

Smart Street Light System

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Abstract: *Imagine walking down a street at night, and suddenly the street lights start to dim to save energy. You may wonder how this is possible it's all thanks to the smart street light system using Internet of Things (IoT) technology. This advanced system integrates various devices such as sensors and cameras to optimize and automate street lighting, providing an efficient and cost-effective solution by using IoT sensors, street lighting can be remotely monitored and controlled, making it possible to adjust lighting levels dynamically based on traffic patterns and weather conditions. This technology offers numerous benefits, including energy savings, improved public safety, and reduced carbon footprint, making our cities more sustainable and environmentally friendly. Overall, the smart street light system using IoT is a game-changer in urban development. It enhances our infrastructure and promotes sustainable growth, providing a better quality of life for all citizens.*

Keywords: Smart Street lights, IoT technology, Sustainable development

I. INTRODUCTION

Smart street light systems using IoT technology are the next generation of street lighting systems that offer improved energy efficiency, reduced costs, and better control and management of street lighting. The basic concept of a smart street light system is to incorporate sensors, wireless communication, and intelligent controllers into the street light infrastructure. These smart lights can be programmed to automatically turn on and off based on the surrounding light levels, as well as other factors like pedestrian and vehicular traffic. Additionally, they can be remotely monitored and controlled using IoT technology. IoT technology allows smart street light systems to gather data and feedback on energy consumption, maintenance needs, and other important factors. This data can then be used to optimize the system, improve energy efficiency, and reduce costs.

Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources every year, and poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting drastically. Manual control is prone to errors and leads to energy wastage's and manually dimming during mid-night is impracticable. Also, dynamically tracking the light level is manually impracticable. The current trend is the introduction of automation and remote management solutions to control streetlighting [9].

II. BRIEF LITERATURE SURVEY

The concept of smart street lighting systems has gained significant attention in recent years due to their potential to enhance energy efficiency, reduce costs, and improve public safety. Several studies have proposed various approaches to smart street lighting systems using advanced technologies such as the IoT, artificial intelligence (AI), and sensor networks [1].

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The system was able to adjust the brightness of the street lights based on the ambient light level, as well as detect and report any faults in the system. Another study by A. Imran et al. (2019) proposed a smart street lighting system that utilized a combination of IoT, cloud computing, and big data analytics [3].

It is stated that the current traditional street lighting systems are inefficient, as they operate on fixed schedules and are not adaptive to real-time changes in traffic or weather conditions. The literature survey highlights that smart street lighting systems can improve energy efficiency, reduce maintenance costs, and enhance public safety [4].

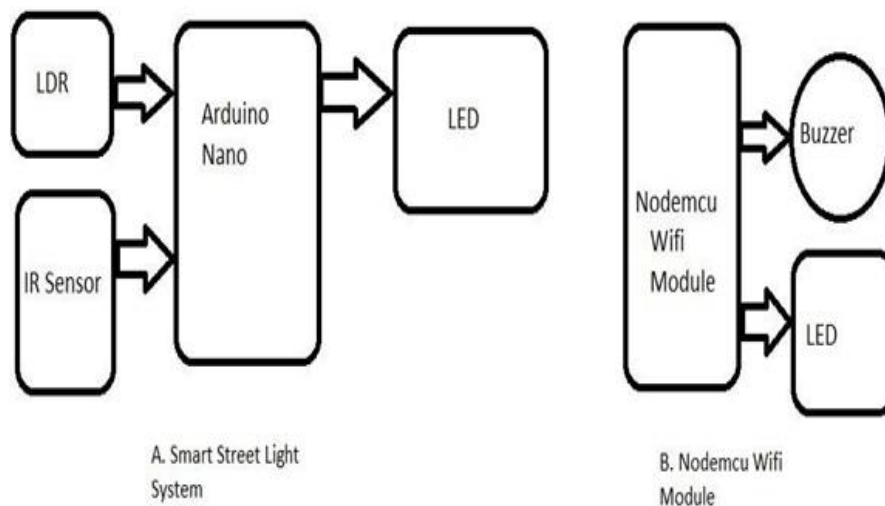
They discuss various approaches, such as using sensors and wireless communication technologies to monitor and control the street lighting system. They also highlight some of the challenges associated with implementing such systems, including the need for reliable and secure communication protocols and the high cost of installation and maintenance [5].

They discuss various approaches, such as using sensors, wireless communication, and machine learning algorithms, to monitor and control the street lighting system. They also highlight some of the challenges associated with implementing such systems, including the need for reliable and secure communication protocols and the high cost of installation and maintenance [6].

The literature survey in this article discusses various studies related to smart street lighting systems and their applications. It includes research on different sensor technologies used in smart street lighting systems, such as IR sensors, PIR sensors, and ultrasonic sensors. The survey also examines different control strategies for these systems, including manual control, time-based control, and adaptive control. Additionally, the literature survey discusses the benefits of smart street lighting systems, such as energy savings, improved safety, and reduced maintenance costs. The survey also explores the challenges associated with implementing these systems, including the initial cost of installation and the need for technical expertise to maintain and operate the system [7].

The survey examines different sensor technologies used in smart street lighting systems, including IR sensors, PIR sensors, and ultrasonic sensors. Additionally, the literature survey discusses the benefits of smart street lighting systems, such as energy savings, improved safety, and reduced maintenance costs. The survey also explores the challenges associated with implementing these systems, such as the need for technical expertise and the initial cost of installation. Furthermore, the literature survey highlights the importance of using Lab [8].

III. PROPOSED METHODOLOGY



This block diagram describes the working of project ‘Smart Street Light System with IoT’.

Arduino Nano and NodeMCU Wi-Fi module to the internet with the code specified in the code and the corresponding AT commands.

The LDR sensor detects light power and sends value to Arduino that stores data.

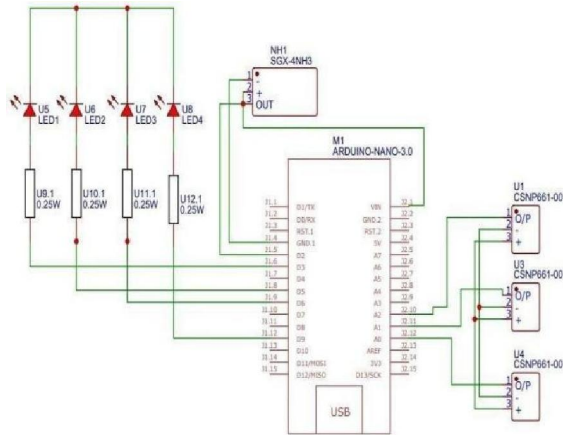
The IR sensor detects movement and sends Data to the Arduino data storage.

When light intensity is low the Arduino has to send a signal to the relay to turn on the LED.

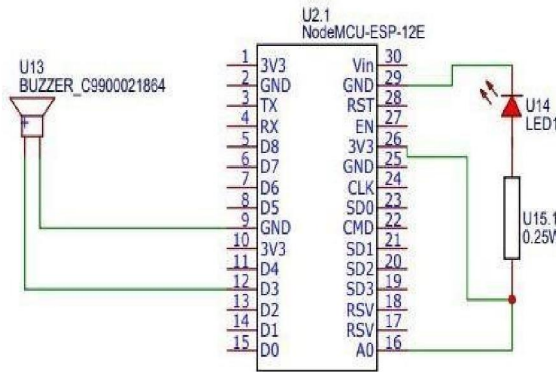
If the IR sensors sense movement, then the Arduino has to send a signal to the relay to the LED.

The B block is separate from the A module if the Led is not glow then the buzzer will get trigger and send notification on the Blynk app via NodeMCU WiFi Module

IV. HARDWARE IMPLEMENTATION



4.1 Street Light System



Node MCU Module

V. SOFTWARE IMPLEMENTATION



The software was implemented using Blynk IoT

VI. RESULTS AND CONCLUSION

Improved visibility and safety: Adequate Street lighting helps improve visibility on the road, reduces accidents, and enhances overall safety for drivers, pedestrians, and cyclists. Reduced crime good street lighting is known to deter criminal activity and make neighborhoods safer. Energy savings: The use of energy-efficient LED bulbs can reduce the energy consumption and maintenance costs of street lighting systems. Environmental benefits lower energy

consumption translates to a lower carbon footprint and contributes to a more sustainable environment. Increased economic activity: Well-lit streets can enhance the aesthetic appeal of an area, making it more attractive for businesses to operate and encouraging economic activity. In conclusion, street lighting systems are an essential infrastructure that plays a critical role in enhancing safety, security, and quality of life in urban areas. An efficiently designed and well-maintained street lighting system can deliver significant benefits to both the community and the environment. By using Smart Street light, one can save surplus amount of energy which is done by Replacing sodium vapor lamps by LED and adding an additional feature for security purposes. It prevents unnecessary wastage of electricity, caused due to manual switching of streetlights when it's not required. It provides an efficient and smart automatic streetlight control system with the help of IR sensors. It can reduce the energy consumption and maintains the cost. The system is versatile, extendable and totally adjustable to user needs.

VII. FUTURE SCOPE

Energy efficiency: The use of sensors and control systems in smart street lights can help optimize energy consumption and reduce costs.

Advanced monitoring: Smart Street lights can be equipped with cameras and other sensors to collect data on traffic flow, air quality, noise levels, and other environmental factors.

Increased safety: Smart Street lights can be programmed to automatically adjust lighting levels based on real-time data, making streets safer and reducing the risk of accidents

Smart traffic management: By integrating with traffic management systems, smart street lights can help manage traffic flow and reduce congestion in real-time.

Environmental sustainability: Smart Street lights can be powered by renewable energy sources such as solar or wind power, reducing the carbon footprint of street lighting systems.

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