SMART HOME SECURITY SYSTEM
(Design of Magnetic Switch Sensor and Phone Dialer)

By

ROSNIDA AB WAHAB

FINAL PROJECT REPORT

Submitted to the Electrical & Electronics Engineering Programme
in Partial Fulfillment of the Requirements
for the Degree
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(Electrical & Electronics Engineering)

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CERTIFICATION OF APPROVAL

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Approved:

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UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

JUNE 2007

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JUNE 2007

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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Rosnida Ab Wahab

ABSTRACT

The report is written to present the work done on the Final Year Project entitled "Home Security System: The Design of Microcontroller Based Automatic Phone Dialer and Magnetic Switch Sensor Circuit". This project aim is to design a system that can monitor home security whenever the owner is away from the house.

This project focuses on designing the circuitry for the magnetic switch sensor and the automatic phone dialer as well as further integrating the two designs for implementation of a complete home security system. The input of the automatic phone dialer comes from the output of the magnetic switch sensor. When there is an intrusion, the output voltage of the sensor rises. The microcontroller which is embedded in the automatic phone dialer circuit acts as the brain for the dialing purposes.

The microcontroller is programmed to work such as by using the special language called 'C programming'. This language interprets whatever the data being inputted to the microcontroller to binary numbers so that the microcontroller can perform the command programmed by the programmer.

In order to successfully implement this project, researches on the topic selected and feasibility studies were carried out. Any problem regarding the project is identified before the conceptual design. With the concept clarified, the model construction is done followed by experimentation and programming the source code. After a numerous testing and troubleshooting, a complete prototype of the whole system is finally designed.

ACKNOWLEDGEMENTS

In the name of Allah, the Most Gracious and the Most Merciful, the utmost thanks to Allah for giving the opportunity to complete the research and study about EE Final Year Project Home Security System, even with some problems faced throughout the project undertaking

Greatest appreciation and gratitude to the Final Year Project supervisor, Dr John Ojur Dennis for his supervision, commitment, professionalism, advice and guidance throughout the semester

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- Colleagues for the encouragement

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CHAPTER 1
INTRODUCTION

1.1 Background of Study

Home security system is widely implemented in today's technology. But somehow most of the systems only give alert to the users when they are inside the house or nearby the house. What happens if they leave the house? With this new design of Home Security System users will be alert on their house security whether they are at home or away from home. The idea is basically by having the sensor to detect any intruder or smoke and send the output to a phone dialer that will dial the owner's mobile phone whenever the owner is away from home. When the user is at home, they can just set the system to only give an alarm without having to dial the owner's mobile phone.

This new designed of Home Security System are incorporated with temperature sensor, smoke detectors, and magnetic switch sensor. Hence the security system will go on alert when there is an attempt of break-in or if there is possible smoke or fire. But when the user is not at home, they can have the system to directly contact them via phone if any of the sensors detect an intrusion or fire.

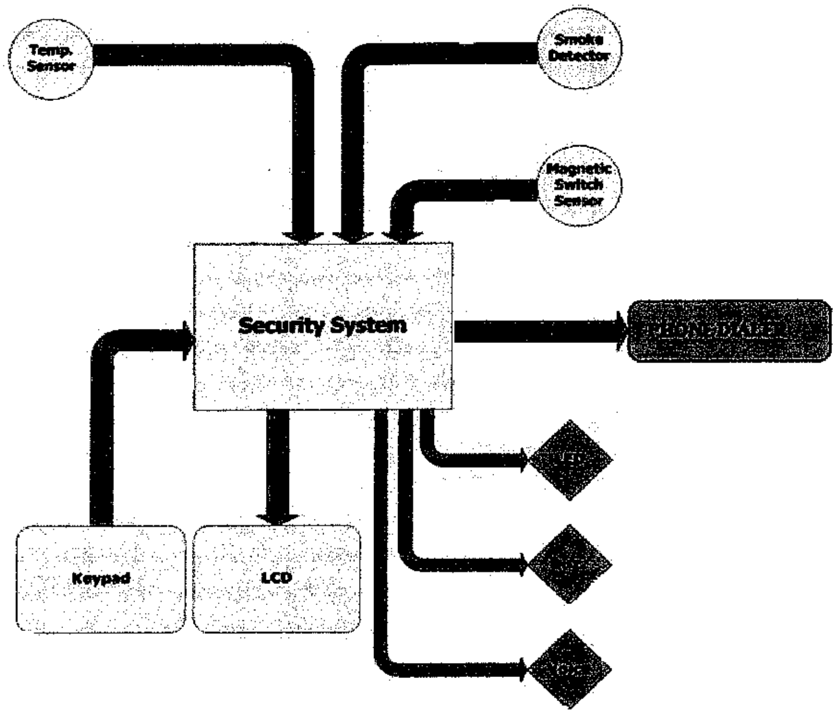


Figure 1.1: The project logic structure

The logical structure of the design is shown in the block diagram in Figure 1.1. The central system will handle all the sensors and keypad input, output information to LCD screen, indicate system status on LED, and make buzz or voice alarm as well sending output to a phone dialer that will connect to the owner's mobile phone.

Basically the whole project is divided into two major parts:

1) The designs of temperature sensor and smoke detector, keypad and LCD display
2) The designs of magnetic switch circuit and automatic phone dialer

Each of the parts will be completed by a student and this researcher will complete the design for each part.

1.2 Problem Statement

A residence without home security system installed in their house is approximately three times more likely to be broken into than one without. Homeowners who have home security systems loose an average of $400 less in valuables in the event of a robbery [1]. These facts prove that the installation of a home security system dissuades intruders and protects your home. Thus, having a security alarm system may decrease the chances of a burglary. Even if the alarm system does not keep a burglar from breaking in, it may cause the burglar to stay a shorter amount of time.

However, most of the security systems implemented today consists of only a specific sensor being applied. Example a burglar alarm system which uses to monitor any unwanted intrusion. But this smart security system is a combination of 3 sensors:

1. magnetic switch sensor for burglar detector
2. smoke sensor for fire prevention
3. temperature sensor for smoke detector

Furthermore, the existing security systems mostly give out alarm when any sensor senses a target. This alarm can only alert the owner when they are inside the house or nearby the house. Thus we introduce a system that can also alert the owner even when they are not at home. The system will dial the owner's mobile number whenever there is an alarm.

1.3 Objective

The objectives of this project are:

- To design and simulate a microcontroller based automatic phone dialer using appropriate tools and methodology.
- To design a circuitry for magnetic switch sensor as an intrusion sensor.
- To construct a prototype for both the magnetic switch sensor and the automatic phone dialer
- To come up with a design which is cost effective, simple to use and easy to set up.

1.4 Scope of Study

The scope of this project takes into consideration the study of the magnetic switch sensor, the microcontroller functions, programming the C language for the PIC16F877A microcontroller, the DTMF telephone, the design and the simulation of all circuits.

On the hardware side, the simulated design is wired nicely on a veraboard and presented in the form of a complete circuitry for both the magnetic switch and the automatic phone dialer. At the end of this project, a prototype of a new home security system will be developed that can be installed in any homes. This project has exposed the author to microcontroller programming and digital electronics design and resulted in a hands-on experience in order to complete the task in a given time frame.

CHAPTER 2
LITERITURE REVIEW AND THEORY

2.1 Sensors

Most sensors are electrical or electronics, although other types exist. A sensor is a type of transducer. Sensors are either direct indicating (e.g. a mercury thermometer or electrical meter) or are paired with an indicator (perhaps indirectly through an analog to digital converter, a computer and a display) so that the value sensed becomes human readable. In addition to other applications, sensors are heavily used in medicine, industry and robotics [2].

In this project magnetic switch sensor will be used as the main detector for any attempt of breaking and entering a house.

2.1.1 Magnetic switch sensor

Magnetic switches are electrical load carrying devices. These switches are mainly used for the detection of the opening of windows and doors.

The translation of contact operations into decisions and in turn the shutdown device and alarm are operated by magnetic switches which act as nerve centers. The configuration of magnetic switches results in both normally open and normally closed contacts to accommodate different wiring designs. Magnetic switching is a pulse sharpening technique which is used with primary switch. Magnetic contact switches for open circuit systems are used when the sensor and magnet are together and where there is open contact. When a window or door is opened, these switches are used to trigger a powerflash module in order to send an ON signal. Magnetic contact switches for closed circuit systems are used when the sensor and magnet are together and where there is closed contact. These switches are water proof. The single stage configuration of magnetic switches is designed to provide different output impedances. The rise times can be made faster using the multistage configuration of magnetic switches. The rise time of a magnetic switch is reduced by the core of the material used in the magnetic switch. A magnetic switch prevents the saw from starting back up automatically if the fuse is blown.

The operation of a magnetic switch depends on the magnetic material with a curve which has sharp saturation. The principle of two part magnetic switch is applicable on door switches. It consists of a switch with a fixed structure or a frame and a switch which is sensitive to the magnetic field is mounted on the frame. Also, a ferromagnetic core which is surrounded by a current carrying conductor is available. Thin metal contacts are placed inside the switch which is pulled together by a magnetic field. The wires from the switch are directed through the wall to the control panel. The central control panel senses the switch. A door, close to the switch is mounted by a magnet when the door is closed. This also keeps the switch in closed position when the magnet is passed over it. The switch turns ON when the magnet is placed nearer the switch. When the door opens, the magnet travels away from the switch which makes the switch open and thus the alarm gets activated.

The different types of magnetic switches used in starter control are

- Solenoid magnetic switches
- Relay magnetic switches

The mounting of the switch depends on the opening which is to be protected. Based on the mounting, magnetic switches are classified as

- Recessed Mount Magnetic Switches
- Surface Mount Magnetic Switches
- Overhead Mounted Magnetic Switches

2.2 Automatic Phone Dialer

The automatic phone dialer will act as the main element for this project. The theory is that whenever an alert situation is detected the microcontroller will activate the DTMF telephone to dial a specific telephone number that has been programmed in the microcontroller.

2.2.1 The PIC16F877A Microcontroller

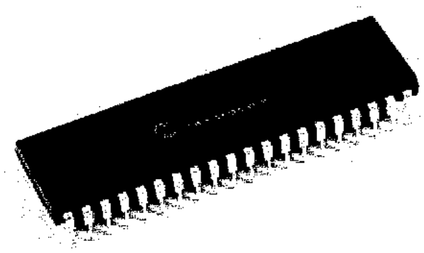


Figure 2.1: PIC16F877A

The PIC16F877A is the microcontroller that is used in the design because of its ability to functions as required in the project. The chip can be programmed to perform operations based on the chip inputs and outputs. To use the microcontroller, two pieces of hardware and software is needed. [3]

Hardware

1. the hardware programmer
2. the circuit to test the inputs and the outputs of the chip in once it has been programmed

Software

1. to write and compile C language code to a hexadecimal (.hex) file
2. to upload the hex file into the microcontroller

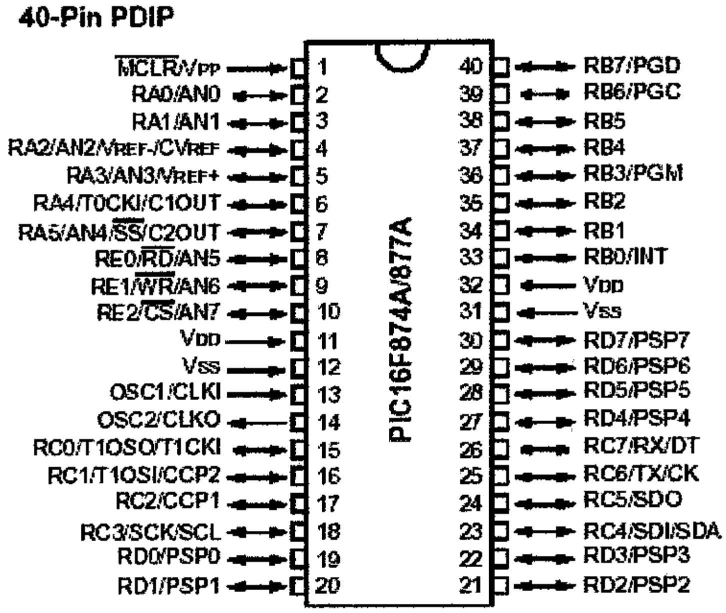


Figure 2.2: The PIC 16F877A microcontroller pins layout

PIC16F877A features 256 bytes of EEPROM data memory, self programming, an ICD, 8channels of 10-bit Analog-to-Digital (A/D) converter, two additional timers, two capture/compare/PWM functions, the synchronous serial port can be configured as either 3 wire Serial Peripheral Interface or the 2-wire Inter-Integrated Circuit bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial appliances and consumer applications. [4]

Besides the usual In/Out ports, the microcontroller also includes PWM (Pulse Width Modulation), a couple of Analog to Digital converters (A/D), and some type of serial communication. The ports can be configured with the programming coding to act as either inputs or outputs. The PWM helps to adjust the duty cycle (how long the outputs is low or high) of a square wave and adjust the frequency of the square wave by giving the PIC the information in the coding itself. The A/D converters can be used to "read" an analog voltage like the output voltage of the magnetic switch sensor. The voltage will then be represented by the PIC as a binary number. [5]

2.2.2 DTMF Telephone Keypad

A **telephone keypad** is a keypad that appears on a "touch tone" telephone. It was standardized when the Dual-tone multi-frequency (DTMF) system was introduced, and replaced the rotary dial [6].

DTMF stands for Dual Tone - Multi Frequency and it is the basis for the telephone system. DTMF is actually the generic term for Touch-Tone (touch-tone is a registered trademark of ATT) [7]. Thus the touch-tone® phone is technically a DTMF generator that produces DTMF tones as the button is pressed.

Dual-tone multiple-frequency (DTMF) signaling is used in telephony applications for sending information, usually key presses, over the telephone line to the exchange or call switching centre. The information must be encoded into signals in the voice-frequency band, as higher frequencies cannot be transmitted through a traditional telephone system.

A typical telephone keypad has 12 to16 keys, arranged in 4x3 or 4x4 arrays. DTMF encoding assigns two frequencies to each key; one frequency indicates the row and the other frequency indicates the column within the keypad matrix. In this way, a 4x4 keypad requires eight frequencies to encode all 16 keys [8].

In DTMF encoding, the eight different frequencies include four high band frequencies for the columns and four low band frequencies for the rows in the keypad. When a key is pressed, the low band frequency for the row and the high band frequency for the column are transmitted simultaneously.

The matrix of frequencies used to encode the 16 DTMF symbols is shown in Figure 2.3. Each symbol is represented by the sum of the two frequencies that intersect the digit. The row frequencies are in a low band, below 1 kHz, and the column frequencies are in a high band, between 1 kHz and 2 kHz. The digits are displayed as they would appear on a telephone's 4x4 matrix keypad (on standard telephone sets, the fourth column is omitted).

DTMF keypad frequencies				
	1209 Hz	1336 Hz	1477 Hz	1633 Hz
697 Hz	1	2	3	A
770 Hz	4	5	6	B
852 Hz	7	8	9	C
941 Hz	*	0	#	D

Figure 2.3: DTMF telephone keypad frequencies

2.3 Voltage Regulator 7805

The magnetic switch sensor circuit and the automatic phone dialer circuit both use 5V DC voltage as the supply voltage. This is system is designed as to have its supplied voltage from 9 V DC battery. Thus voltage regulator 7805 is added to each circuit to regulate the 9 V DC voltages to 5 V DC voltages.

7805 (refer to Figure 2.4) is an integrated three-terminal positive fixed linear voltage regulator [9]. It supports an input voltage of 10 volts to 35 volts and output voltage of 5 volts. It has a current rating of 1 amp although lower current models are available. Its output voltage is fixed at 5.0V. The 7805 also has a built-in current limiter as a safety feature. 7805 is manufactured by many companies, including National Semiconductors and Fairchild Semiconductors. The 7805 will automatically reduce output current if it gets too hot.

It belongs to a family of three-terminal positive fixed regulators with similar specifications and differing fixed voltages from 8 to 15 volts. These are usually packaged in TO220 chip carriers, but smaller surface-mount and larger TO3 packages are also available. The last two digits represent the voltage; for instance, the 7812 is a 12-volt regulator. The 78xx series of regulators is designed to work in complement with the 79xx series of negative voltage regulators in systems that provide both positive and negative regulated voltages, since the 78xx series can't regulate negative voltages in such a system [9].

The 7805 is one of the most common and well-known of the 78xx series regulators, as its small component count and medium-power regulated 5V make it useful for powering TTL devices [9].

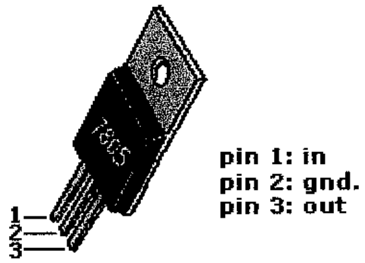


Figure 2.4: 7805 IC

CHAPTER 3

METHODOLOGY/PROJECT WORK

3.1 Procedure Identification

There are six tasks required to be completed for the successful conclusion of the project. These tasks are listed in Table 3.1 and the details are given in the following sections.

Table 3.1: Lists of Tasks for the project

Tasks	Procedure
Task 1	Literature review and planning
Task 2	Magnetic switch sensor and automatic phone dialer circuit designs as well as internal wiring on the DTMF telephone's keypad
Task 3	Programming the C language and loading it into the PIC16F877A
Task 4	Testing the circuits and the programming workability
Task 5	Integrating all circuits and producing final hardware
Task 6	Final report and presentation

Task 1: The scope of literature review includes an analysis about the understanding of magnetic switch sensor operation, the microcontroller, the programming language and the DTMF telephone. Sources from books and internet are very useful during this phase. A lot of information is gained through this process in order to keep the project progressing.

Task 2: Circuits are designed in order to interface the sensors and the automatic phone dialer. These circuits are establish by first designing them using PSPICE and MULTISIM to see the workability of the designs.

Task 3: The C language for the microcontroller can be written and compiled using the PIC C compiler. The PIC Compiler will basically check for errors on the written coding. After all errors are cleared the coding is now ready to be uploaded into the microcontroller. To upload the C language into the microcontroller, user must make sure to use the hex file coding. The hex code is a type of coding that consists of numbers. So basically the PIC language is all raw programs consist of numbers. The assembler, a piece of software which comes with the PICSTART or MPLab package called MPASM (DOS version) or WinASM (Windows version) – translates the words into numbers.

Task 4: The testing for the circuits is done for both the magnetic switch circuit and the automatic phone dialer.

For the magnetic switch sensor design, the testing is verified by connecting the circuit as shown in figure 3.1. By referring to the circuit connection in figure 3.1 the magnetic switch acts as a switch. So whenever the switch is open DC voltage output will be detected at the output.

As for the automatic phone dialer, the testing can be seen by supplying the input pins with a DC voltage of 5V. Outputs will be sent to the telephone's keypad when there is an input of 5V at either pin A0 or A1. To indicate that the phone is dialing, LED is installed at each button on the keypad to notify that dialing process is in progress.

Task 5: The initial hardware was constructed by using the breadboard. After a finalized design is reached only then the design will be made on the veraboard to have a much stable performance and neater look. The final design for all the circuits will be caged in a model home to show the functionality of all the sensors and the automatic phone dialer installed in a house.

Task 6: The final report and presentation will be carried out as scheduled.

3.2 The magnetic switch operation

Magnetic switch sensor can also be referred to as door "switches" or "contacts" or "magnetic contacts," this sensor is the most commonly used in intrusion detection device. As a switch, this sensor incorporates electrical contacts that make or break an electrical circuit as a result of physical movement. The standard magnetic switch sensor consists of two components, each housed separately. One of the housings contains the contacts which will open or close in the presence of a magnetic field. The other housing contains a magnet to provide the required magnetic field. The magnet is mounted on the inside (protected area side) of the portal component which moves (e.g., door, window), and the switch is mounted on the inside frame (see Figure 3.1). When the magnet is removed from the vicinity of the switch (e.g., door is opened), the switch activates (see Figure 3.1).

The amount of movement required is generally less than 2 inches.

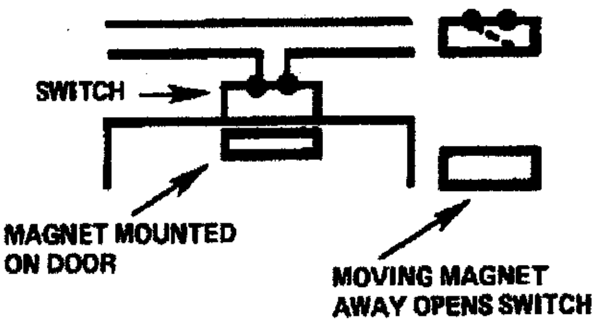


Figure 3.1: conceptual operation of a magnetic switch

3.3 Automatic Phone Dialer operation

The output from all the sensors will be the input for the automatic phone dialer and the center of the whole phone dialer operation circle around the PIC 16F877A. This microcontroller can be programmed in C language to do various type of function. In this project, the microcontroller will be used to connect to the output of all the sensors for the purpose of triggering the automatic phone dialer. Later, it will activate the phone line and immediately dial the owner's mobile number via the normal DTMF telephone that is connected to the TELEKOM line. The owner's mobile number can be stored in the microcontroller by writing a command using C language. The system must be reset after every operation. It was design to avoid confusion between intrusion alert and fire alert, when there is a situation where the intruder open and close the door twice.

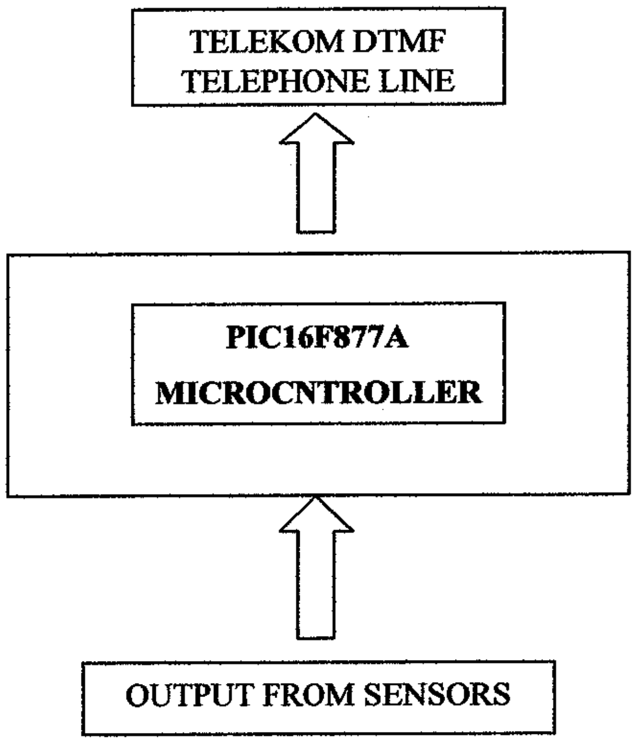


Figure 3.2: Concept of the phone dialer part

3.3.1 PIC16F877A microcontroller operation

The working principles of this PIC microcontroller is that PortA, RA0 (pin2) will be connected to the output of all the smoke detector and temperature sensor and PortB, RA1 (pin3) will be connected to the output of the magnetic switch sensor. Refer to **Appendix I** for detailed explanation of the PIC microcontroller pin diagram. PortC and PortD will be connected to each number of the telephone for dialing routines.

The connection of the phone number and output of the microcontroller is shows in table 3.2.

Table 3.2: connection between the numbers on the phone to the output of microcontroller

No. on the phone	**1**	**2**	**3**
PIC output	RD4	RC7	RC6
No. on the phone	**4**	**5**	**6**
PIC output	RC5	RC4	RD3
No. on the phone	**7**	**8**	**9**
PIC output	RD2	RD1	RD0
No. on the phone	*	**0**	**#**
PIC output	RC3	RC2	RC1

The microcontroller will remains in stand by mode until any of the inputs has been triggered by the sensors. If the smoke detector or temperature sensors (input 2) sense any abnormality, the microcontroller will direct the DTMF phone to dial the number once and twice if the magnetic switch sensor (input 2) sense any intrusion.

CHAPTER 4
RESULTS AND DISCUSSIONS

4.1 Magnetic switch sensor

The circuit design for magnetic switch sensor has been conducted by means of simulating the whole circuit via Multisim as well as hardware design. Figure 4.1 shows the simulated circuit in Multisim.

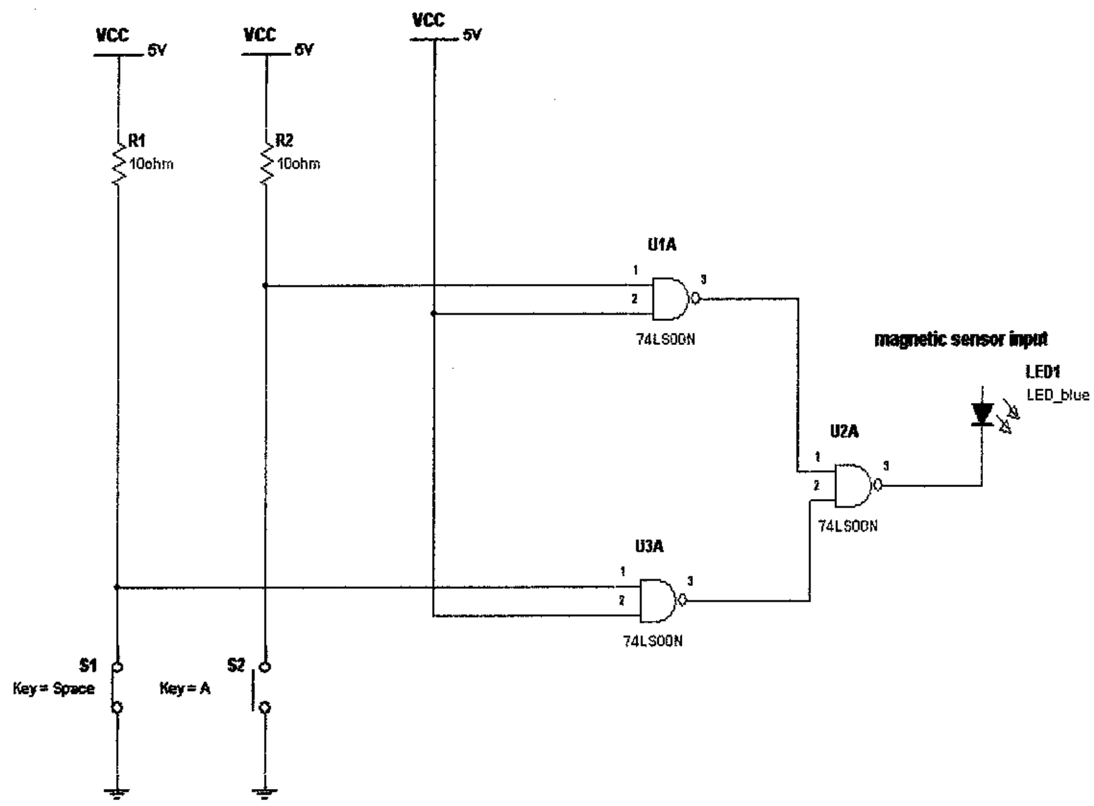


Figure 4.1: software simulation for the magnetic switch

Two magnetic switches are used for the door security. Thus the outputs of both switches are connected using 2 NAND gate connected in parallel. The output of these 2 NAND gate will later be connected to a final NAND gate that will later be the final output to phone dialing component. Two 10 ohm resistors are also connected in series to each magnetic switch. The switches are normally closed. So when the switch is right next to each other, the resistance is zero. When the switch is separated, the resistance will become infinity as if it's disconnected. So the resistor is used to drive up the switch. The software simulation of the magnetic switch sensor is shown in Figure 4.1.

5V of DC voltage are used as the input voltage for the whole magnetic switch circuit and the output voltage to the LED (final output) is 5V. The LED indicates the final output that will be sent to the PIC16F877A microcontroller for the means of triggering the DTMF telephone line.

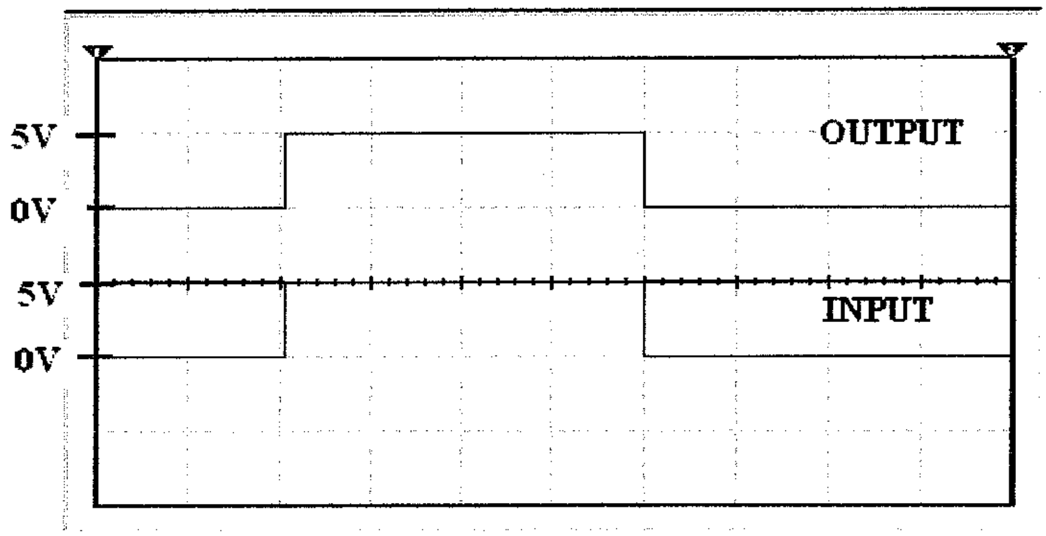


Figure 4.2: DC signals for input and output of the magnetic switch sensor

By referring to Figure 4.2 above, the graph show whenever the magnetic switch sensor is pulled apart a voltage of 5V will appear at both the input and output of the circuit.

4.2 Automatic Phone dialer

4.2.1 Hardware

The circuit has been constructed on the veraboard to test the programming as well as the circuitry (system) of the phone dialer itself. The circuit operates on 5V voltage supply. The input of pin 2 and 3 detect voltage from 2 V to trigger the output to the DTMF telephone. Figure 4.4 show circuit the connection for microcontroller circuitry.

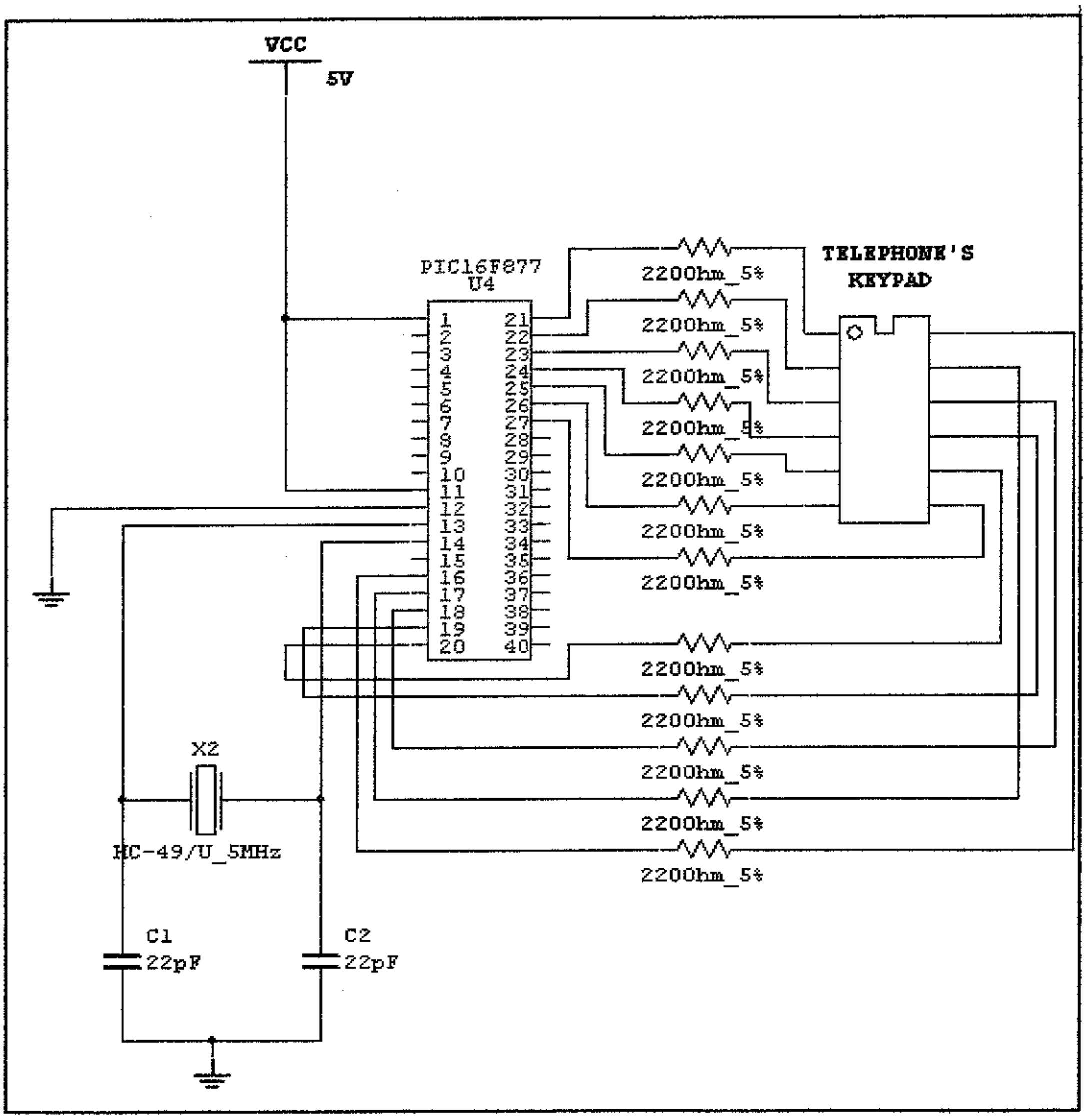


Figure 4.4: PIC16F877A pins connection

The output from PIC16F877A is in digital form where else the signal to DTMF telephone must be in analog form. Thus a serial port RS232 connector is used to convert the digital data to analog data. Refer to Figure 4.5 to see how the connector is interface between microcontroller output and DTMF telephone.

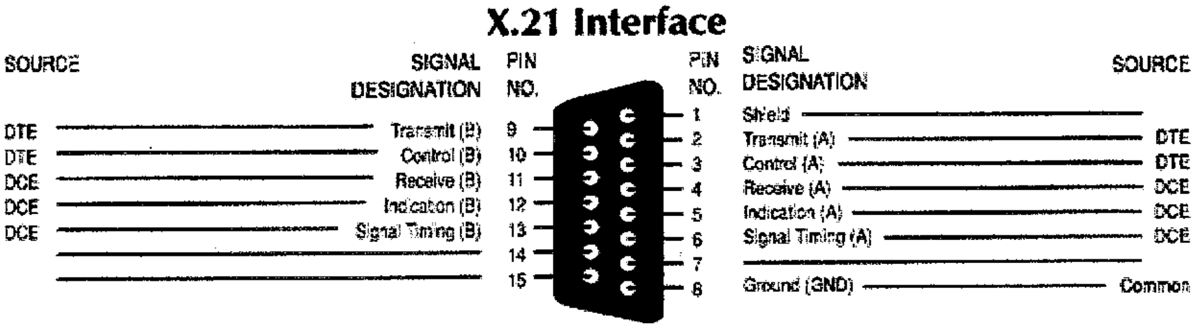


Figure 4.5: RS232 pins connection.

4.2.2 Programming PIC16F877A

To program the microcontroller C language programming is used. The program is written as to apply the specific function to the microcontroller. The main part of the programming is to write a program that can dial a specific number.

The coding for the microcontroller is written in C language using Code Composer Studio (CCS). Figure 4.6 shows the window for compiling the C language in CCS.

When the coding is completed, only then it can be compile to test for any errors (refer to Figure 4.7).

For the full coding please refer to **Appendix II.**

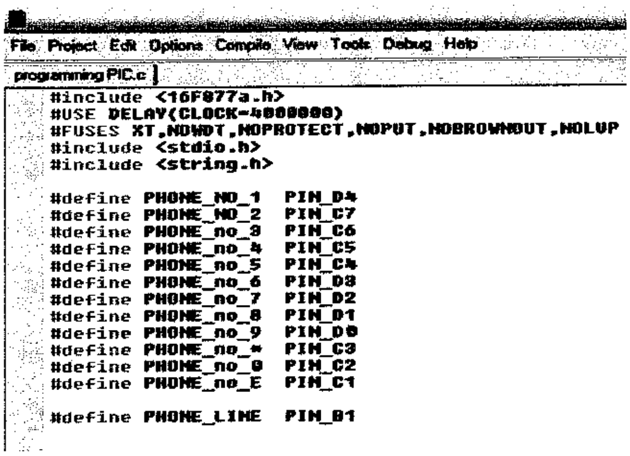


Figure 4.6: Code Composer window

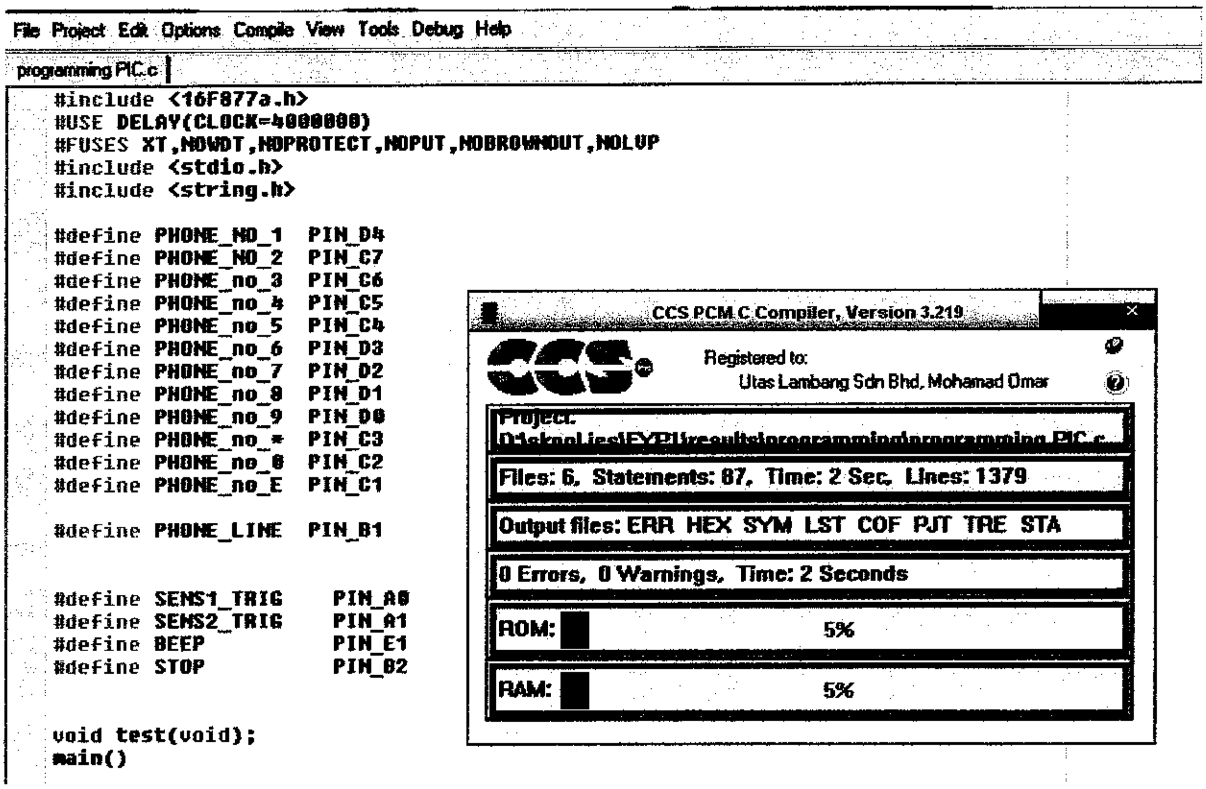


Figure 4.7: Compiling process in CCS

4.3 Integrated Circuits

This new design of Home Security System is the combination of magnetic switch sensor, temperature sensor and smoke detector.

All these sensors will then be combined with the automatic phone dialer. The automatic phone dialer will be activated when any of the sensors give an alert situation.

Figure 4.8 shows the complete design of the Home Security System by integrating all the sensors and the automatic phone dialer.

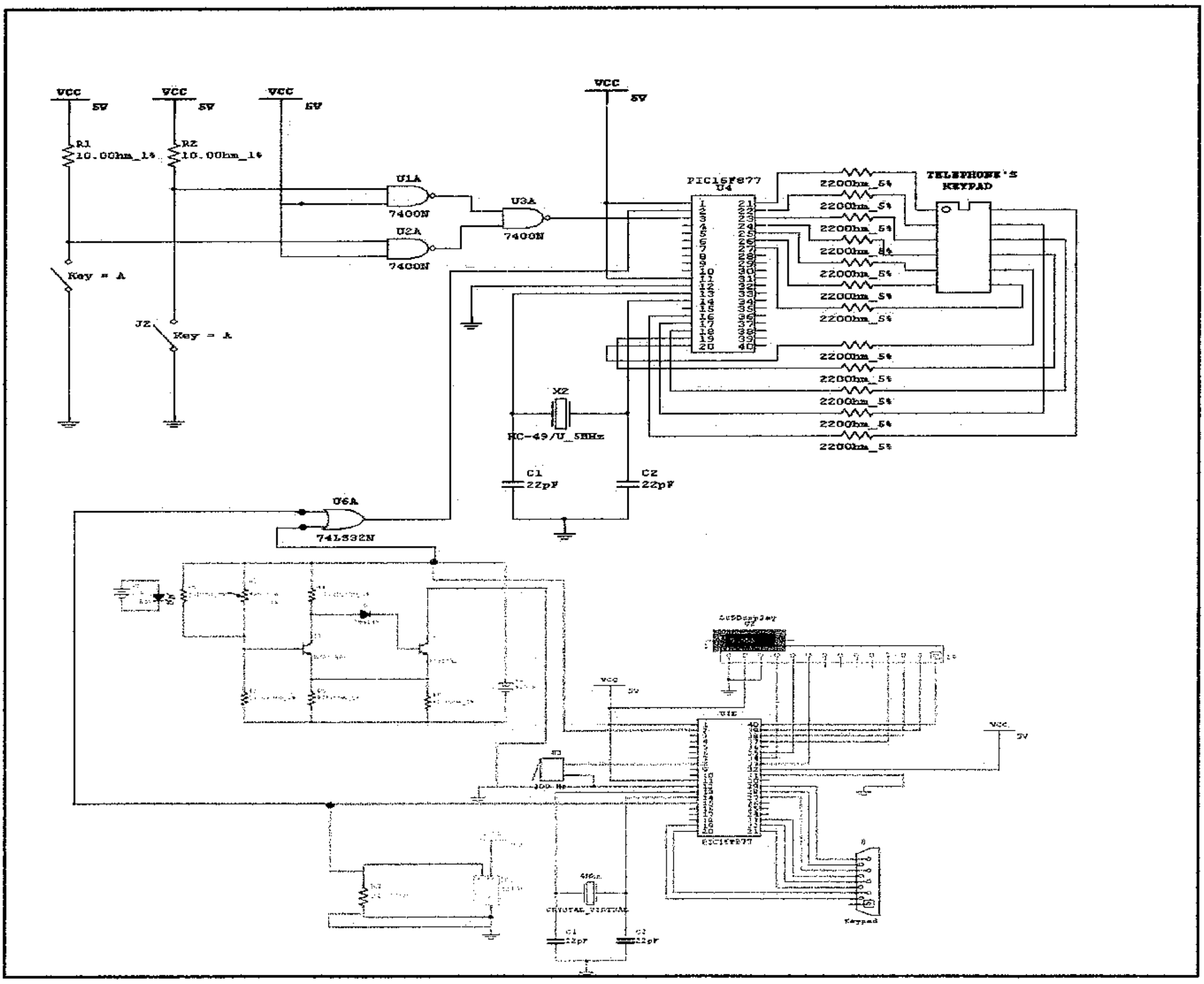


Figure 4.8: Complete circuit of Home Security System

CHAPTER 5
CONCLUSION AND RECOMENDATION

5.1 Conclusion

The project aim was to design and construct a magnetic switch sensor circuit and an automatic phone dialer to further contribute in home security system technology. Consequently, this intention is fully realized. From the development of the project, a conclusion can be made that house security can be reliably monitored even when there is nobody at the house by using the automatic phone dialer.

From the simulation done, the results obtained verified that whenever the magnetic switch is pulled apart (door open) the phone will automatically dial the owner's mobile number to alert them on their house security status. Thus it can be summarized that the whole project is a success.

5.3 Recommendation

To further increase the performance of the system, a few improvements can be added. In future construction, a pre-recorded voice can be added to the automatic phone dialer to answer the phone whenever the person at the other line picks up the phone. Otherwise, instead of having an automatic phone dialer, the system can be designed as to send out message to owner handphone giving alert on their house security.

REFERENCES:

[1] Burglar Alarm- Protect Your House by Alan Ross

http://ezinearticles.com/?Burglar-Alarm---Protect-Your-Home&id=282183

[2] Sensor

http://en.wikipedia.org/wiki/Sensor

[3] http://www.acess.lowtech.org/rain/tutorial.htmlaq.html

[4] PIC16F877A microcontroller specification

http://www.microchip.com

[5] Microcontroller

http://kahuna.sdsu.edu/~tucker/pic/

[6] Telephone Keypad

http://en.wikipedia.org/wiki/Telephone_keypad

[7] DTMF

http://www.genave.com/dtmf.htm

[8] Generating DTMF and FSK Signal

www.cyantechnology.com/public

[9] Voltage Regulator 7805

http://en.wikipedia.org/wiki/7805

Past Year Projects:

- Microcontroller-Based Electronic LPG Detector By Nurul Shazrah Binti Mohd Sarifuddin
- Heart Failure Detector By Chan Seng Keong

APPENDICES

APPENDIX I

Gantt chart (semester 1) of the design project

Time / Activities	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FYP Title Selection and Allocation																
Log Book Submission																
Material and equipment Research																
Preliminary Report																
Phone dialer and Sensors circuit design research																
Research and Find The Component For The Circuits																
Circuit simulation for all the sensors																
Phone dialer programming design																
Phone dialer hardware design simulation																
Testing and Troubleshooting																
Integration of the Whole System Simulation																
Submit Draft report																
Submit interim report																
Preparation for Oral Presentation																
Oral Presentation																

Gantt chart (semester 2) of the design project

Time / Activities	Week 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Project work continues - practical/laboratory Work (testing the circuit)	■	■														
Submission of Progress Report 1			■													
Project work continues - PIC programming, troubleshooting the circuits			■	■	■	■	■									
Submission of progress report 2								■								
Project work continue - integrating all circuits								■	■	■	■	■				
Submission of dissertation final draft													■			
Submission of final report soft cover															■	
Submission of technical report																■

APPENDIX II

```
#include <16F877a.h>
#USE DELAY(CLOCK=4000000)
#FUSES XT,NOWDT,NOPROTECT,NOPUT,NOBROWNOUT,NOLVP
#include <stdio.h>
#include <string.h>

#define PHONE_NO_1  PIN_D4
#define PHONE_NO_2  PIN_C7
#define PHONE_no_3  PIN_C6
#define PHONE_no_4  PIN_C5
#define PHONE_no_5  PIN_C4
#define PHONE_no_6  PIN_D3
#define PHONE_no_7  PIN_D2
#define PHONE_no_8  PIN_D1
#define PHONE_no_9  PIN_D0
#define PHONE_no_*  PIN_C3
#define PHONE_no_0  PIN_C2
#define PHONE_no_E  PIN_C1

#define PHONE_LINE  PIN_B1


#define SENS1_TRIG    PIN_A0
#define SENS2_TRIG    PIN_A1
#define BEEP          PIN_E1
#define STOP          PIN_B2

void test(void);
main()

 {
 while (1)
 {

   if (input(SENS1_TRIG))
     {
      test();
      delay_ms(500);
      output_bit(STOP,0);
     }
     else if (!input(SENS1_TRIG));
     {
     output_bit(STOP,1);
     }

  if (input(SENS2_TRIG))
      { test();
        delay_ms(25000);
        test();
        delay_ms(500);
        output_bit(STOP,0);
      }
      else if (input(!SENS2_TRIG));
      {
      output_bit(STOP,1);
      }
}


est()
[ Loop1:
        output_bit(PHONE_LINE,1);
```

```
delay_ms(1000);

output_bit(PHONE_NO_0,1);
output_bit(BEEP,1);
delay_ms(500);
output_bit(BEEP,0);
output_bit(PHONE_NO_0,0);
delay_ms(500);

output_bit(PHONE_NO_1,1);
output_bit(BEEP,1);
delay_ms(500);
output_bit(BEEP,0);
output_bit(PHONE_NO_1,0);
delay_ms(500);

output_bit(PHONE_NO_2,1);
output_bit(BEEP,1);
delay_ms(500);
output_bit(BEEP,0);
output_bit(PHONE_NO_2,0);
delay_ms(500);

output_bit(PHONE_NO_5,1);
output_bit(BEEP,1);
delay_ms(500);
output_bit(BEEP,0);
output_bit(PHONE_NO_5,0);
delay_ms(500);

output_bit(PHONE_NO_7,1);
output_bit(BEEP,1);
delay_ms(500);
output_bit(BEEP,0);
output_bit(PHONE_NO_7,0);
delay_ms(500);

output_bit(PHONE_NO_8,1);
output_bit(BEEP,1);
delay_ms(500);
output_bit(BEEP,0);
output_bit(PHONE_NO_8,0);
delay_ms(500);

output_bit(PHONE_NO_4,1);
output_bit(BEEP,1);
delay_ms(500);
output_bit(BEEP,0);
output_bit(PHONE_NO_4,0);
delay_ms(500);

output_bit(PHONE_NO_5,1);
output_bit(BEEP,1);
delay_ms(500);
output_bit(BEEP,0);
output_bit(PHONE_NO_5,0);
delay_ms(500);

output_bit(PHONE_NO_7,1);
output_bit(BEEP,1);
delay_ms(500);
output_bit(BEEP,0);
output_bit(PHONE_NO_7,0);
delay_ms(500);
```

```
        output_bit(PHONE_NO_6,1);
        output_bit(BEEP,1);
        delay_ms(500);
        output_bit(BEEP,0);
        output_bit(PHONE_NO_6,0);
        delay_ms(500);

        delay_ms(20000);

        output_bit(PHONE_LINE,0);


}
```

APPENDIX III

PIC16F87X

28/40-Pin 8-Bit CMOS FLASH Microcontrollers

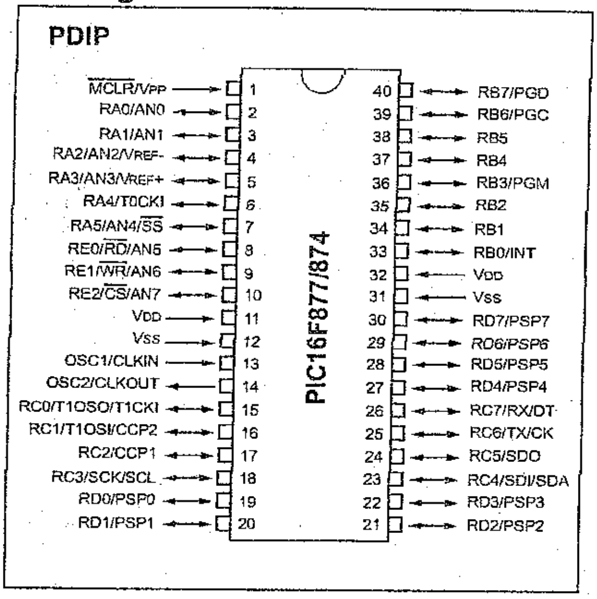
Devices Included in this Data Sheet:

- PIC16F873
- PIC16F874
- PIC16F876
- PIC16F877

Microcontroller Core Features:

- High performance RISC CPU
- *Only 35 single word instructions to learn*
- All single cycle instructions except for program branches which are two cycle
- Operating speed: DC - 20 MHz clock input
  DC - 200 ns instruction cycle
- Up to 8K x 14 words of FLASH Program Memory,
  Up to 368 x 8 bytes of Data Memory (RAM)
  Up to 256 x 8 bytes of EEPROM Data Memory
- Pinout compatible to the PIC16C73B/74B/76/77
- Interrupt capability (up to 14 sources)
- Eight level deep hardware stack
- Direct, indirect and relative addressing modes
- Power-on Reset (POR)
- Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
- Programmable code protection
- Power saving SLEEP mode
- Selectable oscillator options
- Low power, high speed CMOS FLASH/EEPROM technology
- Fully static design
- In-Circuit Serial Programming™ (ICSP) via two pins
- Single 5V In-Circuit Serial Programming capability
- *In-Circuit Debugging via two pins*
- Processor read/write access to program memory
- Wide operating voltage range: 2.0V to 5.5V
- High Sink/Source Current: 25 mA
- *Commercial, Industrial and Extended temperature* ranges
- Low-power consumption:
  - < 0.6 mA typical @ 3V, 4 MHz
  - 20 µA typical @ 3V, 32 kHz
  - < 1 µA typical standby current

Pin Diagram

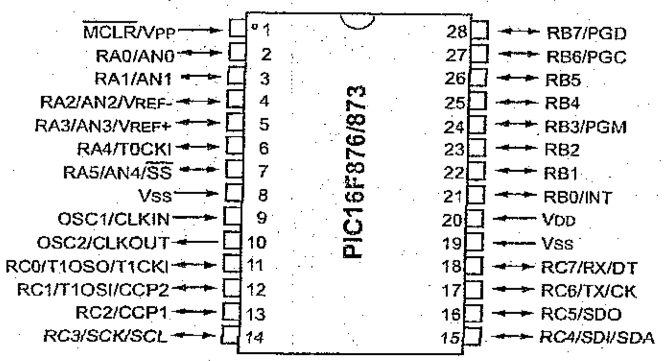


Peripheral Features:

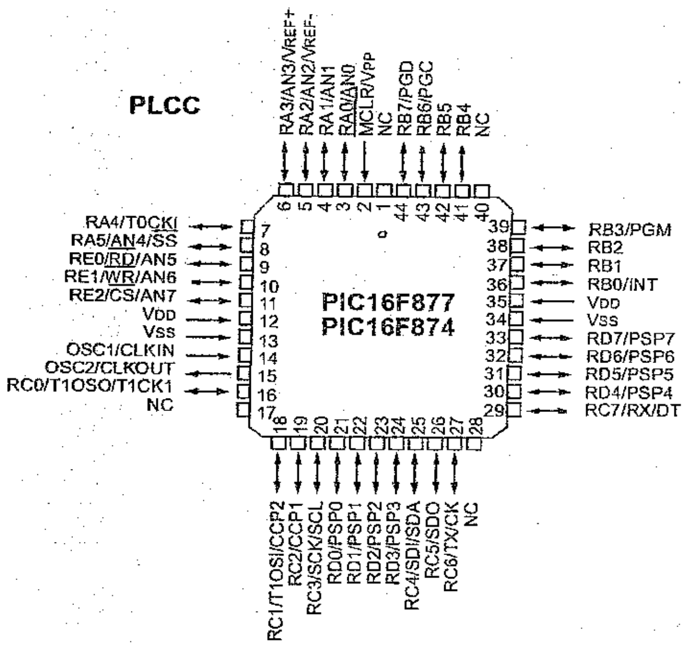
- Timer0: 8-bit timer/counter with 8-bit prescaler
- Timer1: 16-bit timer/counter with prescaler, *can be incremented during SLEEP via external* crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture, Compare, PWM modules
  - Capture is 16-bit, max. resolution is 12.5 ns
  - Compare is 16-bit, max. resolution is 200 ns
  - PWM max. resolution is 10-bit
- 10-bit multi-channel Analog-to-Digital converter
- Synchronous Serial Port (SSP) with SPI™ (Master mode) and I^{2}C™ (Master/Slave)
- Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection
- Parallel Slave Port (PSP) 8-bits wide, with external RD, WR and CS controls (40/44-pin only)
- Brown-out detection circuitry for Brown-out Reset (BOR)

Pin Diagrams

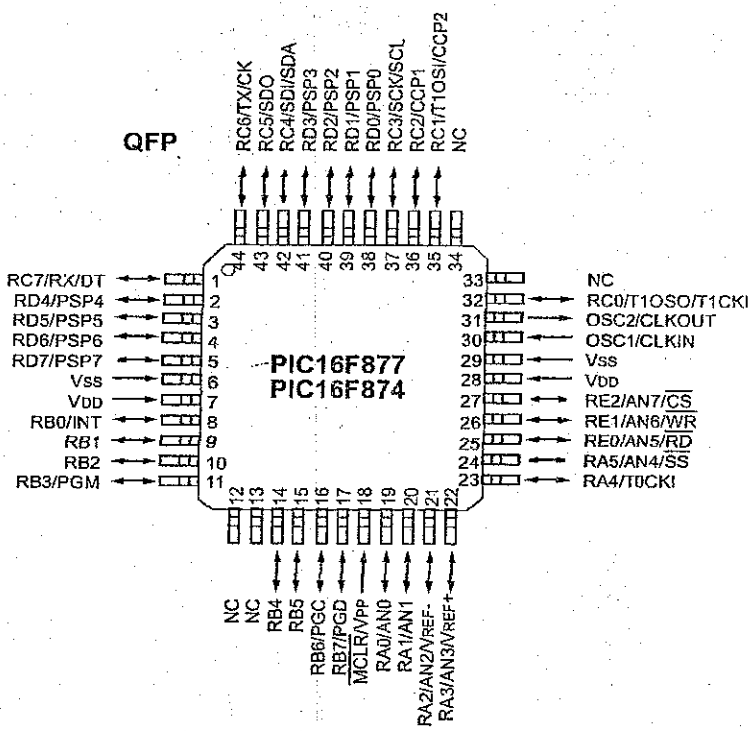
PDIP, SOIC



PLCC



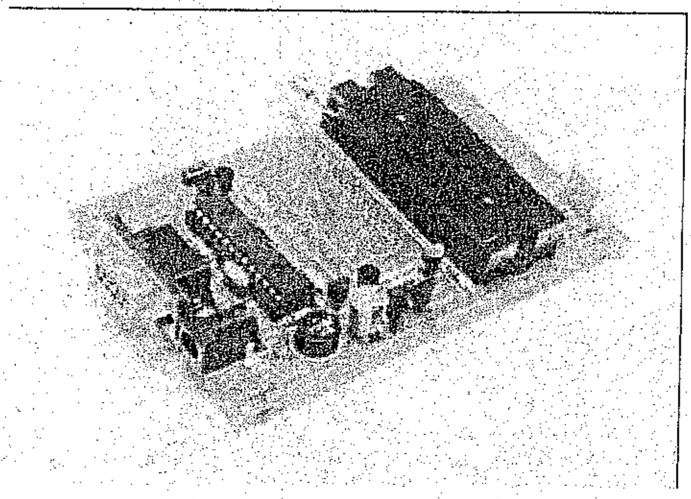
QFP



Key Features PICmicro™ Mid-Range Reference Manual (DS33023)	PIC16F873	PIC16F874	PIC16F876	PIC16F877
Operating Frequency	DC - 20 MHz	DC - 20 MHz	DC - 20 MHz	DC - 20 MHz
RESETS (and Delays)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)
FLASH Program Memory (14-bit words)	4K	4K	8K	8K
Data Memory (bytes)	192	192	368	368
EEPROM Data Memory	128	128	256	256
Interrupts	13	14	13	14
I/O Ports	Ports A,B,C	Ports A,B,C,D,E	Ports A,B,C	Ports A,B,C,D,E
Timers	3	3	3	3
Capture/Compare/PWM Modules	2	2	2	2
Serial Communications	MSSP, USART	MSSP, USART	MSSP, USART	MSSP, USART
Parallel Communications	—	PSP	—	PSP
10-bit Analog-to-Digital Module	5 input channels	8 input channels	5 input channels	8 input channels
Instruction Set	35 instructions	35 instructions	35 instructions	35 instructions

APPENDIX IV

WARP-13



The PIC & AVR Programmer

The WARP-13 is the only PIC programmer (other than Microchip) that is a fully MPLAB compatible programmer. It integrates with MPLAB in exactly the same way as the PICSTART PLUS. In fact, MPLAB thinks that it is talking to a PICSTART PLUS! The WARP-13 is fitted with a ZIF socket as standard unlike other low cost programmers.

It also features an on board ISP connector suitable for in circuit PIC programming and connection to odd pin out devices like the 14000 and the 16C92x Quad pack parts. In addition to supporting a whole range of PIC parts, the WARP-13 offers bonus support for ATMEL AVR micros.

Built on a quality double sided plate-though hole PCB, the WARP-13 is neat and robust and is built to last. It comes complete with a PC serial lead but requires a power supply (15VDC, 2.5mm barrel connector).The WARP-13 is an excellent programmer to fill the gap between the low end cheaper programmers and the quite costly PICSTART PLUS. With MPLAB compatibility as an option the WARP-13 is now even better as a great choice for your PIC programmer.

Software

The Windows 95/98/ME software is included and it is useful for programming all the supported PICs (other than the 18Cxxx parts that are supported with MPLAB) and all the supported ATMEL and serial EEPROMs. This software offers many advanced features but is extremely simple to use. Our online help file and extensive use of "tool tips" guide both beginners and even advanced users though some of the tricky and difficult to remember PIC and AVR settings. A large number of time saving options are built into the software and with on-going development it is designed to serve you well into the future.

Installing the WARP-13 into MPLAB

The WARP-13 PIC programmer is identical to the PICSTART PLUS as far as all communication protocols are concerned. MPLAB considers the WARP-13 to be a PICSTART PLUS and as such there is no separate software to install. Getting the WARP-13 to work with MPLAB may be as simple as a mouse click.

To install the WARP-13 programmer into MPLAB click on the "PICSTART PLUS" menu and then select "ENABLE Programmer." If either of the above menu options are disabled or "grayed out" then MPLAB has been installed without the PICSTART plus support files. In this case MPLAB must be reinstalled with the PICSTART plus support files. To include the PICSTART plus support files run the MPLAB setup program. When the "SELECT COMPONENTS" screen is displayed, ensure the "PICSTART plus support files" option is ticked. This is all that is required. Continue with and finish the MPLAB installation and MPLAB will now be ready to drive your WARP-13 PIC programmer!

16C5x Family:PIC16C52 • PIC16C55 • PIC16C57 • PIC16C54 • PIC16C55A • PIC16C57C • PIC16C54A • PIC16C56 • PIC16CR57B • PIC16C54B • PIC16C56A • PIC16CR57C • PIC16C54C • PIC16CR56A • PIC16C58A • PIC16CR54A • PIC16C58B • PIC16CR54B • PIC16CR58A • PIC16CR54C • PIC16CR58B PDIP, SOIC*, Windowed
CERDIP
16HV540

(All the above PICs require either the 18-pin Zif or 28-pin auxiliary ZIFs to be fitted.)
(Many PIC programmers don't program ANY of the above devices)
12Cxxx Family: 12C508, 12C508A, 12CE518, 12C509, 12C509A, 12CE519
12C671, 12C672, 12CE673, 12CE674

16C50x Family: 16C505, 16C55x Family: 16C554, 16C554A, 16C556A, 16C558, 16C558A

16C6x(x) Family:16C61, 16C62, 16C62A, 16C62B, 16C63, 16C63A, 16C63B, 16C64, 16C64A, 16C65, 16C65A, 16C65B, 16C66, 16C67, 16C66A, 16C67A
16C620, 16C621, 16C622, 16C620A, 16C621A, 16C622A, 16CE623, 16CE624, 16CE625,16C641, 16C642, 16C661, 16C662

16C7x(x) Family:16C707, 16C71, 16C710 (was 16C70), 16C711 (was16C71A), 16C712,16C715, 16C716, 16C717, 16C72, 16C72A, 16C73, 16C73A, 16C73B, 16C74, 16C74A,16C74B, 16C74C, 16C76, 16C77, 16C76A, 16C77A,16C770, 16C771*, 16C773,16C774,16C712, 16C716, 16C717

USB PICs:16C745, 16C765,16F62x,16F7x

16F8x(x) Family:16F83, 16C84, 16F84, 16F84A , 16F627. 16F628, 16F870, 16F871, 16F872, 16F873, 16F874, 16F876, 16F877