

BORANG PENGESAHAN STATUS TESIS*

JUDUL : SMART POST BOX SYSTEM WITH RF TECHNOLOGY AND GSM MODEM

SESI PENGAJIAN : 2012 / 2013

Saya MUHAMAD SUFFIAN BIN SIKANDAR GANI

mengaku membenarkan tesis Projek Sarjana Muda ini disimpan di Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dengan syarat-syarat kegunaan seperti berikut:

1. Tesis dan projek adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan tesis 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)

Alamat tetap: 303, LORONG
ANGSANA 1/5, TMN

PINGGIRAN GOLF, 70400 SBN

Tarikh: _____

(TANDATANGAN PENYELIA)

Nama Penyelia

Dr.Sabrina Ahmad

Tarikh: _____

CATATAN: * Tesis dimaksudkan sebagai Laporan Projek Sarjana Muda (PSM).

** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa.

SMART POST BOX SYSTEM WITH RF TECHNOLOGY
AND GSM MODEM

MUHAMAD SUFFIAN BIN SIKANDAR GANI

This report is submitted in partial fulfilment of the requirements for the
Bachelor of Computer Science (Software Development)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2013

DECLARATION

I hereby declare that this project report entitled
**SMART POST BOX SYSTEM WITH RADIO FREQUENCY TECHNOLOGY
AND GSM MODEM**

is written by me and is my own effort and that no part has been plagiarized
without citations.

STUDENT : _____ Date: 26-AUGUST-2013
(MUHAMAD SUFFIAN BIN SIKANDAR GANI)
SUPERVISOR : _____ Date: 26-AUGUST-2013
(DR. SABRINA AHMAD)

DEDICATION

I would like to thank Allah for giving me opportunity and ability to finish this project. The completion of this thesis is directly related to the role of my beloved parents, Sikandar Gani bin Abdul Kadir and Nisha Banu bt. Shaik Maideen who give endless motivation and support. Then I would like to thank my supervisor Dr. Sabrina bt Ahmad for guiding me in the making of this thesis. Finally, big thanks to Universiti Teknikal Malaysia Melaka, Faculty of Information and Communication Technology, dean, deputy dean, lecturers, friends and staff who help me in the completion of this thesis.

ACKNOWLEDGEMENTS

In the name of Allah, Most Gracious and Most Merciful, My exceptional gratitude goes to my supervisor, Dr. Sabrina Ahmad for her kindness, constant endeavor, and guidance and the numerous moments of attention she devoted throughout her work. I extend my deepest appreciation for her encouragement, cooperation and good ideas throughout the arising matters. Without her help, this thesis would not have been accomplished. Special thanks to my beloved parents, lecturers and friends for their prayers and endless encouragement during my studies years. Finally, thanks to everyone who involves directly or indirectly that contributed to the successful realization of this thesis.

ABSTRACT

This project is an electronic smart post box system which utilizes Radio Frequency (RF) technology. The RF technology is consist of a receiver and a transmitter to detect the mailbox owner identity and automatically sends out Short Message Service (SMS) to the mailbox owner if there is a letter drop in the post box. In addition, alarms actualize the alert mechanism, letter drop update and minimize the people negligent. This project involved both the development of hardware and software. Hardware part includes the sensor circuit, RF circuits and GSM Modem. Software part covers programming in the PIC microcontroller by using PIC C programming. As our world become increasingly complex, we need innovative solution to face tomorrow challenges and the smart post box provides great solution for our daily life. The contribution of this project is believed to improve the quality life throughout the nation.

ABSTRAK

Projek ini adalah sistem peti surat elektronik pintar yang akan melaksanakan beberapa fungsi di peti surat. Ianya akan menggunakan teknologi Frekuensi Radio (RF) yang melibatkan penerima dan pemancar untuk mengesan identiti pemilik peti mel dan juga menghantar khidmat pesanan ringkas (SMS) kepada telefon bimbit pemilik peti surat tersebut jika terdapat penerimaan surat di peti pos. Projek ini akan merealisasikan mekanisme amaran sekiranya terdapat penerimaan surat dan meminimumkan kecuaiian. Reka bentuk projek ini terbahagi kepada pembangunan perkakasan dan perisian sebagai modul projek. Bahagian perkakasan termasuk litar sensor, litar RF dan Modem GSM. Bahagian perisian pula meliputi kod pengaturcaraan dalam mikropengawal PIC dengan menggunakan pengaturcaraan C PIC. Memandangkan dunia kita menjadi semakin kompleks. Kita memerlukan penyelesaian inovatif untuk menghadapi dengan cabaran esok dan peti surat pintar ini menyediakan penyelesaian yang baik untuk kehidupan harian kita. Sumbangan projek ini dipercayai dapat meningkatkan kualiti kehidupan di seluruh negara.

TABLE OF CONTENTS

CHAPTER	SUBJECT	PAGE
	DECLARATION	II
	DEDICATION	III
	ACKNOWLEDGEMENTS	IV
	ABSTRACT	V
	ABSTRAK	VI
	LIST OF TABLES	XI
	LIST OF FIGURES	XIII
	LIST OF ABBREVIATIONS	XVI
CHAPTER 1	INTRODUCTION	1
	1.1 Problem Statement	2
	1.2 Objective.....	2
	1.3 Scopes	2
	1.4 Project Significance.....	3
	1.5 Expected Output	3
	1.6 Conclusion.....	3
CHAPTER 2	LITERATURE REVIEW AND PROJECT	
	METHODOLOGY.....	4
	2.1 Introduction	4
	2.2 Fact and Finding.....	4
	2.3 Proposed System and Product	6

2.4	Project Methodology	6
2.4.1	Project Flow Chart.....	7
2.4.2	Hardware Prototype.....	8
2.4.3	Software Requirement	11
2.5	Project Schedules and Milestone	12
2.6	Conclusion	12
CHAPTER 3	ANALYSIS	13
3.1	Introduction.....	13
3.2	Project Schematic Diagram.....	14
3.3	Project Requirement.....	17
3.4	Conclusion.....	17
CHAPTER 4	DESIGN.....	18
4.1	Introduction.....	18
4.2	High Level Design	18
4.2.1	The Project Architecture	19
4.2.2	Psedocode	20
4.3	Conclusion	20
CHAPTER 5	IMPLEMENTATION.....	22
5.1	Introduction.....	22
5.2	Software Development Environment Setup.....	22
5.2.1	Proteus 7.....	22
5.2.2	MPlab IDE.....	25
5.2.3	PICKit.....	27

5.3	Hardware Part	28
5.3.1	Voltage Regulator Circuit	28
5.3.2	RF Transmitter Circuit	29
5.3.3	RF Receiver Circuit	30
5.4	Conclusion	31
CHAPTER 6	TESTING.....	32
6.1	Introduction.....	32
6.2	Software Part.....	32
6.2.1	Circuit Simulation Using Proteus.....	33
6.2.2	Coding Compilation Using MPLab.....	34
6.3	Hardware Part.....	35
6.3.1	Resistor Testing.....	37
6.3.2	Capacitor Testing.....	38
6.3.3	Diode Testing.....	39
6.3.4	LED Testing.....	40
6.3.5	RF Transmitter Testing.....	41
6.4	Implementation Status	42
6.5	Conclusion.....	42
CHAPTER 7	CONCLUSION.....	43
7.1	Introduction.....	43
7.2	Project Weaknesses.....	43
7.3	Project Strengths.....	44
7.4	Contribution.....	45

7.5 Conclusion45

REFERENCE46

LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1	Project Schedule and Milestone	12
Table 3.1	The LED Function	15
Table 3.2	Project Requirement	17
Table 6.1	Resistor Testing	37
Table 6.2	Testing Capacitor Using Multimeter	38
Table 6.3	Diode Testing Result	39
Table 6.4	LED Testing Result	40
Table 6.5	RF Transmitter Testing Result	41

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1	Project Flow Chart	7
Figure 2.2	Voltage Regulator	8
Figure 2.3	SK40C Enhanced 40 Pins PIC	9
Figure 2.4	Buzzer	10
Figure 2.5	GSM Modem	11
Figure 2.6	RF Module	11
Figure 3.1	Project Schematic Diagram	14
Figure 3.2	PIC 16F877A	15
Figure 3.3	PIC Schematic Diagram	16
Figure 4.1	The PCB Design	19
Figure 5.1	Draw Schematic Diagram Using Proteus Software	23
Figure 5.2	Draw PCB Diagram Using Proteus Software	24
Figure 5.3	3D Component Visualisation Using Proteus Software	24

Figure 5.4	Typing C Language Using MPLAB Software	26
Figure 5.5	After compile .c file the MPLAB will generate .hex file as figure above	26
Figure 5.6	PICkit Main Menu Screen Shot	27
Figure 5.7	Voltage Regulator Circuit	28
Figure 5.8	Voltage Regulator Schematic Diagram	28
Figure 5.9	RF Transmitter	29
Figure 5.10	RF Receiver	30
Figure 5.11	RF Receiver PCB Design	30
Figure 6.1	Simulation analysis using Proteus 7 (Box)	33
Figure 6.2	Simulation analysis using Proteus 7 (Post Box)	33
Figure 6.3	Coding Compilation Using MPLab Software	34
Figure 6.4	List Of Files Created After Compilation Success	35
Figure 6.5	Multimeter Used For Testing	36
Figure 6.6	Testing Resistor Using Multimeter	37
Figure 6.7	Testing The Capacitor Using Multimeter	38
Figure 6.8	Testing Diode Using Multimeter	39
Figure 6.9	Testing LED Using Multimeter	40

Figure 6.10	Testing RF Transmitter Connection	41
--------------------	--	-----------

LIST OF ABBREVIATIONS

PSM	-	Projek Sarjana Muda
RF	-	Radio Frequency
GSM	-	Global System for Mobile
PIC	-	Programmable Interface Controllers
LED	-	Light Emitting Diode
PCB	-	Printed Circuit Board
SMS	-	Short Message Service
GPS	-	Global Positioning System
RFID	-	Radio Frequency Identification

CHAPTER 1

INTRODUCTION

Nowadays, the life of the persons has completely changed and there is no time for them to face the small life issue. So, this is the right time to provide some space to the technology into our lives for monitoring the issues. One of the issues is the letter delivery at our post box but we didn't realize it at all.

As we know the RF and GSM technologies is really reliable and using those technologies, we can design a device which is capable to detect the arrival of letter and forward the signal to the transmitter when it is near and also send an acknowledgement SMS to the owner's hand phone so that he or she will be alert about the letter arrivals. The basic idea of the system is to employ an RF receiver at the post box and the sensor to detect the letter arrivals. The GSM modem will send the SMS when the sensor detects the letter arrivals. Owner will have the transmitter, when he or she walks near by the buzzer will trigger to alert the owner about the letter arrivals.

1.1 Problem Statements

Most of the people are not alert about the letter arrivals, this may lead to the delay in receiving the information and in some scenarios it may also lead to tough situations. One of the examples is, when we are late to pay the telephone bill, the service provider will bar our line and we need to pay the reconnection fee for the telephone line to recover. So in this project aims in providing a very reliable and very user friendly solution to overcome this kind of problem.

1.2 Objectives

This project embarks on the following objectives:

1. To provide alert mechanism for prompt notification.
2. To provide updates upon the letter arrivals.
3. To utilize RF and GSM modem technology at the post box for better living.

1.3 Scopes

The Smart Post Box System was designed to fit almost all types of house. This system can be implemented at the apartments, bungalows, universities and others. The RF technology also has range almost 20 meter to be detected.

1.4 Project Significance

This project mainly designed to provide alert mechanism, so it may help to reduce people's carelessness about the important letter and bill. This kind of problem can be solved effectively using RF technology and GSM modem.

1.5 Expected Output

The expected output of this project is a working device which comprise software and hardware technology that support the Smart Post Box System.

1.6 Conclusion

As a conclusion, this project have 3 objectives that may solve the problem statement stated above. It will combine the RF Technology and GSM modem module to produce the Smart Post Box System. It is clearly explained that this project is develop to contribute alert mechanism to the society.

CHAPTER 2

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

This chapter presents the review from previous researches that are related to this project. There are lots of researches on RF or RFID technologies using different approaches. Almost all of the researchers trying to combine two or more technologies to make the product more efficient and highly usable to the society.

2.2 Facts and Findings

The SMS technology used for various purposes, one of the researchers present a design and implementation of SMS based control for monitoring systems, (Ciubotaru-Petrescu *et al.* 2006). There are three modules involving sensing unit for monitoring the complex applications which consist the processing unit that is microcontroller and a communication module that uses GPRS modem or cell phone. The SMS is used for status reporting such as power failure.

In addition, RFID, GSM modem and GPS technology are widely used for tracking and security purpose. For example, “A RFID, GPS & GSM Based Vehicle Tracking and Employee Security System” combine the installation of an electronic device in a vehicle, with purpose-designed computer software to enable the company to track the vehicle's location, (Penthakar *et al.* 2012). In vehicle tracking systems

they use Global Positioning System (GPS) technology for locating the vehicle. Vehicle information can be viewed on electronic maps via the Internet or specialized software. Due to recently happened mishaps such as burglary, rape cases etc., the employee safety, esp. for the women employees, has become a number one priority for most of the companies. Even though the companies take good precautions to ensure that its employees are safe, there are some serious loop holes in the existing system. Firstly there is no full proof mechanism to track the outsiders to avoid this kind of problem we are going to implement a system that provides more security to the employee. The unit is placed inside the car .When the car picks up the employee, he/she needs to swap the RFID card. The micro controller matches the RFID card no. with its database records and sends the employee's id, cab id & the cab position co-ordinates to the company unit via GSM module. The GSM Modem will receive the message through GSM in the company unit. If employee finds himself/herself in a problem, he/she will press the button. Microcontroller will detect the action & sends a signal to the GSM which will coordinate with to the company unit and police. Microcontroller will also send a signal to the relay which will turn off the car ignition & stop the car. The GSM Modem will receive the message. This message will then be transferred to the computer through the serial port. The employee name, employee id & cab position coordinates (longitude and latitude) get displayed on computer. Once the data is obtained on the computer, it can be used for further analysis. In this way the company unit keeps a track of the vehicle. This will be a much simpler and low cost technique compared to others.”

Besides, people can control home appliances using mobile phones, (Ahmad *et al.* 2011). People can use this system to do things in their home from a far place before they reach home. To control an appliance the user sends a command in form of SMS from his/her mobile phone to a computer which is connected to the appliance, once the message is received the computer will send the command to a microcontroller for controlling the appliance appropriately.

Lastly, the GSM technology explores primary health-care management for the rural population, (Murthy 2008). A solution proposes the use of the mobile web-technologies providing the personal health care services to the rural population. The

system involves the use of SMS and cell phone technology for information management, transactional exchange and personal communication.

From the literature review mention above, most of the researchers try to combine the technologies, for example (Penthakar *et al.* 2012) combine GSM, GPS and RFID to increase the alert mechanism in the society. However, the RFID and GPS have some limitation which are RFID can be detected only on the certain distance while GPS cannot be detected inside the tunnel or building.

2.3 Proposed System and Product

The proposed project is combining the two technologies which are RF and GSM modem technologies in Smart Post Box System. The RF module will directly communicate with GSM modem to increase the alert mechanism to the user. First, the RF receiver will detect the RF transmitter signal, when the connection between transmitter and receiver success it will trigger the buzzer to notify that the letter has been drop at the post box. Then, it will also activate the GSM modem to send the SMS to the owner.

2.4 Project Methodology

This chapter explains the detailed design of the project in order to help the reader to understand on how the project is going to be executed. It is divided to the project Flow Chart and the Hardware Prototype sub section.