected, a signal is transmitted to an Arduino Uno microcontroller, which activates the streetlight based on the input received from the sensors.

While the system successfully eliminates the need for manual activation and offers a foundational approach to automation, it exhibits significant limitations. One key shortcoming is the absence of adaptive brightness control. Each time an object is detected, the light intensity is increased without evaluating the actual lighting needs based on environmental brightness or pedestrian volume. This approach leads to unnecessary energy consumption, particularly in low-traffic scenarios where full brightness may not be essential. Moreover, the system does not consider other variables such as ambient light conditions, object dwell time, or pedestrian behaviour, which are crucial for optimizing real-time lighting efficiency.

These limitations highlight a gap in existing smart lighting solutions namely, the lack of context awareness and real-time adaptability. The proposed Smart Pedestrian Light Monitoring System aims to address these issues by incorporating not only motion detection but also dynamic lighting control, IoT-based data monitoring, and energy-efficient operation. Unlike the system by Saleem Ullah and Ilyas, the proposed design will consider multiple contextual inputs such as time of day, pedestrian frequency, and ambient light levels, thereby reducing power wastage while improving pedestrian safety.

### 2.1.2 Intelligent Streetlighting System for Smart City

The development of smart street lighting systems has emerged as a critical component in the evolution of smart cities, aiming to enhance energy efficiency and provide intelligent infrastructure management. A notable project by Parkash Tambare (2019), titled "Intelligent Streetlighting System for Smart City", introduced the innovative use of piezoelectric sensors as motion detection tools in street lighting systems. Unlike traditional infrared (IR) sensors, which detect the presence of objects based on heat signatures, piezoelectric sensors are particularly sensitive to pressure changes. This makes them highly effective in detecting movement, particularly the motion of vehicles and pedestrians on the road, by responding to the physical pressure exerted by moving objects.

The system is managed by the MSP430 microcontroller, which processes the data received from the sensors and efficiently controls the activation and deactivation of streetlights. The integration of these sensors and microcontrollers eliminates the need for manual intervention, enabling remote control of the streetlights via an internet connection. This remote accessibility provides urban planners with the ability to monitor and manage street lighting in real-time, improving the flexibility and operational efficiency of the city's lighting infrastructure.

A significant advantage of this system lies in its automation capabilities, which help reduce the operational burden and enhance energy savings by ensuring that lights are only active when needed. However, the main drawback is the high initial setup costs and ongoing maintenance expenses associated with installing and maintaining piezoelectric sensors and advanced microcontroller systems. The cost implications may limit the widespread adoption of this technology, particularly in cities with budget constraints. While this system offers a promising approach for modernizing street lighting, its scalability in terms of affordability remains a challenge for broader implementation in smart cities.

### 2.1.3 Smart Streetlighting System

The advent of LED technology has revolutionized the design and efficiency of street lighting systems. A significant contribution to this innovation is the project by Nithya Shree C. M. (2020), titled "Smart Streetlighting System", which utilizes the capabilities of dimmable LED lights. Unlike conventional street lighting, the system optimizes the brightness of streetlights based on the real-time detection of movement in the vicinity. When movement is detected, the lights automatically illuminate at full brightness, ensuring optimal visibility. In contrast, if no movement is detected for a certain period, the lights are dimmed to a minimal brightness level, thus conserving energy.

The system is further enhanced by the integration of wireless technology, allowing for automatic control of the streetlights. This wireless connectivity enables the system to operate efficiently and automatically adjust lighting conditions in real-time, without the need for manual intervention. Such automation not only reduces the energy consumption associated with street lighting but also significantly lowers operational costs, as the system eliminates the need for constant monitoring and manual adjustments.

Moreover, the flexibility and sustainability of the system are notable. By adjusting lighting based on actual usage and movement, it ensures that energy is only used when necessary, contributing to a more eco-friendly and cost-effective solution for urban lighting management. This innovation aligns with the growing focus on smart cities, where technologies like dimmable lighting and wireless control are increasingly being adopted to create more sustainable, responsive, and energy-efficient urban environments.

### 2.2 Summary

In summary, while each system has its merits, the Smart Pedestrian Light Monitoring System proposed in the research aims to integrate the most effective elements from these projects dynamic lighting control, real-time adaptability, and energy-efficient operations. It will consider additional contextual factors like ambient light levels, pedestrian frequency, and time of day to minimize energy waste, enhance pedestrian safety, and contribute to the development of more sustainable and intelligent urban infrastructure.

## 3.0 METHODOLOGY

### 3.1 Block Diagram

Figure 1 shows the Block Diagram of a Smart Pedestrian Light Monitoring System. It is divided into three main sections that is the input section, the processing section, and the output section.

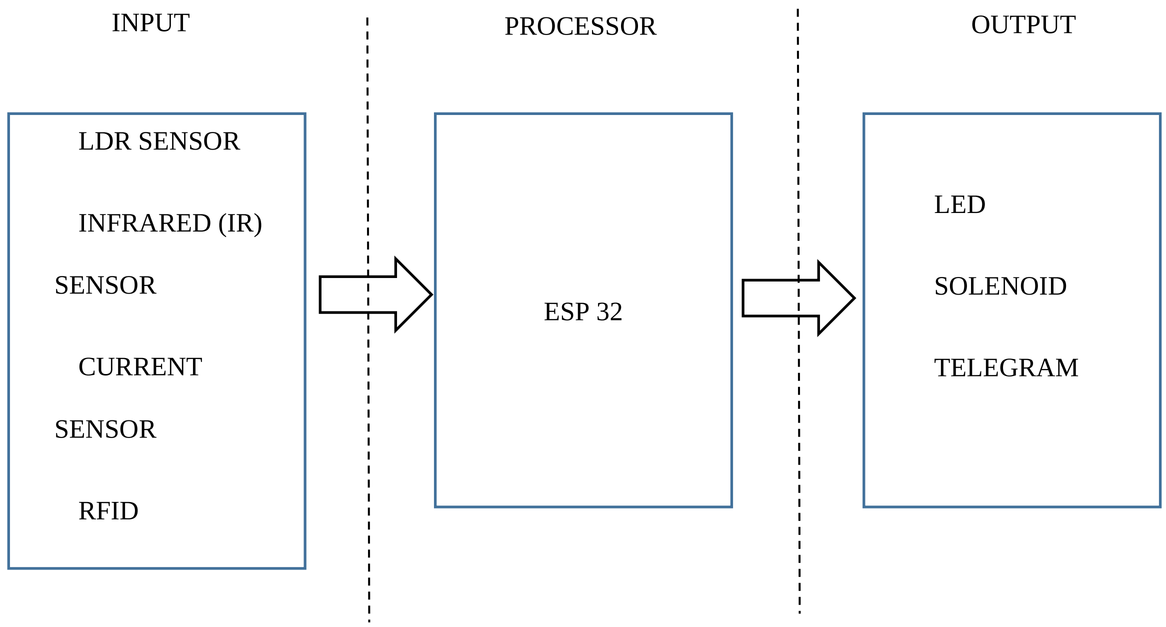


Figure 1: Block Diagram

The input section comprises several essential sensors that is a Light Dependent Resistor (LDR) sensor, an infrared (IR) sensor, a current sensor, and a Radio Frequency Identification (RFID) module. The LDR sensor is responsible for detecting the surrounding light intensity, enabling the system to determine whether it is day or night, which influences the activation of the pedestrian lights. The IR sensor is used to detect the presence or movement of pedestrians in the vicinity of the walk area, allowing the system to respond dynamically based on real-time human presence. The current sensor plays a vital role in monitoring the flow of electrical current through the system, helping to detect abnormalities or faults in the power supply. Meanwhile, the RFID module is integrated as a security feature, allowing only authorized personnel to access the internal components of the street light maintenance box. This enhances system integrity and reduces the risk of tampering.

All input data collected from these sensors is transmitted to the processor section, which is powered by an ESP32 microcontroller. The ESP32 serves as the brain of the system, interpreting sensor data and making real-time decisions based on predefined logic and conditions. This microcontroller analyses input data such as ambient light levels, pedestrian presence, and current flow status, and triggers the appropriate outputs accordingly. It also manages system timing, communication, and coordination between components.

The output section consists of three key elements that is an LED light, a solenoid lock, and a Telegram-based notification system. The LED functions as the actual pedestrian light, turning on or off based on data from the input sensors and the ESP32's logic. The solenoid serves as a locking mechanism for the maintenance box, which is controlled electronically and can only be accessed with verified RFID input, ensuring secure maintenance access. Lastly, the Telegram system is used to send automatic updates and alerts to the designated maintenance officer or system administrator. This ensures that any change in the system's status, such as a malfunction or a triggered event, is communicated promptly and remotely.

The Smart Pedestrian Light Monitoring System integrates various sensors, a microcontroller, and output devices to create a responsive, secure, and efficient solution for managing pedestrian lighting and ensuring system maintenance. It not only enhances pedestrian safety but also streamlines maintenance through smart automation and real-time notifications.

### 3.2 Flowchart of Lighting Detection

Figure 2 describes the operation of an automated lighting system using an LDR (Light Dependent Resistor) and an ESP32 microcontroller.

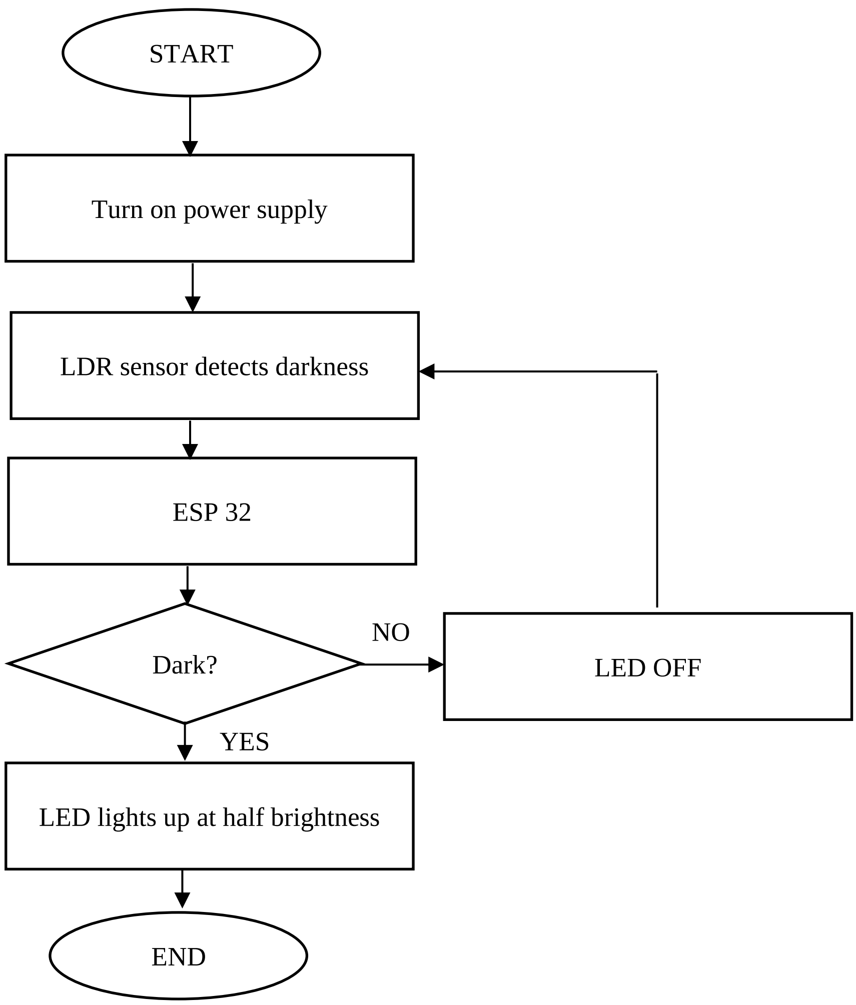


Figure 2: Flowchart of Lighting Detection

The process begins when the power supply is turned on. Once powered, the LDR sensor continuously monitors the surrounding light levels to detect the presence of darkness. The data collected by the LDR is then sent to the ESP32, which processes the information to determine whether the environment is dark.

If the ESP32 determines that it is not dark, the LED will remain off, and the system will continue monitoring the light conditions. However, if the ESP32 detects that the environment is dark, it will trigger the LED to turn on at half brightness. This allows for energy-efficient lighting, providing just enough illumination in low-light conditions without consuming full power. The flowchart concludes at this stage, although in a real-world application, the system would typically continue running in a loop to monitor changes in light levels.

### 3.3 Flowchart of Motion Detection

Figure 3 represents a flowchart of motion detection process. It begins with the initialization of the system, where the sensor is set up and prepared to operate. Once the sensor is initialized, the system continuously reads data from it. After each reading, the system checks whether motion is detected. If motion is detected, the system responds by turning on an LED as an indicator and then introduces a short delay. After the delay, the system goes back to reading the sensor data. If no motion is detected, the system simply skips the LED activation and delay and immediately returns to reading the sensor again. This loop continues indefinitely, ensuring that the system constantly monitors for any motion and reacts accordingly.

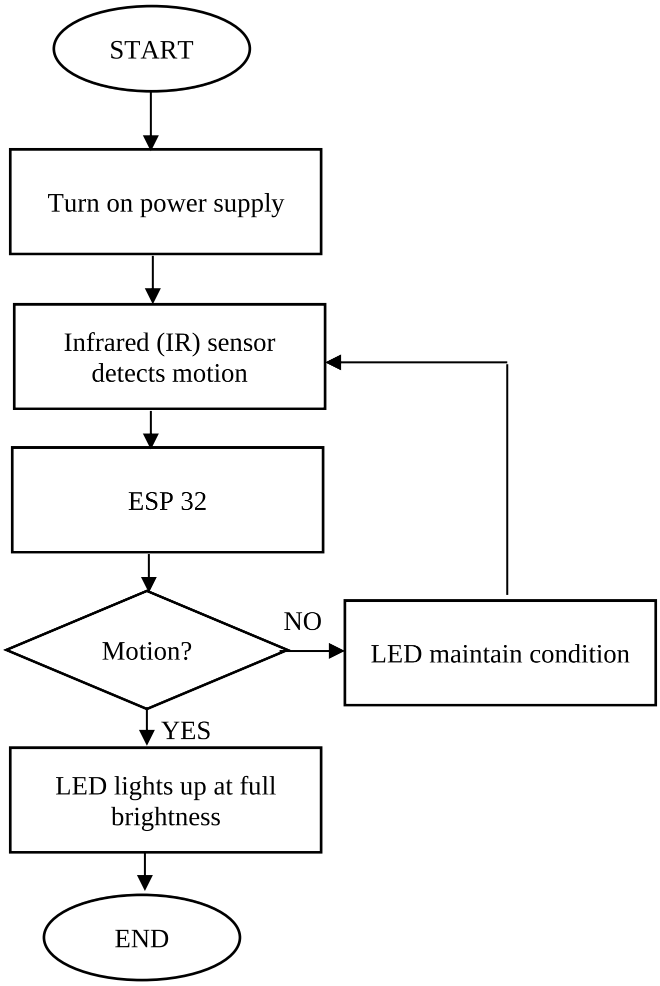


Figure 3: Flowchart of Motion Detection

### 3.4 Flowchart of Maintenance Box Lock System

Figure 4 describes the operation of an RFID-based access control system. The process begins when the system is powered on. Upon start-up, the RFID reader is initialized to begin detecting any RFID tags presented to it. Once a tag is scanned, the system reads the data stored on the tag and proceeds to compare it with a set of stored data containing authorized tag IDs.

The system then evaluates whether there is a match between the scanned tag and the authorized data. If a match is found, access is granted to the user, which may involve unlocking a door or displaying a success message. If there is no match, access is denied, and the system may alert the user or simply remain locked.

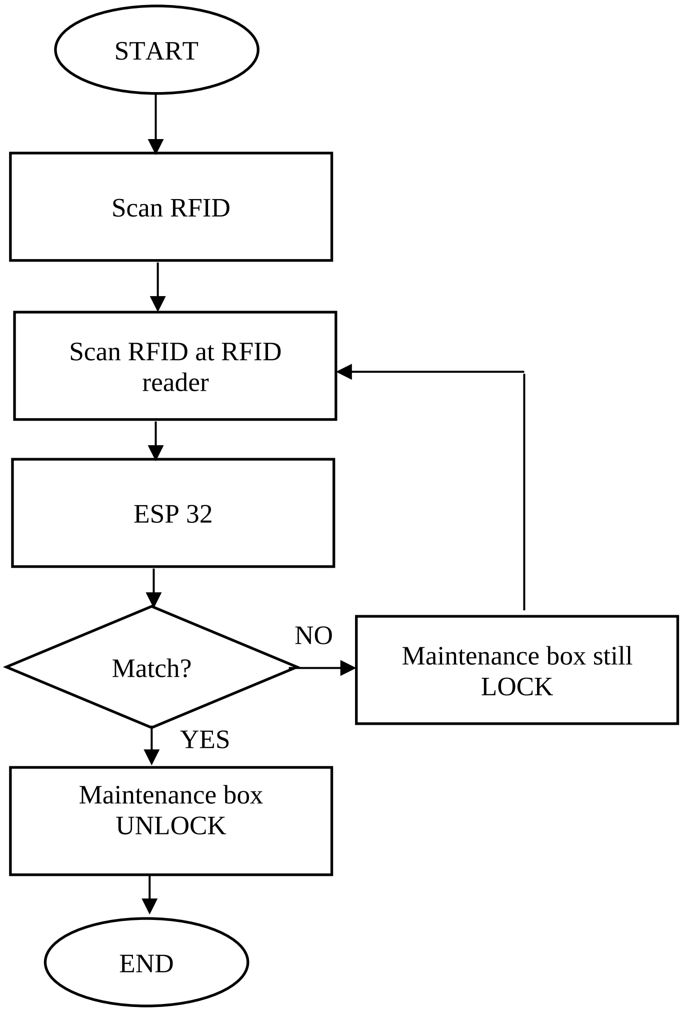


Figure 4: Flowchart of Maintenance Box Lock System

## 4.0 RESULT AND ANALYSIS

The results obtained from the implementation of the project, providing a comprehensive overview of the outcomes achieved. It shows the culmination of the project's efforts, highlighting the key findings, the final product, and the corresponding outputs.

### 4.1 Schematic Diagram for Lighting and Motion Detection

Figure 5 shows the schematic diagram that interfacing multiple IR sensors, LDR sensors, and LEDs with an ESP32 microcontroller, which forms part of a Smart Pedestrian Light Monitoring System. The system is designed to control pedestrian lights based on environmental light levels and the presence of people. It consists of three sets of IR sensors, LDR sensors, and LEDs, all managed by the ESP32 microcontroller.

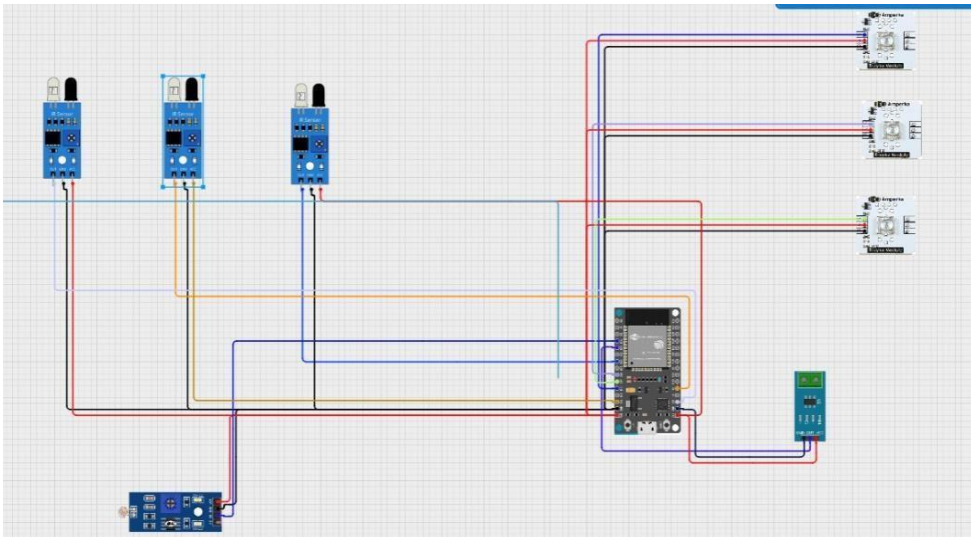

Figure 5: Schematic Diagram for Lighting and Motion Detection Schematic Diagram

These IR sensors detect the presence or movement of pedestrians in specific areas. When a person walks in front of the sensor, it sends a HIGH/LOW signal by depending on logic to the ESP32, indicating motion or presence. LDRs detect the ambient light level in their respective zones. This data is used to determine whether it is day or night, influencing whether the pedestrian LED light needs to be turned on. The LDR continuously monitors the surrounding light intensity, enabling the ESP32 to assess whether it is daytime or nighttime. This allows the system to optimize energy usage by only activating pedestrian lights when visibility is low.

The ESP32 is the core of the system, which processes input from both IR and LDR sensors. Based on the logic coded into it, the ESP32 determines when to activate or deactivate the corresponding pedestrian lights. If the IR sensor detects pedestrian presence and the LDR senses low ambient light indicating daytime or nighttime, the ESP32 sends a HIGH signal to the output pin, turning on the LED light in that zone.

Overall, the system offers a smart and energy-efficient solution for managing pedestrian lighting. It automatically adjusts based on pedestrian movement and lighting conditions, reducing unnecessary power consumption and improving public safety. The modularity of the design also allows for easy scalability to more zones if required, simply by adding more sensors and outputs configured similarly.

Table 1: Control Logic for Smart Pedestrian Lighting System

| IR Sensor (Pedestrian Presence) | LDR Sensor (Ambient Light) | Condition Description | ESP32 Output | LED Status |
|---|---|---|---|---|
| Detected (HIGH) | Low Light (Night) | Pedestrian present & low visibility | HIGH | ON |
| Detected (HIGH) | Bright Light (Day) | Pedestrian present but good visibility | LOW | OFF |
| Not Detected (LOW) | Low Light (Night) | No pedestrian, but low visibility | LOW | DIMMER |
| Not Detected (LOW) | Bright Light (Day) | No pedestrian, and good visibility | LOW | OFF |

### 4.2 Schematic Diagram for Maintenance Box Lock System

Schematic diagram in Figure 6 represents an RFID-based door lock system using an ESP32 microcontroller.

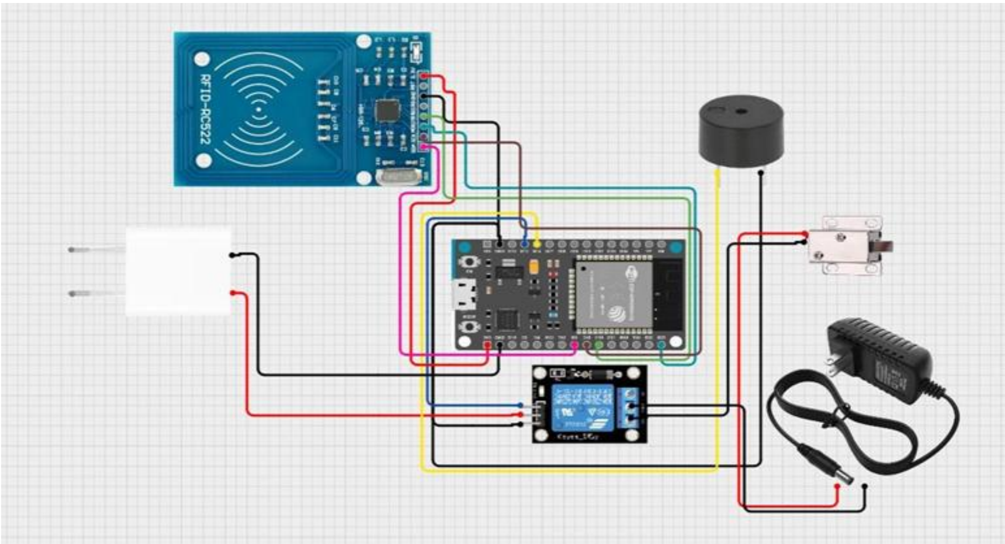


Figure 6: Schematic Diagram for Maintenance Box Lock System

The core of the setup is the ESP32, which manages communication between the various components. An RC522 RFID reader is connected to the ESP32 to detect and read RFID tags or cards. When a card is brought near the reader, it captures the card's unique ID and sends it to the ESP32 for verification. A small OLED display is used to show status messages such as “Scan Your Card,” “Access Granted,” or “Access Denied,” providing visual feedback to the user.

If the scanned RFID tag matches a pre-authorized ID stored in the ESP32’s memory, the system grants access. In this case, the display shows “Access Granted,” a buzzer emits a short beep as a confirmation signal, and a solenoid lock is activated to unlock the door temporarily. If the RFID tag does not match, the display shows “Access Denied,” and the buzzer may sound a longer or repeated tone to indicate unauthorized access. The solenoid lock remains closed, ensuring security.

The entire system is powered by a combination of USB and external power adapters, providing stable voltage to the ESP32, display, buzzer, RFID reader, and lock. The setup is designed to operate continuously, returning to a standby state after each scan to await the next RFID input. This type of system is ideal for secure entry applications in homes, offices, schools, or any facility requiring controlled access.

Table 2: RFID Maintenance Box Lock System Verification and Response

| RFID Tag Status | Match with Stored ID? | Display Output | Buzzer Response | Solenoid Lock Status |
|---|---|---|---|---|
| RFID tag/card detected | Yes | “Access Granted” | Short single beep | Unlocks temporarily |
| RFID tag/card detected | No | “Access Denied” | Long or repeated buzzer tone | Remains locked |
| No tag/card detected | N/A | “Scan Your Card” | No sound | Remains locked |

### 4.3 Telegram Notification

The Telegram-based notification system plays a crucial role in enhancing the overall monitoring and maintenance process of the system. It is designed to provide real-time updates and alerts regarding the system's status, including any faults or issues related to lighting components, as well as unauthorized or authorized access to the maintenance box. By leveraging the capabilities of the ESP32 microcontroller, the system can establish a connection with a pre-configured Telegram bot.

The Telegram bot acts as an intermediary that facilitates two-way communication between the system and the end user. When an event or anomaly is detected such as a malfunctioning light the ESP32 immediately sends a message through the Telegram bot to alert registered users.

Such a system not only improves response time but also enhances remote monitoring and security. The use of Telegram ensures that notifications are delivered promptly and securely over the internet, making it suitable for both indoor and outdoor deployments where maintenance personnel may not always be on-site.

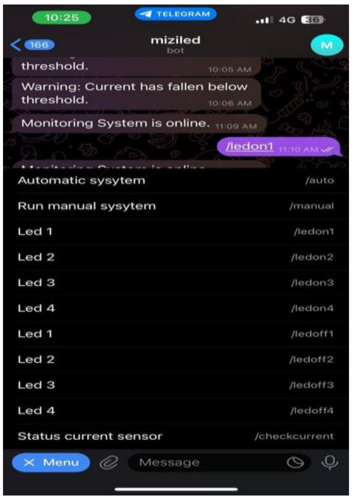


Figure 7: Telegram Notification

Table 3: Notification System of the Smart Pedestrian Light Monitoring System

| Alert Type | Trigger Condition | Notification Details | Response Action |
|---|---|---|---|
| Lighting Fault Alert | Detection of malfunction in pedestrian lights | Telegram bot sends real-time message indicating faulty light component | Dispatch maintenance team to inspect/repair |
| Unauthorized Access Alert | Unrecognized access attempt to maintenance box | Immediate alert sent to Telegram with time and location of access | Investigate access and secure maintenance box |
| Authorized Access Notification | Verified/registered personnel open maintenance box | Notification confirming authorized entry for transparency and recordkeeping | No immediate action, monitor log |

### 4.4 Final Product

Figures 8 and 9 illustrate the fully assembled prototype and internal wiring of the maintenance box. All components functioned as intended during the final integration test. The wiring layout allowed efficient debugging and maintenance access.

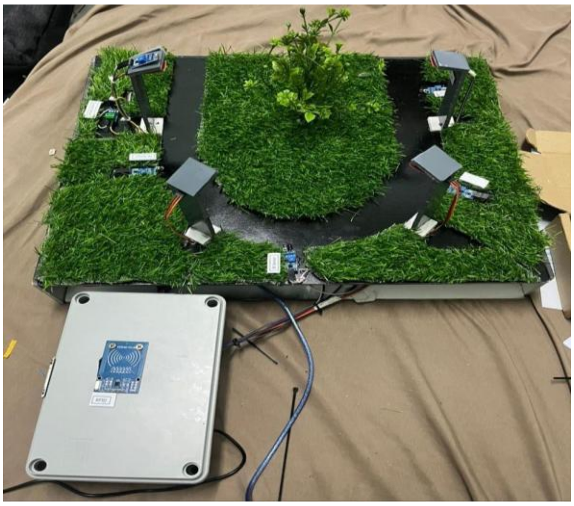

Figure 8: Overall Project Prototype

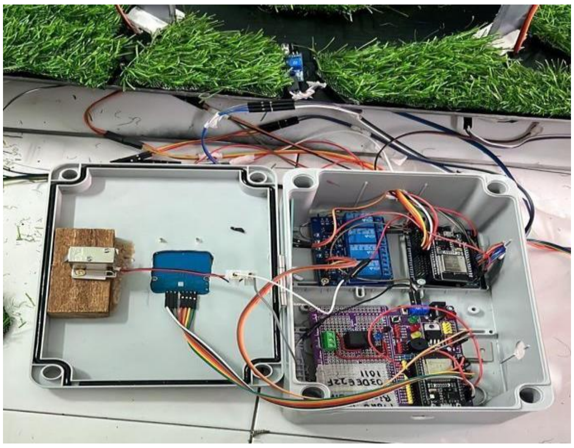

Figure 9: Wiring of Maintenance Box

## 5.0 DISCUSSION AND CONCLUSION

In the development of the Smart Pedestrian Light Monitoring System, several limitations have been identified that affect the system's performance and functionality. Understanding these limitations is important so that improvements can be focused on critical aspects that can enhance the effectiveness and resilience of the system in the future.

Among the main limitations faced is the distance limitation of the IR and LDR sensors. The IR sensor used in this project is only capable of detecting movement within a certain range, which may cause delays in detecting the presence of pedestrians at longer distances. The LDR sensor, on the other hand, only functions well in lighting conditions that are not too bright or too dark, and this limits the effectiveness of the system in long pedestrian areas or areas that require more precise detection.

In addition, this system relies on a stable internet connection to send notifications via Telegram. In areas with weak or unstable internet access, notification messages may experience delays or fail to reach the user. The durability of system components against weather is also a limitation that needs attention. This system has not been fully tested in various weather conditions such as heavy rain, high humidity, or extreme temperatures. Without additional protection, electronic components such as sensors and the ESP32 are at risk of damage when exposed to unpredictable weather.

In terms of data security and privacy, the use of Telegram as a notification medium requires special attention to ensure that only authorized users can receive or send commands to the system. Although Telegram provides several layers of security, the risk of unauthorized access still exists if additional security measures are not taken. Finally, remote control via Telegram has limitations in response speed, especially if there are too many simultaneous requests or if there is interference on the communication network.

Overall, the project has successfully developed and tested a Smart Pedestrian Light Monitoring System that utilizes IoT technology to enhance safety and energy efficiency in pedestrian areas at night. The system integrates various components such as ESP32, LDR sensor, IR sensor, current sensor, as well as the use of a maintenance box equipped with RFID and a solenoid for equipment security. In addition, Telegram software is used as a medium for sending direct notifications to users, enabling remote monitoring and control of the system.

Based on the testing results, all components and functions of the system operated as planned. The LDR and IR sensors successfully detected light conditions and pedestrian presence to control the lights automatically. The current sensor, on the other hand, enabled rapid detection of lighting problems, and the notification system via Telegram proved effective in sending alerts and receiving control commands from users. Overall, this system provides a potential solution for improving pedestrian safety and facilitating the maintenance of lights in the area.

The Smart Pedestrian Light Monitoring System has been successfully designed and implemented to meet its objectives that are automating pedestrian lights, enabling remote monitoring, and improving the security of streetlight maintenance boxes. The system enhances pedestrian safety by automating light operations, ensuring lights respond appropriately without manual intervention. With the addition of remote monitoring features, the system allows real-time observation of the lights' status, enabling quicker response to faults or malfunctions. Furthermore, the integration of a security system for maintenance boxes helps prevent unauthorized access and theft, thereby supporting better infrastructure protection. Overall, this project provides a practical and intelligent solution for improving pedestrian safety and maintaining streetlight systems more effectively.

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