

INTELLIGENT LIGHTING SYSTEM FOR DOMESTIC ENVIRONMENT

By

SARIAH BINTI RAHIM

A Thesis Submitted in Fulfilment of Requirements for Bachelor Degree of
Electronic Engineering (Computer Engineering) with Honours.

Faculty of Electronic Engineering and Computer Engineering
Universiti Teknikal Malaysia Melaka

JUNE 2017

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : INTELLIGENT LIGHTING SYSTEM
FOR DOMESTIC ENVIRONMENT

Sesi Pengajian :

1	3	/	1	7
---	---	---	---	---

Saya SARIAH BINTI RAHIM
(HURUF BESAR)

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan () :

SULIT*

*(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

TERHAD**

** (Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD


(TANDATANGAN PENULIS)

Tarikh: 1/6/2017

Disahkan oleh:

ZARINA BINTI MOHD NOH
Pensyarah
Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
Universiti Teknikal Malaysia Melaka (UTeM)
Jalan Tuanku Razaf
76100 Durian Tunggal, Melaka

(COP DAN TANDA TANGGAL PENYELIA)

Tarikh: 1/6/2017

DECLARATION

I hereby declare that this thesis entitled “ *Intelligent Lighting System for Domestic Environment* ” is based on my original work except for quotations and citations which have been duly acknowledged. I also declared that it has not been previously or concurrently submitted for any degree at UTeM or other institutions.

Signature : 

Name : SARIAH BINTI RAHIM

Date : June 2017

I hereby declare that I have read this thesis entitled “ *Intelligent Lighting System for domestic Environment*” and based on my opinion this thesis is sufficient in terms of scope and quality to be award for Bachelor Degree of Electronic Engineering (Computer Engineering) with Honours.

Signature

:.....

Supervisor Name

: ZARINA BINTI MOHD NOH

Date

: June 2017

DEDICATION

To My Beloved

Rahim Bin Ab Ghani and Che Hasnah Binti Awang Ahmad (Dad and Mom)

My brothers, Anuar Bin Rahim and Mohammad Iylia Bin Rahim

My classmates 4 BENC and my supervisor, Zarina Binti Mohd Noh

ACKNOWLEDGEMENT

Bismillahirrahmanirrahim, I thank to Allah, The Almighty, who guide me safely through every mile and grant me wealth, give me the health and most of all give me the care and love me well and for giving me the strength to complete this project for my degree. I would like to express my gratitude and sincere appreciation to my supervisor, Zarina Binti Mohd Noh for her constructive ideas, encouragement and patience throughout the entire process of this thesis. She has successfully guided me through some difficult times and was always willing to sharpen my understandings of this thesis. My greatest gratitude and appreciation to my parents, Rahim Bin Ab Ghani and Che Hasnah Binti Awang Ahmad who have given me her prayers, encouragement guidance, time, money and unfailing support for me to go throughout this long journey. They are always be there for me when I'm facing stressful time. Finally, special thanks for my friends who also help me and sacrifice their time to teach me in completing my project.

Thank you.

ABSTRACT

Technology is the present world. It affects people's daily lives and technology today has made life easier and quicker when it solve the problem we faced. Intelligent lighting system for domestic environment is a new invention technology that can help people to live their lives better and easier. This system will function in the house which is when there is a person enter the house, the PIR sensor will detect the presence of human and the light in the house will automatically turn on. When the light is turn on, the notification will be send to the house owner by the Blynk apps through their smart phone. After there is no human detected anymore, the light will turn off by itself thus people no need to manually turn on and turn off their house's light. This project are propose to make the live of human become more convenient and avoid from waste of electricity and money. This system is also equipped with a safety and security system, so that human can avoid intruders to enter their house. Human also can control the light in their house by using the smart phone which the device function as an intermediary device between the human and system. Human can turn on or turn off the light by using this smart phone which have the Blynk apps within it. By using this automation system, the wasted of electricity and money can be reduce. This is happen when the mini PIR sensor who are function as human detector sent the input data to the ESP 8266 WEMOS which act as a microcontroller and become the brain for the system to process the data and send the data to the light as an output. This activity will turn on the light in the house. To control the light in the house, Blynk apps need to be download in the smart phone and program it with the suitable source code to make it function properly. Lastly, this system are expected to be fully function and able to solve the problem that human face in their live.

Keyword - mini PIR sensor, ESP 8266 WEMOS, Blynk apps

ABSTRAK

Teknologi adalah penting dalam dunia ini. Ia memberi kesan kepada kehidupan seharian manusia dan teknologi hari ini telah membuatkan hidup lebih mudah dan lebih cepat apabila ia dapat menyelesaikan masalah yang kita hadapi. Sistem pencahayaan pintar untuk persekitaran dalaman adalah teknologi ciptaan baru yang boleh membantu orang ramai untuk menjalani kehidupan mereka dengan lebih baik dan lebih mudah. Sistem ini akan berfungsi di dalam rumah iaitu apabila ada orang yang masuk ke rumah, sensor PIR akan mengesan kehadiran manusia tersebut dan lampu di dalam rumah secara automatik akan menyala. Apabila lampu menyala, notifikasi akan dihantar kepada pemilik rumah oleh aplikasi Blynk melalui telefon pintar mereka. Selepas sistem tidak dapat mengesan kehadiran manusia lagi, lampu akan tertutup dengan sendirinya dengan itu pengguna tidak perlu untuk menghidupkan dan mematikan cahaya rumah mereka secara manual. projek ini bertujuan untuk membuat hidup manusia menjadi lebih mudah dan mengelakkan daripada pembaziran tenaga elektrik dan wang. Sistem ini juga dilengkapi dengan sistem keselamatan, supaya pengguna system ini boleh mengelakkan penceroboh dari memasuki rumah mereka. Pengguna juga boleh mengawal lampu di dalam rumah mereka dengan menggunakan telefon pintar yang berfungsi sebagai alat perantara antara manusia dan sistem ini. Mereka boleh menghidupkan atau mematikan lampu dengan menggunakan telefon pintar yang mempunyai aplikasi Blynk di dalamnya. Dengan menggunakan sistem automasi ini, pembaziran dalam bentuk elektrik dan wang boleh dikurangkan. Ini berlaku apabila sensor PIR mini yang berfungsi sebagai pengesan manusia menghantar data input kepada ESP 8266 WEMOS yang bertindak sebagai pengawal mikro dan menjadi otak untuk sistem untuk memproses data dan menghantar data kepada lampu untuk menghasilkan cahaya sebagai output. Aktiviti ini akan menghidupkan lampu di dalam rumah. Untuk mengawal cahaya di dalam rumah, aplikasi Blynk perlu dimuat turun dalam telefon pintar dan diprogramkan dengan pengkoan yang sesuai untuk membuat ia berfungsi dengan baik. Akhir sekali, sistem ini dijangka fungsi sepenuhnya dan mampu untuk menyelesaikan masalah yang dihadapi manusia dalam hidup mereka.

TABLE OF CONTENT

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENT	viii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
	LIST OF ABBREVIATIONS	xiv
1	INTRODUCTION	
	1.1 Background of Project	1
	1.2 Problem Statement	2
	1.3 Objective of Study	3
	1.4 Scope of Study	3
	1.5 Thesis Outline	4
2	LITERATURE REVIEW	
	2.1 Smart Homes A Solution for a Smart Lighting System	6

2.2 Smart LED lighting system implementation using Human tracking US/IR sensor	8
2.3 A smart lighting system for industrial and domestic use	9
2.4 Design of Small Smart Home System Based on Arduino	10
2.5 FPGA Implementation of a Smart Home Lighting Control System	11
2.6 A Study on Lighting Uniformity for LED Smart Lighting System	12
2.7 A Spectrally Tunable Smart LED Lighting System with Closed-Loop Control	13
2.8 Mobile based Home Automation using Internet of Things	14
2.8 Developing a Smarter Control Mechanism for Park Trail Lighting	15
2.10 An Implementation of Real Time Home Automation System	16
2.11 Summary	17
3 METHODOLOGY	
3.1 Introduction	19
3.2 Design Process	20
3.3 Circuit Application for The System	22
3.4 Hardware for The System	
3.41 ESP 8266 WEMOS	23
3.42 Sensor	26
3.43 LED	27
3.5 Software for The System	
3.51 Arduino Software (IDE)	28

		x
	3.52 Blynk Apps	29
	3.6 Internet of Things (IoT)	31
	3.7 Prototype Designation	32
	3.8 System Flow	33
	3.9 Hardware Connection	34
4	RESULT AND DISCUSSION	
	4.1 Component Testing	
	4.11 Sensor Testing	36
	4.12 Wifi Detection	38
	4.2 IoT Testing	
	4.21 IoT Connection	39
	4.22 Notification	41
	4.23 Email	42
	4.24 Lighting Control	43
	4.3 Complete system	45
5	CONCLUSION AND RECOMMENDATION	
	5.1 Conclusion	61
	5.2 Recommendation	62
	REFERENCES	64

LIST OF TABLES

NO	TABLES	PAGES
3.1	Technical specs of the wemos	24
3.2	Pin function in the wemos	25

LIST OF FIGURES

NO	FIGURES	PAGES
2.1	Concept of smart home	18
3.1	Flow chart of the system	20
3.2	System block diagram	22
3.3	The component use for the system	23
3.4	Top and bottom surface of the ESP8266 WEMOS	23
3.5	Mini PIR sensor	26
3.6	Sample of LED	27
3.7	Arduino software logo	28
3.8	Blynk logo	29
3.9	Example of Blynk interface	31
3.10	Design of the prototype	32
3.11	Design of the system flow	33
3.12	Connection for the components	34
4.1	source code for sensor testing	36
4.2	Source code are successful to upload and run	37
4.3	Sensor detection	37
4.4	Source code for wifi detection	38
4.5	available wifi connection in the serial monitor	39
4.6	Connection to the Blynk application	39
4.7	System connected with the BLYNK cloud	40
4.8	Source code for notification	41
4.9	Notification appear on the screen of the smart phone	41
4.10	Email notification	42
4.11	Picture show that notification of email send by the Blynk	42

4.12	Source code for lighting control	43
4.13	The LED is controlled by the smart phone	43
4.14	LED testing in the prototype	44
4.15	Declaration of component, cloud and microcontroller use	45
4.16	Source code to o the connection with IoT	46
4.17	Source code for the sensor use	47
4.18	LED turn on in living room	48
4.19	LED turn on in kitchen	48
4.20	LED turn on in bedroom	49
4.21	Looks of the lighting system in the BLYNK application	49
4.22	Button in the apps is on for the light in the living room	50
4.23	Button in the apps is on for the light in the kitchen	51
4.24	Button in the apps is on for the light in the bedroom	51
4.25	Notify source code for email and notification	52
4.26	Notification at the screen of smart phone	53
4.27	Notification at the screen of smart phone (living room)	54
4.28	Notification at the screen of smart phone (kitchen)	54
4.29	Notification at the screen of smart phone (bedroom)	55
4.30	Email notification for living room	55
4.31	Email notification for kitchen	56
4.32	Email notification for bedroom	56
4.33	Email send to the user gmail	57
4.34	Email in the gmail interface	58
4.35	Email in the gmail interface	58
4.36	The set input and output	59
4.37	Complete prototype from front view	59
4.38	Complete prototype from above view	60

LIST OF ABBREVIATIONS

IoT	Internet of Thing
IR Sensor	Infrared Sensor
PIR Sensor	Passive Infrared Sensor
IP address	Internet Protocol address
LED	Light-Emitting Diode
US Sensor	Ultrasonic Sensor
PID	Proportional Integrative Derivative
UART	Universal Asynchronous Receiver- Transmitter
WLAN	Wireless Local Area Network
HTML5	Hypertext Markup Language
SPD	Spectral Power Distribution
LAN	Local Area Network
UDP	User Datagram Protocol
TCP	Transmission Control Protocol
FPGA	Field-Programmable Gate Array
API	Application Program Interface
UI	User Interface
WiFi	Wireless Fidelity
USB	Universal Serial Bus
BLE	Bluetooth Low Energy
iOS	iPhone Operating System

CHAPTER I

1.0 INTRODUCTION

1.1 Background of Project

Today modern technology and its development in most significant field in idea that offers ease, solve problems and provides more alternative ways to improve previous technique. Monitoring tools and technique nowadays become more highlight to citizen interested in it as now the technology offer many types of sensors, microprocessors and internet of things where cloud can integrate with device in long distances.

Hence, new technologies such as automatic lighting system become a very common known in high technologies era. It is a good technologies to invent and usually they named it as a smart lighting system or intelligent system. By using intelligent systems, this can add a great deal of configurability to the various components of a building. The lights inside a building can be turned on/off at preprogramed times or intervals and the system is able to monitor and control lights, room temperature, alarms and other household appliances. Good lighting system is when it can be applied in smart homes and being capable of automatically adapting to

user needs and conditions also when uniform lighting produce from the output will make us more comfortable.

Besides, Internet of Things (IoT) is one of the promising technologies which can be used for connecting, controlling and managing intelligent objects which are connected to Internet through an IP address. These technologies is an effective delivery of services without manual intervention in a more effective manner and it also improve quality of life by providing cost effective living including safety, security and entertainment.

Lastly, automation system is very popular nowadays because it is proven that users can enjoy comfort, save energy and make better security. It is also less expensive and better efficient system. The controllers are capable of monitoring and controlling different appliances in the home automatically in response to the signals coming from the related sensors.

1.2 Problem Statement

Nowadays, citizens daily life become more need for money because all the bill payment are increase in price including electricity, thus by using intelligent light system, this system can save the budget for the cost of electricity.

Besides, intelligent light system also offer a great problem solving which is, it can prevent from wasting electricity. As a user, sometimes wasted of the electricity when they did not turn off the lamp or forgot to do it become a habit that is very disadvantageous to them when it comes to saving the money.

Last but not least, it is hard for some user to reach the plug to turn off the light such as shorty people, dwarf or a person with less effort. Hence, this system will be more convenient to them when they want to control their lighting at home. It is only by using their smart phone to turn off and turn on the light.

1.3 Objective of Study

- 1) To design a smart home lighting system that can give convenient to users and develop a prototype that contain hardware and software for the system.
- 2) To create a connection between hardware and software to turn on and turn off the system or light through an apps in the smart phone and program it with the suitable source code to turn off the light by using human control.
- 3) To produce a complete system that can successfully operate in a house as a smart lighting system.

1.4 Scope of Study

This system is designed to be used only for home. It is easier to see the result when it apply to the home although it also can use in manufactory, office, class room and many more. This is because, home will continuously use an electricity for twenty four hour compared to the class room and office.

Besides, this project will only focus on the lighting and will not include the fan, air conditioner and others. This project is basically is a task to make or built an intelligent light. To make sure that this project complete its objective, lamp is the priority to use in this project.

Last but not least, the system also use an IoT connection to control the lighting by using smart phone. This system use Blynk application to connected with the cloud and make the user can control the lighting system by using their application in the smart phone.

1.5 Thesis Outline

This thesis consist of five chapters which include introduction, literature review, methodology, results and discussion, and conclusion and recommendation for this project.

Introduction to the project are state in the chapter 1. In this chapter, background project, problem statement, objectives, scope of projects and report structure are explain. The concept and overall overview of this project will be discussed here.

Chapter 2 is about the literature review, this literature review will give more insight on the concepts regarding to this lighting system and also a comparison of several journals by researchers of the past.

Chapter 3 is about the project methodology. The hardware and the software used for this project will be discuss in this chapter. The synchronization of all the components, the compilation of all hardware will be shown in this chapter.

Chapter 4 will discussed on the Result and discussion that this system have achieved. The expected results from this project and justification of its performance to make sure that the objectives are achieve will be shown in this chapter.

The last chapter which is conclusion and recommendation of the project will conclude everything about the project and also the achievement of the objectives. This chapter also will propose a recommendation to upgrade the project in the future.

CHAPTER II

2.0 LITERATURE REVIEW

In this chapter, the key concept that play specific roles for this project is explained in detail. In addition to that, journals explaining the concept will also be included to aid comprehension. These are the journals that are referred as an idea to complete the project.

2.1 Smart Homes A Solution for a Smart Lighting System[1]

A home is smart when it uses intelligent systems to respond to users' inputs or to situations that require actions to be taken without user intervention and there is technologies that using only a small fraction of the currently available technologies, the possibility of improving residents' safety and economics is becoming more and more accessible.

Thus, this paper describes an intelligent lighting system that tracks users' locations, turns on the light in a room just before the user enters the room and turns off the light when the user has left the room. In this paper, they focus on the Lighting

system that can track user's location and turn on and turn off the light when necessary [1].

Hence, control over electronic appliances is one of the main targets of the smart home concept, providing automation capabilities to the lighting system. By using this concept, they use the technique of Light turn on and turn off at programmed time or interval and they also connect the outdoor light with the intelligent manager system. This will resulting in ability to control the lighting system.

Besides, using controllable lights, the intelligent systems can turn on or off the light depending whether human presence is detected or not inside the room. They can also be configured to light up the destination of the person travelling from one room to another but tracking people inside a room is very difficult and the performance decreases when the number of people inside the room increases. Thus, using more than one type of sensors will give them more accuracy. A floor detection mechanism combined with an infrared detection system can do a better job for the smart home system.

Lastly, when the home have the ability to control the lighting system, it will make the house automatically assign it a security feature because turning on and off the light can give the impression that there is somebody present in the room, which will act as a deterrent for possible intruders. This smart home also provide help for the disabled and elderly people, allowing for an increase in the quality of their life by keeping the independence level to a high enough standard.

2.2 Smart LED Lighting System Implementation Using Human Tracking US/IR Sensor[2]

Recently the proportion of night has increased as national level has increased. Therefore demands of lighting are increasing and currently most suitable light source is LED. Smart LED lighting control is the convergence technology of the sensor and light. It has LED switching action based on sensing data of the sensor. General LED control uses one of (Infrared) IR or (Ultrasonic) US sensor. Operation of IR sensor is possible in low-power. But continuous human tracking is impossible. US sensor can continuously track the human.

Thus, this is the paper that proposes the solution of the continuous human tracking and the efficiency and it leads the direction of the implementation for LED smart lighting system by implementing the hardware based on proposed system. Based on this paper, it seem that they focus of the Solution of the continuous human tracking and the efficiency [2].

Hence, the paper also proposed a Smart LED lighting system based on continuous human tracking data using UltraSonic (US) sensor and Infared (IR) sensor. LED Control of On-Off is determined by the output based on human tracking data using US or IR sensor. To test the theory, they assign each sensor at different area and the firmware for MCU board control is implement using codevision AVR 2.25.3. This method resulting LED in the specific area emits the light [2].

Lastly, this study analysed the principle of human tracking using US/IR sensor and implemented the hardware based on proposed system structure as study of smart LED system. This study led the direction of a study for smart LED light and demonstrated the usefulness of proposed system through the analysis and the implementation. By implementing this application, user can save the energy use and power consumption for the lighting system.

2.3 A Smart Lighting System for Industrial and Domestic use[3]

Efficient energy use, sometimes simply called energy efficiency, is the effort to reduce the amount of energy required to provide products and services. Lighting control is an efficient way to reduce energy consumption and to prevent energy waste, and it can be effectively used in conjunction with LED systems.

Therefore, the goal of this work is to develop a smart LED lighting system for industrial and domestic use, taking into account visual comfort and energy saving of interior lighting. The idea and focus of this paper is to control the lighting level in an energy efficient way, keeping a desired light level where it is needed, while regulating it to a minimum where not required. In order to achieve this goal, a single control unit is needed for each lamp. In this way the system can individually control the desired light level, adapting the LED illumination according to the environment in which it is installed, by means of light sensors, motion sensors and a smart control system [3].

Besides, this system will integrates a low level embedded board for LED control, a trend consumption monitoring system, and a supervision unit for the monitoring and remote control of the whole lighting infrastructure. An embedded controller has been used for data acquisition and processing. It can be connected with other systems for buildings management and can detect faulty components. It can also exchange information with the supervision system using different interfaces, i.e. wired or wireless. Temperature sensors, light sensors and motion sensors have been integrated in the control board, and have been used for retrieving physical measurements.

Lastly, in this paper they use a technique of Proportional Integrative Derivative (PID) law generates the control and Universal Asynchronous Receiver- Transmitter (UART) that resulting in visual comfort and energy saving of interior lighting for the system and also in terms of energy saving, over 50% has been estimated energy save