SMART CAR ALARM SYSTEM USING PIC MICROCONTROLLER

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PROJEK SARJANA MUDA II

Tajuk Projek : **Smart Car Alarm System Using PIC Microcontroller**

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Dedicated to my beloved family

To my father and mother

To my respected lecturer/supervisor

And to all my course mates

For their support, advice, patience and understanding.

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ABSTRACT

The first case of car theft was happened in 1896. It was happened a decade after gas-powered cars were invented. From that time until today, cars have been a good target for thieves. It is because, cars are valuable, easy to resell, and have market. Therefore, car security system has always been a matter of concern among car owners. Advancement in technology enables new and more innovative methods of vehicle safety to be introducing into the market. Today's vehicle security systems mostly only have to lock or unlock the door and sounding the siren in the case of intrusion. The siren can only alert those who are near the vehicle during an emergency and this shows that the existing security systems sometimes are not effective. The main objective of this project is to improve the existing system by developing a sophisticated car alarm system based on combination of GSM modem, PIC16F877A microcontroller, shock sensor, and ultrasonic motion detection sensor. This system is used to send short message service (SMS) to owner when it is triggered. This project will be expected to enhance the capability of the existing system and cost of the system is reduced so it should have good application value in future as well as reduce the statistic of stolen cars.

ABSTRACK

Kes curi kereta pertama diadakan pada tahun 1896. Ia berlaku selepas masa sepuluh tahun kereta gasolin dicipta. Sejak masa itu sampai sekarang, kereta adalah tumpuan pencuri. Hal ini kerana, kereta adalah mahal, senang untuk dijual, dan ada pasaran. Oleh itu, sistem keselamatan telah dijadikan salah satu perkara perlu diambil-beratkan. Dengan berkembangan teknologi membolehkan inovasi yang baru untuk dijadikan cara-cara sistem keselamatan kepada pasaran kini. Hari ini, sistem keselamatan untuk kenderaan hanya kunci dan buka kunci serta menyuarakan bunyi siren jika sesuatu perkara intrusi berlaku. Bunyi siren hanya didengar kepada orang yang berdekatan dan ini jelas bahawa sistem keselamatan ini kurang efektif. Ojektif utama untuk projek ini ialah memperbaikan sistem kini kepada sistem keselamatan kereta yang canggih dengan kombinasi modem GSM, mikrokawalan PIC16F877A, sensor getaran, dan sensor penemuan gerakan ultrasonik. Sistem ini boleh hantar perkidmatan pesanan pendek (SMS) kepada pemilik apabila sistem itu digerakkan. Projek ini diharapkan akan menambahbaikan kebolehan sistem kini dan sistem ini akan merendahkan kos dan ia patut mempunyai nilai applikasi yang baik pada masa hadapan serta merendahkan kadar kerata dicuri.

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LIST OF ABBREVIATION

NO	TITLE	PAGE
1	GSM - Global System for Mobile Communications	1
2	PIC - Programmable Interface Controller	1
3	SMS - Short Message Service	1
4	LCD – Liquid Crystal Display	2
5	GPS – Global Positioning System	3
6	HEX – Hexadecimal	4
7	AT – Attention	5
8	CPU – Central Processing Unit	6
9	ALU – Arithmetic Logic Unit	6
10	ADC – Analogue to Digital Converter	7
11	PWM – Pulse Width Modulation	7
12	RISC – Reduce Instruction Set Computer	7
13	CISC – Complex Instruction Set Computer	7
14	RAM – Random Access Memory	8
15	EEPROM – Electrically Erasable Programmable ROM	8
16	PC – Personal Computer	10
17	MCU – Microcontroller Unit	10
18	ICSP – In-Circuit Serial Programming	10
19	JDM – Jens Dyekjar Madsen	11
20	LED – Light Emitting Diode	13
21	PIR – Passive InfraRed	15
22	DTE – Data Terminal Equipment	18
23	EIA – Electronic Industries Alliance	18
24	DCE – Data Circuit Terminating Equipment	19
25	SDCCH – Slow Speed Data Channel	20

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27	**PCB – Printed Circuit Board**	**24**
28	**PWB – Printed Wiring Board**	**24**
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CHAPTER I

INTRODUCTION

1.1 PROJECT OVERVIEW

The appearance of automobiles impacts the life of people. It is becoming the progressive symbol of modern society. Not only the demand on performance and quality of vehicles increase rapidly, but there is also demand on anti-theft system for vehicles. Although some sophisticated system like GPS can use to retrieve vehicles, but people dare not use it due to the cost is too high. By using the GSM network for this anti-theft system, the cost is lower compare to GPS. (1)

This Smart Car Alarm System is focusing on anti-theft security system for car. The remote part of this system is based on GSM communication network. The system is composed by MOD9001 GSM modem, PIC16F877A Microcontroller, vibration sensor, ultrasonic sensor, 2x16LCD screen, buzzer, and user's mobile phone.

The idea of using a shock sensor is simple: if someone hits, jostles or moves your car, the sensor sends a signal to the PIC microcontroller and indicating the motion. Then the PIC microcontroller signals a warning. Through GSM modem, the microcontroller sends SMS to mobile phone of the car owner. Moreover, if a thief armed with a tow truck and lifted up your car

and drag the car away, shock sensor can detect this situation. To protect against car thieves with tow trucks, shock sensor is the solution.

This system is equipped with 2x16 LCD to indicate status of the system. The LCD is to display which sensors are sending the signal to the microcontroller and detected by the microcontroller. In addition, the car owner will automatically receive and notification SMS from the system when the alarm is triggered. Once the message sent, the LCD will display: Message Sent. This as to indicate the alert message has already been sent by the system to the owner.

The working principle of the whole system is: The car is in a situation where alarm is activated when the owner of the car leaves. The first type of protection: When a theft trying to steal the car and entered the car, the ultrasonic sensor detects movement inside the car. The system will trigger the buzzer and send message to notify the owner at the same time. The LCD shows the ultrasonic sensor is detected and message sent. The second type of protection: When a theft trying to steal the car by towing the car. The vibration sensor detects the shock of the car when towing. The system will trigger the buzzer and send message to notify the owner at the same time. The LCD shows the vibration sensor is detected and message sent.

1.2 OBJECTIVES

The following objectives are needed as a guide to achieve the goal of this project. They are:

i) To design a car alarm system using PIC microcontroller.
ii) To trigger the car alarm when intruders inside the car are being detected.
iii) To trigger the car alarm when the car is being tow by a tow car.
iv) To interface PIC microcontroller to GSM modem.
v) To write a program in C programming language for the microcontroller to detect the sensors' signals and trigger the alarm as well as send the alert message to owner via GSM modem.

vi) To display the alarm status on 2x16 LCD.

1.3 PROBLEM STATEMENT

The first documented case of car theft was in 1896, only a decade after gas-powered cars were first introduced. From that early era to today, cars have been a natural target for thieves. They are valuable, reasonably easy to resell their parts. Moreover, people are putting a lot of valuable items inside their car: For example, they put wallet, coins, hand bags, important documents, smart-tag, laptops and etc. That is why for a normal switches alarm is not enough to protect car from stolen, windows broken, and car towing.

A car security system has always been a matter of concern among car owners. The advancement in technology helps us to create more and more methods to protect our cars. Today's car security systems mostly only have simple switches on the doors and sounding the siren in the case of intrusion. The siren can only being triggered by intruders. Nowadays, thieves are smart; they can break a window or tow a car by a truck. This shows that the existing security systems are not effective. By improving the existing system a smart car alarm system is required. This system enables sensors to detect the window breaks, car vibrations, and car lift by tow truck.

Although some sophisticated system like GPS can use to retrieve vehicles, but people dare not use it due to the cost is too high. By using the GSM network for this anti-theft system, the cost is lower compare to GPS. (1) Moreover, face detection technique also implemented in car security because this kind of technique is effective and fast, and one alarm signal could be given to make an alarm or "call" the police. (2) However, once again the system is costly and people around the car seldom pay attention to the sounded alarm signal when alarm is triggered by the face detection system.

1.4 SCOPE AND ORGANIZATION

There are several processes was involved in order to complete this Smart Car Alarm System. The system consists of several devices such as PIC, shock sensor, ultrasonic motion sensors, LCD screen, and GSM modem.

Besides the components and devices, there are two programs used in this project. Proteus 7 Professional is used to design the circuit and do some simulation works, while the other one is PIC C Compiler is software which used to compile the C language code to HEX code so that it can be compatible to the PIC. The above programs are used in this project to complete the system.

Inputs: Shock sensor, Ultrasonic motion sensor.

Outputs: Siren, LCD, SMS.

The following shows all the circuits applied in this project:-

a) Shock sensor circuit

The idea of using a shock sensor is simple: if somebody hits, jostles or otherwise moves the car, the sensor sends a signal to the microcontroller and indicating the intensity of the motion. Depending on the severity of the shock, the microcontroller signals the siren.

b) Ultrasonic Motion Detector

It is to protect your car from stolen. It can detect motion of intruder inside your car. The detector is transmitting and receiving ultrasonic so that it can detects motion. Once that occurs, the detector can turn on the buzzer.

c) Liquid Crystal Display (LCD)

It is to current status of the system such as message sent, alarm has triggered, shock detected motion detected, and etc. The ideal of using this device in the project is because it is much lighter and consumes less power than the cathode-ray tubes. Moreover, it is easy to interface with

microcontroller digitally and its running power is 5volts which is same and the microcontroller.

d) GSM modem

It is to transfer data from microcontroller to GSM network. Generally, the GSM modem is used for remote application such as vehicle navigation, remote monitoring, wireless Internet access, and etc. The function of the modem in this project is to send text message using SMS. It is convenient to use because it runs on AT command set and RS232 interface.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews some references from previous projects, journals, articles, books and datasheets. All these information were collected from the different sources such as library, internet, product manual and etc. Furthermore, the information gathered is related to the background study of this project.

2.2 CHAPTER OVERVIEW

This chapter explains on information which related to the Smart Car Alarm System. This chapter reviewed each component used in the system. The components involve are: Microcontroller, Shock Sensor, Ultrasonic Motion Detector, GSM modem, and LCD.

2.3 MICROCONTORLLER

A microcontroller consist of Central Processing Unit (CPU), Arithmetic Logic Unit (ALU), input / output (I / O), memory and peripherals devices combined together to a form of integrated chip. Microcontroller and

microprocessor both contains CPU, however, besides the usual arithmetic and logic elements the microcontroller integrates additional elements such as read-write memory for data storage, read-only memory for program storage, Flash memory for permanent data storage, peripherals, and input/output interfaces. Furthermore, microcontrollers are consuming relatively small energy power (milliwatts or even microwatts), and will generally have the ability to retain functionality while waiting for an event such as a button press or interrupt. Some microcontrollers are compatible with energy saving function. During that time the power consumption may be just nanowatts, making them ideal for low power and long lasting battery applications.

2.3.1 PIC Microcontrollers

Microchip manufactures a series of microcontrollers called PIC. That is Peripheral Interface Controller or Programmable Intelligent Computer. They are different kinds of microcontroller available from Microchip. They are from some basic low memory types to ADC (Analogue to Digital Converter) and even PWM (Pulse Width Modulation) ready. The PIC Microcontrollers are in Reduce Instruction Set Computer (RISC) design which is containing small number of instructions only. For example the PIC16F877A, it just contains thirty seven instructions. Since it is less instruction compare to Complex Instruction Set Computer (CISC), so its design also will be much simpler than CISC. Because of its RISC design, it must support high clock speed to make it faster.

The microcontroller that will be used in this project is PIC16F877A. It is at middle-high-range series of the microcontrollers developed by MicroChip Inc and it is also characterized as RISC architecture microcontroller. There are 35 single word instructions in this microcontroller. Figure 2.1 shows the pinout for the PIC16F877A.

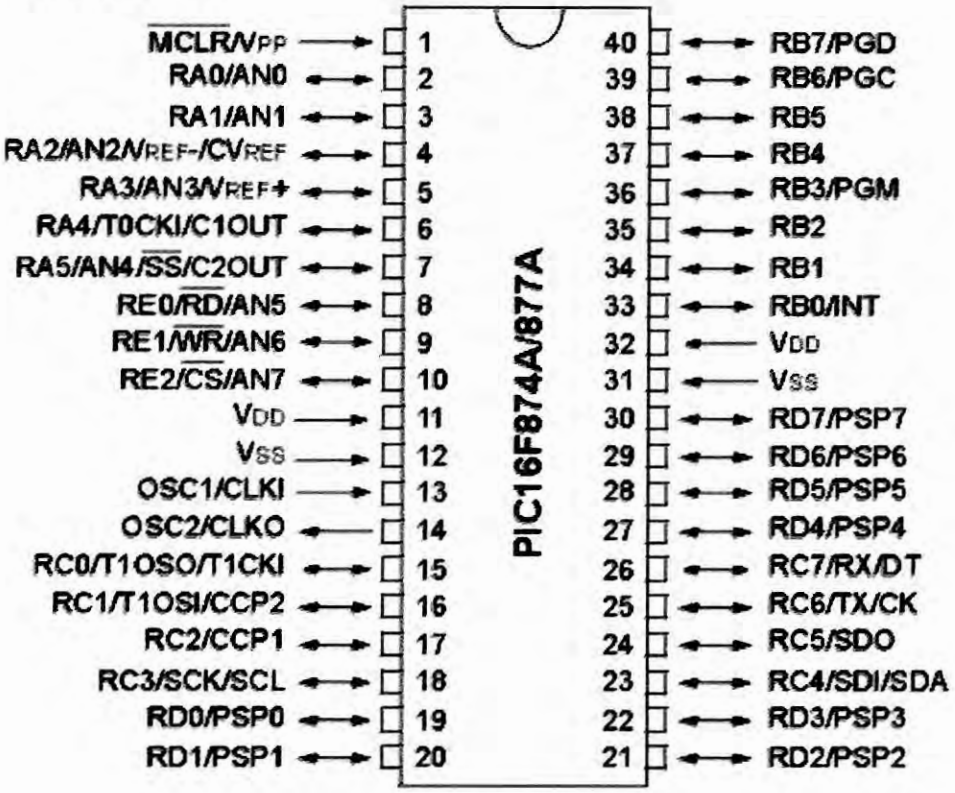

Figure 2.1 PIC16F877A pinout

From the Figure 2.1, there are 5 ports available in this PIC which is port A, port B, port C, port D, and port D. These ports are bidirectional I / O ports, which mean each port can be used as an input or an output or both. Moreover, it has many powerful features such as interrupt capability, 8K × 14 words of Flash program memory, 368 × 8 bytes of data memory (RAM), 256 × 8 bytes of EEPROM data memory, and single 5V in circuit serial programming capability and etc.

The following shows the usages and features of the PIC16F877A.

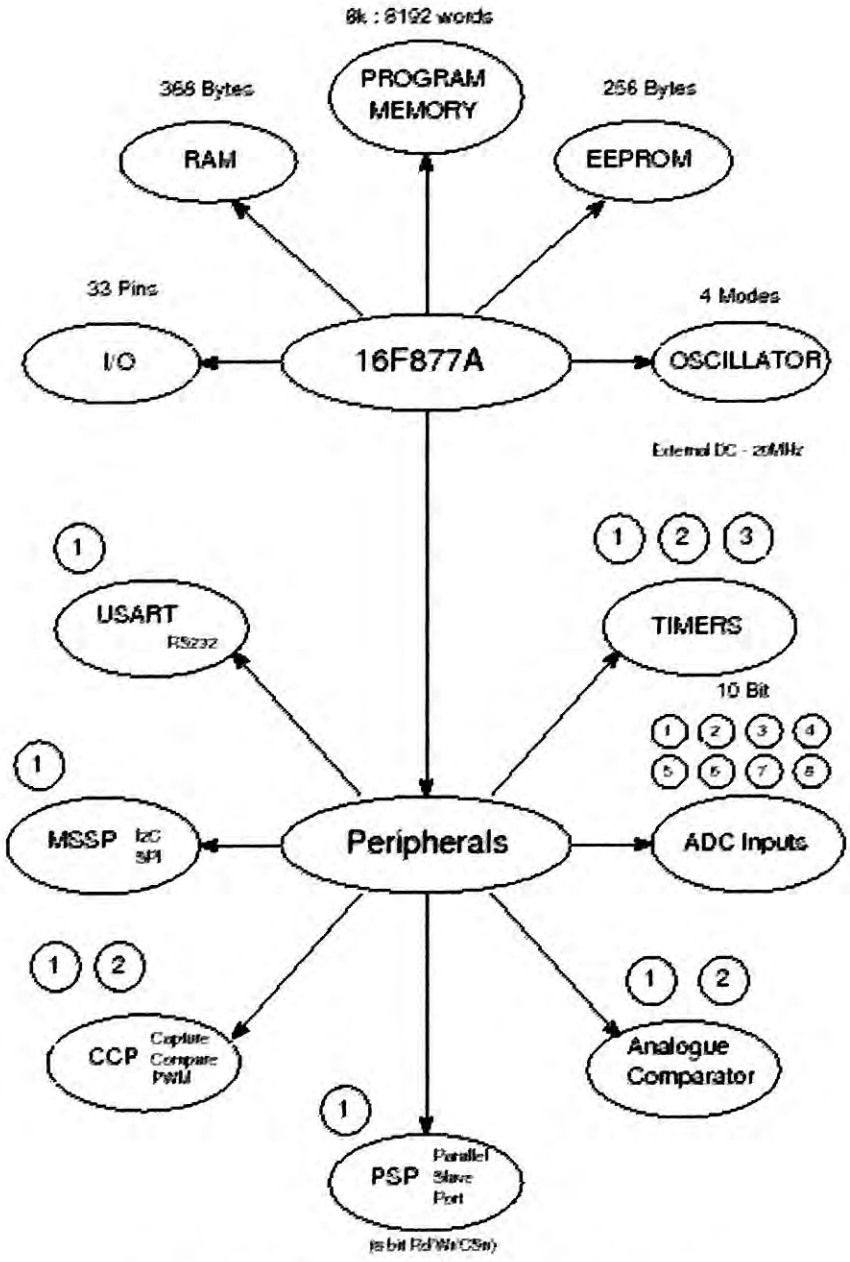

Figure 2.2 PIC16F877A usages and features