UNIVERSITI TEKNOLOGI MARA SARAWAK

FINAL YEAR PROJECT REPORT

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SOLAR POWERED SMART STREET LIGHT

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ABSTRACT

The primary objectives of this project are centered around reducing power consumption in urban areas by implementing a solar-powered smart streetlight system. The system employs an ESP8266 as its main controller and incorporates advanced features to enhance energy efficiency. Specifically, streetlights are designed to operate at high intensity only when motion is detected, dimming in the absence of people or vehicle movements. By harnessing solar energy during the day and storing it in efficient battery systems, smart streetlights ensure nighttime operation with minimal power usage. This approach contrasts with traditional streetlight systems that consume power throughout the entire night. Moreover, the integration of a Light Dependent Resistor ensures that the smart streetlights remain inactive during daylight hours, further conserving energy. Activation occurs when the Light Dependent Resistor detects insufficient sunlight, coupled with motion detection by an Infrared Sensor. The combination of these technologies not only optimizes power utilization but also contributes to a sustainable urban future. This innovative project offers a promising solution for reducing energy consumption in public lighting systems, promoting environmental consciousness and efficient resource utilization in urban settings.

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1.1 BACKGROUND OF STUDY

An intelligent and economical alternative for urban lighting systems is a solar-powered smart street light that integrates the ESP8266 microprocessor, light-dependent resistor (LDR), and infrared (IR) sensor. The system is environmentally sustainable since it uses solar panels as its main power source, utilising renewable energy to light public areas like roadways. This sustainable strategy helps to cut carbon emissions while also lessening reliance on traditional grid electricity.

The ESP8266 microcontroller, which offers connectivity and control features, is the brains behind the smart street light. Because of its wifi capabilities, authorities can monitor and administer the device remotely. Using a centralised platform, they can detect faults, optimise energy consumption, and alter brightness levels. In order to improve overall system reliability, the microcontroller also makes it easier to include smart features like predictive maintenance and adaptive lighting that is dependent on real-time conditions.

The inclusion of a light-dependent resistor (LDR) enables the system to respond dynamically to ambient light levels. During daytime, the LDR detects natural light and triggers the system to conserve energy by dimming or turning off the street lights. As dusk falls, the LDR signals the microcontroller to activate the lights gradually, ensuring a seamless transition from natural to artificial illumination. This adaptive lighting strategy enhances energy efficiency and aligns with the principles of sustainable urban development.

Furthermore, an infrared (IR) sensor adds an intelligent layer to the street light system by detecting the presence of pedestrians, vehicles, or any potential obstructions. This capability enables the lights to brighten automatically when motion is detected, providing enhanced safety and security in dimly lit areas. The combination of the ESP8266, LDR, and IR sensor creates a smart infrastructure that not only optimizes energy usage but also prioritizes public safety, making it a valuable addition to modern urban planning.

1.2 PROBLEM STATEMENT

CHAPTER 2

LITERATURE REVIEW

1.1 INTRODUCTION

In the context of smart societies, where the landscape of urban living is rapidly evolving, traditional street lighting management has encountered new challenges. Over the past few decades, regulations governing street lights have been relatively straightforward, catering to conventional urban environments. However, with the swift rise of smart societies in contemporary cities, driven by increased affluence and urbanization, managing and regulating street lights has become a complex task. The existing control systems, often labor-intensive and inefficient, rely on manual switches installed in each street lamp, leading to significant electrical energy losses in the urban environment.[1]

Addressing this challenge, our project introduces an autonomous street light system that leverages an infrared (IR) sensor, a light-dependent resistor (LDR), and a NodeMCU. This innovative solution aims to streamline street light regulation in smart cities by eliminating the need for laborintensive manual control. The IR sensor plays a pivotal role in detecting objects through the sensing of infrared radiations reflected from them. When an object is detected, the street light turns on; conversely, it turns off when the object passes by without any detection. The LDR sensor complements this by activating the street light only in dark conditions, minimizing unnecessary energy consumption during daylight.

To enhance the efficiency and connectivity of the system, we utilize the ThingSpeak and IoT platforms, enabling real-time monitoring and control. This integration ensures that the street lights are responsive to environmental conditions and contribute to a more sustainable and intelligent urban infrastructure. By pioneering an autonomous street light solution, this project represents a crucial step towards optimizing energy usage, reducing environmental impact, and creating a smarter and more resilient urban environment for the future.