EE2043 - Electrical Measurements and Instrumentation

Project Proposal

Intelligent street lighting system (ISLS)

210334N	LAKSHAN S.H.K.
210337C	LAKSHITHA G.N.K.
210338F	LANKANAYAKE L.M.I.A.

Introduction

The Intelligent Street Lighting System (ISLS) is a revolutionary project that optimizes energy use and ensures traffic safety by combining advanced technologies like fog detection systems, radar sensors, and light-dependent resistors (LDRs). The system monitors traffic parameters and the environment in real time, enabling adaptive regulation of street lighting intensity. Its benefits include environmental sustainability, energy efficiency, enhanced safety, and reduced carbon emissions. The ISLS's primary objectives include energy efficiency, enhanced safety, and environmental sustainability, thereby enhancing the overall quality of life on the streets.

Background and Context

Street lighting is a fundamental aspect of urban infrastructure, essential for ensuring public safety, enhancing security, and facilitating nighttime activities. However, traditional street lighting systems often face significant challenges related to energy inefficiency, maintenance issues, and lack of adaptability to changing conditions. These challenges present an opportunity for the development and implementation of intelligent street lighting systems (ISLS) that can address these issues effectively.

Objectives

•**Energy Efficiency**: To reduce energy waste during the day and night, LDRs are used to monitor ambient light levels and modify streetlight intensity accordingly.

•**Enhanced Safety**: The system optimizes illumination levels for better visibility and road safety by using radar sensors to detect approaching cars and pedestrians.

•**Environmental Sustainability**: Creating a greener urban environment by reducing the carbon footprint and mitigating light pollution through the integration of energy-saving methods into street lighting operations.

• Adaptive control algorithms enable ISLS to adjust quickly to environmental factors for optimal illumination in various weather.

Project Scope

In this project, our primary focus is on automating the activation and deactivation of streetlamps based on ambient darkness levels and adjusting the light intensity according to vehicle movement. Additionally, we emphasize monitoring vehicle speed. The system is designed to integrate with road safety enhancement functions, effectively reducing the occurrence of higher-speed vehicles and providing warnings to drivers.

Project Boundaries:

- **Location:** The project focuses on urban areas, specifically targeting streets.
- **Automation Features:** The system automates the activation and brightness adjustment of streetlamps based on ambient darkness levels and vehicle movement.
- **Single-Lane Roads**: The system is currently designed for single-lane roads and may not be suitable for complex road geometries, intersections, or multi-lane roads.
- **Radar-Based Speed Detection:** Radar sensors are used to detect vehicle speed and influence system functionalities such as light brightness and warning alarms.
- **Fog Detection and Visibility:** A fog detection sensor assesses road visibility based on vehicle headlight intensity. The system adapts its response and changes the streetlamp state.

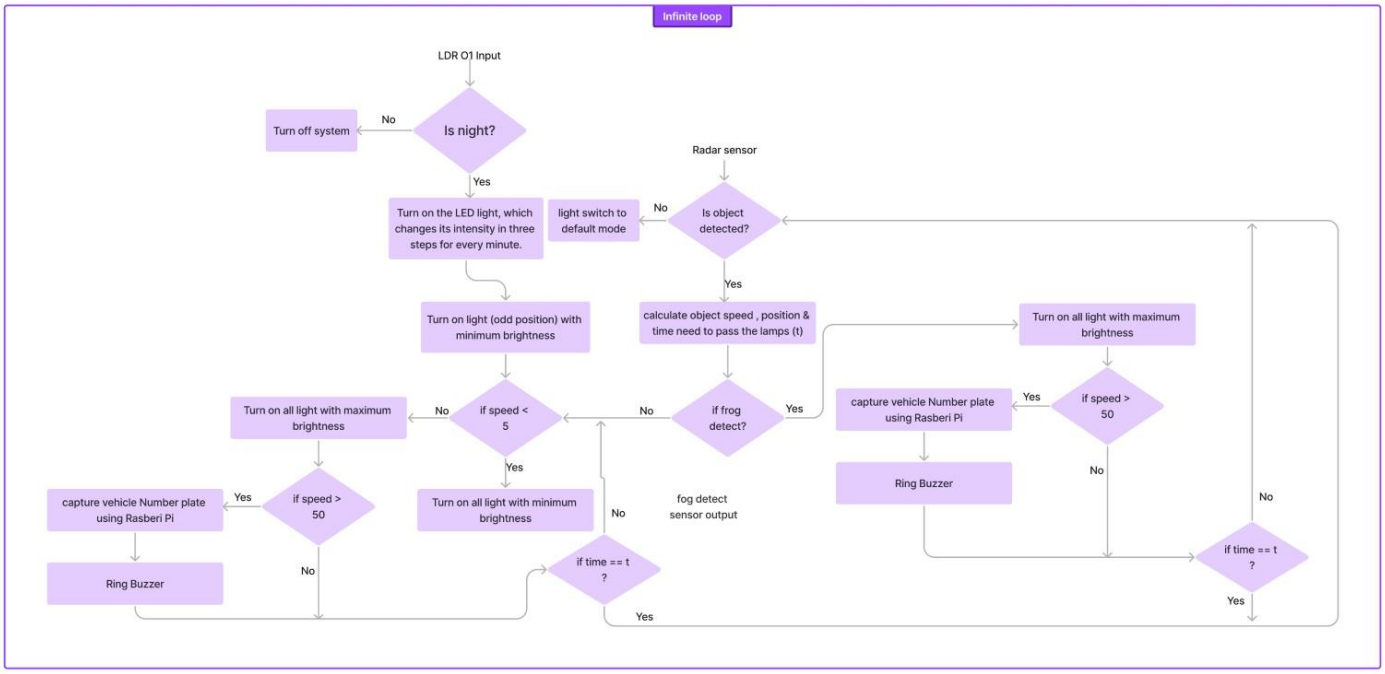
- **Energy Optimization:** The project aims to reduce energy consumption by optimizing electricity use through intelligent control of existing lighting infrastructure. Replacing lamps or other equipment is not within the scope of this project.

Methodology

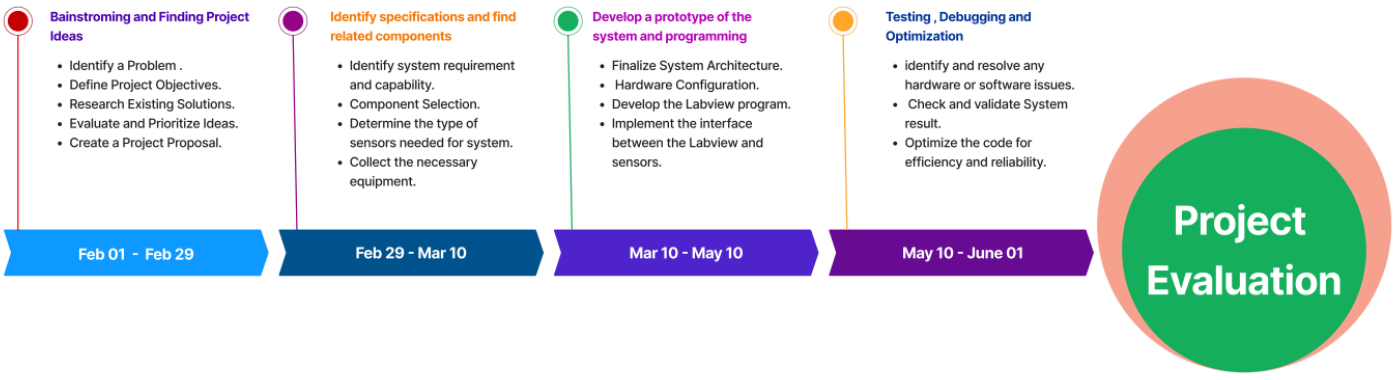
Our methodology for developing the Intelligent Street Lighting System (ISLS) follows a structured approach:

- **Requirement Analysis:** Gather stakeholder input and define system requirements.
- **Design Phase:** Develop the system architecture and specify adaptive control algorithms.
- **Implementation:** Build the ISLS prototype and integrate sensors and IoT devices.
- **Testing and Validation:** Conduct laboratory and field tests to validate performance.
- **Deployment:** Install the ISLS prototype in urban areas and monitor system behavior.
- **Evaluation:** Assess energy savings, maintenance efficiency, and user satisfaction.

The development of an efficient ISLS prototype suited for urban settings is ensured by this methodology, which follows an iterative and systematic process.



Timeline



Conclusion

The proposal outlines the development of an Intelligent Street Lighting System (ISLS) using IoT, sensors, and data analytics to optimize energy usage, reduce costs, and improve performance in urban areas. Traditional street lighting systems face challenges related to energy inefficiency and maintenance. The ISLS aims to address these challenges by implementing adaptive lighting strategies, remote monitoring, and predictive maintenance. The project is timely due to energy concerns, technological advancements, cost-saving opportunities, and urbanization trends. Developing an ISLS can contribute to creating safer, more sustainable, and livable urban environments. The ISLS is expected to bring benefits such as improved public safety, reduced energy consumption, and cost savings to urban communities.

References

1. Z. Chen, M. Li, P. Li, and S. Fan, "An Intelligent Lighting Control System for Urban Street Lamps Using Internet of Things," *Mobile Information Systems*, Aug. 31, 2022. https://doi.org/10.1155/2022/5678532
2. Sahu, Ritam and Shil, Moyuri and Datta, Rimpi and Sarcar, Piyu, Street Light Glows on Detecting the Vehicle Movement Using Arduino Uno (2019). International Journal of Electrical Engineering & Technology, 10(3), pp. 16-20, 2019 , Available at SSRN: https://ssrn.com/abstract=3553790
3. Ijraset, "Automatic Street Light on and Off Using LDR," *IJRASET*. https://www.ijraset.com/research-paper/automatic-street-light-on-and-off-using-ldr
4. R. Santos and R. Santos, "Car Plate Recognition System with Raspberry Pi and Node-RED | Random Nerd Tutorials," *Random Nerd Tutorials*, Apr. 02, 2019. https://randomnerdtutorials.com/car-plate-recognition-system-with-raspberry-pi-and-node-red/