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Adaptive Light Control Using IoT

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ABSTRACT: An IoT based Automated Street Lighting System is proposed. This system manages the automatically switches the street light ON and OFF based on movement on the road. This research work focuses on faulty light. This project automatic light that will change it's brightness on the bases of movement on the road, detects fault and also control light automatically, that we can control light through IoT but it required internet to all street light. The main purpose of this project which will control the light, detects the fault and record the power consumption.

KEYWORDS: Arduino application, Node MCU

I. INTRODUCTION

In the era of rapid urbanization and advancing technology, the need for smarter, more sustainable urban infrastructure is paramount. Street lighting, a fundamental component of any city, presents a unique opportunity for innovation and efficiency enhancement. operational costs and adverse environmental effects. To address these challenges, our project, the "Smart Street Lighting System with IoT Integration," proposes a forward-thinking solution. This initiative leverages the power of the Internet of Things (IoT) to transform traditional street lighting into an adaptive, data-driven system that responds intelligently to real-time conditions.

In this project, we outline a comprehensive approach to modernizing street lighting, with a focus on energy efficiency, fault detection, cost savings, environmental sustainability, safety enhancement, user-friendliness, data driven decision-making, scalability, integration with existing smart city infrastructure, and community engagement. By combining IoT technology with cutting-edge data analytics and responsive control mechanisms, we aim to create urban environments that are not only well-lit but also environmentally responsible, cost-effective, and responsive to the needs of the community.

II. LITERATURE SURVEY

[1] J.V. Anchitalagammai; S. Mohamed Alim; C. V. Amris Sarthy; Proposed:

IoT has had a big impact on the development of smart cities, among other things. In this regard, the development of IoT-based smart street lights has gained considerable interest. A smart street light system adjusts the intensity of the lights based on the amount of ambient light to consume less electricity while increasing brightness. Along with that, it has the capacity to detect the presence of people or vehicles and adjust the brightness of the lights accordingly. Furthermore, it automatically locates and updates or sends data to the cloud when a street light fails.

[2] M. Caroline Viola Stella Mary; G. Prince Devaraj;

The traditional manual street lighting requires manual operators, uses a lot of power, and is expensive to install, all of which have been significant drawbacks. Through intelligent on/off mechanisms, controlled progressive dimming, and planned power usage, the cost of electricity can be promptly lowered to 35%. By doing correct maintenance, we may cut the overall consumption expenses by up to 42%. The suggested method makes use of an energy-efficient strategy to regulate street lights by turning them off automatically when there are people or vehicles nearby road.

[3] R. Bhavadeesh; P. Traun Chandra Kumar; D. Srinivas;

In accurate street lighting may also be a sign of criminal activity on a road or avenue. By utilizing our method, we are able to manually control the light by adjusting the brightness from anywhere in the globe using a mobile device or laptop, and we are also able to determine the bulb lifespan. As a reply, emancipate current rate basically, prolong the usefulness viability of street lights and belonging and redeem labor value of subsistence and commodities subsequently. At the top of the web scheme via history, the street light might and authority system act.

Problem Definition

Public lighting in roads and public areas are lit even during daytime resulting in the wastage of precious energy. The conventional method being employed is manual switching on and off and in some places, there has been a shift towards timer control for the on-off of public lighting. However, this has not been very effective. System to be simulated by the participants Desired Outcome: Smart public lighting systems, that are centrally controlled by IOT would facilitate dynamical adjustment of illumination and provide a record of the consumption. This would dramatically result in lower operating costs and would aid in low downtime of failed lighting systems as the defective locations can be identified.

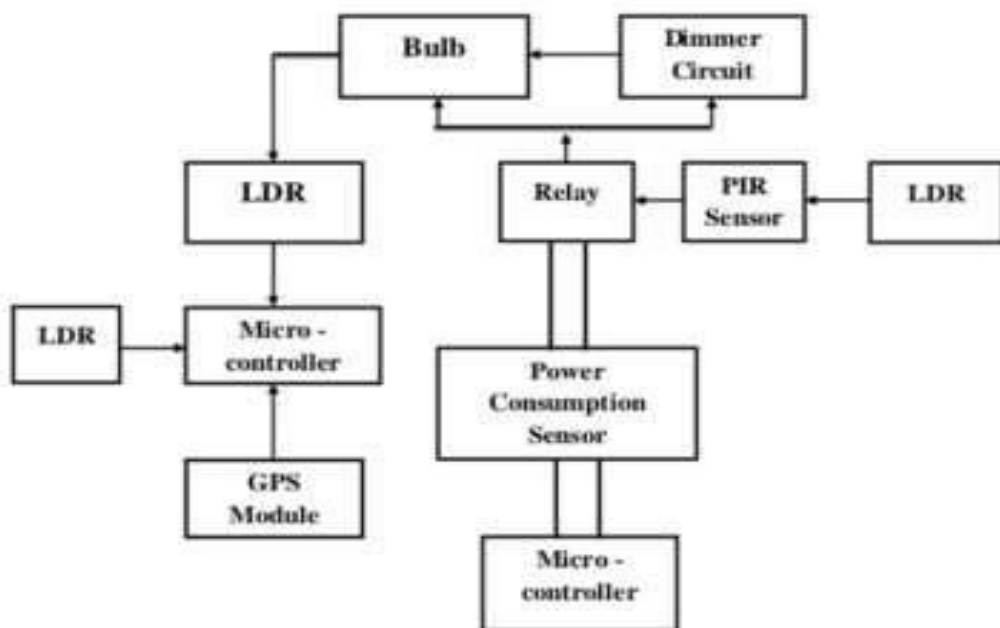
Objective:

Energy Efficiency: Reduce energy consumption by automatically adjusting the lighting based on occupancy and natural light availability.

Reduce Maintenance: Reduce maintenance cost by using long- lasting LED bulbs and automation of lighting control.

Cost Savings: Help users save on electricity bills by minimizing necessary lighting usage.

Block Diagram



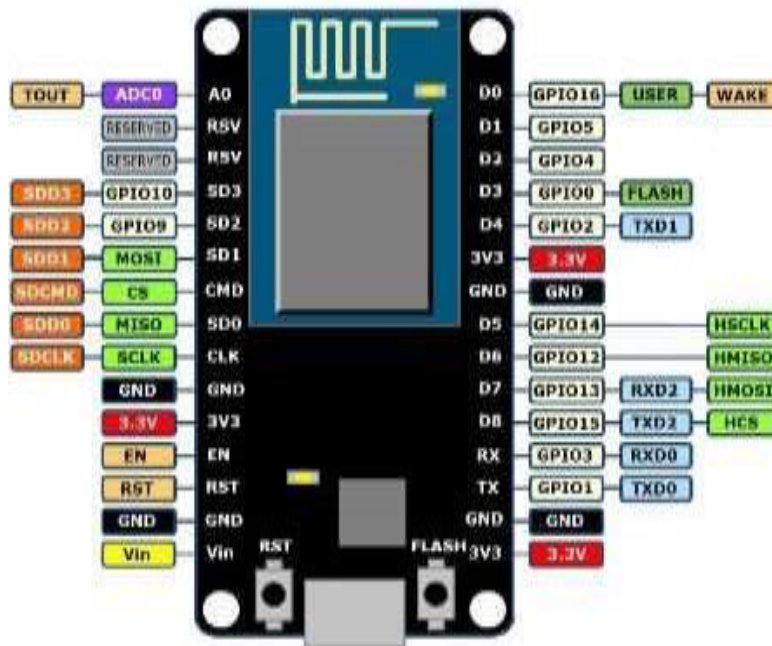
Proposed Methodology of solving Identified Problem

The main purpose of this project is to save energy, manpower time and save the data for statistics. For controlling it remotely we will use IOT (internet of things). The idea of project is we will use one controller for every 10 lights, that will control and monitor the operation of each bulb. We will use separate motion sensor and LDR for each bulb.

1. System components

a) Microcontroller

Node MCU is an open-source firmware and development kit designed for Internet of Things (IoT) applications. It is built around the ESP8266 Wi-Fi module, which allows it to connect to the internet and interact with other devices. Node MCU provides an easy-to-use platform for developers to prototype IoT projects, as it offers a Lua-based scripting language and a variety of GPIO pins for connecting sensors and actuators. With its compact size and affordable cost, Node MCU has gained popularity for its versatility in creating smart and connected devices. Whether you're a hobbyist or a professional, Node MCU is a valuable tool for building IoT solutions. We will use multiple Node MCU boards.



b) PIR sensor

A Passive Infrared (PIR) sensor is a widely used electronic device that detects motion by measuring changes in infrared radiation in its field of view. It's often employed in security systems, lighting controls, and home automation. PIR sensors are "passive" because they don't emit any energy themselves but instead detect variations in the heat emitted by objects in their surroundings. When motion is detected, they trigger an electrical signal, making them valuable components in applications where motion detection is crucial.



c) LDR sensor

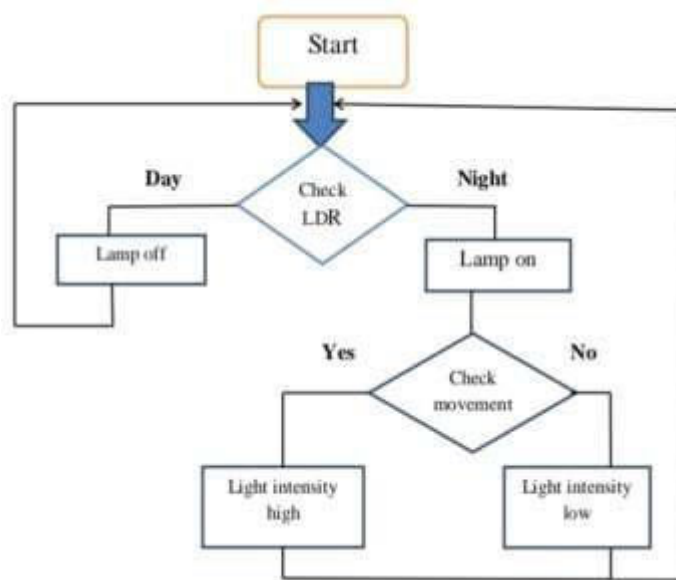
A Passive Infrared (PIR) sensor is a type of motion sensor that detects changes in infrared radiation in its environment. These sensors are widely used in various applications, including security systems, lighting controls, and automation. PIR sensors work by sensing the heat emitted by objects within their field of view. PIR sensors are passive because they do not emit any energy themselves but rely on detecting thermal radiation emitted by other objects to function.



d) Light dimming circuit

A light dimmer circuit is an electronic device designed to control the brightness or intensity of lighting fixtures, typically incandescent, halogen, or dimmable LED bulbs. It allows users to adjust the level of illumination according to their preferences. The basic principle behind a light dimmer circuit involves regulating the amount of electrical voltage supplied to the light source

Design and development



2. Benefits:

- power saving
- less manpower required
- time saving
- easy to find fault

Advantages

- Energy savings
- Increased convenience
- Cost-effective

Disadvantages

- Initial setup may require technical expertise
- Dependency on internet connectivity
- Dependency on internet connectivity



III. CONCLUSION

Our automatic light control system, powered by IoT technology, offers an efficient and intelligent solution for optimizing energy usage and enhancing convenience. By integrating Node MCU, LDR, PIR sensor, and power consumption sensor, we have created a system that not only saves energy but also improves the overall user experience.

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Proposed:

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