

DEVELOPMENT OF PIC BASED SAFETY VEHICLE SYSTEM

CASSANDRA LEONG CHAI EE

This Report Is Submitted In Partial Fulfillment Of Requirements For The Bachelor of
Electronics Engineering (Telecommunication) with Honours

Faculty Of Electronics & Computer Engineering
University Technical Malaysia Melaka
June 2015



UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : DEVELOPMENT OF PIC BASED SAFETY VEHICLE SYSTEM

Sesi Pengajian :

4	B	E	N	T
---	---	---	---	---

Saya CASSANDRA LEONG CHAI EE 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

Disahkan oleh:

(TANDATANGAN PENULIS)

(COP DAN TANDATANGAN PENYELIA)

Tarikh:

Tarikh:

STUDENT'S DECLARATION FORM

“ I hereby declare that this report entitled “ Development of PIC Based Safety Vehicle System” is the result of my own research except as cited in the references. The report has been not accepted for any degree and is not concurrently submitted in candidature of any other degree”

Signature :

Name : CASSANDRA LEONG CHAI EE

Matric Number : B021210271

Date : 07/6/2015

SUPERVISOR DECLARATION FORM

“ I declare that I have read through this report entitled “ Development of PIC Based Safety Vehicle System” and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Industrial Electronics”

Signature :

Name : DR ZAMRE BIN ABD GHANI

Position : SUPERVISOR

Date :

ACKNOWLEDGEMENTS

Foremost,I would like to express my deepest gratitude to my supervisor, Dr Zamre Bin Abdul Ghani, for the continuous support of my degree final year project for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of develop project and writing of this thesis. I could not have imagined having a better supervisor for my final year project.

On top of that, I take this opportunity to express gratitude to all of the Department faculty members for the stimulating discussion, for the sleepless nights we were working together before deadlines and for the fun we have had fun in this three years. Last but not the least,I would like to thank my parents for the encouragement, support and attention to complete this thesis and my final year project. I also place on record, my sense of gratitude to one and all, who directly or indirectly involve in this project.

Thank You.

ABSTRACT

This project is to design and develop a vehicle safety alert system by using transmitter and receiver in a circuit with the utilization of the PIC. The main purpose of this project is to prevent collision caused by driver when the front car uses sudden brake. The car behind will be more alert when a signal received from the front car. Besides that, the alert message will be displayed in the LCD display together with an alert sound according to what we have been program into PIC. In addition, the sensor will be added on the left and right side of the car. The main purpose is to detect vehicles from left and right side because sometimes the driver is unable to detect the presence of vehicles due to blind spot. This will caused accident to occurred immediately. With the installation of sensor, it will help driver to detect the nearest vehicles within the detection angle.

ABSTRAK

Projek ini adalah untuk mereka bentuk dan membangunkan sistem amaran keselamatan kenderaan dengan menggunakan pemancar dan penerima dalam litar dengan penggunaan PIC. Tujuan utama projek ini adalah untuk mengelakkan kemalangan yang disebabkan oleh pemandu apabila kereta depan menggunakan brek secara tiba-tiba . Kereta di belakang akan lebih berjaga-jaga ketika isyarat yang diterima daripada kereta depan. Selain itu , mesej amaran akan dipaparkan dalam paparan LCD bersama-sama dengan bunyi amaran dengan apa yang kami telah program ke dalam PIC . Di samping itu, sensor akan ditambah di sebelah kiri dan kanan kereta. Tujuan utama adalah untuk mengesan kenderaan dari sebelah kiri dan kanan kerana kadang-kadang pemandu tidak dapat mengesan kehadiran kenderaan kerana sudut buta. Kemalangan ini akan berlaku serta-merta dan merata tempat. Dengan pemasangan sensor, ia akan membantu pemandu untuk mengesan kenderaan yang terdekat dalam sudut pengesanan.

TABLE OF CONTENTS

CHAPTER	CONTENT	PAGE
	ACKNOWLEDGEMENT	I
	ABSTRACT & ABSTRAK	II
	TABLE OF CONTENT	IV
1.0	INTRODUCTION	
	1.1 : Overview	1
	1.2 : Introduction	1
	1.3 : Project Objective	3
	1.4 : Problem Statement	3
	1.5: Scope Of Project	4
	1.6 : Project Methodology	4
	1.7 : Project Planning	7
	1.8 : Thesis Outline	7
2.0	LITERATURE REVIEW	
	2.1 : Overview	9
	2.2 : Case Study	9
	2.3 : Journal and Internet Research	10
	2.3.1 : Volvo Car Group Reveal World First Cyclist Detection With Full Auto Brake	10
	2.3.2:Automatic Braking System With Proximity Detection To A Preceding Vehicle	11
	2.3.3 : Honda Introduces City Brake Active System To Help Prevent Low Speed Accident	11
	2.3.4 : Comparison Between Existing Automatic Braking System And Safety Detection Alert	12

	Braking System	
	2.4 : Transmitter	14
	2.5 : Receiver	14
	2.6 : Programmable Integrated Circuit (PIC) 16F877A	15
	2.7 : Ultrasonic Sensor	17
	2.8 : LCD display	20
	2.9 : RF-TX-315	21
	2.10 : PIC Start up Kit	22
3.0	METHODOLOGY	
	3.1 : Overview	23
	3.2 : Data Collection	23
	3.3 : Gantt Chart	24
	3.4 : Project Work flow	27
	3.5 : Block Diagram of project	29
	3.6 : Components Installation	30
	3.7 : Transmitter and receiver RF-TX-315	32
	3.8 : Hardware Development	34
4.0	RESULT AND DISCUSSION	
	4.1 : Overview	40
	4.2 : Transmitter and receiver are constructed in Proteus	40
	4.3 : Transmitter and receiver is constructed on breadboard	42
	4.4 : The combination of TX/RX with ultrasonic and PIC circuit on breadboard	42
	4.5 : Circuit in PCB Layout	43
	4.6 : Programming of PIC	47
	4.7 : Implementation of Circuit into Models	48
	4.8: Transmitter Circuit Analysis	49
	4.9: Receiver Circuit Analysis	51
	4.10: System simulation	51
	4.11: Ultrasonic Sensor with PIC	52

	4.12: System Output	54
5.0	CONCLUSION AND RECOMMENDATION	
	5.1 : Overview	58
	5.2 : Conclusion	58
	5.3 : Recommendation	60
6.0	REFERENCE	62
7.0	APPENDIX	63

LIST OF FIGURES

FIGURE	TITLE	PAGES
Figure 2.3.1.1	Volvo Car Windscreen Display Red Warning	11
Figure 2.3.3.1	City Brake Active System	12
Figure 2.4.1	Transmitter Circuit	14
Figure 2.5.1	Receiver Circuit	14
Figure 2.6.1	PIC16F877A PDIP 40 Micro controller Pin Description	15
Figure 2.7.1	Ultrasonic Sensor	17
Figure 2.7.2	Ultrasonic Working Principle	19
Figure 2.8.1	LCD Display	20
Figure 2.9.2	RF-TX-315 Description	21
Figure 2.10.1	40 Pin PIC Controller	22
Figure 3.3.1	Gantt Chart	26
Figure 3.3.2	Milestones	26
Figure 3.4.1	Project Flow Chart	28
Figure 3.5.1	Block Diagram Of Project	29
Figure 3.6.1	RF-TX-315	30
Figure 3.8.4.1	Soldering Process	36
Figure 3.8.4.2	Rosin Soldering Flux	37
Figure 3.8.4.3	Soldering Iron	37
Figure 3.8.4.4	Soldering Lead	38
Figure 3.12.1	Sucker	38
Figure 4.2.1	Transmitter Circuit in Proteus Software	41
Figure 4.2.2	Receiver Circuit in Proteus Software	41
Figure 4.3.1	Circuit Construction On breadboard	42
Figure 4.4.1	Combined Circuit On Breadboard	43

Figure 4.5.1	The Transmitter Circuit Constructed in PCB Layout	44
Figure 4.5.2	The Receiver Circuit Constructed in PCB Layout	44
Figure 4.5.3	The PIC Circuit Constructed in PCB Layout	45
Figure 4.6.1	Coding For PIC	47
Figure 4.7.1	Transmitter and Receiver Circuit including PIC Circuit with Ultrasonic Sensor	48
Figure 4.7.2	Two Model Of Cars	49
Figure 4.8.1	Transmitter Circuit	50
Figure 4.9.1	Receiver Circuit	51
Figure 4.10.1	Simulation Result	52
Figure 4.11.1	PIC Circuit	53
Figure 4.11.2	PIC Circuit With Ultrasonic Sensor	53
Figure 4.12.1	Front View Of The Car	55
Figure 4.12.2	Side View Of The Car	55
Figure 4.12.3	Two Model of the CARs	56

LIST OF TABLES

TABLE	TITLE	PAGES
Table 2.3.4.1	Comparison Between System Used From Different Journal	12
Table 2.3.4.2	Comparison Between Automatic Braking And Braking Detection	13

CHAPTER 1

INTRODUCTION

1.1 Overview

In this chapter, it described in more detail on the development of Programmable Integrated Circuit (PIC) Vehicle Based Safety Alert System. In addition, it also describes the objectives, problem statement, project scope, project methodology , project planning and theses outlines.

1.2 Introduction

A lots of accidents happen nowadays. According to the statistic in newspaper or a

magazine, it shows a road accident is increasingly rising. Various environmental factors that contributed to these accidents. One of the main factors is drastically braking from the driver. For example, when the first car suddenly pushes a brake, the second car surely could see it and have time to push the brake. What will happen to the third car? For sure, it is too impossible for the third car to identify if the first car pushed the brake drastically. This is due to limited sight. Besides that, it also happens from a side car when driving out from a junction or roundabout, the driver may be unable to determine any vehicle passing by because of a blind spot. So, the development of a Programmable Integrated Circuit (PIC) Based Safety Vehicle Alert System is a solution. This development is very useful for safety purposes especially in the transportation field and it can reduce accidents anywhere.

Based on research, there are no written papers that published or clarified this system yet. Most of the research or journal that found, it explained more about an automatic braking system not a vehicle safety alert detection system. The automatic brake uses the sensor and no driver input to brake. While this system uses a transmitter and receiver concept with input from the driver. Besides that, we added a side sensor to sense any obstacle from the side to alert the driver.

For this system, it applied transmitter and receiver concepts. The general function of the transmitter is to modulate and send a signal to the receiver. It generates a desired correct transmission. While, the general function of the receiver is to receive a signal from the transmitter and convert the information carried by them to a usable form.

This system can be implemented in an actual situation for example when in front of a car pushes a brake, the transmitter sends a signal to the car in a certain range. Based on this system, the range is about 100m. But usually the distance between three cars is roughly around 10m. The car in range gets a signal. The signal sent by the transmitter to the receiver. The buzzer alarms and the LCD displays once it receives a signal. The car behind which is in range also gets an alert and depends on the driver either to brake or not. This system gives an alert to the car behind that the car in front is braking but braking depends on driver input. The car behind takes action based on the alert from the transmitter and the accident also

can be avoided. Beside that, sensor are added sided of the car. The sensor function to sense any obstacle 2m around the car and it directly activate buzzer and LCD displayed on the screen. Overall, this system is used concept of transmitter and receiver, ultrasonic sensor, Programmable integrated Circuit and LCD display. Transmitter and receiver worked in the range of 100m with the frequency 315MHz. However, the distance can be adjusted depends on antenna design, environmental and supply voltage.

1.3 Project Objective

There are several objectives involved in this project that should be focused to in order to achieve the design of project:

- i. To simulate the transmitter and receiver circuit.
- ii. To develop the transmitter and receiver hardware.
- iii. To develop system programming using PIC and display it on LCD.
- iv. To develop sensor circuit use to detect presence of obstacles.

1.4 Problem Statement

Lots of accidents happen due to sudden brake by drivers. Normally first car behind the front car are able to detect when driver in front braking. But, following car behind first car have difficulty to detect it. Due to limited sight, accident tend to happen anywhere. Therefore, this phenomena trigger our main problem and gives the idea to reduce the accident by designing an emergency breaking system to alert the cars behind when the car in front are braking and also to solve blind spot problem. Beside that, it also happen from sided car when drive out from junction or round about, driver may unable to determine any vehicles pass by.

1.5 Scope of Project

-In order to achieve the objective of the project, several scope need to be identified. The scope of this project is:

1. The concept of transmitter and receiver must be understand by browse the web, refer journal and books. The comparison of similarities and differences is makes by previous journal.
2. Transmitter and receiver used concept of RF. The transmitter used is RF-TX-315 and receiver RF-TX-315. The frequency is 315MHZ and range up to 100m.
3. Transmitter and receiver made up of IC, resistor, LED and many more to implement into a model.
4. Three model of car are used to run the circuit whether it function or not.
5. PIC 16F877A are used to program and result shown in LCD display. Besides that, sensor are used for function to detect vehicles and avoid from hitting them.

1.6 Project Methodology

Phase 1: Research

- Must understand the concept of transmitter and receiver circuit , sensor and PIC.
- Surf web, journal and read book.

Phase 2: Design

- Designed the transmitter and receiver circuit.
- Developed sensor circuit for vehicle detection.

Phase 3: Hardware development

- Developed transmitter, receiver and sensor circuit.

Phase 4: Hardware testing

- Testing hardware to test functionality.
- Fabricate in PCB board to test result.

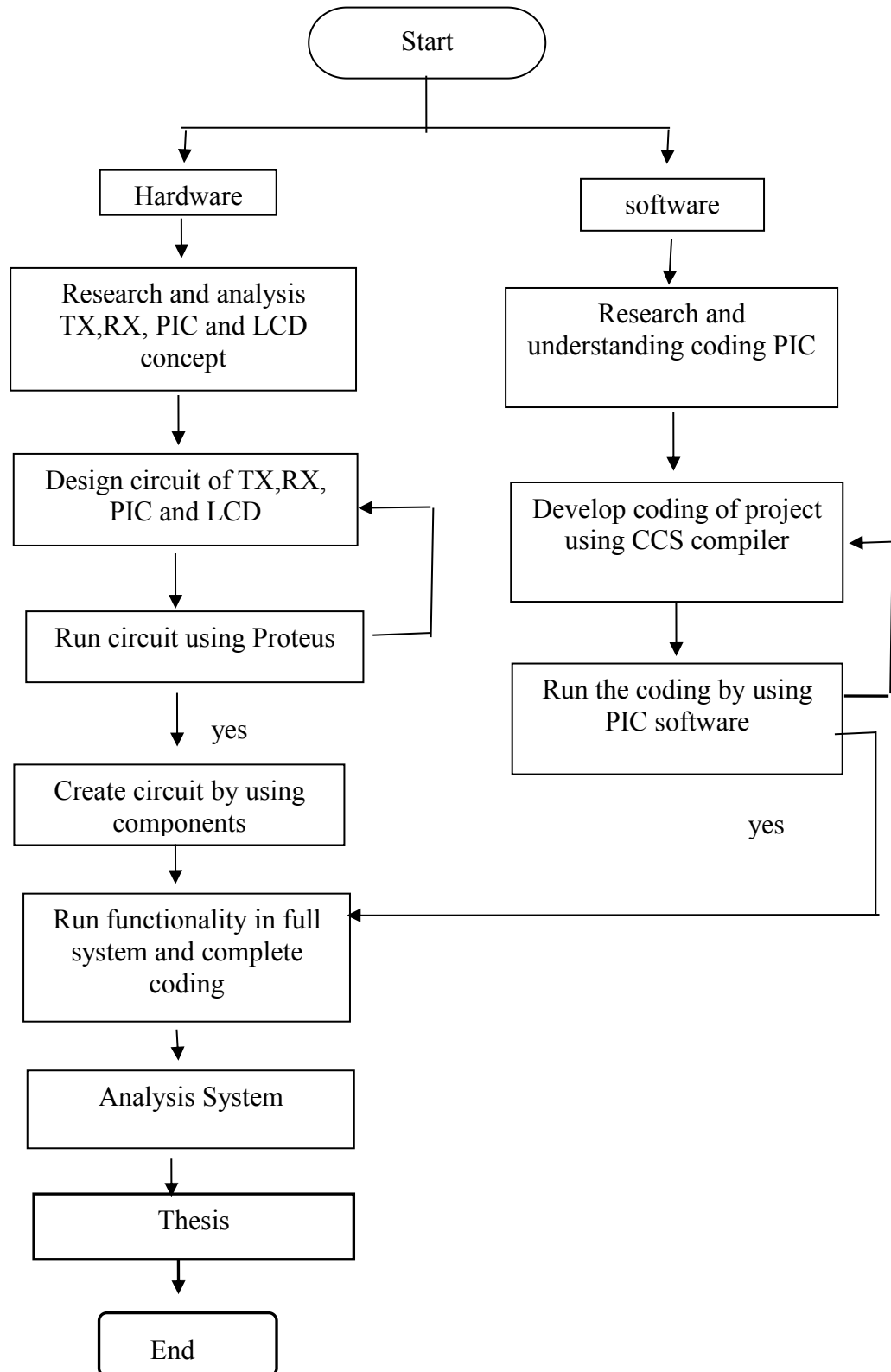
Phase 5: Hardware implementation

- Phase involving each transmitter and receiver having connection each others.
- Phase involving sensor and PIC together.

Phase 6: Analysis Data

- Data will be collected for analysis and suggest for overcoming weakness of project.

Flowchart:



1.7 Project Planning

This Project is done based on the project planning schedule which is Gantt chart. This project started from September 2014 until June 2015.

1.8 Thesis Outline

This thesis consists of five chapters, namely the introduction, literature review, methodology, results and discussion and final section is the conclusion and recommendations. Each chapter explains in depth about what is done with this project .

Generally , chapter one is preferable to the introduction of the project . In this section , it explains the objectives , problem statement, project scope , project methodology , project planning and theses outlines.

Chapter 2 describes the research project literature. It explains about the journal or articles associated with the project. In addition, comparison and differences of each journal has been declared. The components used in this project are also highlighted .

Chapter 3 is the methodology of the overall project. In this chapter we discussed about the project schedule as work flow and methods used to prepare this project . Methods used as data collection methods , circuit construction , the etching process , the soldering process , the drilling process , the implementation of components and troubleshot process . In addition, the Gantt chart will also show for review .

Chapter 4 discusses the results and discussion of the project. This chapter analyzes the transmitter and receiver circuits .It also includes a circuit PIC 16F877A with ultrasonic sensors and display on the LCD display . In addition, it has a simulation system and also shows the output of the system. Discussions explain the whole problem that occurs during the execution of this project from the beginning until the end .

Chapter 5 deals with the conclusions and recommendations of this project . In this

section , it is concluded achievement and the overall project. Then , some proposals have been made to recommend further research will come and improved from time to time.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

This chapter discusses the journal and articles related to the project, namely the development of PIC based safety alert system. In this chapter, it state the difference between this project and existing project in term of circuit, components and methods were used. In addition, the operation and specification has also been disclosed.

2.2 Case Study

Development PIC of vehicle safety alert system is applied transmitter and receiver

concept. The function of transmitter is modulated and sends signals to the receiver while receiver function as received the signal and convert information carried by them to usable form. Beside that, PIC 16F877A act as interface between receiver, sensor and LCD display. Ultrasonic sensor is implemented into this project because of the wide area coverage. The signal send by the transmitter to receiver. And the LED light up and buzzer alarm and display in LCD display according what we have been program. This system worked in range of 100m with frequency 315MHz.

2.3 Journal and internet research

This study was carried out by surfing the internet and journals. Based on the research , no writing paper issued and explain about this system . There is a lot of discussion paper on automatic brake the vehicle tracking system . Sensor automatically use sensor but no driver input to the brakes. Although , the system use the transmitter and receiver to the concept by the driver to brake. Comparison between the brake automatic and this\ s system also be done .

2.3.1 Volvo Car Group Reveal World First Cyclist Detection With Full Auto Brake

This system uses the concept of a combined radar and camera sensor . Radar working as a detector that uses radio waves to determine the distance , distance and speed of an object . In addition, the radar scans the area in front of the car . It shows the radar has a range of vision. After radar detected an object, the camera verified whether the object is vehicle , pedestrian or bicycle . Then , the camera keep an eye on the object if a critical condition. With advanced sensor technology , it can use the full braking power instantly when necessary . If the situation becomes critical and in danger , red warning appear in the mirror and brakes the car automatically be activated. Figures 2.3.1 shows volvo car mirror displays red when it detects pedestrians.



Figure 2.3.1.1: Volvo car windscreen display red warning

2.3.2 Automatic braking system with proximity detection to a preceding vehicle

The system for detecting the distance between the vehicle and vehicle-mounted systems with min prior to moving the ultrasonic generator. It brake automatically to ensure the safety of passengers when the vehicle is approaching the preceding vehicle in a preselected distance . It consists of a speed sensor and proximity sensor. This system used to monitor vehicle speed and the distance between the vehicle and the preceding vehicle . It determines the time required for a vehicle which collided with the previous vehicle by vehicle speed compared with the past. The distance to the preceding vehicle to move the brake automatically when the time is shorter than the marginal childhood preselected .

2.3.3 Honda introduces city brake active system to help prevent low speed accident

Honda has developed a support system for accident avoidance braking called active systems . Brake active system operates when the vehicle is moving at speeds less than 30 km/h . It uses a laser radar mounted on the top of the windscreen to detect when a collision occurs . If the brake system of the city actively identify high- risk collision, it emits audio and visual warning to the driver . If the driver does not take action to avoid a collision , the system automatically applies the brakes .

Active brake system also protects the driver from the acceleration due to