CENTRALIZED MONITORING SYSTEM FOR STREET LIGHT FAULT DETECTION AND LOCATION TRACKING HARDWARE SMART AUTOMATION

A PROJECT REPORT

Submitted by,

D Vachan Kumar - 20211CIT0058
Poojitha U - 20211CIT0077
Mohana Krishna Raju BD - 20211CIT0102
G Vinay - 20211CIT0107
Rakesh R - 20211CIT0149

Under the guidance of,

Ms Raesa Razeen

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING IN INTERNET OF THINGS

At

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY

BENGALURU

MAY 2025

PRESIDENCY UNIVERSITY

SCHOOL OF COMPUTER SCIENCE ENGINEERING

CERTIFICATE

This is to certify that the Project report **"CENTRALIZED MONITORING SYSTEM FOR STREET LIGHT FAULT DETECTION AND LOCATION TRACKING HARDWARE SMART AUTOMATION"** being submitted by "D VACHAN KUMAR, POOJITHA U, MOHANA KRISHNA RAJU BD, G VINAY, RAKESH R" bearing roll number(s) "20211CIT0058 ,20211CIT0077, 20211CIT0102, 20211CIT0107, 20211CIT0149 " in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering in Internet of Things is a bonafide work carried out under my supervision.

Raesa

Ms Raesa Razeen
Assistant Professor
School of CSE&IS
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13/5/2025

Dr. ANANDARAJ S P
Professor & HoD
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Dr. SAMEERUDDIN KHAN
Pro-VC School of Engineering
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Presidency University

PRESIDENCY UNIVERSITY

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DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **CENTRALIZED MONITORING SYSTEM FOR STREET LIGHT FAULT DETECTION AND LOCATION TRACKING HARDWARE SMART AUTOMATION** in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Computer Science and Engineering**, is a record of our own investigations carried under the guidance of **Ms Raesa Razeen, Assistant Professor, School of Computer Science Engineering & Information Science, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

Name	Roll No	Signature
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Mohana Krishna Raju BD	20211CIT0102	MKR
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ABSTRACT

This project creates a street light monitoring system capable of collecting real-time data through if an ESP32 microcontroller, which is then referred to Blynk platform, to detect and raise faults in real-time. The project is supposed to resolve the problem of the urban infrastructure by automating the detection of fault in street lights since it is usually carried out by manual inspection. The solution ensures iteration in timely maintenance, reduction of energy wastage, and an improvement in public safety as it enables the use of voltage sensors, relay controls, and cloud alerts. And finally, this solution includes automated scalability for monitoring several lights at once, with voltage thresholds modified for greater flexibility towards standard infrastructure.

The project major innovation relates to the use of analytics real-time and two-way control (manual + automated). Thereby, filling the gaps of conventional lighting management systems.

This hardware implementation involves the use of voltage dividers powered by ESP32s connected to each street light. Resistors (30kΩ + 7.5kΩ) reduce input voltages to safe levels for ADC measurement. Four relays and pushbuttons allow maintenance personnel to locally override the controls to enable or disable the lights or remotely control them via Blynk. The analog pins on the ESP32 (GPIO32-35) are used for sampling the voltage data, and the digital pins (GPIO9-12) control the relays. Zener diodes guard against voltage spikes, while opt isolation prevents any EMI influence on sensor accuracies. Powered with a 5V power supply, our enclosures can be put outdoors (IP65) to withstand the environmental stress. Testing has shown measurement accuracy to within ±0.2V, thereby ensuring dependable detection of faults.

This firmware is programmed in Arduino C++ and is a cloud-based Blynk IOT real-time dashboard for visualizing aspects like voltage graphs and alerts plus threshold configuration via a mobile app. Virtual pins V4 to V7 correspond to bulb voltages, while

V0 correspond to dynamically adjusting the alert threshold. It applies logic to keep track of states to avoid sending alerts repeatedly, and it triggers alerts only when voltages drop below the setpoint, e.g. 9V. WIFI Manager manages network credentials and thus allows updates to be downloaded in the field without having to reprogram the device. Some of the key features include:

- For immediate push notifications, use Blynk.logEvent().
- Debounced button inputs for relay control.
- Low-power modes optimize energy consumption while the system is not in use.

Field trials showed that the system was capable of reaching 98.5% fault detection accuracy by informing users within 200ms of voltage deviation. The alert from the Blynk monitoring dashboard was unified, while response time to any repairs was shortened by 70% through relay controls. Energy savings were remarkable as one faulty 100-watt light stayed on unnecessary: It would save about 1kWh daily. The voltage divider circuits proved their stability over temperatures ranging between -10 and 50°C and WiFi connectivity remained stable to 15m only distance. Minor challenges like ADC noise (solved by averaging) and relay contact bounce (fixed by debouncing through software) existed. Proved scalable as changes were made from 4 lights to 12 lights without much code modification.

Such an open-source design fosters community participation for improvements, presenting cities with a very cost-effective (less than $20 per node) and sustainable solution to managing intelligent infrastructures. Integration of real-time monitoring with user-friendly controls prepares the ground for a much broader range of applications in smart cities.

City lighting management through Internet-of-Things technology has demonstrated its merit in enabling predictive maintenance while sustaining significant operational cost savings. Some future iterations would include:

- Off-grid solar panels.
- Current sensors for sensing failures in bulbs (open circuits).

- Machine Learning that takes voltage trends and tests them against a predicted failure pattern.
- Such open-source designs would engage the community toward progressive improvement, presenting a very economical (less than $20 per node) and sustainable solution to cities regarding intelligent infrastructure. The integration of real-time monitoring with user-friendly controls lays just the foundation for some much broader smart city applications.

ACKNOWLEDGEMENT

First of all, we indebted to the **GOD ALMIGHTY** for giving me an opportunity to excel in our efforts to complete this project on time.

We express our sincere thanks to our respected dean **Dr. Md. Sameeruddin Khan**, Pro-VC, School of Engineering and Dean, School of Computer Science Engineering & Information Science, Presidency University for getting us permission to undergo the project.

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We thank our family and friends for the strong support and inspiration they have provided us in bringing out this project.

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Mohana Krishna Raju BD (3)

G Vinay (4)

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1	Are the contents in the report arranged in the specified sequence?	Yes
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7	Details of mapping the project with the Sustainable Development Goals (SDGs) enclosed?	Yes
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Guide Name: Raeza Razeen
Guide Signature: Raese
Semester: 8
Reporting HoD Name: Dr. S.P Anandraj
Date: 13/05/25

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