



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DESIGN AND DEVELOPMENT OF WIRELESS SWITCHING
CONTROL (WSC) USING SMARTPHONE**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Telecommunications) with Honours.

by

AHMAD TAQIYUDDIN BIN MOHD ABDAH

B071310166

910207-01-5211

FACULTY OF ENGINEERING TECHNOLOGY
2016

DECLARATION

I hereby, declared this report entitled “Design and Development of Wireless Switching Control using Smartphone” is the results of my own research except as cited in the references.

Signature :

Author’s Name :

Date :

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

.....

(Mohd Saad Bin Hamid)

ABSTRAK

Projek ini mencadangkan reka bentuk dan pembangunan Kawalan Pensuisan Tanpa Wayar (WSC) menggunakan telefon pintar. Kawalan Pensuisan Tanpa Wayar (WSC) adalah sistem yang mengawal semua peralatan seperti lampu dan kipas. Objektif utama projek ini membantu untuk memahami teori operasi komunikasi tanpa wayar dan juga untuk mereka bentuk aplikasi telefon pintar menggunakan platform Blynk untuk berhubung dengan Kawalan Pensuisan Tanpa Wayar (WSC). Fungsi system ini bergantung kepada jarak operasi peranti. Sebagai tambahan, ia boleh menjimatkan kos elektrik untuk lampu boleh dikawal mengikut kesesuaian pengguna. Secara umumnya, kebanyakan peralatan rumah dikawal dari jauh menggunakan alat kawalan jauh. Kawalan Pensuisan Tanpa Wayar (WSC) mencipta satu sistem untuk mengawal lampu rumah lebih jarak jauh, yang menggantikan alat kawalan jauh menggunakan telefon pintar mudah alih (telefon pintar). Untuk membuat telefon pintar yang berfungsi sebagai alat kawalan jauh, satu perisian telah direka menggunakan Blynk Platform. Blynk adalah sebuah aplikasi yang digunakan untuk mereka bentuk aplikasi dimaksudkan. Satu modul NodeMCU perkakasan mikropengawal yang digunakan untuk menyambung telefon pintar untuk peralatan elektrik. Sistem ini telah diuji dengan membangunkan model mini dan mengambil kira keadaan di rumah domestik. Ujian ini adalah berdasarkan kepada tahap kawalan untuk tanpa wayar menggunakan Wi-Fi dan jarak antara lampu dan telefon pintar. Keputusan ujian ini, sistem boleh digunakan pada peralatan atau peralatan rumah lain bagi maksud mengawal atau pelarasan.

ABSTRACT

This project proposes the design and development of Wireless Switching Control (WSC) using a Smartphone. Wireless Switching Control (WSC) is a system that controls all appliances such as a lamp and fan. The main objective of this project helps to understand the operation theory of wireless communication and also to design a smartphone application using Blynk Platform to connect with the Wireless Switching Control (WSC). The functionality of the system depends on the operating distance of the device. In addition, it can save the cost of electricity for lighting can be controlled to suit the user. Generally, most home appliances controlled from a distance using a remote control. Wireless Switching Control (WSC) created a system for controlling home lighting over long distance, which replaces the remote control using mobile smart phone (smartphone). The smartphone will function as a remote control, an application was designed using Blynk Platform. Blynk is an application used for designing applications intended. A hardware microcontroller NodeMCU module which is used to connect the smartphone to the electrical equipment. The system has been tested by developing a mini model and take into account the situation in the domestic home. The test is based on the level of control for wirelessly using Wi-Fi and the distance between the lamp and the smartphone. The results of this test, the system can be used on equipment or other home appliances for the purpose of controlling or adjustment

DEDICATION

This thesis is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time. They also helped me financially and supported throughout finishing this project report.

ACKNOWLEDGEMENT

First of all, I would like to express my full appreciation to the management of Universiti Teknikal Malaysia Melaka, for giving me an opportunity to do this bachelor's degree project.

I also like to show my token of appreciation to our lecturers at Universiti Teknikal Malaysia Melaka who really helped me a lot throughout finishing my project. They don't hesitate to teach me whenever I need help even when I make mistakes.

Other than that, I would like to thank my friends and coursemates who really helped in sharing their information in finishing my project.

Furthermore, I also like to thank my colleagues who helped me directly or indirectly during the journey in finishing this task.

Last but the not least, I wish to thank once again to everyone involved in completing my project and report successfully.

Thank you

TABLE OF CONTENT

Declaration	i
Approval	ii
Abstrak	iii
Abstract	iv
Dedication	v
Acknowledgement	vi
Table of Content	vii
List of Tables	x
List of Figures	xi
List of Abbreviations, Symbols and Nomenclatures	xiii

CHAPTER 1: INTRODUCTION **1**

1.0	Introduction	1
1.1	Background	1
1.2	Problem Statement	2
1.3	Objective	2
1.4	Work Scope	3

CHAPTER 2: LITERATURE REVIEW **4**

2.0	Introduction	4
2.1	Background	4
2.2	Wireless Switching Control	5
	2.2.1 Wireless	5
	2.2.2 Switching	5
	2.2.3 Control	5
2.3	Wireless Communication in Technology	6
	2.3.1 Infrared (IR)	6
	2.3.2 Radio Frequency (RF)	6
	2.3.3 Bluetooth	8
	2.3.4 Wi-Fi	8

2.4	Hardware	9
2.4.1	Microcontroller	9
2.4.1.1	Arduino Platform	9
2.4.1.2	PIC	13
2.4.2	Sensor	14
2.4.2.1	Light Sensor	14
2.4.2.2	PIR Motion Sensor	15
2.4.2.3	Gas Sensor	16
2.4.3	Acuator	17
2.4.3.1	Relay Module	17
2.5	Software Development Tools	18
2.5.1	MIT App Inventor	18
2.5.2	Android Studio	19
2.5.3	Basic4Android	20
CHAPTER 3: METHODOLOGY		21
3.0	Introduction	21
3.1	Overall System Block Diagram	21
3.2	System Overview	23
3.3	Electrical Hardware Review	24
3.4	NodeMCU	24
3.4.1	NodeMCU Module (ESP8266-12E)	26
3.4.2	Advantages of NodeMCU Module (ESP8266-12E)	26
3.5	Blynk Platform	27
3.5.1	How Blynk Works	27
3.6	Relay Module	28
3.7	PIR Motion Sensor	29
3.7.1	PIR Sensor Operation and Detection Area	29
3.8	Power Supply 5V and 9V	30
3.8.1	Step by Step to Make Power Supply	30
3.8.1.1	Design Circuit in Proteus	30
3.8.1.2	Etching Process of Power Supply	31
3.9	Blynk Server	33

3.10	Wireless Switching Control System of This Project	34
CHAPTER 4: RESULT & DISCUSSION		35
4.0	Introduction	35
4.1	Power Supply 5V and 9V	35
4.2	Basic Circuit Operation in This Project	36
4.3	Relationship between power supply and operation of circuit Functions	36
4.4	Time Delay for Sending The Data	39
CHAPTER 5: CONCLUSION & FUTURE WORK		40
5.0	Introduction	40
5.1	Conclusion	40
5.2	Recommendations	41
REFERENCES		42
APPENDICES		44
A	Gantt Chart (Project Planning)	44
B	Coding	45

LIST OF TABLES

2.1	Transmitter Pin Function	7
2.2	Receive Module Pin Function	7
2.3	Comparison between Infrared, Radio Frequency, Bluetooth and Wi-Fi	8
2.4	Comparison between Arduino Uno, Mega, and Due.	12
2.5	Function of the Relay Connection	17
3.1	NodeMCU Pin Out	26
4.1	Operation +5Volt Power Supply	37
4.2	Operation +9volts Power Supply	38
4.3	Result Time Delay for Sending the Data	39

LIST OF FIGURES

2.1	Diagram of RF Transmitter and RF Receiver	6
2.2	The pin of Arduino Uno Board	10
2.3	Arduino Mega Board	11
2.4	Arduino Duemilanove Board	12
2.5	PIC Microcontroller	13
2.6	Light Sensor	14
2.7	PIR Motion Sensor	15
2.8	Range of Passive Infrared (PIR) Sensor	15
2.9	Gas Sensor Module	16
2.10	Relay Module	17
2.11	MIT Inventor Apps	18
2.12	Android Studio Apps	19
2.13	Basic4Android Apps	20
3.1	Methodology Flowchart	22
3.2	System Overview	23
3.3	NodeMCU (ESP8266-12E)	24
3.4	ESP8266-12E Pin Out	25
3.5	NodeMCU Pin Out.	25
3.6	NodeMCU connected to Blynk Platform	26
3.7	Blynk Platform	27
3.8	Blynk Flow Concept	28
3.9	Relay Module Board	28
3.10	PIR Sensor Module	29
3.11	Power Supply Circuit in Proteus	30
3.12	Power Supply Track line	31
3.13	Power Supply in 3D Visualizer	31
3.14	Track line in Laminate Paper	32
3.15	UV Curing Station	32
3.16	Etcher Machine	32
3.17	PCB Green Track Line	33

3.18	Power Supply Track Line Board	33
3.19	Wireless Switching Control System Flowchart	34
4.1	Power Supply	35
4.2	Basic Circuit of Wireless Switching Control	36
4.3	Figure of V_{out} vs V_{in} +5V	37
4.4	Figure of V_{out} vs V_{in} +9V	38

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AC	-	Alternating Current
CCTV	-	Closed-circuit Television
DC	-	Direct Current
GND	-	Ground
IDE	-	Integrated Development Environment
IoT	-	Internet of Things
LDR	-	Light Dependent Resistor
LED	-	Light Emitting Diode
MIT	-	Massachusetts Institute of Technology
PCB	-	Printed Circuit Board
PIR	-	Passive Infrared Sensor
UI	-	User Interface
USB	-	Universal Serial Bus
VB	-	Visual Basic
VIN	-	Input Voltage
VOOUT	-	Output Voltage
Wi-Fi	-	Wireless Fidelity
WSC	-	Wireless Switching Control

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter discusses about background, problem statement, objective and work scope of this project. The problem statement states the aim why this project is carried out.

1.1 Background

Wireless Switching Control (WSC) is a system that controls all appliances such as a lamp and fan. The system performance is same as smart home automation. As example their performance for controlling the property home equipment, for instance illumination connected with lighting of light, speed of fan, heat connected with air-condition and so on. This system is used to improve the technology for home automation by using smart phone application and web server. Users can use any options to help them to control on their residence automation system. Therefore, it is easier to use and it also provides comfort to the user to control in long distances.

In the days of modern technology, the utilization of smart phone increasing day by day and also extremely important device to people. This enhances the usage of internet. Variance applications in smartphone mostly help people to solve their problem such as social and education. The smartphone also provides important functionality such as good in processing power and ease of access of a smartphone.

1.2 Problem Statement

The cost of living is getting higher day by day; users are desperate to cut all of those living costs. Electrical power is one of the costs that its price keeps increasing each passing year. One of the easiest ways to control the cost of users electrical cost is to control and monitor the usage of the home appliances around the house.

We disable to control the electrical appliances from outside for security purposes. As a security purpose to prevent from danger when people came home late.

Disabled people meet barriers to make their daily works. However, technology is helping to lower many of these barriers and also give a lot of benefit to the disabled people. By using this application it also can help and ease for handling a wider range of activities independently.

1.3 Objective

The objectives of this project are as follows:

- i. To understand the operation theory of wireless communication.
- ii. To design a smartphone application using Blynk Platform to connect with the wireless switching control.
- iii. To analyze wireless communication performance for smart home application.

1.4 Work Scope

Smartphone application uses to control home appliances such as lamp and fan. Sometimes we forget to closed appliances at home when we at the outside of the house. Normal switch is difficult to make a switching when at the outside of the house and outdated. For help by following the development of technology, the smartphone is best idea to make a controlling home appliance using an application. The application will monitor the condition of home appliances, whether it is on or off.

The wireless switching control can cover depends on router signal strength. The connection range of Wi-Fi module depends on the type of Wi-Fi module normally the range accommodates in a house only. Another connection, it also can be connected to the web server or mobile application for controlling outside the house.

This application is suitable for a home that has an internet connection. These projects will connect to smartphone between the Wi-Fi modules. The range of the communication will connected home appliances inside and outside the house.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will contain the research and information from a thesis or journal about the concepts that related to project and there are several important things need to be taken for study case that should be focuses. This chapter also includes the details of the component that used for designed the wireless switching control and the comparison of each other. All the information has been researched from different resource as the references in order to take out the basic idea in producing the best yield from that discussed in this chapter.

2.1 Background

Before starting this project, idea from researchers was very important and helpful as a reference and a suggestion in this project, for example, in terms of the programming system, communication medium, application system and controlling system. In this chapter the literature review is the beginning to start a new project in comprehend the basic concepts and methods of project development.

2.2 Wireless Switching Control

2.2.1 Wireless

According to (Ishiguro & Huang, 2011), Wireless mean communication of information between two or more transceivers that connected without using wires. For example, there are many types of wireless device such as infra-red, radio frequency, Bluetooth, Wi-Fi and satellite. Radio frequencies are the commonly used in wireless technology. By utilizing wireless communication has more benefit between using electrical conductor such as increase-including cost savings, flexibility and power consumption.

2.2.2 Switching

Normal switch is outdated for make switching in home appliances. The renewal technology for the switching is the combination between normal switch and electronic switch means that can use remote to make a switch. Relay module is an electronic switch normally that be used to make control a switch on and off (Balasubramanian & Oral 1992).

2.2.3 Control

In wireless communication, the receiver will receive the data from transmitter to control and electrical and electronic device. The smartphone is the best technology that is easy to use because agrees users to remotely monitor their home state and control home appliances using a smartphone application (Bian et al, 2011). The Internet of things is the latest technology being developed for the smartphone.

2.3 Wireless Communication in Technology

Nowadays, Internet of Things (IoT) is a new communication among technologies. Wireless communication without using wire is the best source to send data in further the distance to control home appliances. The transmitted data can be everywhere exceeding the distance.

2.3.1 Infrared (IR)

According to (Rose Mary, 2011), it was explained about Infrared (IR) communication data through the light radiation. Infrared is an electromagnetic communication to send the data and received the data in the medium range. The communication cannot have any barriers between transmitter and receiver. For more knowledge, infrared is frequently used in television remote controls.

2.3.2 Radio Frequency (RF)

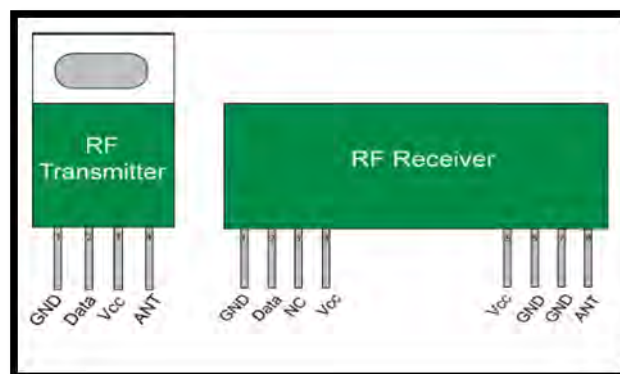


Figure 2.1: Diagram of RF Transmitter and RF Receiver (Kushagra, 2012)

Based on (L. Li, 2004) RF modules are a most functionality modules for both mobile phone and other wireless applications. Radio frequency module typically is small electronic devices that use to transmit and/or

receive radio signals between two devices and is regularly desirable to communicate with another device wirelessly. Figure 2.1 shows the diagram of RF transmitter and also RF receiver. RF Transmitter has four pins which are GND pin, Data pin, Vcc pin and ANT pin. This RF module must be connected to the encoder and decoder. For an RF transmitter module, it must be connected with the encoder and the RF receiver must be connected to a decoder. Table 2.1 and 2.2 were displayed the pin function on the transmitter and receiver.

Table 2.1: Transmitter Pin Function (Kushagra, 2012)

Pin	Function	Name
1	Ground	Ground
2	Pin of Serial data	Data
3	Source voltage	Vcc
4	Pin of output Antenna	ANT

Table 2.2: Receive Module Pin Function (Kushagra, 2012)

Pin	Function	Name
1	Ground	Ground
2	Pin of Serial data and output	Data
3	Source voltage	Vcc
4	Pin of input Antenna	ANT

2.3.3 Bluetooth

Bluetooth is a wireless second technology that is famous before Wi-Fi technology. It can transmit and received the data around 10 meters for the distances using short-wavelength UHF and for the frequency around 2.4 to 2.485GHz. Purpose to (Jingfu, 2005) The Bluetooth module circuit design is on the basis of two ICs, SiW1701 and SiW1750. The latter one is used for the Baseband, and the other is for the RF parts. The external control of the module is connected through two ports (USB and UART) to exchange data.

2.3.4 Wi-Fi

Reported that (Li et al. 2009) Wireless Fidelity are the latest technology, that are popular in the world of transmitting data fast and long distance. Wi-Fi used 2.4GHz frequency which can use CLOUD to send the data and information on long range and also can communicate between the modules such as ESP8266 modules. Wi-Fi is module price are not expensive and any people can make their own project in the communication system.

Table 2.3: Comparison between Infrared, Radio Frequency, Bluetooth and Wi-Fi (Li et al. 2009)

Type Of Communication	Infrared	RF Transmitter And Receiver	Bluetooth	Wi-Fi
Range	0 ~ 1 meter	Broad Range (up to 250 meter)	0 ~ 10 meter	0 ~ 100 meter
Operating Frequency	800 – 900nm	434MHz	2.4GHz	2.4GHz, 5.8GHz
Cost	Low cost	Low cost	Medium cost	Medium cost

2.4 Hardware

2.4.1 Microcontroller

As is known, that the microcontroller is a central processing unit (CPU) existing in a single integrated circuit. It also committed to perform one task and execute one specific application. In microcontroller contains memory, programmable input/output peripherals as well a processor and for the microcontroller are most of economical to manage an electronic device. Based on that, the microcontrollers are usually designed for embedded applications and a lot can be used in automatically controlled electrical and electronic devices.

2.4.1.1 Arduino Platform

According to (Badamasi 2014), Arduino is an open-platform that's easy to use based on software and hardware. Arduino board has many input and output, but it depends on their type of Arduino. Functions of Arduino board are to control an electronic device using an Arduino programming language.

Arduino UNO

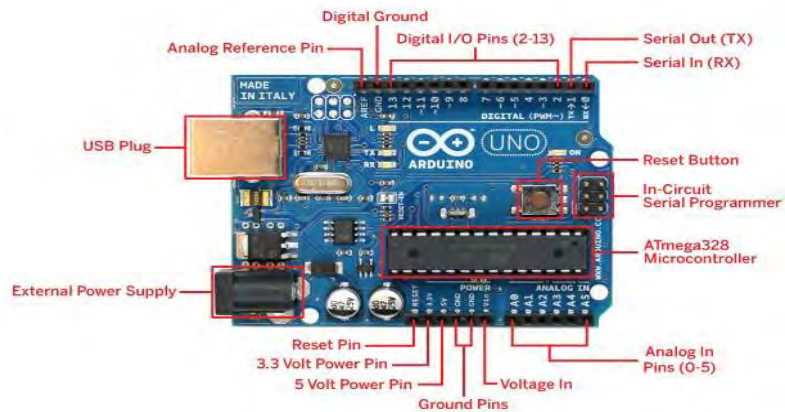


Figure 2.2: The pin of Arduino UNO Board (Tom Igoe, 2014)

Arduino is easy to use because it is only needed to connect through a computer by using USB cable and it also uses an IDE library in the Arduino software. It also can use AC to DC adapter or battery to power on the Arduino. Arduino UNO will be powered by via USB connection or with power supply and it will detect automatically. For battery can be implanted in the Gnd and VIN pin headers on the Arduino board (Aaron, 2013). In addition, the Arduino board only can be operated 6 to 20 volts for the external supply. Arduino board has many outputs depends on the type of Arduino meanwhile, for Arduino UNO it have pin port have their own function and own meaning for operation. It has 3 power pin which is pin Vin, pin 5V, pin 3.3V, pin GND and also pin IOREF. In Arduino UNO, 14 digital pins can be used as input and output pin. To the pin of the 14 digital pins on the UNO can be used as an input or output where only use pin Mode (), digital Write (), and digital Read functions.