International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 10 | October - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Automatic Public Lighting

Prem.S.Revankar, Arnavi.S.Malandkar, Aryan.A.Dhanagar , Aditya.R.Kalagi, Shubhangi .T. Patil

[1]*Computer Science& Engineering & Sanjay Ghodawat Institutes*
[2]*Computer Science& Engineering & Sanjay Ghodawat Institutes*
[3]*Computer Science& Engineering & Sanjay Ghodawat Institutes*
[4]*Computer Science& Engineering & Sanjay Ghodawat Institutes*
[5]*Lecturer at Sanjay Ghodawat institutes.*

Abstract - This document shows the required format and appearance of a manuscript prepared for SPIE e-journals. The abstract should consist of a single paragraph containing no more than 200 words. It should be a summary of the paper and not an introduction. Because the abstract may be used in abstracting and indexing databases, it should be self-contained (i.e., no numerical references) and substantive in nature, presenting concisely the objectives, methodology used, results obtained, and their significance. A list of up to six keywords should immediately follow, with the keywords separated by commas and ending with a period.

Key Words: Comprehensive Solution Automatic Street Lighting,CitiesSensors,Microcontrollers,Supplementary Supplies, Optimize Energy Consumption ,Enhance Safety

1.INTRODUCTION

Metropolitan communities all around the world are constantly looking for creative ways
to build infrastructure that is more sustainable and energy-efficient. A key element of
this metropolitan environment is street lighting. In the era of smart cities, the traditional
systems, which rely on predetermined schedules or manual control, are obsolete and ineffective.
In order to address these problems, the "Automatic Public lighting System"
project will provide a flexible and effective solution. This system autonomously adapts
to the environment by integrating cutting-edge technology like sensors, microcontrollers,
and renewable energy sources, leading to enhanced energy conservation and safety.

• Examining the potential use of Automatic Public lighting in smart cities.
• Addressing the shortcomings of the current street lighting infrastructure
• While previous work in smart city technologies, renewable energy integration, and
sensor-based systems provides the groundwork for this project's growth, ineffective street lighting increases energy consumption and carbon emissions.
• Implementing Automatic Public lighting system will help cities use less energy, be
safer, and spend less money running it. This aims to give a workable solution for
smart cities by integrating sensor technologies, microcontrollers, renewable energy
sources, and remote monitoring for adaptive lighting that adjusts based on ambient light, the presence of vehicles, and weather conditions.
• Success criteria is determined by factors including energy savings, adaptive lighting,
cost savings, remote monitoring, integration of renewable energy sources, environmental
impact, and improved safety.

2. Body of Paper

CHAPTER 1 Review of Literature

1.1 Study of Existing System
By studying and taking overview of above existing system, there are some features listed
above but, there are drawbacks in their system such as: 1. This manual control leads to inefficiencies as lights often remained on during day time, wasting electricity. 2. The electrical energy is somehow wasted when there is no one on the road, but street lights glow on full brightness.
SOLUTIONS: 1. Automatic Street Lighting: The main goal is to ensure that street lights are active only when they are needed, conserving energy and reducing costs. These systems use technology to control when the street lights are on and off. These systems rely on sensors and timers.
2. Types of sensors: Several types of sensors are commonly used in automatic street lights.
a. Light sensors: These sensors are used to detect light levels and turn on the street lights
when it gets dark and automatically turning them off when its daylight again.
b. Motion sensors: motion sensors are used for detecting the movement within a specific
range. When no motion is detected, the light will turn to dim up to 30 percent, fully
brighten when motion is detected.

c. Timer-based systems: Systems use timers to schedule that when the lights should on or This approach for predictable lighting need areas such as busy cities.
3. LED lightning: LED lights are used because it is energy efficient. LED technology
consumes less energy and don't have longer lifespan.
4. Adaptive lightning: system can adjust the brightness of street lights based on traffic
conditions, whether conditions, etc.
5. Benefits: • Energy efficiency: By only illuminating street lights when they are necessary.
Helps in energy consumptions, leading to cost savings and environmental benefits.
• Enhanced safety: Well-lit streets can improve safety for drivers, reducing the accidents.
• Reducing maintenance: As the technology is handling the control, maintenance costs
are reduced.
1.2 Findings from Literature Review
Traditional street lighting: Street lights have been an integral part of infrastructure from decades. They are installed in cities, villages, towns for visibility, safety, etc. Street lights were controlled manually requiring human intervention to switch them on and off.

CHAPTER 2 PROPOSED SYSTEM& PROBLEM DEFINATION

2.1 Problem Statement
Systems for traditional street lighting are ineffective and lead to excessive energy use. They rely on predetermined schedules or manual control, which frequently results in excessive energy use during daylight hours and subpar illumination levels during bad
weather or busy periods. In addition to increasing energy costs, this compromises street safety.

2.2 Project Scope
• Deployment in Urban Environments: The system is designed specifically for
urban towns and smart cities where energy efficiency, sustainability, and safety are
top priorities.
• Energy Efficiency: By using real-time monitoring and adaptive controls, the project
will significantly lower the amount of energy used for street lighting.
• Adaptive Lighting: The technology automatically adjusts the lighting conditions based on variables including ambient light and vehicle presence in order to increase
visibility and safety on the roads.
• Remote Monitoring and Maintenance:By utilizing wifi connectivity, maintenance
delays can be minimized through remote monitoring and quick defect detection.
• Integration of Renewable Energy: In order to increase sustainability, the project
incorporates solar panels as a source of renewable energy.
• Reduced Operational Costs: The project seeks to lower the operating expenses of
cities through the use of energy-efficient and adaptive lighting.
• Environmental Impact: The project will assist towns in lowering their carbon
footprint and environmental effect by reducing energy consumption and encouraging
the usage of renewable energy.
2.3 Key High-Level Goals and Problems
• Goals: The introduction of an intelligent street lighting system is the main goal of this project. This technology seeks to reduce operational costs, improve safety, and significantly reduce energy usage in urban settings. The initiative hopes to aid in the creation of smarter, more sustainable cities by achieving these objectives.
• Problems: Current street lighting systems' inefficiencies lead to excessive energy use, raising operating costs and leaving cities with a bigger carbon imprint. These concerns highlight the need for a more adaptable and energy-saving approach to adequately handle these issues.

CHAPTER 3 OBJECTIVES

Objective of Proposed System
1. Fundamental Objective: An energy-saving programmed road lighting framework in view of the Web of Things. Progressively changing light power, the framework switches on at night and switches off ordinarily at day break, limiting light during evening time low traffic hours.
2. Energy Efficiency: The main goal is to minimize the energy consumed by the street lights by implementing a self-dependent system which works automatically by adjusting the brightness level of lights on real time conditions.
3. Automated Mechanism:Automated Infrastructure which has capabalities like movement detections and weather sensing for adjusting the intensity of the light.
4. Cost Cutting:By the competent use of streetlamps, the module tries to intensively decrease the power spent on lighting the street lights which directly results in saving the amount spent on them. This techniques can save upto 47- 68 percent of amount spent on streetlamps.
5. Communication with Arduino Board:Signals from the sensors are transmitted to an microcontroller, facilitating efficient control and management of the street lighting system.

CHAPTER 4 METHADOLOGY

4. Methodology

• Several key components and technologies are utilized to design and implement the IoT-based Automatic Street Light Automation System. Each component played a crucial role in enhancing the efficiency, responsiveness, and functionality of the system.

• Arduino microcontroller: Arduino microcontrollers are based on 8-bit Atmel AVR or 32-bit ARM-based architectures. They feature varying clock speeds (typically 8-16 MHz), flash memory for program storage (ranging from 16 KB to 256 KB), SRAM for variable storage (1 KB to 8 KB), and EEPROM for data retention. Arduino boards offer digital and analog pins, supporting communication protocols like UART, I2C, and SPI. Operating voltages vary (5V or 3.3V), accommodating diverse projects.

• Light Intensity Sensor (LDR):Light dependent resistor are also called as Photo resistor, the LDRs are used to detect the sun light and change the working state on basis of light present in enviornment.,this LDR or Photo resistor are commonly used in electronic components where it is necessary to sense the light level. • Passive Infrared Sensor: A PIR sensor works with the reference of infrared radiation which is created by it in its range. It catches the motion when the infrared radiation gets interrupted. PIR sensors are mostly used in home automation or similar systems. These sensors help in improving automation and reduce human efforts.

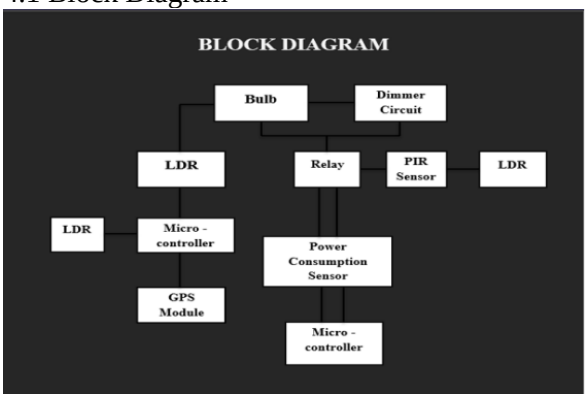
• WIFI: Wi-Fi technology enables wireless communication between devices using radio waves, which allows them to connect to the internet and local networks eliminating the need for physical cables.

• ACS712: The ACS712 current sensor is capable of measuring both AC and DC currents. It is a hall effect based current sensor module. It follows the working principle that a magnetic field induces a voltage proportional to the current flowing through a conductor. This sensor provides a linear voltage output corresponding to the measured current. It is widely used in electronics and industrial applications for monitoring current consumption, overcurrent protection, and power management.

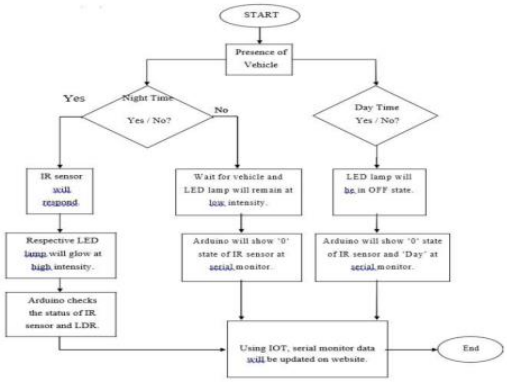
• Fault Detection: It is used to detect any fault in the street lighting pole, which works with help of current sensor.

• Relay Module: Relay is a electromagnetic switch, which works at l2v and minimum I amps current. It acts as an junction between low-voltage microcontrollers or digital circuits and high-voltage or high-current devices, allowing them to be controlled safely.

4.1 Block Diagram



4.2 Flowchart



CHAPTER 5 REQUIREMENTS

5 Requirements

Software Requirement

• Frontend

1. Web Browser
2. HTML5
3. CSS 3
4. JavaScript

• Backend

1. Node.js
2. Mongo Db-Database

•Hardware Requirement

1.Arduino Uno Board.
2.PIR Motion Sensors.
3.ACS712 Current Sensor Module.
4.Rain Sensor Module.
5.Relay Modules.
6.Lights.

CHAPTER 6 APPLICATION

1. Energy Efficiency: Motion detectors and ambient light sensors, among other sensors, are used by automatic public lighting systems to regulate the amount and timing of illumination. As a result, less energy is used and running expenses are reduced.

2. Sustainability: The system contributes to environmental sustainability by lowering greenhouse gas emissions and energy waste through decreased energy use.

3. Progressed Safety: The system can adjust lighting settings in response to changing environmental conditions, ensuring that areas are well-lit when necessary. This improves safety for both vehicles and bikers.
4. Reduced Light Pollution: By directing light just where it is required, automatic public lighting may be suggested to reduce light pollution and its effects on the surrounding homes and night sky.
5. Cost Savings:Municipalities may see cost savings as a result of reduced energy consumption, decreased maintenance expenses from proactive monitoring, and longer LED light lifespans.
6. Maintenance Predicting: By using predictive maintenance algorithms, maintenance costs may be further decreased and dependability can be increased by anticipating when parts (such as bulbs and sensors) need to be changed.

CHAPTER 7 ADVANTAGES& DISADVANTAGES

•Advantages

1.Energy Efficiency: These systems can adjust the intensity of lighting based on real-time conditions which reducing energy usage and it can save electricity costs.
2.Cost Savings: By reducing electricity usage and maintenance costs. Municipalities and other organizations can save a lot of money by implementing this systems.
3.Enhanced Safety: These systems can improve safety by ensuring well-lit areas,reducing accidents and deterring crime.
4.Reduced Light Pollution: These system has a feature of light dimming when they're not needed helps reduce light pollution, making it easier to see stars and improving quality of life for residents.
5.Environmental Benefits: These systems have lower energy consumption which can reduce light pollution,contribute to a smaller carbon footprint and a greener environment.

•Disadvantages

1.Initial Cost: Installing these systems can be expensive due to the cost of sensors, controllers,and LEDs.
2.Maintenance Complexity: While these systems reduce maintenance needs through proactive monitoring, they require regular maintenance to ensure proper operation.
3.Technology Dependence: Reliance on technology for lighting can pose challenges in the event of system failures or cybersecurity breaches

8. CONCLUSIONS

The IoT-based Automatic Street Light System utilizes Embedded System technology which represents a significant stride in urban infrastructure innovation. This project showcases the intelligent integration of Arduino Microcontroller, enabling smart street light auto-switching and efficient energy usage. By incorporating sensors like LDR for light intensity detection and Motion Sensors for vehicle movement, the system ensures seamless and responsive street light control based on environmental conditions, specifically dark or nighttime periods. The project's adaptability is a notable feature, as it allows for further enhancements in the future. By expanding the system with more street lights equipped with Motion sensors, the coverage area can be extended, ensuring consistent and energy-efficient lighting across urban landscapes. Additionally, the integration of Wifi technology provides an avenue for timely data exchange, facilitating remote monitoring and control of the street lighting system. This holistic approach not only optimizes energy consumption but also enhances safety and urban living experiences, contributing to the development of smarter, more connected cities.

ACKNOWLEDGEMENT

We would like to express our gratitude and appreciation to all those who gave me
the possibility to complete this report. I would like to express my profound gratitude
to Mr.S.V.Chavan, Head of Department, Computer Science and Engineering, and
Dr.V.V.Giri (Principal, SGI) for their contributions to the completion of my project titled Automatic Public Lighting.
We would like to express our special thanks to our Project Guide Mrs S.T.Patil for her
time and efforts she provided throughout the year. Your useful advice and suggestions
were really helpful to me during the project's completion. In this aspect, I am eternally
grateful to you. we would like to acknowledge that this project was completed entirely by us and not by someone else.

Prem.S.Revankar
Arnavi.S.Malandkar
Aryan.A.Dhanagar
Aditya.R.Kalagi

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