VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi – 590014.

Internship Project Report

On

"Smart Intelligent Street Light System"

Submitted in partial fulfillment of the requirement for the award of 7th SEM

of

BACHELOR OF ENGINEERING

In

INFORMATION SCIENCE & ENGINEERING

&

COMPUTER SCIENCE & ENGINEERING

By

PRATHAP M	**(1AP21IS026)**
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YASHWANTH GOWDA H K	**(1AP22CS054)**

2023 - 2024

DEPARTMENT OF

INFORMATION SCIENCE AND ENGINEERING

&

COMPUTER SCIENCE AND ENGENERRING

A P S COLLEGE OF ENGINEERING

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Project Completion Certificate

I,

PRATHAP M (Roll No: 1AP21IS026), hereby declare that the material presented in the Project Report titled **"Smart Intelligent Street Light System"** represents original work carried out by me in the **Department of ISE** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

With My signature, I certify that:

- I have not manipulated any of the data or results.
- I have not committed any plagiarism of intellectual property and have clearly indicated and referenced the contributions of others.
- I have explicitly acknowledged all collaborative research and discussions.
- I understand that any false claim will result in severe disciplinary action.
- I understand that the work may be screened for any form of academic misconduct.

Date: **Student Signature**:

In my capacity as the supervisor of the above-mentioned work, I certify that the work presented in this report was carried out under my supervision and is worthy of consideration for the requirements of the B.Tech. Internship Work.

Advisor's Name: **Guide Name:**

Project Completion Certificate

I,

RAJUNAIK S N (Roll No: 1AP21CS038), hereby declare that the material presented in the Project Report titled **"Smart Intelligent Street Light System"** represents original work carried out by me in the **Department of CSE** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

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Advisor's Name: **Guide Name:**

Project Completion Certificate

I,

YASHWANTH GOWDA H K (Roll No: 1AP21CS054), hereby declare that the material presented in the Project Report titled **"Smart Intelligent Street Light System"** represents original work carried out by me in the **Department of CSE** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

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Date: **Student Signature**:

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Advisor's Name: **Guide Name:**

Project Completion Certificate

I,

Evaluation Sheet

Title of the Project: Smart Intelligent Street Light System

Name of the Students:

PRATHAP M

YASHWANTH GOWDA H K

RAJUNAIK S N

External Supervisor:

_____

Internal Supervisor:

_____

_____

Date:

Place:

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ABSTRACT

The **Smart Intelligent Street Light System** represents a transformative approach to urban lighting, aiming to enhance energy efficiency, sustainability, and public safety. Leveraging advanced IoT technologies, the system automates streetlight operation based on real-time environmental and traffic conditions. By integrating sensors such as motion detectors, light intensity monitors, and data communication modules, the system ensures that streetlights operate only when necessary, thereby significantly reducing energy consumption.

This innovative system addresses the inefficiencies of traditional street lighting, which often remains active regardless of traffic density or pedestrian activity, leading to resource wastage. The smart streetlights can dim or brighten automatically depending on ambient conditions, ensuring optimal illumination while conserving energy. Additionally, the system includes realtime monitoring capabilities to detect faults or malfunctions and immediately notify maintenance teams, improving operational reliability and reducing downtime.

The **Smart Intelligent Street Light System** also promotes safer urban environments by providing adaptive lighting in high-risk areas or during peak traffic hours. The integration of cloud-based analytics allows for data-driven decision-making, enabling city planners to optimize lighting patterns and energy usage over time. Furthermore, the system is designed to be scalable and compatible with future enhancements, such as solar power integration and AIbased predictive maintenance.

This comprehensive solution not only reduces the environmental impact of urban lighting but also aligns with the broader vision of sustainable smart cities, making it an essential innovation for modern urban infrastructure.

INTRODUCTION

The Smart Intelligent Street Light System optimizes urban lighting using IoT and AI technologies, adjusting streetlight operation based on real-time conditions like traffic and ambient light. This system reduces energy consumption, enhances public safety, and minimizes maintenance costs. By providing adaptive, automated lighting and remote management capabilities, it supports sustainable urban development and smart city initiatives.

Objective

The objective of the **Smart Intelligent Street Light System** is to create an energy-efficient, automated lighting solution that optimizes urban illumination based on real-time conditions. By integrating IoT technologies, the system aims to reduce energy consumption, enhance public safety, and streamline maintenance operations. This innovative approach aligns with smart city initiatives, promoting sustainability and operational efficiency in modern urban infrastructure.

Problem Statement

Traditional street lighting systems are resource-intensive and environmentally unsustainable.

Key issues include:

- **Energy Wastage:** Continuous illumination during low traffic periods leads to unnecessary energy consumption.
- **Manual Control:** Requires human intervention, making maintenance slow and inefficient.
- **Safety Concerns:** Poor illumination during critical times can result in accidents or criminal activities.
- **High Costs:** Conventional lighting systems often incur higher costs due to inefficiencies in energy and maintenance.

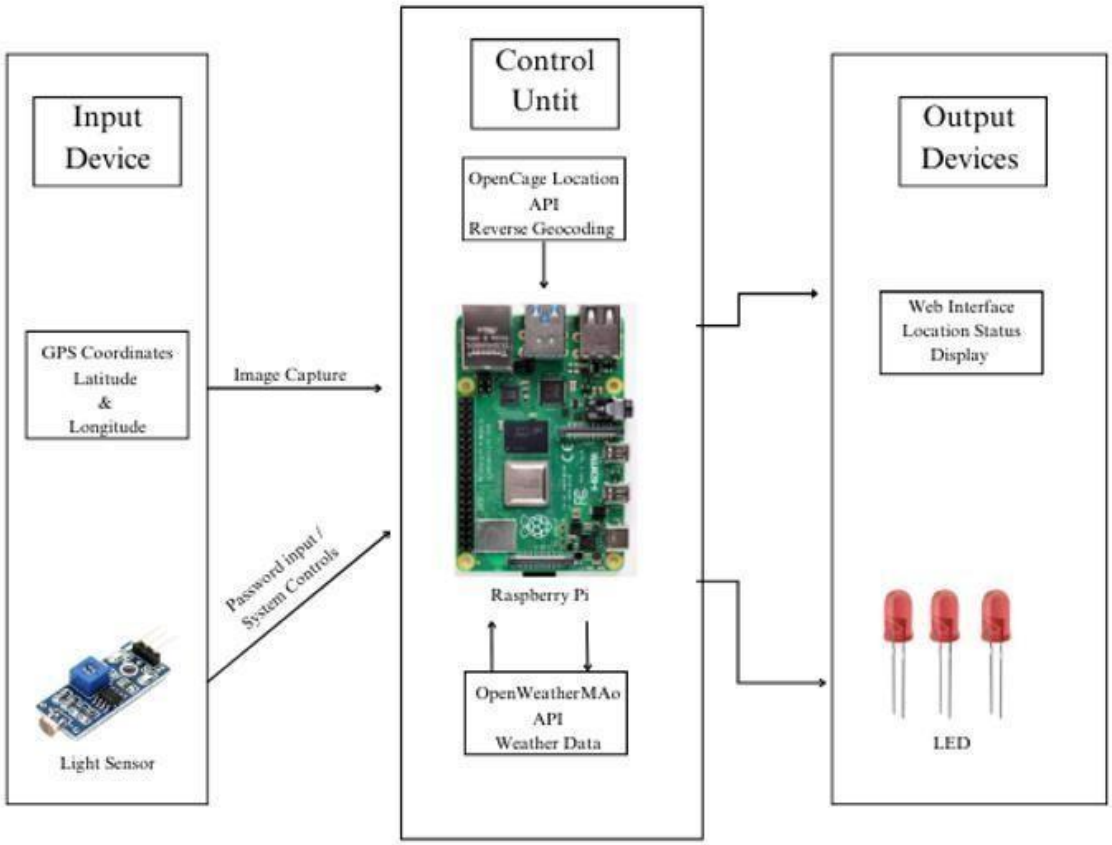
APPLICATIONS

1. **Dynamic Illumination:**
   Automatically adjust brightness levels based on real-time traffic and pedestrian activity, ensuring optimal lighting and energy savings.
2. **Energy Efficiency:**
   Reduces electricity consumption by dimming or switching off lights during lowtraffic periods, significantly lowering energy costs and environmental impact. 3. **Enhanced Safety:**
   Provides adaptive lighting in high-risk areas and during critical hours, reducing the likelihood of accidents and crimes.
4. **Real-Time Fault Detection:**
   Monitors streetlight functionality and sends instant alerts for maintenance, ensuring quick resolution of issues and minimizing downtime.
5. **Integration with Smart City Infrastructure:**
   Connects seamlessly with other IoT systems, such as surveillance cameras and environmental sensors, to create a unified and efficient urban ecosystem.
6. **Traffic Flow Optimization:**
   Uses motion and density data to aid traffic management systems, improving road safety and reducing congestion. 7. **Remote Monitoring and Control:**
   Allows centralized oversight of streetlights through web or mobile platforms, enabling efficient operation and resource management.
8. **Environmental Sustainability:**
   Supports renewable energy sources like solar panels and minimizes energy wastage, aligning with green initiatives for urban development.

COMPONENTS

1. **Hardware:**
   - **Raspberry Pi: Central control unit.**
   - **Light Sensor: Detects ambient light intensity.**
   - **LEDs: Represent streetlights.**
   - **GPIO Pins: Control and monitor LEDs and sensors.**
   - **Power Supply: Provides energy to the Raspberry Pi and LEDs.**
2. **Software:**
   - **Flask Framework: For the backend application.**
   - **OpenWeatherMap API: Fetches real-time weather data.**
   - **OpenCage API: Converts GPS coordinates to city names.**
   - **HTML/CSS (Tailwind CSS): Creates a responsive web dashboard.**
3. **APIs and Libraries:**
   - **Requests: For API calls.**
   - **RPi.GPIO: For hardware control.**

FLOWCHART



This block diagram represents a Smart Street Light Monitoring System, which operates by processing inputs, managing control decisions, and generating outputs. The input devices include a GPS module for capturing geographic coordinates (latitude and longitude), a light sensor to detect ambient light levels, and a password or system control input for manual configuration or authentication. These inputs are sent to the control unit, which is centered around a Raspberry Pi. The Raspberry Pi uses the OpenCage Location API to perform reverse geocoding, converting GPS coordinates into readable addresses, and the OpenWeatherMap API to fetch weather data for the location. Based on the data received from the inputs, the control unit processes the information and makes decisions, such as turning LEDs on or off depending on the light and weather conditions.

The output devices include LEDs, which visually indicate system responses, and a web interface that displays the system's status, location, and other monitoring information in a userfriendly format. The system is designed to ensure efficient streetlight operation by dynamically adapting to real-time environmental and weather conditions.

CONCLUSION

The Smart Street Light Monitoring System demonstrates the potential for IoT to improve energy efficiency and environmental sustainability. The integration of real-time data and automated decision-making ensures optimal streetlight operation, minimizing energy waste while maintaining safety.

FUTURE WORK

The **Smart Intelligent Street Light System** has significant potential for further enhancements and broader applications. Several areas of future development can elevate its functionality, scalability, and impact:

1. **Integration with Voice Assistants:** Enable voice commands through popular platforms like Amazon Alexa, Google Assistant, or Apple Siri, allowing for intuitive and handsfree control of streetlight settings.

2. **Advanced Security Features:** Incorporate additional safety mechanisms such as facial recognition and motion-triggered surveillance cameras to enhance security. These features can help identify unauthorized activities or potential threats, triggering alerts for faster responses.

3. **Renewable Energy Integration:** Equip streetlights with solar panels to leverage renewable energy sources, ensuring cost-effective and environmentally sustainable operations. Excess energy generated can be stored in batteries for nighttime usage or shared with nearby systems.

4. **AI-Based Predictive Maintenance:** Implement machine learning algorithms to predict component failures, optimize repair schedules, and reduce downtime. This proactive approach would extend the lifespan of hardware and minimize maintenance costs.

5. **Traffic and Environmental Analytics:** Collect and analyze real-time data on traffic patterns, air quality, and noise levels. This information can support city planning, optimize resource allocation, and improve urban living conditions.

6. **Smart Scheduling and Customization:** Introduce scheduling features to automatically adjust lighting based on user-defined preferences, special events, or seasonal changes. This could include dimming during off-peak hours or providing extra illumination during festivals and public gatherings.

7. **Mobile Application Development:** Develop a dedicated mobile app for users, city planners, and maintenance teams. The app can offer real-time system status updates, fault notifications, energy usage statistics, and remote control options.

8. **Cloud-Based Management and Analytics:** Leverage cloud technology for storing sensor data, generating insights, and providing remote access to administrators. This enables centralized control, automatic updates, and data sharing across city infrastructure systems.

APPENDIX

PSEUDO CODE