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Street Light Fault Identification And Alerting Using Notification

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Abstract: Street lighting plays a vital role in ensuring public safety and efficient transportation during night hours. However, conventional street light monitoring systems often fail to detect faults such as lamp failures, power fluctuations, or wiring issues in real-time, leading to energy wastage and inconvenience to the public. This project proposes smart fault identification and alerting system for street lights using IoT technology. In the proposed system, sensors and microcontrollers are integrated with each street light unit to continuously monitor its operating status, including parameters such as current flow, voltage level, and light intensity. When an abnormal condition or fault is detected—such as bulb failure, power outage, or abnormal power consumption—the system automatically identifies the faulty light and transmits the data to a central server through wireless communication (e.g., Wi-Fi/GSM). An application installed on the concerned authority's smartphone receives instant fault notifications, including the location and type of issue. This system enables timely maintenance, reduces manual inspection efforts, and improves energy efficiency and reliability of street lighting infrastructure. Additionally, the use of app-based alerts ensures rapid response and enhanced operational management. The proposed solution contributes toward building smarter, safer, and more sustainable cities.

Keywords: BT136-600E, MOC-3021, ACS712, HC-SR 501 PIR, LM393 LDR, ESP 32s.

I. INTRODUCTION

Smart streetlight is considered as a backbone of future. It will play a major role energy conservation in smart cities. Smart streetlight system is an interconnected network smart lights which are equipped with lamp controller, sensors, and cameras. A smart light automatically controls the lights based on the brightness, darkness, weather conditions, movement of objects in its vicinity. Thereby, saving a considerable amount of energy and maintenance cost. Smart streetlight may also contain real time data monitoring system which will allow operator to control various functionalities of the streetlights as well as give the insight of the real time data. The technology behind smart streetlights can vary depending on its features and requirements, but typically, it involves a combination of cameras and sensors. When implemented on standard streetlights, these devices can detect movement that enables dynamic lighting and dimming.

II. OBJECTIVE

The objectives of the project are:

1. Enhance energy efficiency: Smart streetlights can adjust their brightness based on the ambient light levels, traffic density, and pedestrian activity, reducing energy consumption and lowering operational costs.
2. Improve public safety: By ensuring adequate lighting levels on the streets, smart streetlights can enhance the visibility of drivers and pedestrians, reducing the risk of accidents and crimes.
3. Reduce maintenance costs: Smart streetlights can detect faults and failures in the lighting system and alert maintenance personnel, enabling quick and efficient repairs and minimizing downtime.

III. LITERATURE SURVEY

(Paper 1) Andrea Zanella, Nicola Bui, Angelo Castellani, Lorenzo Vangelista, Michele Zorzi
"Internet of Things for smart cities" in IEEE Internet of Things Journal (Volume: 1,
Issue: 1, February 2014) :Smart streetlight poles are used as carriers for the omnipresent electricity Internet of Things and smart city development trends and building techniques. The quick growth of the modern city and the pervasive influence of the Internet of Things (UPIOT), as well as the rising need for different kinds of sensors and monitoring devices in urban infrastructure, are all discussed in this paper by Fenqing Du and Xing De Huang. At the same time, however, the amount of usable urban space has been somewhat reduced. It is one of the main causes for the emergence of smart poles in recent years, which integrate a variety of features such as illumination, monitoring, and security. Three stages of the evolution of street light poles are described in this paper. At last, it compares the actual situation in Shanghai and puts forwards a more efficient and flexible ways for Shanghai Electrical company to be involved fully and understand the importance of smart streetlight system in smart city and IoT construction.

(Paper 2) Fengqing Du; Xingde Huang; Aiqiang Pan; Xiaoman Qi; Zhiya Niu, "Development trend and construction strategies of smart city and the ubiquitous power Internet of Things with smart streetlight pole as carrier" at CIRED 2020 Berlin Workshop (CIRED 2020) Year: 2020, Volume: 2020, Conference Paper, Publisher: IET Analog, power driver, and digitally controlled circuits with blending design methods 15make up the main circuit. Using just two switches, the electronic lowering can change the luminance of LEDs. The user may choose between controlling the switches in automatic or manual mode.

The chip has been placed with all digital control circuitry. As a result, it's not necessary to use a microprocessor to dim LEDs; instead, this chip's extremely cost-effective architecture can save interface components. The dimming approaches employ current mode instead of PWM (Pulse Width Modulation) to eliminate flickering and maintain high-stable LED lights. Up to 16 stages are used in the multi-level current approach to regulate LED illumination. The step accuracy for a smart lighting system is 6.25%. This method uses variable consistent current regulation to improve lighting efficiency, lower noise emissions, and extend the

lifespan of LEDs in smart lighting systems.

(Paper 3) Shih-Chang Hsia, Ming-Hwa Sheu ; Jyun-Jia Ciou, Cost-Effective LED Dimming Driver with Single Chip Design for Smart Lighting System in IEEE, Volume 8, 2020 In this paper the highlight how a street lighting management platform is made up of three major components smart streetlights, network infrastructure and administration and the control system, this document has three distinct sections real-time lighting management which is achieved by manually setting up or scheduling of real facts such as smart street-lighting system information, which detects environmental parameters and streams of real-time IP camera captures is also offered and an for previous data inquiry is given also including storage for videos, this papers proposed system consists mostly of the following components a web based user interface, management platform and an edge orchestrator.

Also, with accelerated growth of smart lights comes the quick creation of a management platform that can handle computing networking and storage resources as well as the numerous demands made by lamps as a result it is critical to design a massive scalable platform with simple transition quick deployment and increased resource utilization this article used container-based virtualized deploying technologies to achieve quick deployment and scalability.(Paper 4) An Implementation of High Efficient Smart Street Light Management System for Smart City by Yu-Sheng Yang, Shih-Hsiung Lee, Guan-Sheng Chen, Chu-Sing-Yang in IEEE, Volume 8, 2020 Simulation designing communications in smart and modern cities, the authors have presented their perspectives on communication networks and the way they have become a vital component in the creation of smart cities they also discuss how the information flowing via thousands of devices and sensors should be managed to ensure that appropriate quality, and security assurances.

This article puts forward the simulation tool which aids in the development of smart cities 16 intricately integrated and converging network system.(Paper 5) Indoor Lighting In Proceedings of 2016 IEEE International Conference on Computing, Communication and Automation (ICCUBEA), Aug. 13 This paper discusses base station (BS) sleeping strategy in the hybrid energy-powered cellular network on the IoT platform, how base strategy works for on grid energy saving in cellular which have Hybrid energy supplies. An algorithm is deployed which changes the sleeping state of a Base station based on the real traffic it is receiving, and solar energy is suggested to improve on-grid energy savings.(Paper 6)Frequency Support Through LED Street Lighting in Small Non-Synchronous Power Systems" IEEE Transactions on Industry Applications (Early Access), 23 November2022-2023.next-Generation IOT Devices: Energy Harvesting, Wireless Connectivity, and Sustainable Eco-Friendly Manufacturing Potential solutions for resolving the fundamental problems with creating sustainable IOT devices are provided by authors of this work.

Their work focuses on creating next-generation IOT devices with consideration for sustainable power method, environmentally friendly manufacturing method, and wireless connectivity. The number of IOT systems is growing very quickly because to the numerous and diversified uses of IOT applications in wearable technology, industrial automation, and smart cities.

IV.BLOCK DIAGRAM

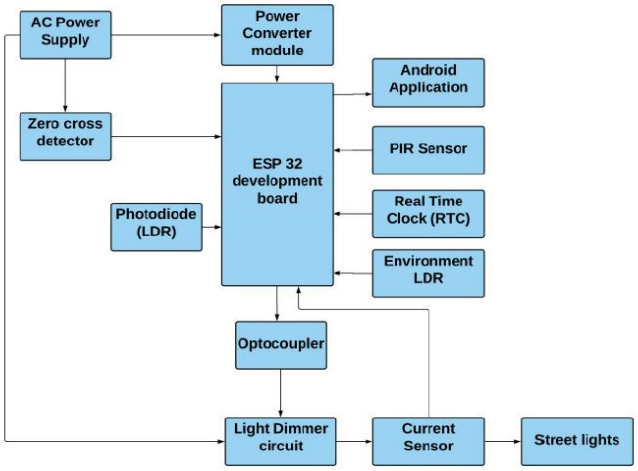


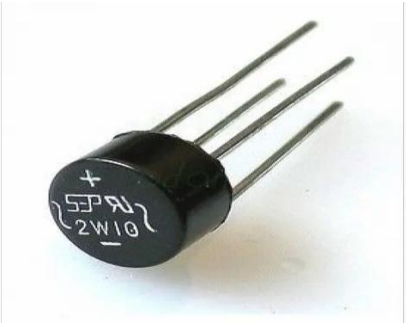
Fig.1. Block Diagram

V HARDWARE COMPONENTS

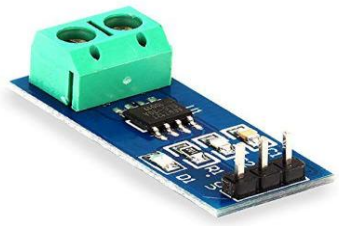
1. ESP 32S Development Board

2. LM393 LDR

3. HC-SR 501 PIR sensor

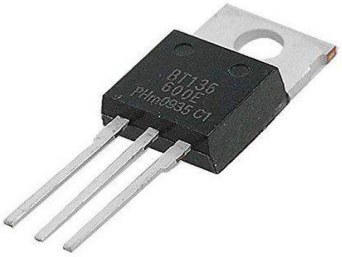


4. ACS712 Current Sensor Module



5. MOC-3021 Optocoupler

6. BT136-600E TRIAC



7. 2W10 Bridge Rectifier

VI CONCLUSION

This system can lead to significant energy savings, as the streetlights will only operate at full brightness when necessary. It can also reduce light pollution and improve safety by providing better lighting when people or vehicles are present. However, the implementation of such a system would require careful planning and consideration of factors such as sensor placement, communication protocols, and power management. Additionally, maintenance and repair of the system would need to be considered to ensure reliable operation. Overall, a smart streetlight system based on PIR sensor and LDR sensor has the potential to be a cost-effective and sustainable solution for public lighting.

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