



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**SMART CONTROL ELECTRICAL APPLIANCES
VIA RF MODULE**

This report submitted in accordance with requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree of Electrical Engineering
Technology (Industrial Automation and Robotics) (Hons.)

by

NIK AHMAD RAFI UDDIN BIN NIK LEH

B071110096

890919115071

FACULTY OF ENGINEERING TECHNOLOGY

2015

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: SMART CONTROL ELECTRICAL APPLIANCES VIA RF MODULE

SESI PENGAJIAN: 2014/15 Semester 2

Saya **NIK AHMAD RAFIUDDIN BIN NIK LEH**

mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (✓)

SULIT

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

TERHAD

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

TIDAK TERHAD

Disahkan oleh:

Alamat Tetap:

PS 006 Kg Kemal,

16800 Pasir Puteh,

Kelantan

Cop Rasmi:

Tarikh: _____

Tarikh: _____

** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I hereby, declared this report entitled “Smart Control Electrical Appliances Via RF Module” is the results of my own research except as cited in references.

Signature :

Author’s Name : NIK AHMAD RAFIUDDIN BIN NIK LEH

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 Electrical Engineering Technology (Industrial Automation and Robotics) (Hons.). The member of the supervisory is as follow:

.....
En. Khalil Azha Bin Mohd Annuar

ABSTRAK

Sejajar dengan kemajuan sains dan teknologi, pelbagai kemudahan dapat diperolehi. Aplikasi sains dan teknologi yang semakin moden dapat membawa kepada perubahan dalam kehidupan seharian kita. Justeru itu aktiviti seharian kita dapat dilakukan dengan pantas dan efektif. Tujuan projek ini direka untuk mengawal perkakas elektrik dengan menggunakan alat kawalan jauh. Alat kawalan jauh ini dicipta untuk mengawal perkakas elektrik terutama di makmal. Antara perkakas elektrik yang mampu dikawal adalah seperti lampu, kipas, kelajuan kipas dan ianya juga boleh digunakan untuk mengawal pintu samada dalam keadaan buka atau tutup. Alat kawalan jauh ini dibina dengan menggunakan sistem penghantaran frekuensi radio. Ianya dicipta untuk mengawal perkakas elektrik dalam keadaan buka (*ON*) dan tutup (*OFF*). Semua perkakas elektrik ini dapat dikawal hanya menggunakan satu alat kawalan jauh sahaja. Kawalan pintu dapat meningkatkan lagi sistem keselamatan terutama di makmal. Alat kawalan jauh menggunakan frekuensi radio ini terdiri daripada pemancar dan penerima. Pemancar akan menghantar isyarat kawalan perkakas elektrik melalui antena pemancar dan akan diterima oleh antena penerima. Seterusnya, penerima akan mengawal isyarat yang diterima melalui geganti sebagai pengantara kepada setiap perkakas elektrik yang hendak dikawal. Geganti sebagai suis untuk menghidup dan mematikan operasi. Operasi projek ini dikawal dengan frekuensi radio yang tetap iaitu 315Mhz. Selain itu, alat kawalan jauh ini dapat memudahkan pengguna untuk melakukan aktiviti seharian dengan pantas.

ABSTRACT

In line with the advancement of science and technology, a lot of facilities are available. Application of science and technology are able to lead the changes in our daily lives. Hence our daily activities can be done quickly and effectively. The purpose of this project is to control electrical appliances using the remote control especially laboratory. Among the appliances that can be controlled such as lights, fans, fan speed, and it can also be used to control the door whether it is open or closed state. The remote control is built by using radio frequency transmission system. It was created to control appliances in the open (*ON*) and close (*OFF*). Condition remote control is used to control the entire appliances. To improve the system security especially in laboratory the door system control is applied. The remote control used radio frequency consists of a transmitter and receiver. The transmitter will transmit a signal through the antenna of the control electric appliances and the signal is receive by the antennas receiver. Next, the receiver will control signal received by the relay as an interface to all appliances which will be control. Relay as a switch to turn on and turn off the operation. Project operations are controlled by the radio frequency of 315 MHz fixed. In addition, this remote control can help users to perform daily activities immediately.

DEDICATION

To my beloved parents

ACKNOWLEDGEMENT

In the name of Allah S.W.T, the most gracious and merciful, praise to Allah the lord of universe and may blessing and peace of Allah be upon his messenger Muhammad S.A.W. First, and foremost thank to Allah for giving me wellness and ideas to do this project. Without any of it, I surely cannot complete this project in the time given.

I would like to express my deepest gratitude towards to my project supervisor, Mr Khalil Azha Bin Mohd Annuar and every lecturer that help and guide by giving brilliant advices and guidance to me as well as provision of the valuable time management, encouragement and patience during the time period to completing this project.

Last but not least, I would like to express my very thankful and send our grateful to my entire friend and my family for the moral and financial support. Their views and tis are useful definitely. Without all these people encouragement, support and advices this thesis project might not be successfully carried out. To those that I forget to mention, please forgive me. I do appreciate all the things you have done for me.

TABLE OF CONTENT

Declaration	iv
Approval	v
Abstrak	vi
Abstract	vii
Dedication	viii
Acknowledgement	ix
Table of Content	x
List of Tables	xiii
List of Figures	xiv
List Abbreviations, Symbols and Nomenclatures	xvi
List of Appendices	xvii
CHAPTER 1: INTRODUCTION	1
1.1 Project Background	1
1.2 Problem Statement	2
1.3 Project Objectives	3
1.4 Scope of Project	4
CHAPTER 2: LITERATURE REVIEW	5
2.1 Introduction	5
2.2 Ultrasonic	5
2.3 Infrared	6
2.4 Xbee	6
2.5 Radio Frequency Module	7
2.6 Applying of Microcontroller Based on RF	8
2.7 Remote Control of Multiple Street Lighting	9
2.8 Collision Analysis	9
2.9 Methods of Controlling Radio Frequency Interference	10
2.9.1 Low Impedance Shunt Filter and Adopt High Impedance Series	10

CHAPTER 3: METHODOLOGY	11
3.1 Introduction	11
3.2 Overview	11
3.2.1 Work Flow Chart	12
3.2.2 Problem Solving	13
3.2.3 Block Diagram	14
3.3 Software	15
3.3.1 Proteus	15
3.3.2 Eagle for Printed Circuit Board (PCB)	15
3.4 Hardware	16
3.4.1 Transmitter	16
3.4.2 Process (Receiver)	18
3.4.3 Process	20
3.4.4 Output Relay 5V	21
3.4.5 Light-Emitting Diode (LED)	22
3.4.6 Liquid-Crystal Display (LCD)	22
3.4.7 Motor Driver L298	23
3.4.8 Magnetic Door Lock	24
3.4.9 Gas Sensor (MQ-5)	24
3.4.10 Temperature Sensor (DS18B20)	25
3.5 System Operation	26
CHAPTER 4: RESULT & DISCUSSION	27
4.1 Introduction	27
4.2 System Overview	28
4.3 Hardware Testing	30
4.4 The Relationship Between The Lengths of Antenna Against Length of Data Transmits	33
4.5 Operating Voltage Versus Distance of Transmit Data	34
CHAPTER 5: CONCLUSION & RECOMMENDATION	38
5.1 Conclusion	38
5.2 Recommendation	39

5.3	Potential Commercialization	39
	REFERENCES	40
	APPENDICES (A-E)	42

LIST OF TABLES

Table No.	Title	Page
3.1	Characteristic of RF Module 315 MHz	16
4.1	Result from LCD Display	30
4.2	Result of Length of Antenna Between Maximum and Minimum Distance Transmitter and Receiver to Operate	33
4.3	Result Distance Data Transmitted by Induced Different Operating Voltage	36

LIST OF FIGURES

Figure No.	Title	Page
1.1	Distance Between Switch and Door	2
1.2	Actual View of Control, Instrumentation & Mechatronic Lab	3
2.1	Conceptual Architecture Overview	7
2.2	Transmitter and Receiver	7
2.3	Circuit Diagram	8
2.4	RF Channels is Changed (Theoretical)	9
2.5	Load is Varied (Theoretical)	10
3.1	Flow Chart of Work Progress	12
3.2	Idea Development	13
3.3	System Operation	14
3.4	Complete Circuit	15
3.5	Flow Chart of PCB Work	16
3.6	RF Transmitter Module	17
3.7	Transmitter and Receiver Block Diagram	17
3.8	RF Receiver Module	18
3.9	The Connection for ID Pin RF Module	19
3.10	PIC 16F877A and Pin Out	20
3.11	Relay Connection	21
3.12	LCD 16x2	22
3.13	LCD Schematic	23
3.14	Motor Driver L298	23
3.15	Magnetic Door Lock	24
3.16	Gas Sensor	24
3.17	Temperature Sensor	25
3.18	Flow Chart of System Operation	26
4.1	Remote 4 Channel	28

4.2	Hardware Prototype	28
4.3	Application Door Lock	29
4.4	Different Length of Copper Wire	33
4.5	Minimum Distance Transmitter and Receiver to Operate	34
4.6	Maximum Distance Transmitter and Receiver to Operate	35
4.7	Installation Procedure for Transmitter and Receiver	35
4.8	Operating Voltage Versus Distance of Data Transmits	37

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

RF	-	Radio Frequency
PCB	-	Printed Circuit Board
LED	-	Light Emitting Diode
LCD	-	Liquid Crystal Display
ID	-	Identification
GUI	-	Graphic User Interface
WPAN	-	Wireless Personal Area Networks
PIC	-	Peripheral Interface Controller
ASK	-	Amplitude Shift Keying
MHz	-	Mega Hertz
M	-	Metre
CM	-	Centimetre
V	-	Voltage
A	-	Ampere
DC	-	Direct Current
AC	-	Alternative Current

LIST OF APPENDICES

Appendices	Title	Page
A	Project Prototype	42
B	SK40C	43
C	Block Diagram and Complete Circuit	44
D	Software Programming	45
E	Size Prototype	51

CHAPTER 1

INTRODUCTION

1.1 Project Background

Radio Frequency (RF) is a rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves and the alternating currents which carry radio signals. The person who developed this method is Heinrich Hertz from Germany which is Germany physicist. The first primitive radio transmitters were built by him during his pioneering investigations of radio waves. These generated radio waves by a high voltage spark between two conductors.

By using this technology, people life will be easier and will make user satisfaction. So this paper intends to address the problem associated. RF was chosen because of its characteristic, which can penetrate most solids, low power required, receiver sensitivity, not light sensitive and can transmit data for longer range. At present, as we know the main disadvantage of RF is signal collision, it is happen because nowadays many applications used in RF device, one of them is hand phone, car key, and walkie-talkie. And the probability of signal collision will occur. This paper introduces a better alternative by proposing a method between transmitter and receiver.

1.2 Problem Statement

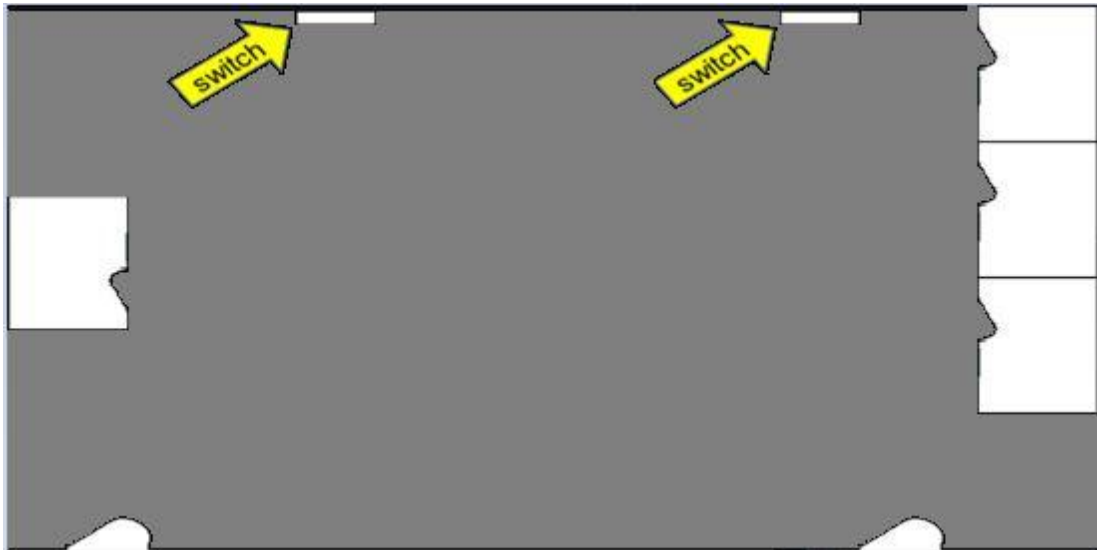


Figure 1.1 Distance Between Switch and Door

Figure 1.1 shows the problems occur at Control, Instrumentation & Mechatronic laboratory of the Faculty of Engineering Technology (FTK) building. It also shows the distance between the doors with the main switch is too far. The distance between the door and switches is about 15 meters which is far enough. When staff and students come at early of the morning, they need to walk in the dark in order to reach the main switch.

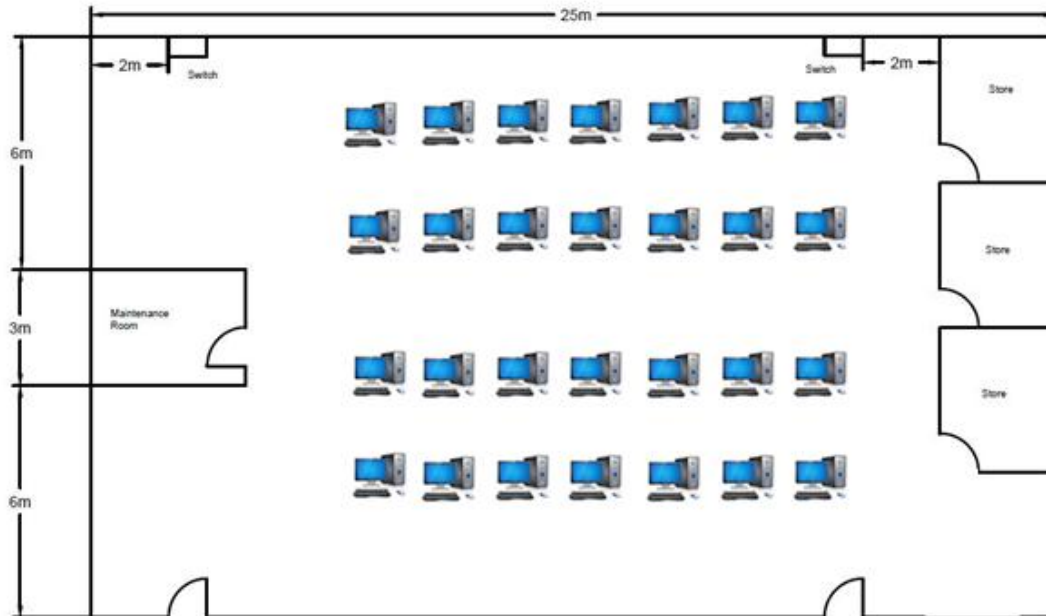


Figure 1.2 Actual View of Control, Instrumentation & Mechatronic Lab

In addition, Figure 1.2 show the actual view of Control, Instrumentation & Mechatronic Lab, there is a lot of equipment in the lab, such as computers and other devices. Furthermore, the spaces are really cramped to users in order to move around. In the case of negligence by the user, it can lead to accident and will lead to huge losses. The device in the lab is very expensive to purchase and repair.

1.3 Project Objectives

The objectives of this project are as follow:

- (i) To design a remote control for lighting application system and fan by using radio frequency method.
- (ii) To control fan speed by designing a remote.
- (iii) To control the door whether it locked or not by using remote control.

1.4 Scope of project

In order to achieve the objectives of the project, the scope of this project are:

Hardware system

- (i) Design RF circuit.
- (ii) Designs relay circuit.
- (iii) Develop remote control and receiver circuit.

Software system

- (i) Develop program (receiver & transmitter).

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The aim of this chapter is to give the overview information about type of wireless technology nowadays. The best type of wireless is choose and suitable towards the problem identification. The comparison between all the types of wireless is done. Moreover, in this chapter, the explanations will focus more on radio frequency (RF). Nevertheless the review also discuss about the method to prevent frequency disturbance. Combination of reference from various sources such as journal, previous thesis and references book, the literature review has been carried out to collect information related to this project.

2.2 Ultrasonic

Adler, et al, (1982), explains about how to make an Ultrasonic Remote Control for Home Receivers. Electromagnetic signaling systems can be designed to bridge the short distance involved, but their signals do not remain confined between the walls of buildings or apartments. Because the distance between receivers in adjacent apartments may easily be less than the viewing distance in a single large home, individual receivers must operate on different frequencies this is inconvenient in manufacture and installation.

2.3 Infrared

Maureen Kaine-Krolak, et al, (1995), studies about infrared to make an Introduction to Infrared Technology, Applications in the Home, Classroom, Workplaces and Beyond. Infrared technology increasingly present in mainstream applications, but there is several disadvantage by using the method, receiver and transmitter must be almost directly aligned. Main problem is the signal will lose if blocked by common material, people wall, plant and etc.

2.4 Xbee

Gill, K, et al, (2009), created about a Zigbee-Based Home Automation System. A ZigBee based home automation system and Wi-Fi network are integrated through a common home gateway as shown in Figure 2.1 . The home gateway provides network interoperability, a simple and flexible user interface and remote access to the system. This system demonstrates the feasibility and effectiveness of the proposed system. The ZigBee (IEEE 802.15.4) is a new technology that permits the implementation of Wireless Personal Area Networks (WPAN). It is very suitable for wireless sensor networks due to the very low power consumption. System allows home owners to monitor and control connected devices in the home, through a variety of controls, including a ZigBee based remote control, and any Wi-Fi enabled device which supports by Java.

Lili, Y, Y.Shuang-Hua et al, (2006), research about the Safety and Security of Remote Monitoring and Control of intelligent Home Environments in Systems, Man and Cybernetics. Safety and security are two most important issues in the remote monitoring and control of intelligent home environments. The outdoor part is a mobile phone (or a PDA) equipped with a specially designed GUI (Graphic User Interface). The indoor part includes a broadband modem, a home portal (or called home server), and a wireless home network. The broadband modem maintains a permanent internet connection.

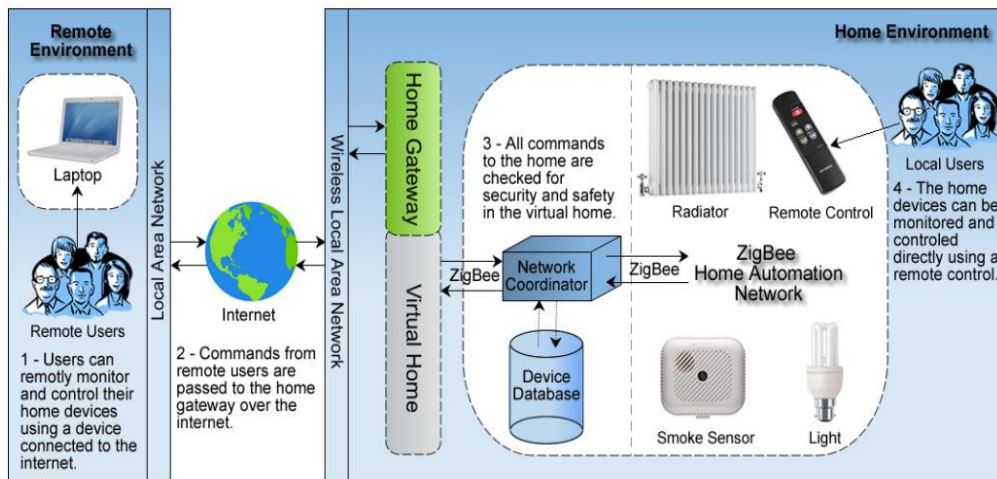


Figure 2.1 Conceptual Architecture Overview

2.5 Radio Frequency Module

Maureen Kaine-Krolak, et al, (1995), studies about infrared to make An Introduction to Infrared Technology, Applications in the Home, Classroom, Workplace and Beyond. RF receiver and transmitter as shown in Figure 2.2 can communicate without line of sight. The signal also cannot block by any material. In addition, it can use for long range application. They also highlighted that RF is better than IR because radio recurrence vitality wave superimposed upon an infrared vitality wave and outlines the backwards relationship between recurrence and wavelength. The infrared vitality wave finishes almost 5 and a half cycles in the time that the radio recurrence wave finishes 2 cycles.



Figure 2.2 Transmitter and Receiver

2.6 Applying of Microcontroller Based on RF

Aru, O.E, et al, (2013), research about Design Exploration of a Microcontroller Based RF Remote. The PIC microcontroller family is manufactured by Microchip Technology Inc. Currently; they are one of the most popular microcontrollers, used in many commercial and industrial applications. Over 120 million devices are sold each year. The PIC microcontroller architecture is based on a modified Harvard RISC (Reduced Instruction Set Computer) instruction set with dual – bus architecture, providing fast and flexible design with an easy migration path from only 6 pins to 80 pins and from 384 bytes to 128 Kbytes of program memory.

Balasubramaniam, et al, (1992), design of Microprocessor based multifunction relay switching [home automation]. Implementing microcontroller based on RF provides a more flexible and functional alternative to the current commercial systems in controlling electronic devices as shown in Figure 2.3. The author state that the project consists of microcontroller interfaced with” KYL-500S” micro power wireless transceiver data module and connected with an electromagnetic relay which turns the switch OFF with open contact and turns it ON with closed contact. The remote control transmits radio frequency signals which are received by the receiver of the wall socket and decoded by the microcontroller which now turns the relay ON or OFF.

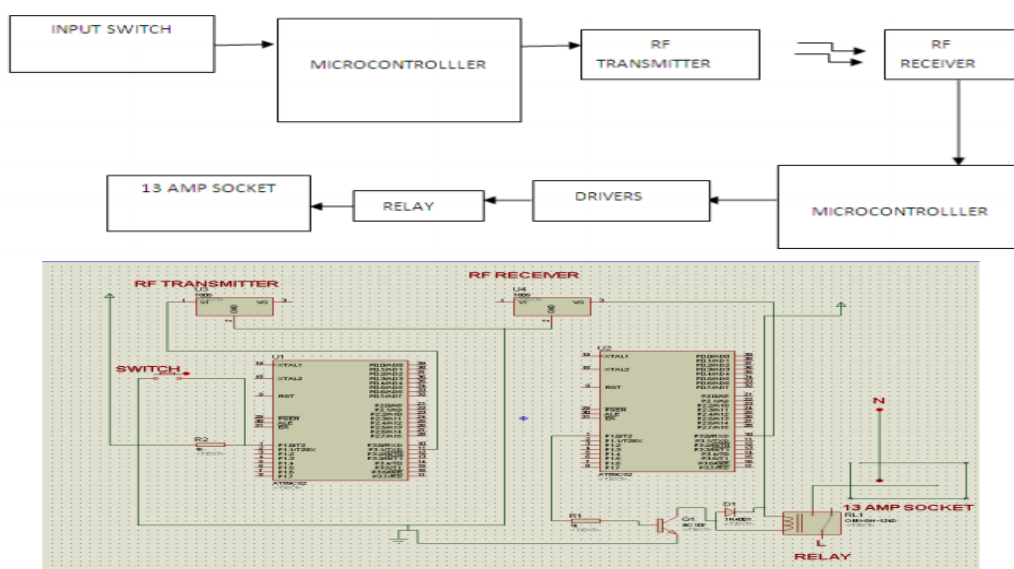


Figure 2.3 Circuit Diagram