IoT Based Street Light Fault Detection and Location Tracking System

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A B S T R A C T

The rapid advancement of Internet of things has enabled the development of smart city applications, enhancing urban infrastructure and services. This paper presents a "IoT based street light fault detection and location tracking system" designed to improve the efficiency and reliability of street lighting networks. This system continuously monitors street light for faults such as lamp failures and electrical issues, providing real time data and precise location tracking through GPS. Additionally, it features an automatic control mechanism that turns light on at dusk and off at down, ensuring energy efficiency. When a fault is detected, the system logs to issue and alerts maintenance team with the exact location for quick repairs. This comprehensive solution enhances operational efficiency, reduce energy consumption and improves public safety by maintaining consistent and reliable street lighting. Each street light is equipped with sensors that monitor operational parameters such as light intensity, power consumption. In the event of fault, the sensors immediately relay data to the central control unit via wireless network. The control unit processes the data and identifies the exact location and nature of fault which is then displayed on web application or mobile application.

Keywords: Smart lighting; Fault monitoring; Real-time monitoring; Smart city solutions

1. INTRODUCTION

Street lighting is an essential public service that ensure safety and enhances the aesthetic appeal of urban and rural areas. It provides us with light at night and making our street safer, the government of India have invested 70 crore for street light maintenance and pays 200 crore as electrical bill to BESCOM. Traditional street lighting system often face challenges such as high energy consumption, maintenance inefficiencies and delayed fault detection. An IoT based street light fault detection and location tracking system addresses these issues by integrating smart technology to monitor and manage street light efficiency.

IoT in street lighting:

The Internet of things refers to a network of interconnected devices that can collect, share and act on data. In the context of street lighting, IoT enables the connection of street lights to a central management system, allowing real-time monitoring and control, this integration facilitates immediate detection of faults and precise location tracking, enhancing the maintenance and operational efficiency of street lighting system. The automatic street light system is designed to control the on and off operations of street light without human intervention, these system utilize various sensors and technologies to detect environmental conditions and adjust lighting accordingly. The primary objective is to ensure the street lights are only active when needed, thereby conserving energy and reducing maintenance costs.

Nomenclature

IoT: Internet of things

LED: Light emitting diode

GPS: Global positioning system

GSM: Global system for mobile communications

LDR: Light dependent resistor

1.1 PROPOSED SYSTEM

Designing an IoT based system involves several components and considerations. Here is a proposed model

Sensors Network: Install sensors on each street light to monitor various parameters like light intensity, power consumption and status(on/off)

Microcontroller unit: Use a microcontroller like arduino to gather data from sensors and process it for analysis.

Connectivity and data analysis: Incorporate wireless communication protocol like GSM to transmit data from MCU to central server or cloud platform.

Fault detection and reporting: When a fault is detected, the system should immediately report it to the central server or maintenance team

Location tracking: Integrates GPS module to track the exact location of faulty street light

Remote control: Optionally, add remote control capabilities to the system, allowing operators to manually turn on/off or adjust the brightness level.

Power management: Implement power saving feature to ensure the system operates efficiently and does not drain excessive energy.

2. METHODOLOGY

This system aims to develop a centralized street light fault detection system and location tracking system. The LDR and voltage sensor is connected to ESP 32 which results in automatic on/off the street light. GPS sensor and GSM module is used to detect the fault and track the location by sending SMS to authorized person.
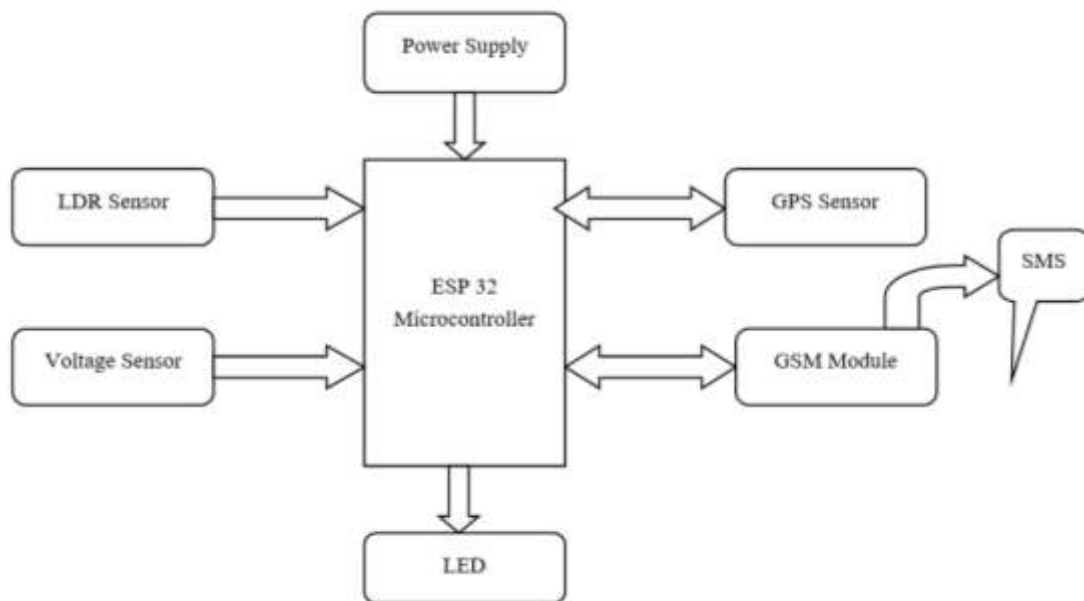
Fig.1: Block Diagram

The System will consist the following components:

ESP32: The ESP32 is a microcontroller that will be utilized for collect data from the sensors and send through SMS.

LDR: The LDR Sensor is used to check the operational status of street light(on/off).
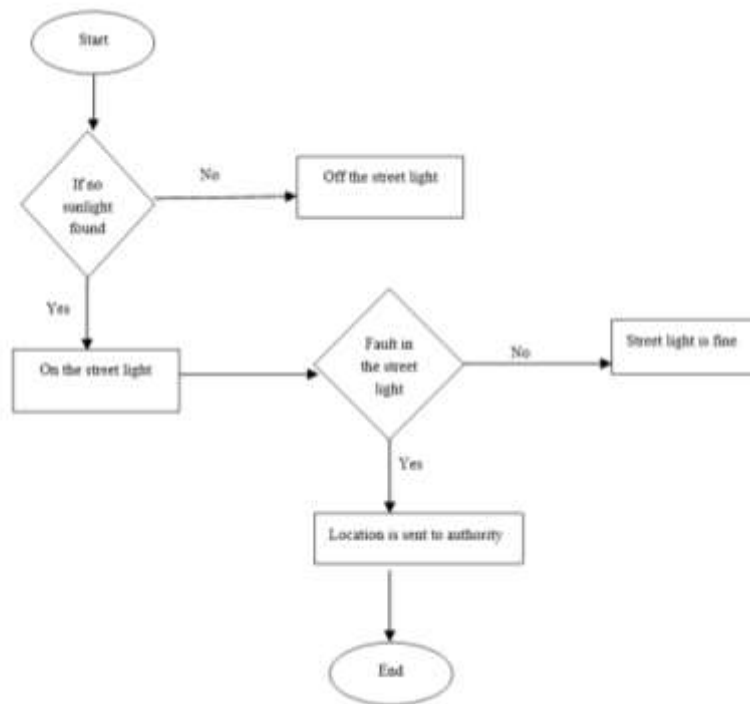
Voltage Sensor: Used to measure the voltage levels and identify abnormal conditions.

GSM Module: Used for the areas where Wi-Fi is not available and cellular communication is required.

GPS Sensor: To provide location tracking for each street light**.**

Power Supply: To provide the necessary power to microcontroller and sensors.

3. FLOW DIAGRAM

CONCLUSION

The conclusion would highlight its effectiveness in improving the overall performance and reliability of street lighting infrastructure. The system's ability to detect faults in real-time ensures prompt identification and resolution hence enhances reliability, by optimizing maintenance efforts and reducing energy wastage the system leads to significant cost saving and improve public safety.

Overall, an IoT-based street light fault detection and location tracking system offers a comprehensive solution to enhance the efficiency, reliability and sustainability of urban lighting infrastructure, benefiting both community and environment.

FUTURE SCOPE

The future scope of IoT-based street light fault detection and location tracking system is driven by advancements in technology and the increasing push towards smart city initiatives, Here are several key areas,

Comprehensive urban management, Enhanced sensor and communication technologies, Advanced mapping and geo location services, Cost reduction and accessibility.

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