IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

Street Light Automation And Fault Detection

[1] M. Devi, [2] Sahil Dhanaji Zimal ,[3] S. Vignesh
[1] Assistant Professor, [2]Student, [3] Student
Electrical and Electronics Engineering,
New Prince Shri Bhavani College of Engineering and Technology Chennai, India

ABSTRACT: The Smart Street Light Automation System with Fault Detection aims to revolutionize urban lighting infrastructure by introducing an integrated solution that combines adaptive control mechanisms and proactive maintenance capabilities. Leveraging advanced light sensors, microcontrollers, and communication modules, the system autonomously adjusts street light brightness levels in response to ambient lighting conditions, ensuring optimal visibility while minimizing energy consumption. Moreover, the incorporation of fault detection sensors, including temperature and current sensors, enables real-time monitoring of street light health, facilitating the early detection of anomalies such as overheating or electrical faults. By promptly identifying and reporting faults to a centralized monitoring station, the system enables expedited maintenance interventions, thus reducing downtime and enhancing overall system reliability. Through its innovative approach to street light management, this project aims to contribute to the development of smarter and more sustainable cities, where efficient lighting infrastructure plays a crucial role in enhancing safety, comfort, and energy efficiency for residents and visitors alike.

Index Terms - fault detection, urban lighting infrastructure, energy consumption, real-time monitoring, sustainable city, microcontrollers.

I. INTRODUCTION The Smart Street Light Automation System with Fault Detection ushers in a new era of intelligent urban infrastructure. This innovative project revamps conventional street lighting by incorporating cutting-edge technologies and advanced control systems.The system's core functionality hinges on a combination of adaptive light control and proactive maintenance features, optimizing street light operation and ensuring seamless service. By leveraging advanced light sensors, microcontrollers, and communication modules, the system autonomously adjusts light brightness based on ambient conditions. This dynamic control not only enhances visibility and safety on city streets but also minimizes energy consumption, promoting environmental sustainability and cost savings.

Furthermore, the system integrates fault detection sensors, including temperature and current monitors, enabling real-time tracking of street light health. Continuous monitoring of critical parameters allows for prompt identification of anomalies like overheating or electrical faults, which could lead to system failures or safety risks. Early detection of such issues is crucial for preventive maintenance interventions, minimizing downtime and ensuring the overall reliability of the lighting infrastructure.

Data collected by the fault detection sensors is transmitted to a central monitoring station for real-time analysis and processing. Deviations from normal operating conditions trigger automated alerts, notifying maintenance personnel of potential problems requiring immediate attention. This streamlined approach to fault detection and maintenance streamlines operations, boosting system reliability and uptime.

Beyond its practical benefits, the Smart Street Light Automation System with Fault Detection holds immense potential for the development of smarter and more sustainable cities. By optimizing energy use, reducing maintenance costs, and enhancing overall system reliability, the system contributes to creating safer, more comfortable, and environmentally conscious urban environments. Additionally, its innovative approach to streetlight management paves
the way for the integration of advanced technologies into essential infrastructure systems, setting a precedent for future advancements in urban planning and design.

II. LITERATURE REVIEW

A smart city is the global development vision to integrate multiple information and communication technology (ICT) solutions in a secure and simple way to manage a city's assets. Smart transportation is the basic component in future smart cities. Thus we are concentrating on the street light automation by detection of motion of object. Lighting which is not necessary can be neglected by targeted dimming of area of the city, town, roads or individual luminaries. The main objective of street light automation is to reduce the power consumption occurring due to lightening of street light during night when there is no objective motion on the street. During day time, the lights will be turned off and during night it will be turned on. In street light automation we are using Pulse Width Modulation (PWM) technique to control the light intensity in different condition like day, night, no vehicle condition & vehicle condition. In this paper we are working on street light automation by means of self responsive cars with collision avoidance system.

The Public Street Lighting System is a street lighting system at night or when the environment is dark. Control and monitoring system is one of the critical sides in the implementation of Public Street Lighting as a whole. So far, the Public Street Lighting treatment system is done manually, that causes many problems to the whole system. These problems resulted in very high maintenance costs and usability of Public Street Lighting that became not optimal. This paper is tended to design an automation control and monitoring of the system based on internet of things (IoT) system to address the problems. Several sensors, microprocessor system, actuators and a software graphical user interface are utilized in this research. Based on several experiments it can be said that the proposed system able to maintain Street Lighting System more satisfaction, low maintenance system andaccurate.

Energy-efficient lighting is a priority both at national and European level. Street lighting is one of the major energy consumers in municipalities, which has an impact on the growth of energy consumption in recent years. The proposed design solutions lead to an increase in energy efficiency.

This paper focus on automation of street lights that saves electrical energy, that 21 st century is striving hard to achieve. Conventionally, an operator is assigned to switch on the lights in the evening and switch off them in the morning from street to street covering the whole city/ town. This results in delay after sunset and wastage of energy in the morning as the operator needs time to cross from street to street. This project eliminates the above problems and also provides additional features like intensity control with respect to vehicle density, real time controlling etc. As the project is prototype version, ultrasonic sensors are used for sensing vehicles and NI Lab VIEW is used forreal time controlling.

With the development of communication technology, in order to meet the smart city's demand for intelligent infrastructure, the smart street lighting system based on NB-IoT is an effective method to realize the goal. This paper elaborates on the smart street lighting system's architecture, including the perception and control layer, the transport layer, the platform layer and the application layer. In addition, the actual system is built to verify. This system uses STM32 to build the perception and controller, and relies on China Telecom's NB-IoT communication network for the data transmission, finally using the IoT management platform-Huawei OceanConnect- to implement the connection management, the device management, the data calculation and the remote control functions. This system verifies the feasibility of the smart street lighting system based on NB-IoT technology, which provides the reference for the promotion and application. It is expected to provide intelligent, diversified, efficient and economical services for the smart cities.

EXISTING SYSTEM:

The world of street light automation is a dynamic field filled with established solutions and room for innovation. While commercially available systems excel in proven technology and scalability for large-scale deployments, their primary focus often lies in energy efficiency achieved through features like dimming based on ambient light or motion detection. These systems employ similar sensors to yours, including light-dependent resistors for controlling on/off functionality and temperature sensors for monitoring bulb health. However, they may not offer the level of customization that your Arduino microcontroller project allows.

In contrast, the open-source community provides a valuable platform for exploration with cost-effective solutions that utilize similar Arduino microcontrollers and communication protocols like your NRF modules. These open-source projects offer a learning environment and the potential to incorporate features beyond those found in commercial systems. However, they may require a higher level of technical expertiseto set up and maintain.

Research conducted in the field aligns with your project's goals. Park et al. (2020) investigated the potential of deep learning for real-time traffic prediction in smart street lighting. This allows for adaptive dimming based on anticipated traffic patterns, which resonates with the potential application of your vibration sensor in areas with high traffic volume anda greater risk of physical damage. Similarly, research by Wang et al. (2018) emphasizes the importance of temperature and current sensors for early fault detection in intelligent street lighting systems, directly mirroring your project's focus on monitoring these parameters for proactive maintenance.

III. PROPOSED SYSTEM:

Cost-Effectiveness:

Arduino-based design offers a more cost-effective solution compared to some commercially available systems.

Open-source platform reduces licensing fees and allows for component selection based on budget.

Ideal for smaller-scale deployments or pilot projects.

Customization:

Open-source Arduino platform allows forcustomization of functionalities to suit specific needs.

Additional sensors or functionalities can be easilyintegrated based on the deployment environment.

Programmable logic enables tailoring the system'sbehavior to address unique challenges.

Enhanced Fault Detection:

Unique vibration sensor detects physical damage or tampering with the light pole, providing valuable information for maintenance personnel.

Early detection of physical damage prevents further issues and ensures safety.

Complements existing fault detection methods (temperature, current) for a more comprehensive approach.

Scalability:

System can be easily scaled for larger deployments by adding more street lights and NRF modules to the network.

Modular design allows for phased implementation and easier maintenance.

Ideal for large-scale deployments in cities or sprawlingareas.

I. METHODOLOGY

Hardware Setup and Integration: Ensure all hardware components, including sensors, microcontrollers, communication modules, LEDs, and displays, are correctly connected and integrated to form a functional system. Sensor Calibration and Testing: Calibrate sensors accurately to ensure reliable data readings.

Thoroughly test each sensor individually and as part of the integrated system to verify its functionality and accuracy.

Fault Detection Algorithm Development: Develop robust algorithms for analyzing sensor data to detect faults such as short circuits or open circuits in the street light circuitry. Implement fault detection logic in the Arduino code to trigger alerts and display fault status. Programming and System Testing: Write clean, efficient Arduino code for both the transmitter and receiver boards. Test the integrated system rigorously to ensure proper communication between components, accurate sensor readings, and correct fault detection.

Documentation and Presentation: Document the project methodology, design, implementation, and testing process thoroughly. Prepare a clear and concise presentation or report summarizing the project's objectives, methodology, results, and findings for stakeholders and interested parties.

II. COMPONENTS

Arduino Microcontroller: Acts as the brain of the system, controlling the operation of all components and executing the programmed logic for street light automation and fault detection.

Light Dependent Resistor (LDR): Detects ambient light levels to determine when it's dark enough to activate the street lights, enabling automatic switching between day and night modes.

LED (Light Emitting Diode): Serves as the light source for the street lights, illuminating when darkness is detected by the LDR.

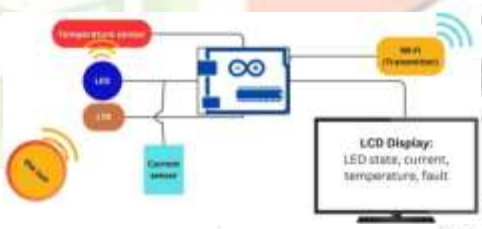
Current Sensor: Monitors the current flowing through the LED to detect abnormalities such as short circuits or open circuits, providing crucial information for fault detection.

Temperature Sensor: Measures the temperature of the bulb to detect overheating, which can indicate potential issues with the street light's circuitry or environment.

Vibration Sensor: Detects any physical damage or movement to the light pole, providing additional input for fault detection and maintenance alerts.

NRF Module: Facilitates wireless communication between the transmitter and receiver Arduino boards, allowing for real-time transmission of sensor data and fault alerts.

LCD Display: Provides visual feedback by displaying sensor data, fault status, and other relevant



information, making it easy for users to monitor the system's operation.

Fig 1 Block diagram

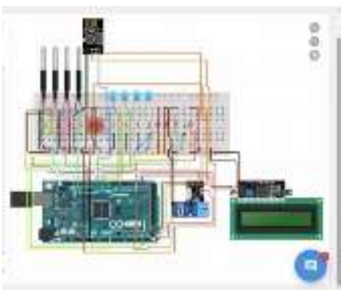


Fig 2 Circuit diagram

REFERENCES

[1] Bhagyashree Beeraladinni, Ankita Pattebahadur, Suraj Mulay, Vijay Vaishampayan, "Effective street light automation by self responsive cars for smart transportation" 2016 International Conference on Computing Communication Control and automation (ICCUBEA), Pune, India, DOI: 10.1109/ICCUBEA.2016.7860112.

[2] Andi Adriansyah, Akhmad Wahyu Dani, Gerri Irman Nugraha, "Automation control and monitoring of public street lighting system based on internet of things" 2017 International Conference on Electrical Engineering and Computer Science (ICECOS), Palembang, Indonesia, DOI: 10.1109/ICECOS.2017.8167140.

[3] Borislav Boychev, "Improving the energy efficiency of settlements by renewing the street lighting system" 2022 14th Electrical Engineering Faculty Conference (BulEF), Varna, Bulgaria, DOI: 10.1109/BulEF56479.2022.10021193.

[4] B. Krishna Chaitanya, R. Suresh, A.S.K. Kaushik, M. Mahesh, Chandra Kala; K.S. Ravi Kumar, "Automation of street lights using Arduino & NI Lab VIEW" 2015 IEEE UP Section Conference on Electrical Computer and Electronics (UPCON), Allahabad, India, DOI:10.1109/UPCON.2015.7456689.

[5] Shichao Chen, Gang Xiong, Jia Xu, ShuangshuangHan, Fei-Yue Wang, Kun Wang, "The Smart Street Lighting System Based on NB-IoT" 2018 Chinese Automation Congress (CAC), Xi'an, China, DOI: 10.1109/CAC.2018.8623281.