Faculty of Electrical and Electronic Engineering Technology

SMART STREET LIGHTING SYSTEM USING NODEMCU

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DEDICATION

I dedicate my dissertation study project to my parents, Puan Nor Aishah Binti Hashim and Ce Uteh bin Mohd Lani who have always supported me financially and morally and advised me to never give up. For meeting all of my demands and teaching me that even the most difficult tasks can be achieved if handled in little increments and steadily.

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Last but not least, I'd want to dedicate my thesis to a friend who has been a fantastic supporter of mine during the development of my project, motivating me with her undivided attention to finishing my work with real respect.

ABSTRACT

In the era of globalization, An IoT ecosystem is made up of web-enabled smart devices that gather, send, and act on data from their surroundings using embedded systems such as CPUs, sensors, and communication hardware. By connecting to an IoT gateway or other edge device, IoT devices may exchange sensor data that is either routed to the cloud for analysis or examined locally. These gadgets may occasionally interact with one another, and act on the information they receive. Although individuals may engage with the devices to set them up, give them instructions, or retrieve data, the gadgets conduct the majority of the work without human participation. This is because the community uses the internet daily. In this paper, the internet is used as an intermediary between the user and the streetlight. It helps society especially road users to stay safe and practice the saving of electrical energy. Dimming the lights during off-peak hours is a simple and practical solution to this problem. The lights around it will shine in the usual (bright) mode whenever presence is sensed. This would save a significant amount of energy while also lowering the cost of operating the lamps. The timer feature was used in the former streetlight system. It is upgraded to another system using a sensor. However, it is still less effective, especially for highway streetlights. They use a lot of electricity to operate, and their heat outputs are also extremely substantial. To monitor and access the system, this system employs an IoT base connected to the Microcontroller wifi. Technology implement is more detailed and safe than the previous system [1] of a streetlight. We can use IoT to check the status of street lights on the internet in real-time from anywhere and resolve any difficulties that arise throughout the process.

ABSTRAK

Di era globalisasi internet pelbagai benda (IoT), ekosistem IoT terdiri dari peranti pintar berkemampuan tinggi yang mengumpulkan, mengirim, dan bertindak berdasarkan data dari persekitarannya menggunakan sistem tertanam seperti CPU, sensor, dan perkakasan komunikasi. Dengan menyambung ke gerbang IoT atau peranti tepi lain, peranti IoT dapat menukar data sensor yang disalurkan ke Cloud utama untuk dianalisis atau diperiksa secara tempatan. Peranti ini mampu saling berinteraksi dan bertindak berdasarkan maklumat yang mereka terima. Meskipun manusia mungkin terlibat dengan peranti untuk, memberi arahan, atau mengambil data, peranti ini mampu melakukan sebahagian besar tanpa adanya manusia. Hal ini demikian kerana setiap hari internet digunakan oleh seluruh lapisan masyarakat. Oleh itu, internet digunakan sebagai perantara antara pengguna jalan raya dan lampu jalan. Ia membantu masyarakat terutama pengguna jalan raya untuk tetap selamat dan mengamalkan penjimatan tenaga tenaga elektrik khususnya. Penyelesaian yang mudah dan berkesan untuk ini adalah dengan meredupkan seketika lampu pada waktu puncak. Setiap kali pergerakan dikesan, lampu di sekeliling akan menyala pada mod normal (terang). Hal ini sedikit sebanyak akan menjimatkan banyak tenaga dan juga mengurangkan kos operasi lampu jalan. Sistem lampu jalan sebelumnya menggunakan fungsi pemasa. Ia dinaik taraf ke sistem lain menggunakan sensor. Walau bagaimanapun, ia dilihat masih kurang berkesan terutamanya untuk lampu jalan raya. Hal ini kerana banyak tenaga elektrik untuk berfungsi dan pelepasan haba yang cukup tinggi. Sistem ini menggunakan pangkalan IoT yang disambungkan ke Wifi Microcontroller untuk memantau dan mengakses sistem. Peranti teknologi alaf baru ini lebih terperinci dan selamat berbanding sistem lampu jalan sebelumnya. Individu dapat memeriksa status lampu jalan di internet menggunakan (IoT) dari mana sahaja dalam masa nyata dan mampu menyelesaikan masalah jika berlaku semasa pemprosesan.

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LIST OF SYMBOLS

V	-	Voltage
I	-	Current
R	-	Resistance
lx	-	Lux
°	-	Degree
%	-	Per cent
δ	-	Voltage angle

LIST OF ABBREVIATIONS

V	-	Voltage

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

The main focus of this project is to wisely operate streetlights. For example, by placing this system on streetlight poles, it detects vehicle and pedestrian movement and turns the light on and off accordingly. It may also adjust the brightness of street lights in response to the detection to prevent accidents. There is a risk of thefts and crimes when lamps are turned off at night and there is no detection. Based on the previous system in Malaysia, the streetlight operates when timer at 7 pm. The lights will turn on whether there is vehicle movement or not. Then, it will turn off at 7 pm. It consumes a lot of energy to generate electricity.

Cities are being transformed into smart cities in every way thanks to modern technologies. It's necessary to find ways to manage the underlying infrastructure for physical sensing and actuation resources. The Internet of Things contains lots of such solutions, mostly at the lower (communication) layer (IoT). Street lighting is the most expensive energy expense in a city. Municipal street lighting might be cut in half with the smart street lighting system (SSLS). The smart street lighting system turns on and off the lights automatically depending on the circumstance. It detects the movement of the object within a certain range automatically.

1.2 Problem Statement

In today's world, humans and technology are inextricably linked since they are both essential to achieving any goal. This includes the amount of energy we use in our daily lives. Nowadays, we can observe that every company, particularly the electrical business, by employing new technology to construct their systems to function at a high level.

It is to minimize power usage, especially between the hours of 12:00 A.M. and 5:00 A.M. when there are no people or vehicles on the road, parking lots, gardens, motorways, playgrounds, housing societies, and private/public places are all examples of public/private places. The stars may be obscured by light pollution in urban areas, hindering astronomy and the migration of many bird species.

1.3 Project Objective

Mainly, the objective will clarify the results that need to be accomplished at the end of the project. The goal of the objectives is to preserve the project accurately and well specified. The key to this objective is recorded as below:

a) To develop the new system for street lights in Malaysia cities.

b) To conduct green technology of energy saving.

c) To develop an effective new technology using the Internet of Things (IoT).

1.4 Scope of Project

This project intends to create and implement innovative embedded technologies for energy savings in street lighting, particularly in smart cities. The Street Light Lamp is equipped with Internet of Things (IoT) sensors such as PIR, LDR sensor, Microcontroller, and WIFI module. The sensors detect motion and light and provide data to the microcontroller, which operates the lamp and communicates data to the user application over

Wi-Fi. As a result, the system is intended to be controlled remotely and to operate in AUTO mode on behalf of the users' application.

1.5 Organisation

This project focuses on improving the streetlight system by applying IoT applications to control the lamp function. There are five chapters in this report. The project's introduction, objectives, issue descriptions, and scope are all outlined in the first chapter. In the second chapter, it is significant to develop literary studies that have been applied from past sources for reference purposes. In chapter three, you will find a description of the component, a flowchart for the project, and an explanation of the technique used. All of the analyses done during the project development process are tallied in the fourth chapter, and the results are presented.

1.6 Structure of Report

This report contains three chapters that precisely explain the idea and theory of the project where it requires all action to accomplish the final product. The description of each chapter will be in a paragraph as follows.

Chapter 1 briefly defines the background and basic information about the system of streetlight itself. In addition, problem statements, objectives, and the scope of this project are also proposed in this chapter.

Chapter 2 describes a literature review that approaches the previous projects that are related to this project. In addition, this chapter contains the concept of software and hardware requirements for the system that will be developed.

Chapter 3 alerts more on the methodology of the project from starting point until the end. The methodology consists of the software and hardware development of this project.

The software development consists of the application of streetlights in the city. The hardware development consists of certain components supported by the Blynk application.

Chapter 4 aims at analysing the result of software and hardware development. The results will be in form of figures and discussion.

Chapter 5 will be the summary of this project along with the discussion and recommendation for future improvements.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The goal of the literature review in this chapter is to assess and investigate previously executed projects about the Smart Street Lighting system using the Internet of Things (IoT). Every piece of research is based on a study completed no later than 5 years after the project's implementation date, thus it may be used as a reference. In addition, the research's applicability for the project in question will be examined, assessed, and evaluated. A comparison of the hardware used is also carried out to make the selection possible of appropriate hardware that will be utilized, as well as the benefits and drawbacks of hardware and systems, to produce a more accurate hardware selection. The results and techniques of previous studies will be scrutinized and assessed to verify that they are the best and most accurate source of information for this project.

2.2 Related Work

2.2.1 NodeMCU ESP32 Microcontroller

The NodeMCU [1] ESP32 is the newest product of Ai-Thinker in the global market. Equipped with an L106 32-bit RISC microprocessor core with running speed at 160 MHz, which is faster than the ESP8266 model (80MHz). It also comes with Bluetooth 4.2 and HT40 on Wi-Fi. This is including the temperature sensor and touch sensor.

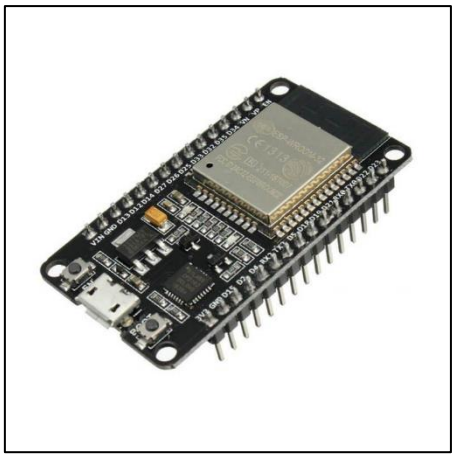

Figure 2.1 NodeMCU ESP32

2.2.2 GPIO

The general-purpose input-output device is one sort of input-output device (GPIO). GPIO [2] pins can be set to act as a general-purpose input, a general-purpose output, or one of up to six pin-dependent functionalities. The ESP32 has its own set of GPIO banks. It has RX for data reception and TX for data transmission. A 3.3V VCC supply powers all GPIO banks. The ESP32's row of GPIO pins along the top edge of the board is a standout feature. On all current ESP32 boards, there is a 36-pin GPIO header.

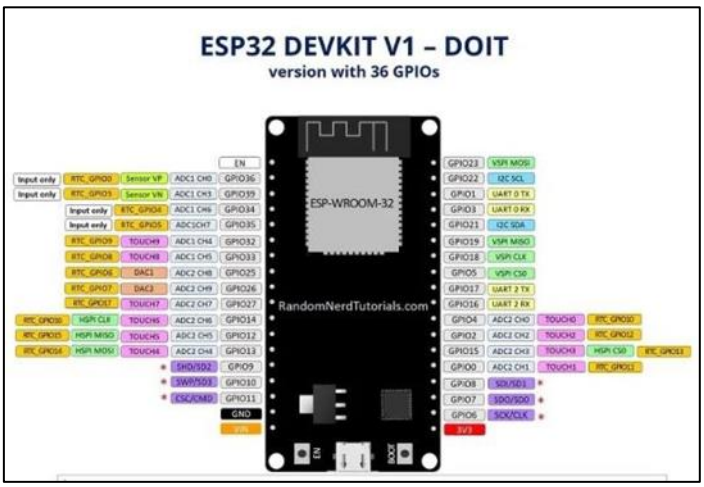

Figure 2.2 GPIO Pinout

2.2.3 Smart LED Systems Using Esp32 IoT Based Wi-Fi

Based on a proposal for a project by [3], this project aims for a Smart LED system based on ESP32 technology. The current sensor, voltage sensor, PIR sensor, and ZCD circuit are all included. This project works when the voltage and current sensors are connected to the ESP32's ADC pins, and the passive actinic radiation sensor is connected to the ESP32's GPIO pin. Power usage is detected and communicated to the cloud [3] using the current sensor, voltage sensor, and ZCD data.

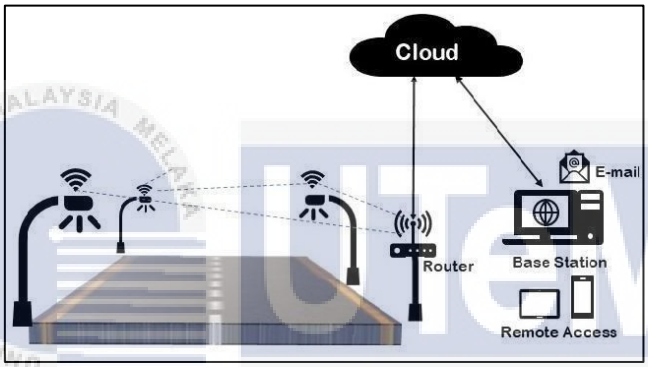

Figure 2.3 Schematic Diagram of ESP32 Streetlight Based Wi-Fi

Network assets boards are used to create smart links between existing networks and context-aware computing. are two important divisions of IoT as a state in the study by [4]. The conceptual scheme of the proposed system is presented in Figure 2.1.3. It comprises streetlights and a central base station. An adjacent structure houses the central base station. This system is simple to extend. The cloud is used to communicate between the central base station and the streetlights.