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# IoT Enabled Street Light System

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**ABSTRACT:** The Smart Street Lighting System is a cutting-edge initiative designed to revolutionize urban illumination by incorporating advanced technologies for enhanced energy efficiency and safety. Key features include intelligent activation using motion sensors to minimize unnecessary energy consumption, light automation based on real-time data for optimized brightness, and a fault detection and monitoring subsystem for swift maintenance. This multifaceted approach not only improves the quality of urban lighting but also reduces energy consumption, mitigates light pollution, and promotes overall sustainability. The project embodies a modern and responsible approach to urban infrastructure, setting a benchmark for smart city development.

**KEYWORDS:** street lighting, cost efficiency, real time monitoring, internet of thing

## I. INTRODUCTION

Street lights are an essential part of our infrastructure, providing safety and security for pedestrians and motorists alike. However, street lights can also be prone to faults, which can lead to dark streets and increased safety risks.

Traditional methods for street light fault detection and repair are often inefficient and time-consuming. Manual inspections are required to identify faulty street lights, and repairs may be delayed due to a lack of resources or coordination.

This project proposes a centralized street light fault detection and alert system. The system will be able to automatically detect and report street light faults to a central control center, where maintenance personnel can be dispatched to make repairs quickly and efficiently.

An automatic street light on/off system using a IR sensor, relay, and bulb is a simple and effective way to reduce energy consumption and save money. The system works by using a IR sensor to detect the presence of people or vehicles. When motion is detected, the IR sensor sends a signal to the relay, which turns on the street light. The light remains on for a set period of time after motion is no longer detected, and then turns off automatically.

This type of system is often used in areas where there is low traffic or pedestrian activity, such as parking lots, alleyways, and rural roads. It can also be used in residential areas to save energy on porch lights and other outdoor lighting.

## II. RELATED WORK

The street lights use a significant amount of energy, so finding ways to lower this consumption is crucial. Creating controllable, intelligent street lighting is a subject that many researchers worldwide are very interested in. The street lighting has been greatly improved by the lighting control network. Implementing a control system can provide excellent results [1]. The integration of wireless communication, intelligent controllers, and sensors into street lights is the fundamental idea behind a smart street light system. These smart lights can be set up to switch on and off automatically in response to various environmental conditions, including light levels and traffic from cars and pedestrians[2]. Streetlights are a key asset in any city as they provide a sense of safety and security to the public, especially pedestrians, and increase the quality of life by artificially extending the day. Streetlights that are smart and operate intelligently and autonomously can provide added benefits of additional lower energy consumption and lower carbon emissions [3]. This solution refers to smart city street lights using an IoT network while performing visual management so that managers can clearly understand the status information of each street lamp in each block. At the same time, each street lamp has built-in sensors or smart plugs to preset lighting equipment, to ensure that the switch state and lighting brightness of each lamp can be accurately controlled, so as to truly realize on-demand lighting and achieve the effect of energy saving[4]. The street lights work automatically by detecting the movements of objects on the street. IR sensor is used to detect the object. The system also includes a DHT11 Temperature-Humidity sensor that provides exact information on the temperature and

humidity of the region. DHT11 is a sensor that contains a digital output of the temperature and humidity. The LDR sensor and IR sensors are used to sense the light intensity and the objects of particular area. It then transmits the data to the base station where energy gets stored using wireless technology[5] In this research work, an IOT based Automated Street Lighting System is proposed. This system manages the automatically switches the street light ON and OFF based on the amount of sunlight present. It is important in the smart cities where energy will be conserved by efficient switching ON and OFF of the streetlights at the right time as needed[6]. Developing smart street lighting with a control system is another topic of major interest to many researchers around the world. The lighting control network is an excellent upgrade to street lighting. Deploying a control system can offer great solutions that contribute to safety and sustainability[7].

### III. METHODOLOGY

The implementation phase begins with the development of the system firmware. The firmware is the code that controls the ESP32 microcontrollers. The firmware is responsible for collecting data from the sensors, controlling the street lights, and communicating with the central control center.

Once the firmware is complete, the mobile app and web-based application are developed. The mobile app allows maintenance personnel to view the status of street lights, receive alerts of new faults, and dispatch teams to make repairs. The web-based application allows the central control center to monitor the status of all street lights and manage maintenance tasks.

**Testing** :- The testing phase is essential for ensuring that the system meets the requirements and is free of bugs. The testing phase begins with unit testing. Unit testing is performed on individual components to ensure that they work as expected. Once the unit testing is complete, integration testing is performed. Integration testing is performed on the entire system to ensure that all of the components work together correctly.

**Deployment** :- Once the system has been tested and found to meet the requirements, it is deployed in the field. This involves installing the system hardware and software, configuring the system, and training the users.

**Maintenance** :- The maintenance phase is ongoing. The system is maintained to fix bugs, add new features, and improve the performance of the system. This is a general overview of the SDLC for a centralized street light fault detection and alert system.

#### Feasibility Study

Feasibility Study for a Centralized Street Light Fault Detection and Alert System

#### Technical Feasibility

The technology required to implement a centralized street light fault detection and alert system is available and affordable. The system can be implemented using a variety of hardware and software components, including:

1. ESP32 microcontrollers
2. LDR sensors
3. RFID readers
4. Current sensors
5. GPS modules
6. Solar panels and batteries
7. Mobile app for maintenance personnel
8. Web-based application for the central control center

#### 1. Economic Feasibility

The cost of implementing a centralized street light fault detection and alert system will vary depending on the size and complexity of the system. However, the system is likely to be cost-effective for most municipalities. The benefits of the system include:

- Reduced costs for street light maintenance
- Improved efficiency of street light maintenance operations
- Increased reliability of street lighting

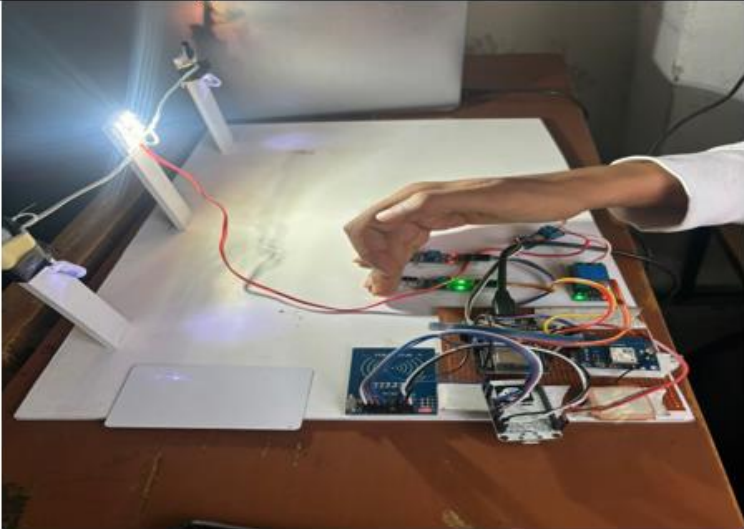
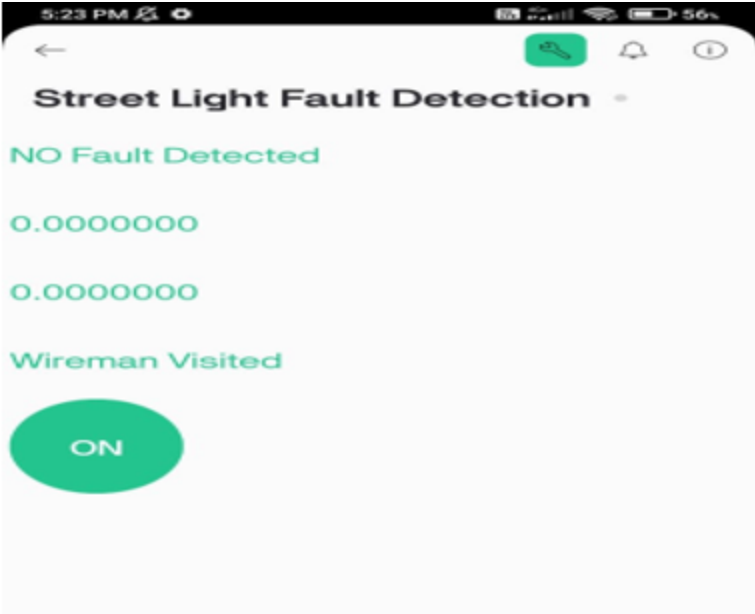
**Schedule Feasibility**

A centralized street light fault detection and alert system can be implemented in a reasonable amount of time. The specific timeframe will depend on the size and complexity of the system, as well as the resources available.

**Operational Feasibility**

A centralized street light fault detection and alert system is operationally feasible. The system can be integrated into existing street light infrastructure and maintenance operations.

**IV. EXPERIMENTAL RESULTS**

Image	Description
	<p>Here we can see that when any object is been identified or detected by IR sensor, the light turns on during night time only. It won't get turn on during day light due to LDR Sensor. It helps in saving the maximum consumption of energy as well as light.</p>
	<p>We can also operate the same project using IoT Applications such as Blynk. If any IR sensor is not working properly, we can turn it on using such applications. Here we can see that we can turn the lights on as well as off. Also, with the help of IoT application we can see that where the actual fault is arisen and detected using GPS in Big Prototypes. A notification will be sent directly on the wireman phone through the app.s Then the wireman will visit and correct the fault</p>

## V.CONCLUSION

Your project has successfully demonstrated the development and implementation of a centralized street light fault detection and alert system using an ESP32 microcontroller, LDR sensor, RFID reader, current sensor, GPS module, Blynk app, solar panel, IR sensor, and battery

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