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JUDUL: **DATABASE SECURITY SYSTEM WITH MULTI ENTRANCES**

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DATABASE SECURITY SYSTEM WITH MULTI ENTRANCES

MOHD NURFAJREN BIN MAT ISA

This thesis is submitted as partial fulfillment of the requirements for the award of the Bachelor Degree of Electrical Engineering (Hons.) (Electronics)

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Date : 23 NOVEMBER 2009

Specially dedicated to
My beloved family, and those who have guided and inspired me
Throughout my journey of learning

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ABSTRACT

Database security system is a simple system that stores the user information in high secured location such as research laboratory. Only authorized users are allowed to enter the room by using a simple keypad as an entry point. The information of the user will be displayed and store in the PC using Visual Basic software. The information may include user name's, date and time entrance. Microcontroller MC68HC11A1 is used as its processor to control the whole system operation. By using Electromagnetic Door Lock (EDC) the door will be unlocked automatically if the valid password is keyed in. In order to create user friendly environment, a LCD display is connected to the system.

ABSTRAK

Sistem keselamatan berpengkalan data merupakan suatu sistem yang ringkas dimana sistem ini berupaya menyimpan maklumat pengguna. Sistem ini sesuai digunakan khususnya di kawasan yang memerlukan kawalan keselamatan yang tinggi seperti di makmal penyelidikan. Hanya pengguna yang mempunyai kata laluan yang sah sahaja dibenarkan menggunakan sistem ini. Sistem ini menggunakan papan kekunci sebagai panel masukan kata laluan pengguna. Segala maklumat pengguna seperti nama, masa, dan tarikh penggunaan sistem akan dipaparkan dan disimpan di dalam computer mengunakan perisian Visual Basic. Keseluruhan sistem ini dikawal oleh pengawal mikro MC68HC11A1. Magnet pintu akan terbuka apabila kata laluan yang sah dimasukan. Paparan LCD diguunakan untuk memaparkan mesej kepada pengguna.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Number of cases related to unauthorized entry has increased over the years. This is due to the fact that economy crisis that strikes heavily in the recent century with the increasing number of housing areas, as well as mass immigration of foreign workers to our country. Due to these problems many companies design and manufacture automated door security system. Door security system are designed to protected houses, shops, office and other building from forced entry and minimized the changes of robbery.

These security door systems are available in different specifications to suit the security requirement of different type of building. There are many type of security systems exist, from a simple numerical code shared by every users to most sophisticated biometric authentication like finger print or iris scanner. Others options available such as camera to record who is crossing the door, card with proximity reader, card with swipe reader, laser technology and etc.

But the problem is the security door systems are very expensive when it consists of biometric solution like finger print or iris scanner. A numerical code access would be simple and cheap, but it means sharing the code, which could easily be given to unauthorized users. Due to that problem, this security door system should be introduced because the system has database that capable to keep the user information. The system is fully controlled by the microcontroller M68HC11. The system has a keypad as the input to enter the code and unlock the electronic locking device. All the data will be stored in database.

1.2 Objective

The objective of this project is to design and develop a simple database security system that capable of monitoring a few entrances using M68HC11. This system is capable of storing information of the user such as users, time and date.

The system will unlock the door if the valid password is keyed-in. Otherwise, an alarm will be activated if unauthorized users try to enter the premise.

1.3 Scope of Project

This project aims to design and develop a simple database security system that capable of monitoring a few entrances using M68HC11A1. Three microcontroller

M68HC11A1 is used to develop this system. All microcontrollers are operating in bootstrap mode to control the operation of the system. Two microcontrollers are used at the entrances and the other microcontroller is used to operate the database system.

The keypad is used as the input to this system while the LCD (liquid crystal display) is used for displaying status or guideline at the entrances. The EDC (electromagnetic door lock) module is required to unlock the entrance for authorized user.

The wireless communication is used to communicate between the entrance and database system. The microcontroller at the entrance will send the information to the database using RF. The user information will be stored in the computer.

1.4 Thesis Outline

This thesis is divided into six chapters. The content of each chapter is summarized as follow.

Chapter 1 discusses the overview of the concept for this Database Security System project. This includes the objective and scope of the project.

Chapter 2 describes briefly the hardware components used in this project, including their architecture, accessing methods and images.

Chapter 3 elaborates in a detailed way each hardware module used in this project. The discussion includes the block diagrams, pin configurations, operation characteristics and connection circuit.

Chapter 4 focuses on the software development of each module. The discussion is based to the flow diagram designed.

Chapter 5 discusses the testing of each module based on the flow diagram developed in Chapter 4 to test the functionality of each module.

Chapter 6 discusses the overall outcome of the project and proposes recommendations for future enhancement of the project. Overall costs used as well as the commercialability of this project are also discussed.

CHAPTER 2

SYSTEM ARCHITECTURE

2.1 Introduction

In general, the Database Security System consists of the following hardware modules:

- Microcontroller Motorola 68HC11A1 Module
- Keypad Module
- LCD Module
- Electromagnetic Door Lock (EDC) Module
- Wireless Module

2.2 System Architecture

The complete operation of the security system is simplified in the block diagram of Figure 2.1.

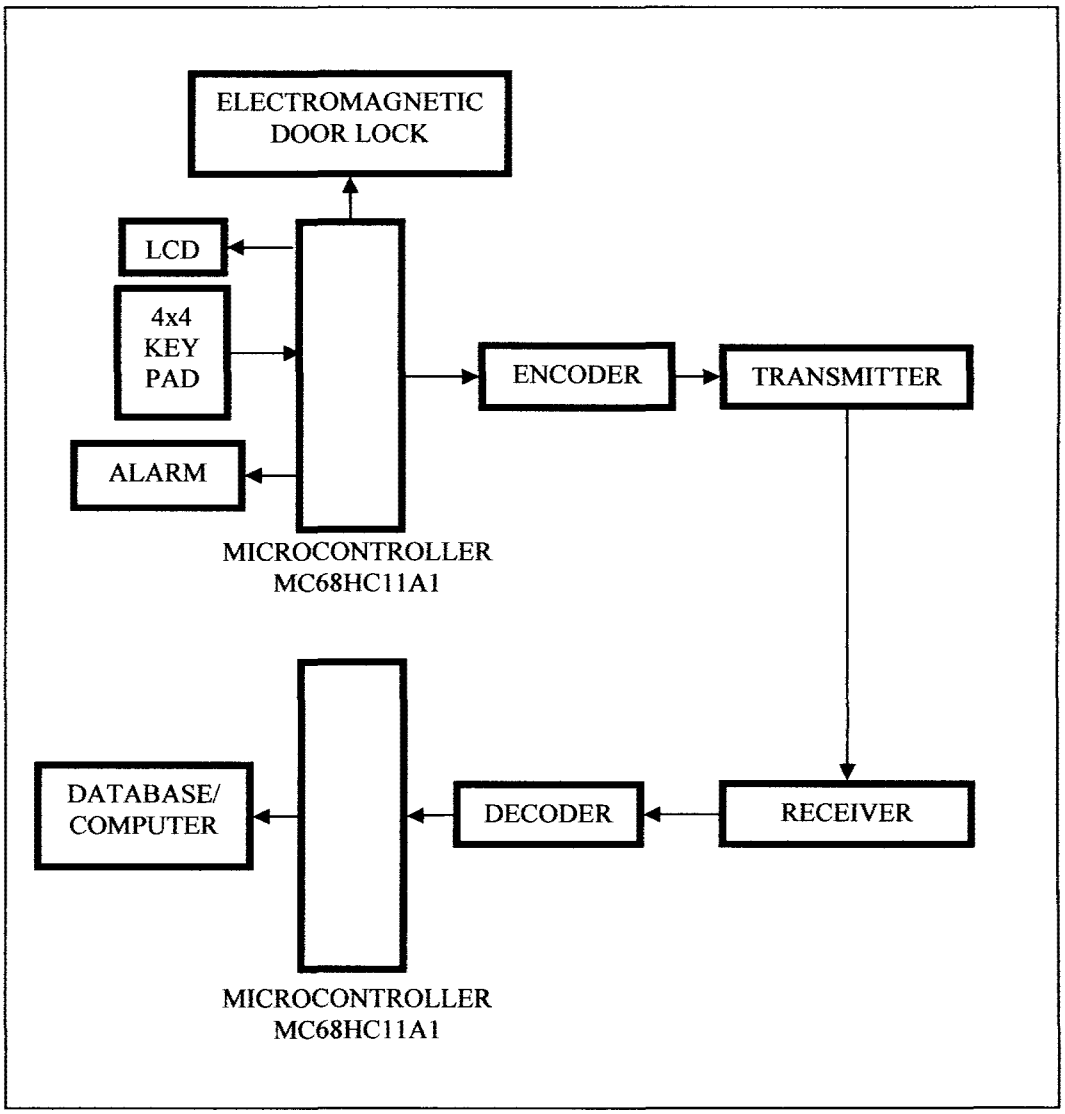

Figure 2.1: Block Diagram of Database Security System

2.2.1 Microcontroller Motorola 68HC11A1 Module

There are various versions of 68HC11. This microcontroller can be operating in four mode of operation. There are bootstrap mode, single chip mode, special test mode, and expended mode. In this project, the MC68HC11A1 is used and it operates in bootstrap mode. Mode A and Mode B is grounded in order to assign the operating in this mode. The microcontroller is responsible to monitors the entire operation of the system. Figure 2.2 and 2.3 show the microcontroller and its modules respectively.

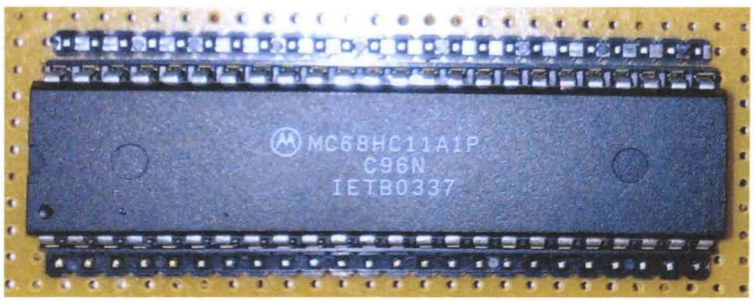

Figure 2.2: Microcontroller 68HC11A1

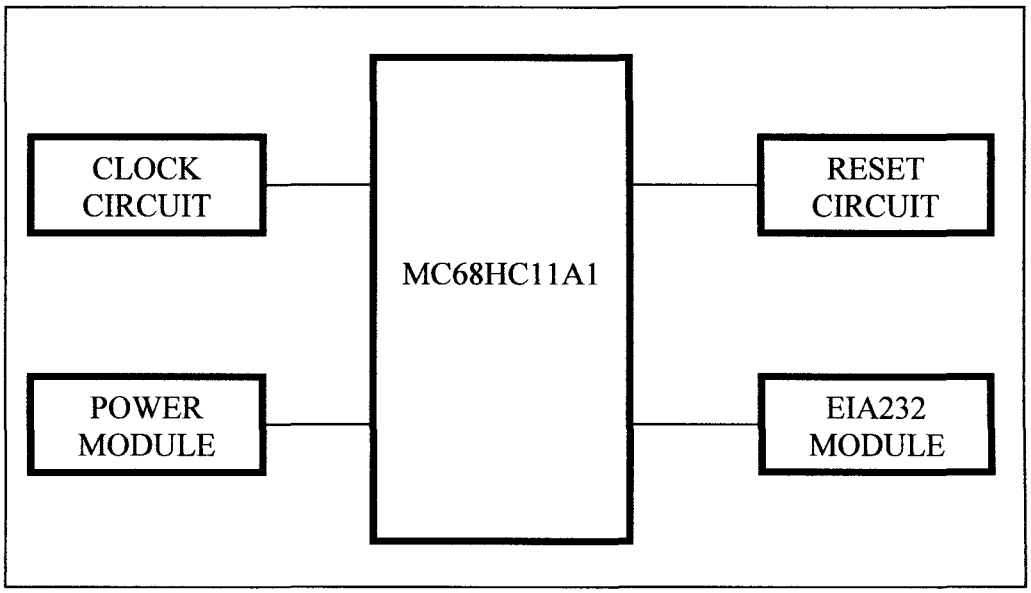

Figure 2.3: Microcontroller Module

2.2.2 Keypad Module

In this project, the input device is a standard 4x4 matrix keypad. The keypad is very important in this system because in order to activate the system, the users need to insert their password through this keypad device. The keypad contains 16 keys, symmetrically arranged in four rows with four keys each. To simplify the hardware design and software development, a keypad decoder, MM74C922 is used. It decodes the key-in numbers or alphabets, and produces their four bits binary representation as output. Figure 2.4 and 2.5 shows the keypad and the module used in this project.

Figure 2.4: The 4x4 keypad

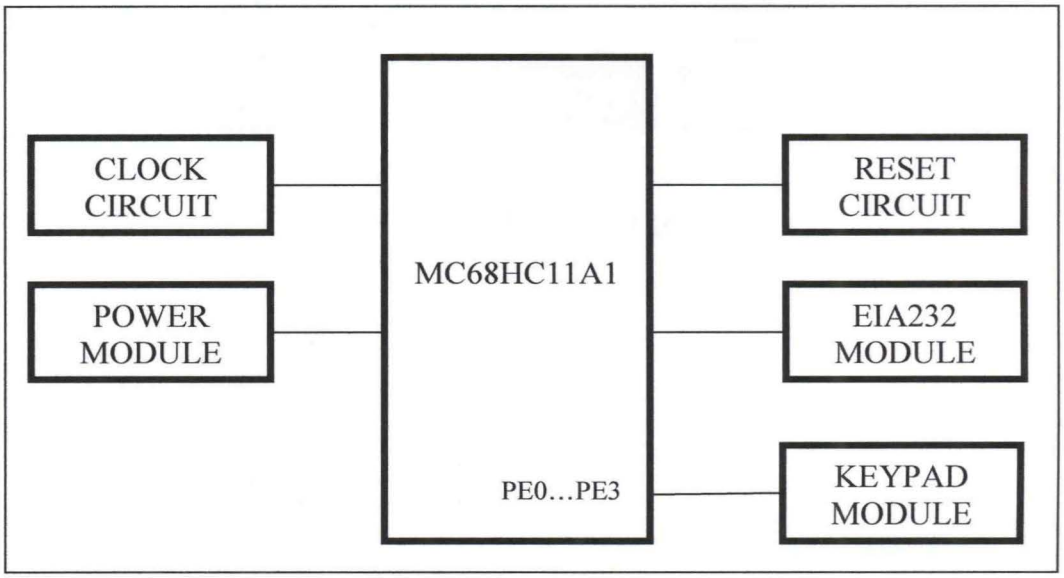

Figure 2.5: Keypad Module

2.2.3 Liquid Crystal Display (LCD) Module

The role of the LCD is to display the status and information of the system. There are various type and model of LCD available in the markets. LCD JHD 162A is used in this project. Figure 2.6 shows the LCD and the module.

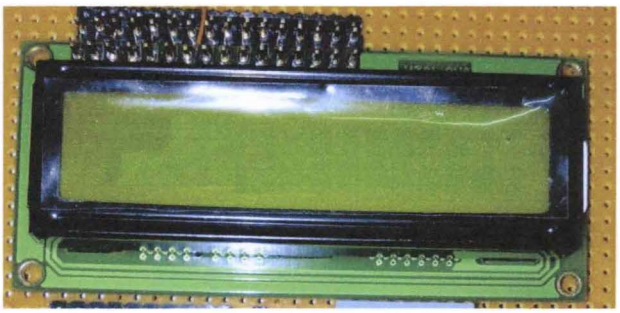

Figure 2.6: LCD JHD 162A

2.2.4 Electromagnetic Door Lock (EDC) Module

In this project, the SL-200T Electromagnetic Lock type is used as an output device. It features consists of:

- Electromagnetic lock
- Used for one way swing door
- Fail safe type (power to lock)
- Lock status sensor, timer, and door status sensor
- Holding forces: 600lbs
- Build in delay egress control point

- Power supply 12V
- Operating current 500mA

The electromagnetic lock will operate when current flow and the electromagnet attract the plate and holding the door close. When there is no current flow, the door is unlocked.

2.2.5 Wireless Module

The wireless module consists of two main parts, the transmitter and the receiver. These transmitter and receiver need an encoder and decoder to ensure both devices can communicate with each other through radio wave. The signal will be sent to the encoder (HT12E) to encode this signal into a serial code. This code will be transmitted by the RF transmitter through the space, to the receiver. The receiver will receive the code and will decode the code using decoder (HT12D) and sends it to the microcontroller. Figure 2.7 and 2.8 shows the transmitter and receiver modules respectively.

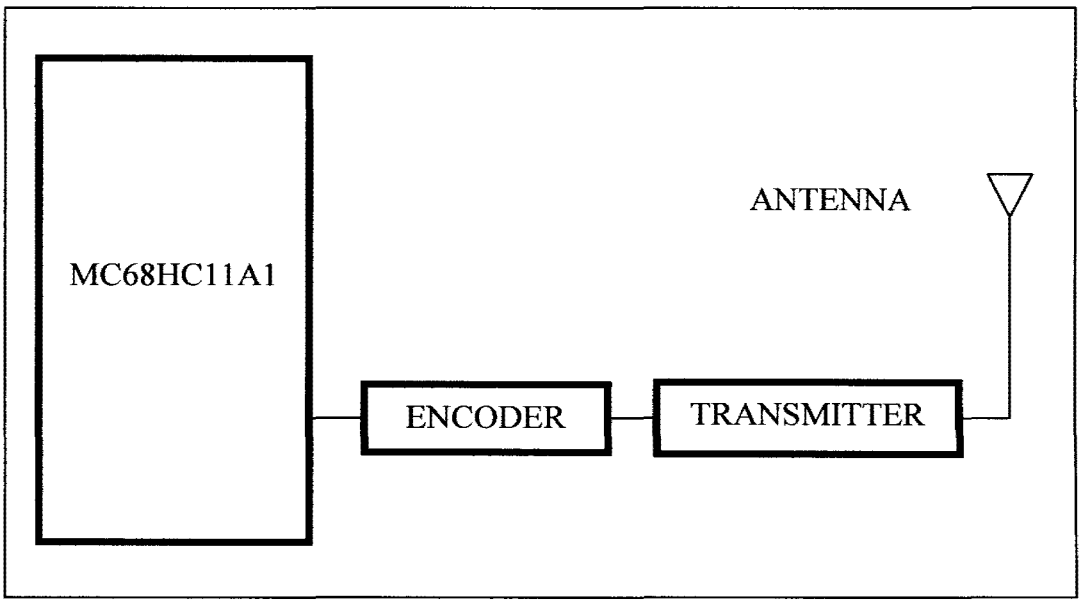

Figure 2.7: Transmitter Module

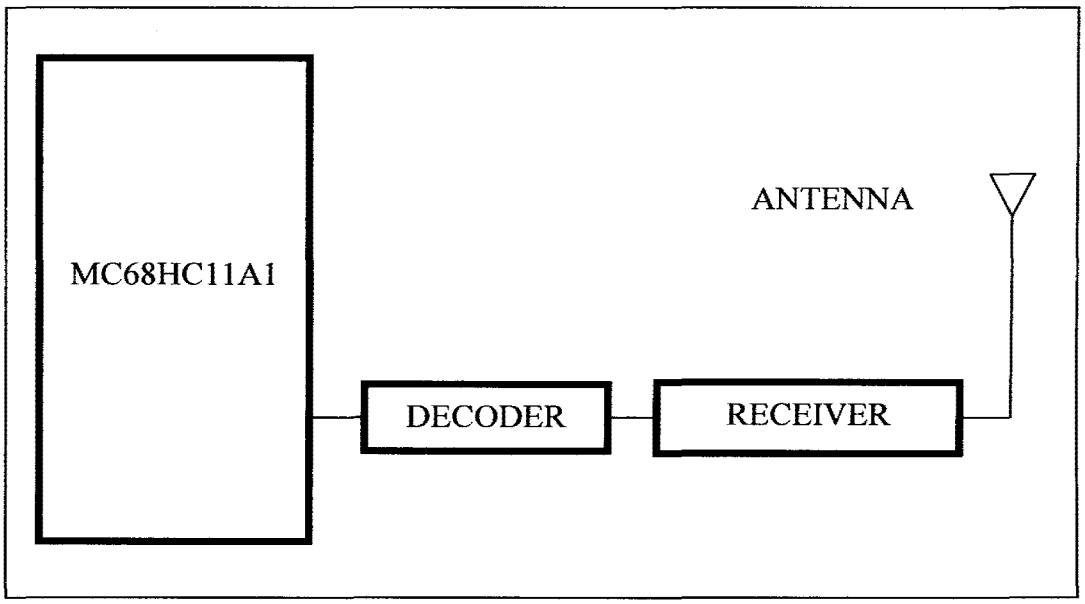

Figure 2.8: Receiver Module

CHAPTER 3

HARDWARE DESIGN

3.1 Introduction

The detailed perspectives of each hardware module used in the Database Security System will be discussed. Each module is constructed and tested individually before they are integrated to become the system.

3.2 Microcontroller Module

There are various versions of 68HC11 with different memory sizes and features. In this case, the MC68HC11A1 is used and its operated in bootstrap mode. The microcontroller MC68HC11A1 is one of the most common 8-bit controllers manufactured by Motorola. It is a high-performance microcontroller unit (MCU) and is based on the M68HC11 Family. This high speed, low power consumption chip has

multiplexed buses and a fully static design. 8MHz crystal is used so that the microcontroller E clock will produce 2MHz frequency. The pin configuration of the microcontroller is shown in Figure 3.1.

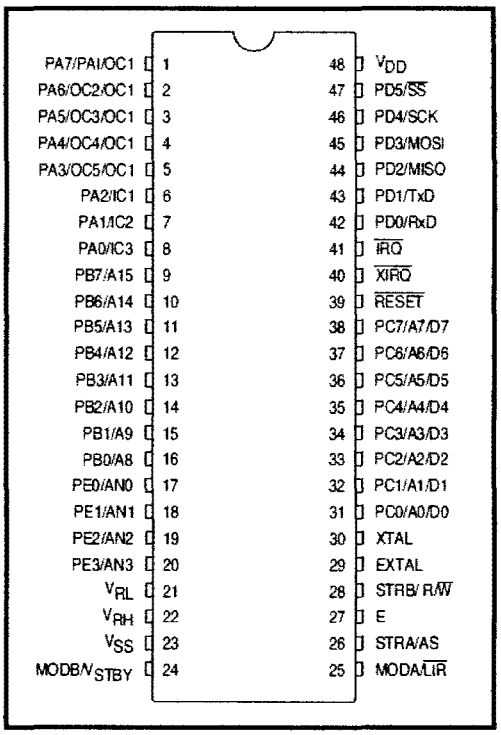

Figure 3.1: Microcontroller MC68HC11A1 Pin Configurations

The on-chip memory system includes 512 bytes of Electrically Erasable Programmable ROM (EEPROM) and 256 bytes of Random-Access Memory (RAM). Major peripheral functions are provided on-chip. An eight-channel analog-to-digital (A/D) converter is included with eight bits of resolution, but as one of the members of MC68HC11A family, MC68HC11A1 only has 4 input ports. An Asynchronous Serial Communications Interface (SCI) and a separate Synchronous Serial Peripheral Interface (SPI) are included. The main 16 bit, free running timer system has three input-capture lines, five output-compare lines, and a real time interrupt function. Table 3.1 shows the functions of every port (Port A to Port E) of MC68HC11A.

Table 3.1: Function of MC68HC11A ports

PORT	FUNCTIONS
A	• Parallel input and output (PA0-PA7) • Timer / Counter
B	• Output port (PB0-PB7) • Upper address (A8-A15) in expended mode
C	• Input / Output port (PC0-PC7) • Lower address (A8-A15) in expended mode • Data bus (D0-D7) in expended mode
D	• 6 bits input or output port • Serial Communication Interface port (SCI) • Serial Peripheral Interface (SPI)
E	• 4 input port (PE0-PE3) • 4 channels input analog for ADC

The architecture of microcontroller is shown in Figure 3.2. This figure shows the operation of microcontroller internally.

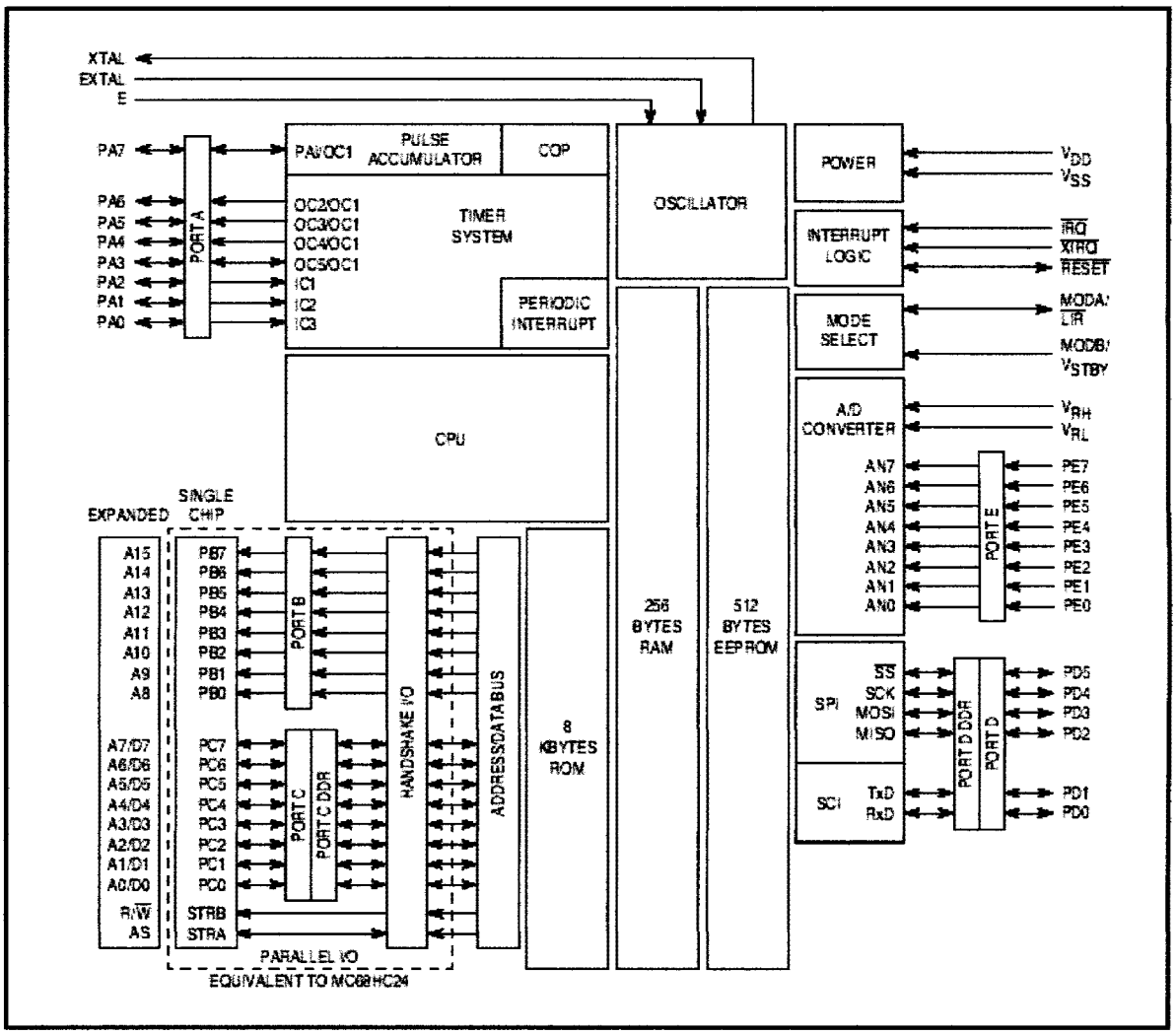

Figure 3.2: Architecture of Microcontroller

In MC68HC11, the two 8-bit accumulators called the D Register, which allows a set of 16-bit operations even though the CPU is technically an 8-bit processor. The largest group of instructions added involves the Y and X Index Registers. These Index Registers are important when the program involves index mode operation. Program Counter (PC) which is 16-bit is an indicator to display the next address of instruction that will be executed. An 8-bit Control Code Register (CCR) shows the information result due to execution of instructions that cause the CCR flags to change. Stack Pointer

(SP) are commonly used to keep track of CPU register information during execution. Figure 3.3 shows the Programmer's Model of MC68HC11.

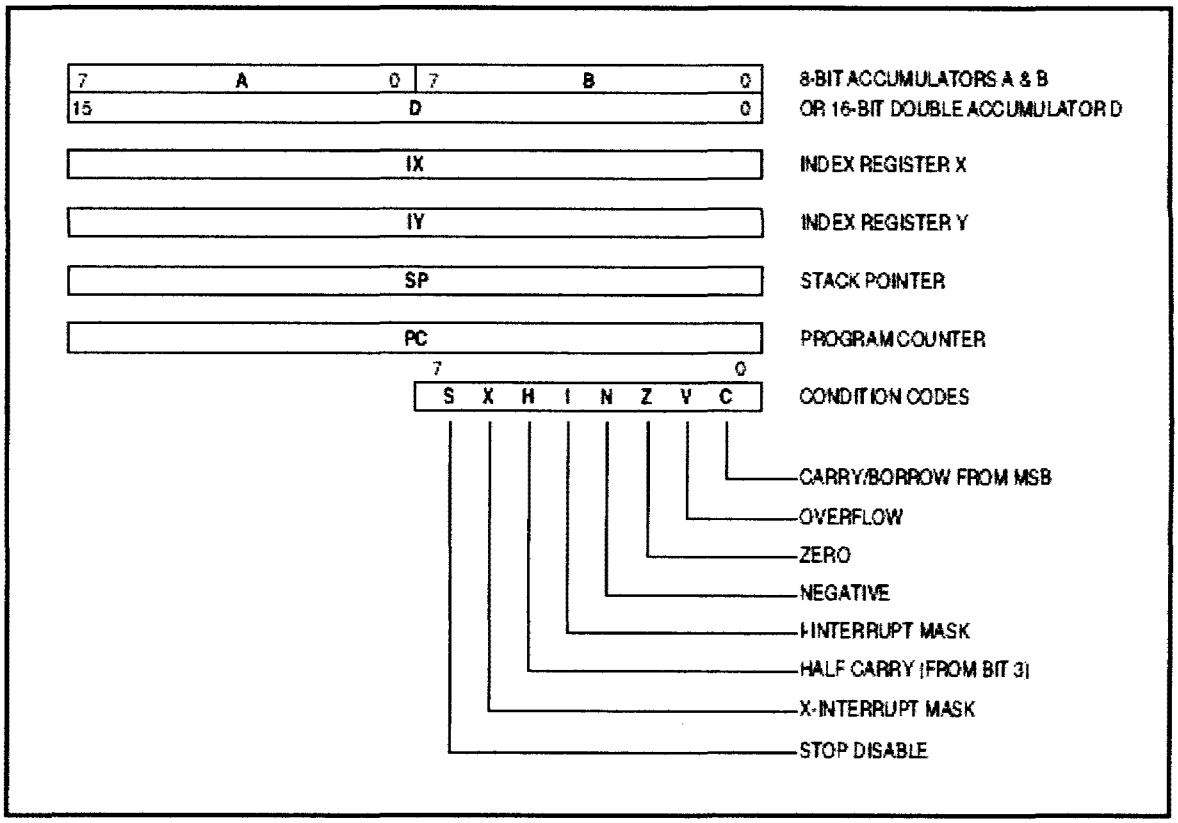

Figure 3.3: Programmer's Model of MC68HC11

The MC68HC11 microcontroller can be operating in four modes as summarized in Table 3.2. By pre-setting the logic for MODA and MODB during the reset operation, the operation modes of the controller can be selected.

Table 3.2: Microcontroller Operation Mode

INPUT		MODE
MODB	**MODA**	
0	0	Special Bootstrap
1	0	Single Chip
0	1	Special Test
1	1	Expanded Multiplexed

Normal single chip mode commonly used for mass production because ROM and RAM would be used in order to reduce production cost. In special bootstrap mode, the operation program is placed into RAM. Special test mode is accessed by the manufacturers to test the functionality and future development of the microcontroller. Expanded multiplex is used when the program is exceeding the total amount of available internal memory.

3.2.1 Operation of Microcontroller in Bootstrap Mode

For Bootstrap Mode operation, Mode A and Mode B is connected to the ground. The bootstrap mode program is executed in ROM starting from address $BF40 until address $BFFF. It also loads a 256-byte program into the on-chip RAM at the address $0000- $00FF, alternatively the bootstrap mode also can be used to program the internal EEPROM for extra code memory (512 bytes). Figure 3.4 shows the block diagram for microcontroller operated in bootstrap mode.

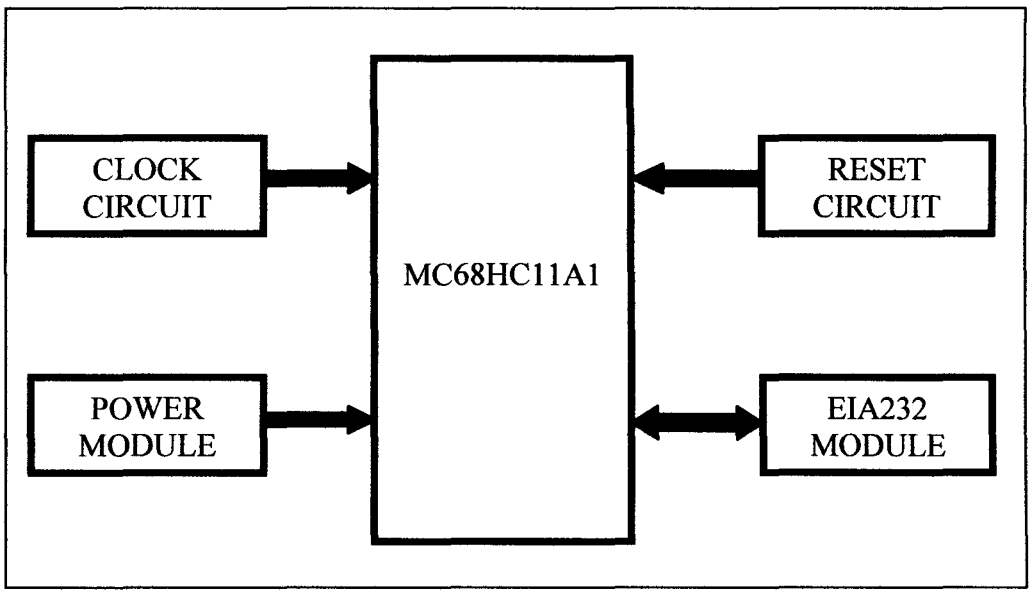

Figure 3.4: Block Diagram for Bootstrap Mode

3.2.1.1 Clock Circuit

Figure 3.5 show a simple and low cost connection for the clock. In this case, 8MHz crystal is used so that it produces E clock output of 2MHz. The E clock output determines the speed of program execution of the microcontroller.

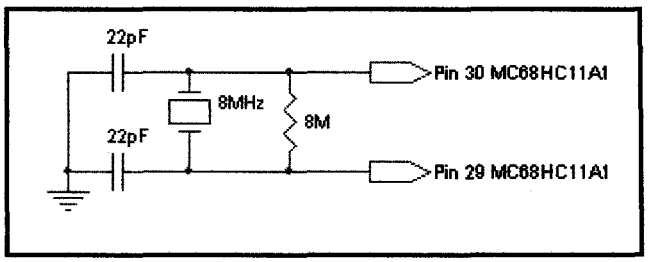

Figure 3.5: Clock Circuit

3.2.1.2 Power Module

A voltage regulator 7805 is used for power module to limit the input voltage to microcontroller at 5V accurately. The power supply circuit responsible to provide 5V input to the microcontroller. Figures 3.6 show the details of the power supply circuit.

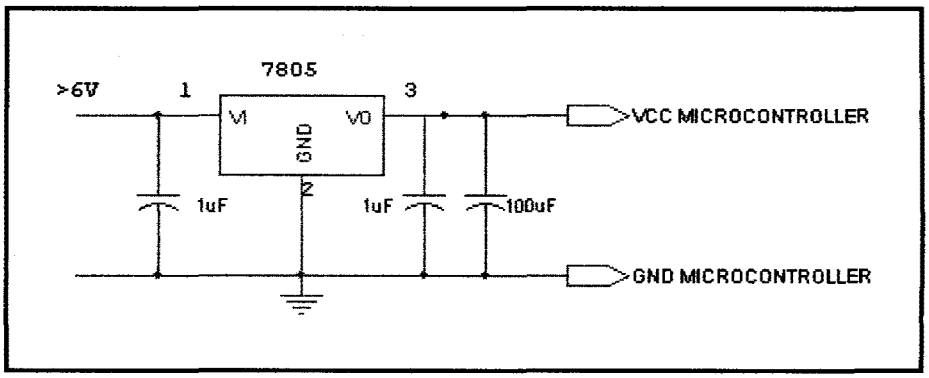

Figure 3.6: Power Circuit

3.2.1.3 EIA232 Module

In order to download object code to EEPROM or RAM location of the microcontroller through the computer, serial communication is required. In this case, the E1A232 module is used as a line driver that communicates the microcontroller with serial port by using a DB9 connector. The line driver, MAX233 is capable of converting the EIA232 standard to TTL and vice versa. The details of pin configuration for MAX233 and the EIA module circuit are shown in Figures 3.7 and 3.8.

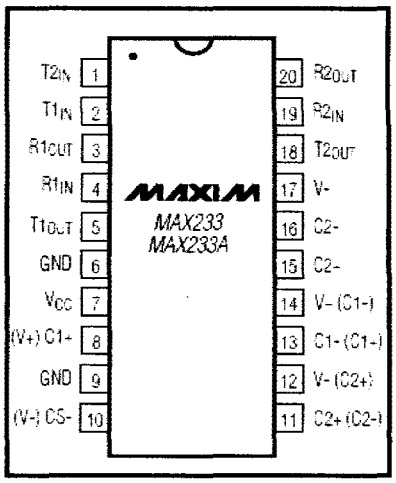

Figure 3.7: Pin Configurations for MAX233

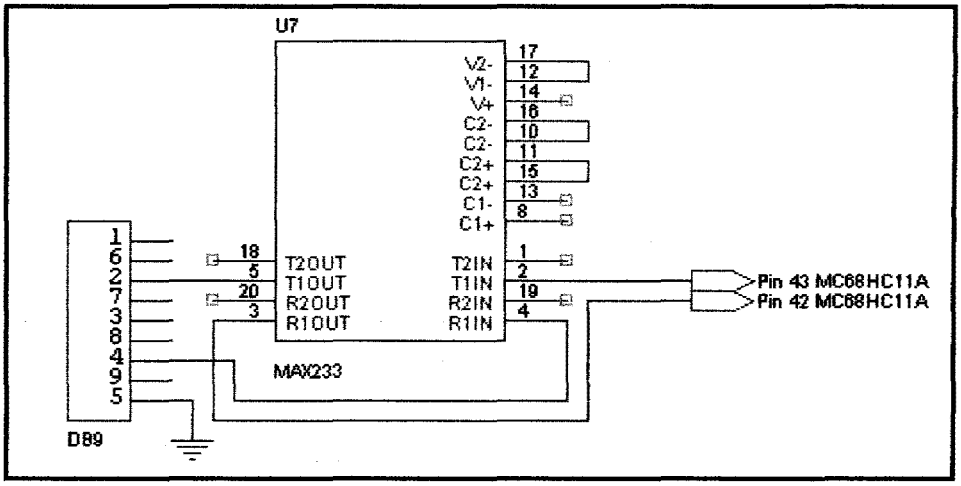

Figure 3.8: EIA232 Module

3.2.1.4 RESET Circuit

Like any microprocessor or microcontroller, the MC68HC11 required a RESET circuit. In this case, the circuit drives the microcontroller to a lower level of VDD, in order to cease, or prevent undesirable program execution. In addition, it prevents unintentional corruption of EEPROM data. Figure 3.9 shows the simple RESET circuit.

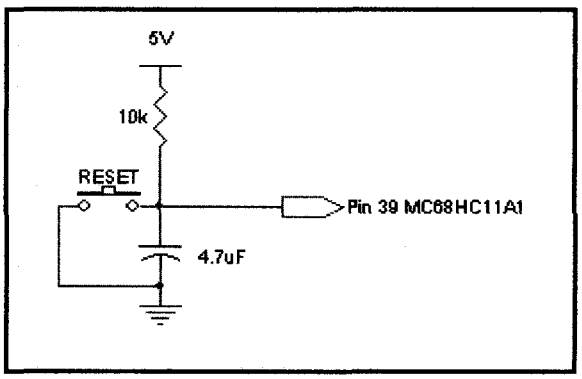

Figure 3.9: RESET Circuit

3.3 Keypad Module

The keypad module allows user to key in the password by pressing the specific key. The rows are representing by X1-X4 and the columns are representing by Y1-Y4. In order to simplify the design, a keypad encoder MM74C922 is used to interface keypad with the microcontroller. Table 3.3 summarizes the truth table of keypad encoding.

Table 3.3: Keypad Truth Table

KEY	A3(PE0)	A2(PE1)	A1(PE2)	A0(PE3)
1	0	0	0	0
2	0	0	0	1
3	0	0	1	0
A	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
B	0	1	1	1
7	1	0	0	0
8	1	0	0	1
9	1	0	1	0
C	1	0	1	1
*	1	1	0	0
0	1	1	0	1
#	1	1	1	0
D	1	1	1	1

The output of MM74C922 consists of 4 bits of binary numbers and data available (DA). If the key is pressed, DA is activated. On the contrary, DA is disabled if no key is pressed. The output MC74922 (D0-D3) are connected to Port E of MC68HC11A1. Pin configurations for MM74C922 and circuit for keypad module are shown in Figure 3.10 and 3.11.

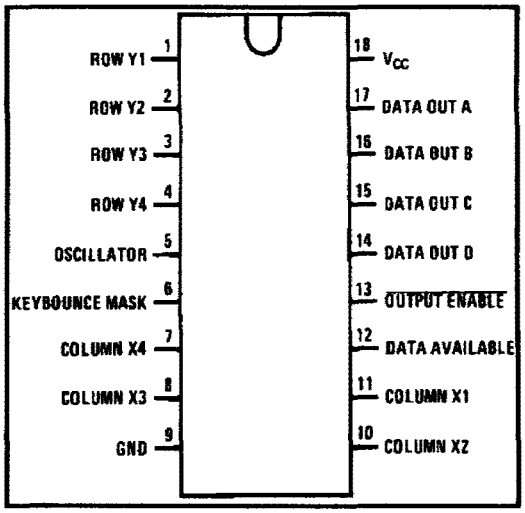

Figure 3.10: Pin Configurations for MM74C922

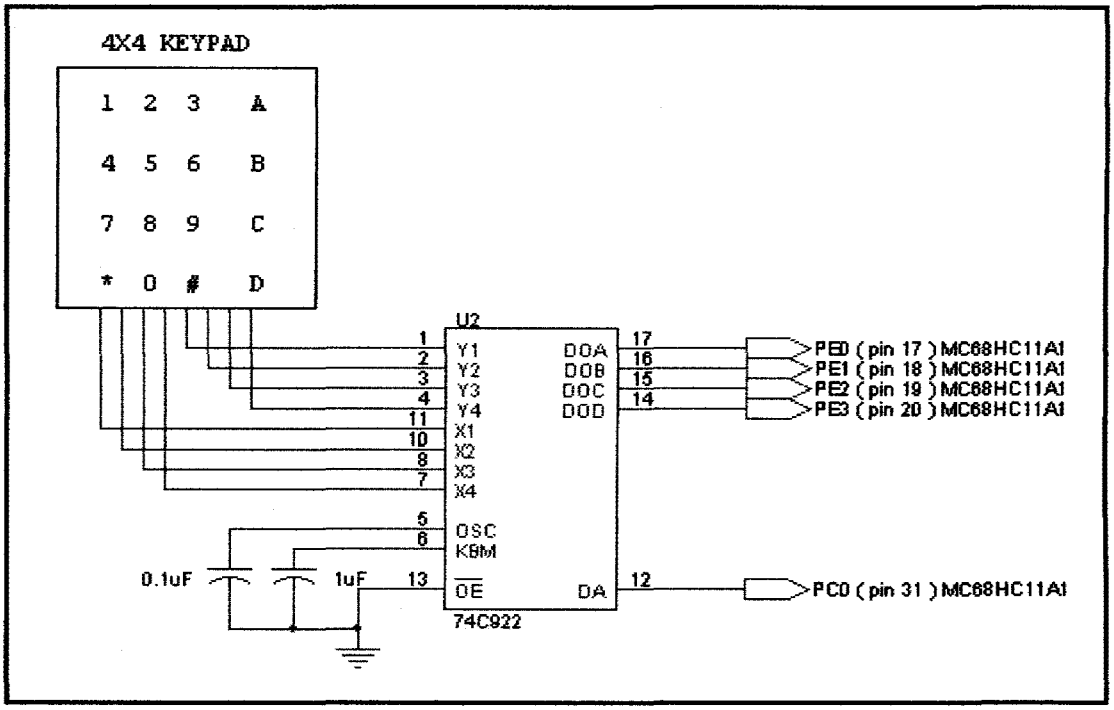

Figure 3.11: Keypad Module Circuit

3.4 Liquid Crystal Display (LCD) Module

Liquid Crystal Display (LCD) is a device that is used to display and control characters. Some features of the LCD are:

- 16 character x 2 row
- 7 x 5 dots
- Reflective with EL and LED backlight
- LED/4.2 VDC

LCD is divided into two register bits that is control register and data register. Control register is used to control the operation of the LCD while the data register is used to display the character. The control instruction is shown in Table 3.4.

Table 3.4: Command Control Codes for LCD

Instruction	RS	RW	D7	D6	D5	D4	D3	D2	D1	D0	Description	Clocks
NOP	0	0	0	0	0	0	0	0	0	0	No Operation	0
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears display & sets address counter to zero.	165
Cursor Home	0	0	0	0	0	0	0	0	1	0	Sets address counter to zero. returns shifted display to original position. DDRAM contents remains unchanged.	3
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction. and specifies automatic shift.	3
Display Control	0	0	0	0	0	0	1	D	C	B	Turns display (D). cursor on/off (C) or cursor blinking(B).	3
Cursor/display shift	0	0	0	0	0	1	S/C	R/L	0	0	Moves cursor and shift display. DDRAM contents remains unchanged.	3
Function Set	0	0	0	0	1	DL	N	M	G	0	Sets interface data width(DL). number of display lines (N,M) and voltage generator control (G).	3
Set CGRAM Addr	0	0	0	1	Character Generator RAM						Sets CGRAM Address	3
Set DDRAM Addr	0	0	1	Display Data RAM Address							Sets DDRAM Address	3
Busy Flag & Addr	0	1	BF	Address Counter							Reads Busy Flag & Address Counter	0
Read Data	1	0	Read Data								Reads data from CGRAM or DDRAM	3
Write Data	1	1	Write Data								Writes data from CGRAM or DDRAM	3

Figure 3.12 and Table 3.5 show the pin configurations for LCD.

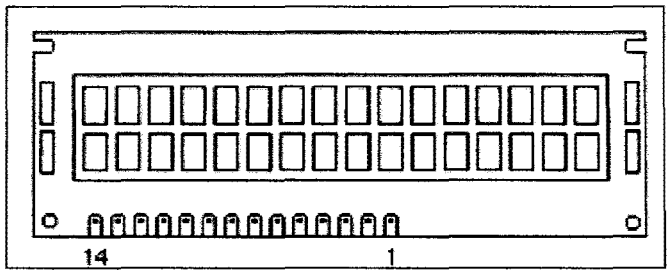

Figure 3.12: LCD Panel

Table 3.5: Pin Configuration for LCD

Pin No	Name	I/O	Description
1	Vss	Power	GND
2	Vdd	Power	-5v
3	Vo	Analog	Contrast Control
4	RS	Input	Register Select
5	R/W	Input	Read/Write
6	E	Input	Enable *(Strobe)*
7	D0	I/O	Data *LSB*
8	D1	I/O	Data
9	D2	I/O	Data
10	D3	I/O	Data
11	D4	I/O	Data
12	D5	I/O	Data
13	D6	I/O	Data
14	D7	I/O	Data *MSB*

The connection of the LCD and microcontroller is very trivial when the data lines D0-D7 are connected directly to the output port of microcontroller, PB0 to PB7. This eight bits parallel data lines encode an ASCII code to be displayed on the LCD. Pin VEE is called the contrast adjust while pin RS and pin E is used for register select and enable function. Pin R/W* connect to the ground as only write operation is

performed. Pin LED+ and LED- are optionally connected to 5V and 0V to supply the backlight of the LCD. The connection of the LCD module to the microcontroller is shown in Figure 3.13.

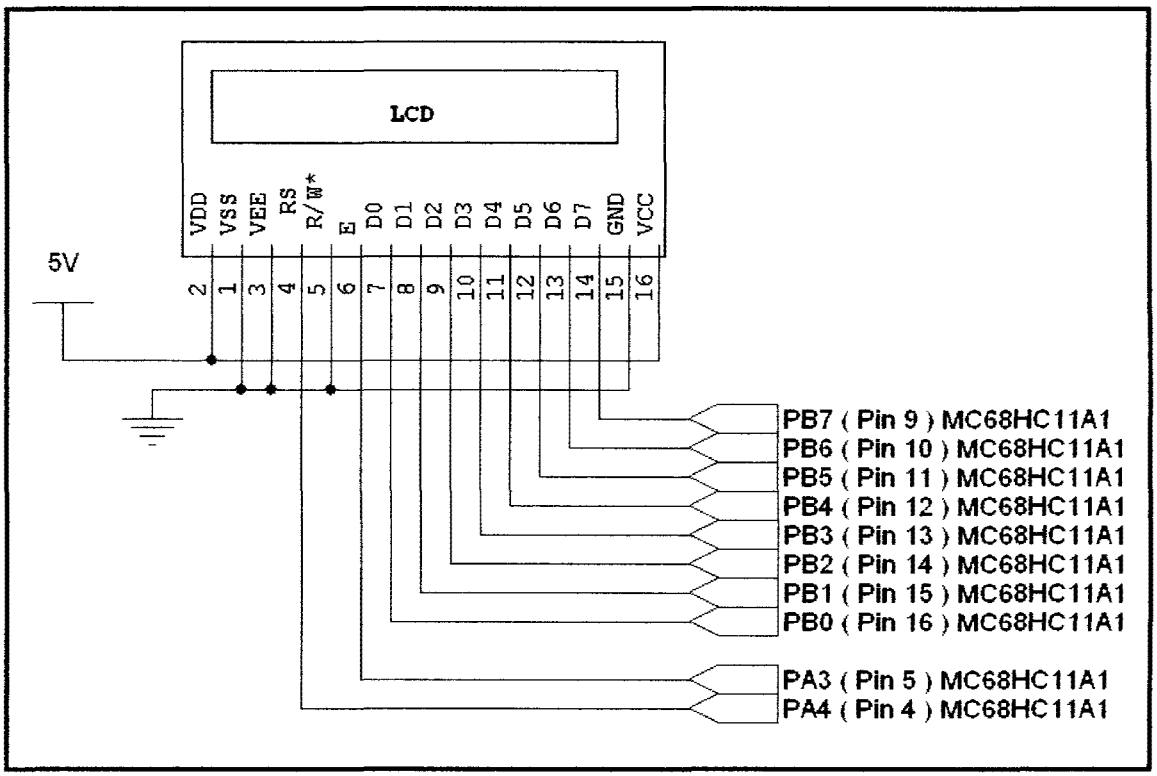

Figure 3.13: LCD Module Circuit

3.5 Electromagnetic Door Lock (EDC) Module

The Electromagnetic Door Lock (EDC) module play important role in this project. However, modification is required to connect the EDC to microcontroller. This is due to the fact that current from MC68HC11A1 is insufficient to provide the

necessary current and voltage to turn ON a relay. Thus a relay driver circuit is required. The basic function of the driver is to provide the necessary current to energize the relay coil as shown in Figure 3.14.

Generally, relay coils operates from 5V to 24V. It also requires about 25mA to 100mA current to energize the coil in order to turn ON the relay. This current is called "PULL IN" or "HOLDING" current. A 6V relay is used to control the EDC. The resistor is used to set the base current for the transistor. It's important because the transistor is driven into saturation so that the voltage drop across the transistor is minimum thereby dissipate less power.

A diode (1N4004) is connected across the relay coil function to protect the transistor from damage due to the back electromagnetic force generated in the relay's inductive coil. When the transistor is switched OFF the energy stored in the inductor is dissipated through the diode and the internal resistance of the relay's coil.

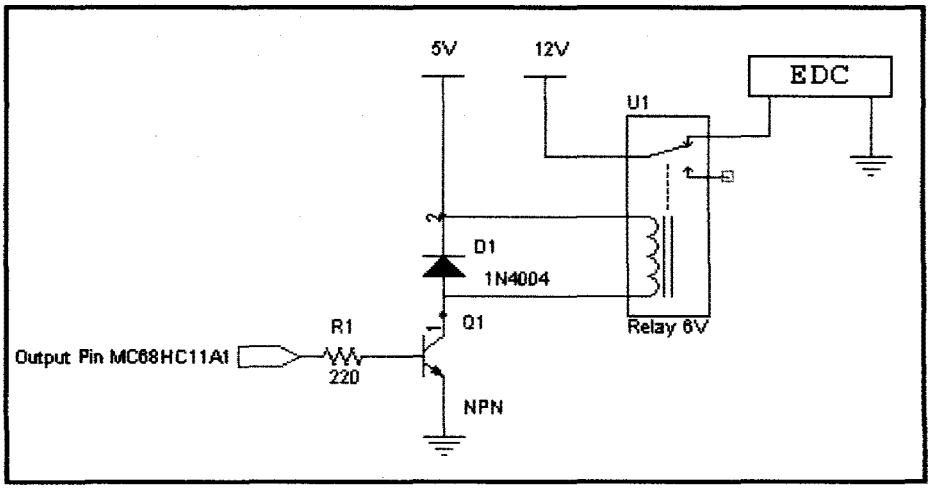

Figure 3.14: EDC Module Circuit

3.6 Wireless Module

The wireless module consists of two main parts, the transmitter and the receiver. These transmitter and receiver need an encoder and decoder respectively to send data through radio wave. The signal is sent to the encoder (HT12E) to encode this signal into a code. This code then is modulated and transmitted by the RF transmitter through the space to the receiver. The receiver will receive the signal and demodulated the signal using decoder (HT12D) and sends it to the microcontroller. Figure 3.15 and 3.16 shows the pin configuration for HT12E and HT12D.

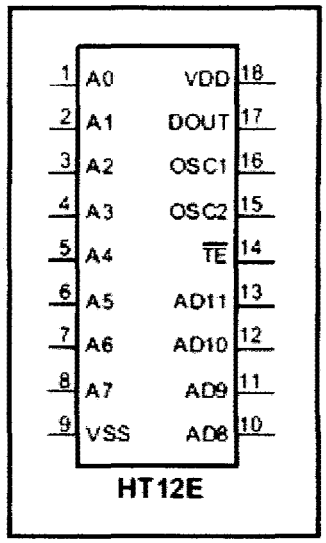

Figure 3.15: Pin Configurations for HT12E

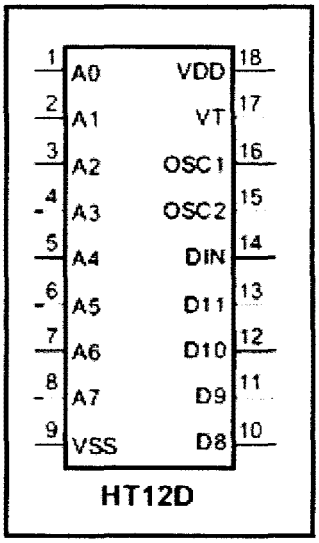

Figure 3.16: Pin Configurations for HT12D

3.6.1 RF Transmitter and Encoder

Figure 3.17 shows the connection for the transmitter module. The data from MC68HC11A1 will be encoded using the encoder HT12E. The encoder converts the parallel data to serial data and ensure only extended receiver received the signal. AD8 to AD11 are data and connected to the output port of MC68HC11A1 while pin A0 to A7 are the address for this subsystem. For the HT12E encoders, transmission is enabled by applying a low signal to the TE.

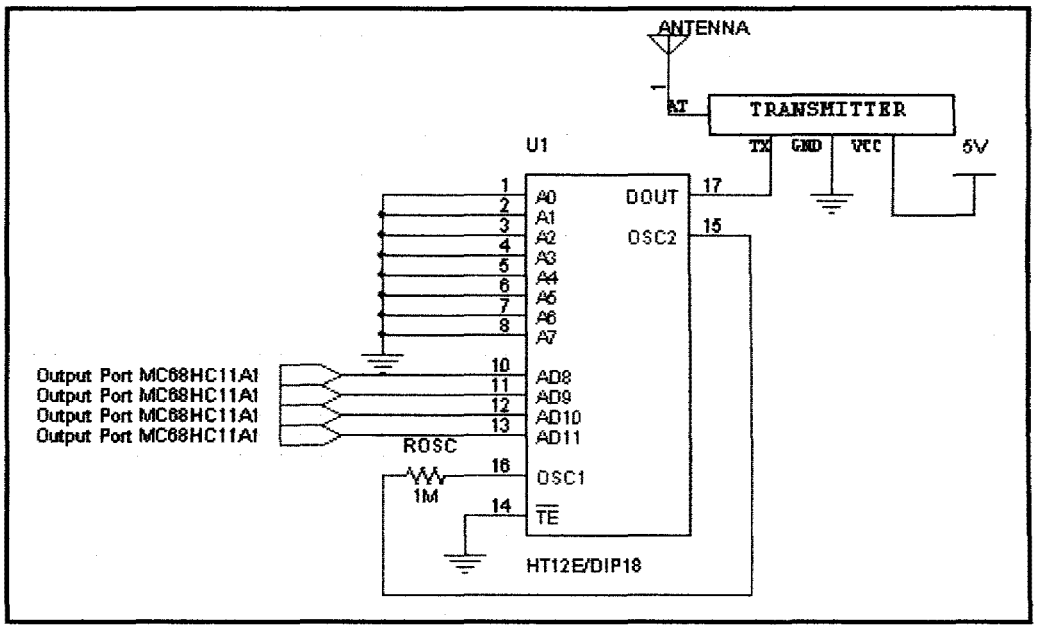

Figure 3.17: Transmitter Module Circuit

3.6.2 RF Receiver and Decoder

In order to ensure receiver receive the signal, the address at receiver must be similar with the transmitter. The data received from the transmitter will be decoded before it is sent to the microcontroller. Figure 3.18 shows the connection for receiver module.

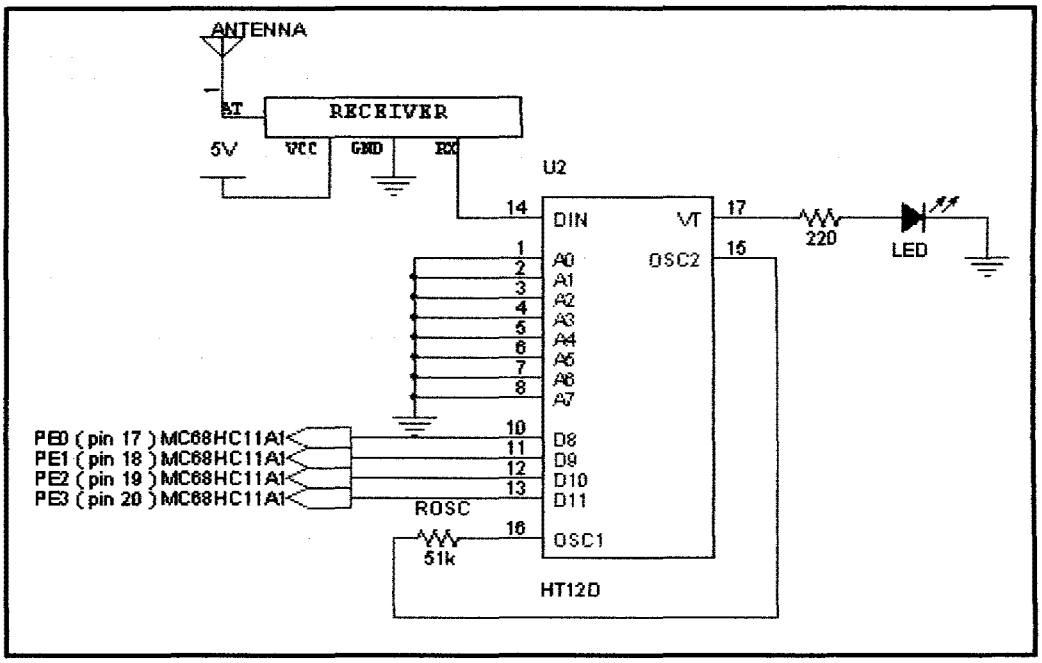

Figure 3.18: Receiver Module Circuit

CHAPTER 4

SOFTWARE DEVELOPMENT

4.1 Introduction

A software development is a structure imposed on a development of a software product. Software is a set of command that is placed in a system to enable it to perform certain task. Software needs a platform, called hardware to run its commands. Hardware modules that are used in this project have been discussed in the previous chapter. In this chapter, software development for this project will be discussed.

As mention earlier, the main controller of the system is the microcontroller itself. However, the hardware will not able to function properly if the development of the program is not performing satisfactory program. Software program that is placed in this microcontroller is written in Assembly Language. Then this set of program is assembled into Machine Code and is downloaded into the microcontroller. In order to develop the software program that operates this security system, the hardware is tested individually with its own program. It is a common practice that program flow chart for each module must be developed first before the program is written.

4.2 Microcontroller Module Testing Algorithm

Since the microcontroller is very important part for this project, a simple program is designed to ensure the microcontroller is functioning properly. The flowchart in Figure 4.1 performs a simple 8 LEDs blinking by the microcontroller. These 8 LEDs are connected to Port B (PB0-PB7).

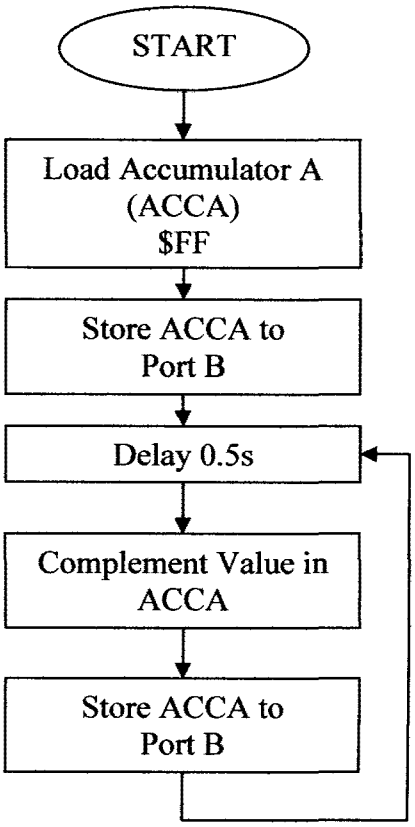

Figure 4.1: Flow Chart of Microcontroller Module

Based on Figure 4.1, the accumulator A (ACCA) is loaded with value of $FF. The data $FF is stored into Port B and send logic HIGH to all the LEDs connected to the port, thus all eight LEDs will glow at the same time. Then after delay for some fraction of second, the content of accumulator A is complimented and stored into Port B. The procedure is repeated continuously and displayed a blinking movement to the LEDs. This process continues as long as the microcontroller module is powered up.

4.3 Keypad Module Testing Algorithm

This program is designed to test the keypad functionality by interfacing the keypad and MC68HC11A1. The function of keypad can be tested by connecting the keypad pins to a keypad decoder MM74C922. The four output pins of this decoder are connected to Port E (PE0-PE3) of the microcontroller and the data available (DA) is connected to the Port C (PC0) of microcontroller. The LEDs is connected to Port B (PB0-PB3) to indicate the binary representation. Figure 4.2 represents a flow diagram that tests the functionality of the keypad module.

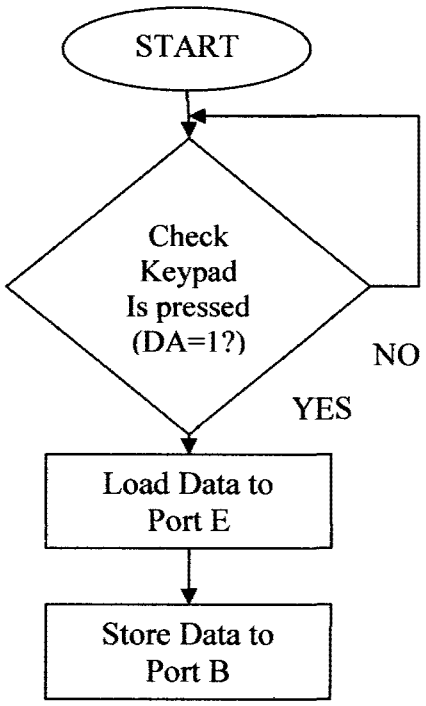

Figure 4.2: Flow Chart of Keypad Module

4.4 Liquid Crystal Display (LCD) Module Testing Algorithm

The functionality of an LCD can be tested by connecting the LCD to the microcontroller. A program is written and downloaded to test the functionality of LCD. First, the LCD is initialized by setting the display such as clear display, display cursor, set function, character entry mode and display cursor on command. The program execution will write the data into the LCD to be displayed. In the program, the words FAJREN and EA07092 is pre-defined, and will be written and displayed on the LCD screen as the microcontroller is powered up. The flow diagram for LCD module testing is shown in Figure 4.3.

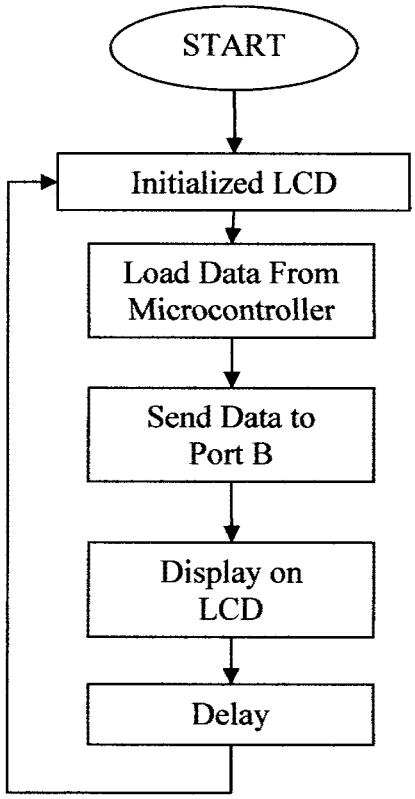

Figure 4.3: Flow Chart of LCD Module

4.5 Electromagnetic Door Lock (EDC) Module Testing Algorithm

Based on flow chart in Figure 4.4, a simple program is designed to test EDC. This program is used to activate and deactivated the door. Initially, logic high is sent by the microcontroller MC68HC11A1 to EDC. It causes the door to be unlocked. Then, a 7 seconds delay is generated before it is locked again. This process is continued to verify the functionality of interface microcontroller MC68HC11A1 to the EDC.

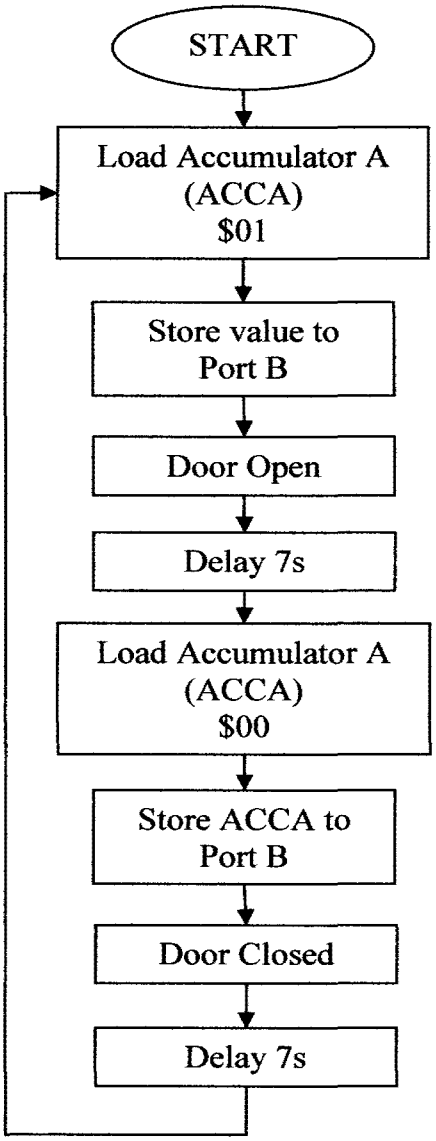

Figure 4.4: Flow Chart of EDC Module

4.6 Wireless Module Testing Algorithm

The wireless module includes encoder, transmitter, receiver and decoder. The transmitter and receiver are tested individually in order to ensure the ability of these components to transmit and receive data effectively and accurately.

4.6.1 Transmitter Module Testing

Based on Figure 4.5, the data will load and stored at output port of the microcontroller. The encoder HT12E will check if the TE is enabled or not. If the TE is enabled, the data will be transmitting.

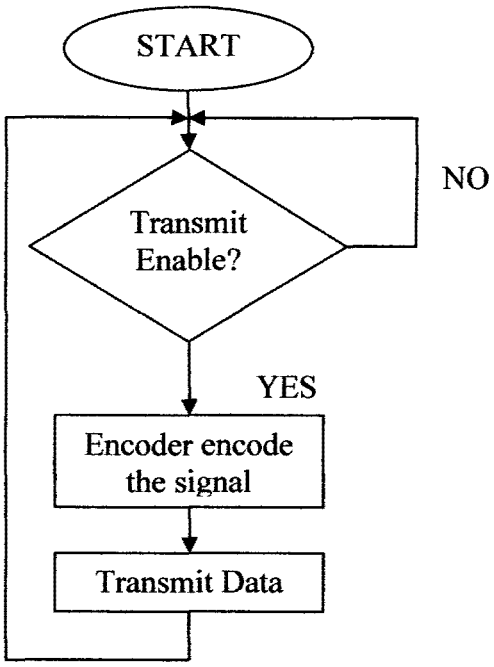

Figure 4.5: Flow Chart of Transmit Module

4.6.2 Receiver Module Testing

Based on figure 4.6, the decoders receive data that are transmitted by an encoder. If the received address codes match the address of the decoder, the receiver will receive the data from transmitter.

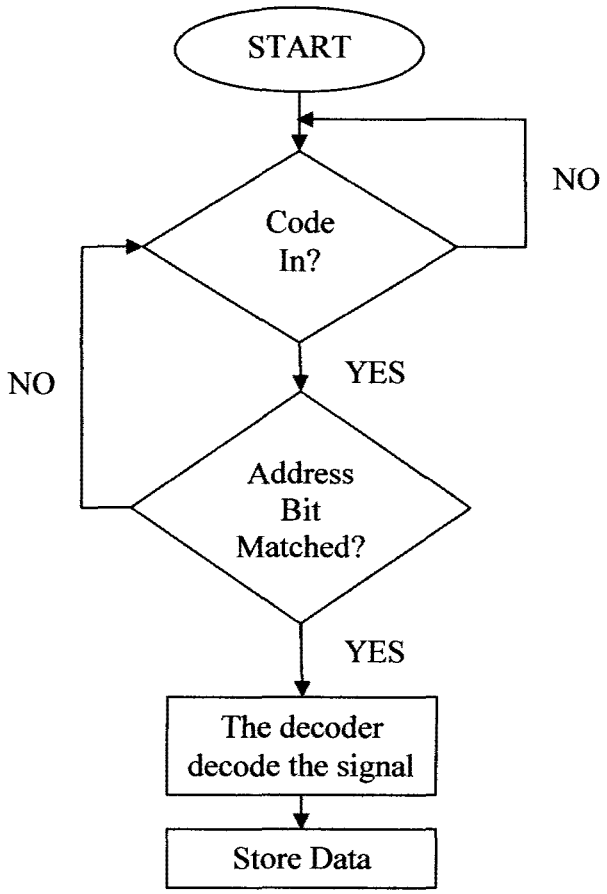

Figure 4.6: Flow Chart of Receiver Module

4.7 Database Module Testing

Software communication is required to communicate the system board and computer. The HyperTerminal is used as communication software to communicate between two systems. In order to interfacing the Database Security System with computer, a few commands must be included in Visual Basic. Visual Basic is the most powerful programming language that provides standard windows object and graphic user interface that will make the system become user friendly. Figure 4.7 shows the flow of the program.

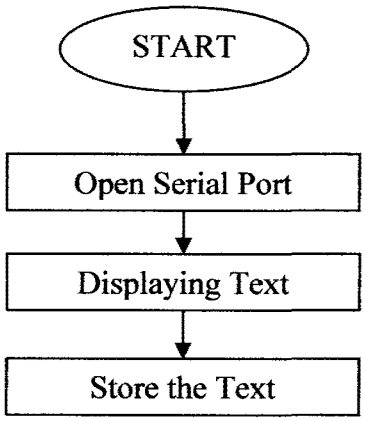

Figure 4.7: Flow Chart of Database Module

4.8 Testing Algorithm for Whole System

As shown in Figure 4.8, the entire modules are initialized. These include a microcontroller module, keypad module, LCD module, EDC module and wireless module. The system monitors the status of the keypad.

If the password is valid, the door is unlocked and the information of the user will be stored. In other hand, if the invalid password is placed, alarm will be activated. If a user attempt to key-in the password, the system evaluates the password randomly. If the password is valid, the user info such as name, ID, date, time will be sent to master module to store this info. At the same, the EDC will be unlocked and allow the user to enter the premise. On the other hand if the invalid password is key-in, the door remains unlocked. If the same users key-in the invalid password for the 3rd attempt, the alarm will be generated.

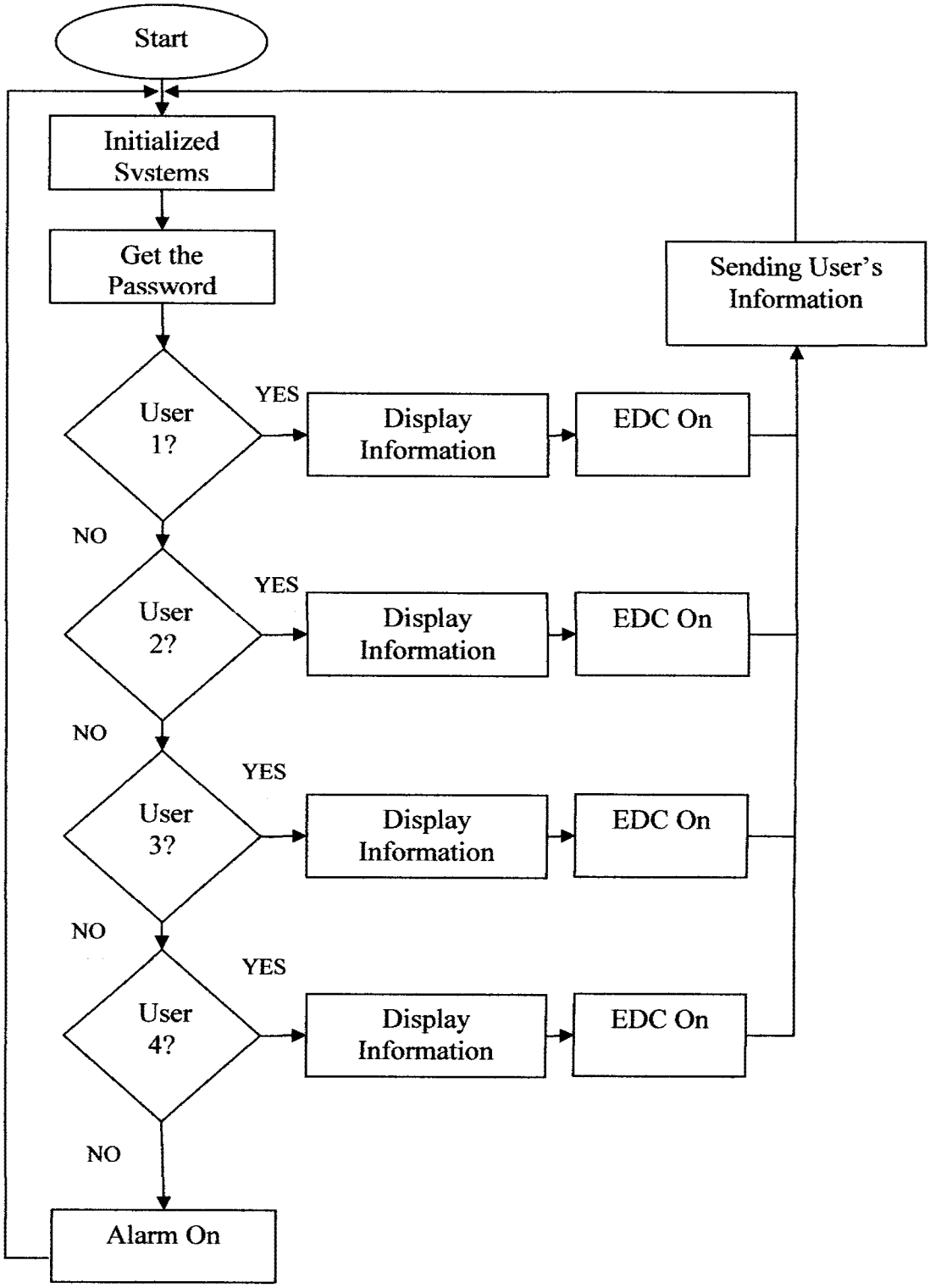

Figure 4.8: Flow Chart for Whole System

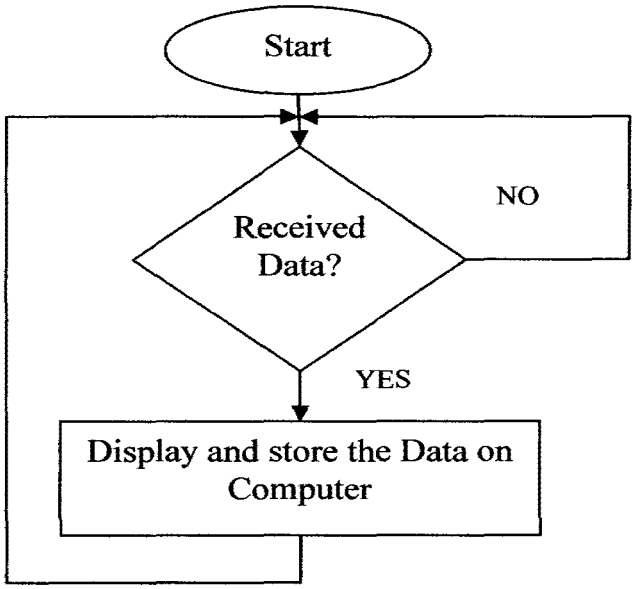

Figure 4.8: Flow Chart for Whole System (continue)

CHAPTER 5

TESTING AND RESULT

5.1 Introduction

This chapter will discuss on the testing methods and the results obtained for each of the individual module. Testing is an extremely important procedure in order to make sure each module can function properly before the process of integrated is resumed. In addition, individual testing assists the exploring and understanding the function of each module, and hence simplifies the task of troubleshooting after the integration process. The testing and result procedure is focusing on these five main modules:

- Microcontroller Module Testing
- Keypad Module Testing
- LCD Module Testing
- EDC Module Testing
- Wireless Module Testing

5.2 Microcontroller Module Testing

In order to test the functionality of the microcontroller module, a segment of program is written and downloaded into the microcontroller. This program is based on flow diagram in Figure 4.1. This program segment produces the result of 8 LEDs blinking continuously.

Figure 5.1 shows the hardware connection of the microcontroller testing, and Figure 5.2 shows the software programming of the microcontroller testing.

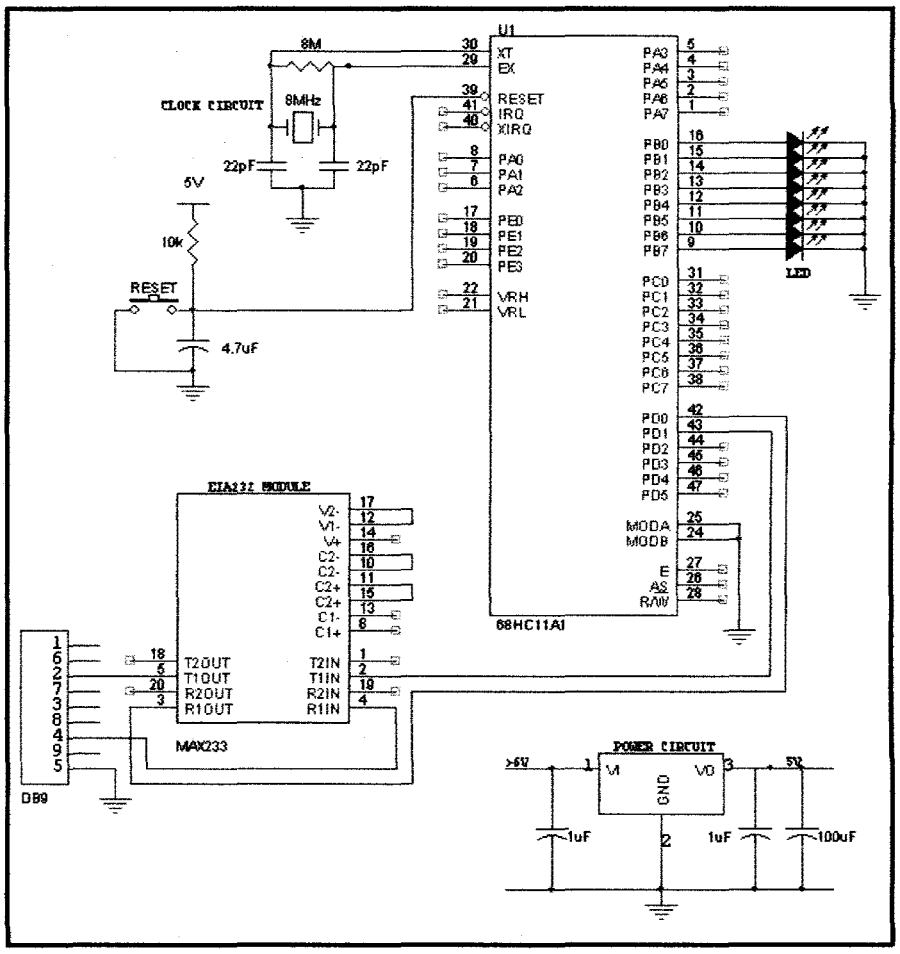

Figure 5.1: Hardware Connections for Microcontroller Testing

```
        ORG   $B600
        LDX   #$1000    ; load IX with address REGS
        CLR   4,X       ; clear Port B
AGAIN   LDAA  #$FF      ; load data into ACCA
        STAA  4,X       ; store data into Port B
        BSR   DELAY     ; call delay
        COMA            ; compliment data in ACCA
        STAA  4,X       ; store data into Port B
        BSR   DELAY     ; call delay
        BRA   AGAIN     ; branch always to AGAIN

DELAY   PSHA
        PSHY
        LDAA  #2
RPT1    LDY   #$FF00
RPT2    DEY
        BNE   RPT2
        DECA
        BNE   RPT1
        PULY
        PULA
        RTS
        END
```

Figure 5.2: A Simplified Program of Microcontroller Test

After the program has been downloaded into the microcontroller, as soon as the module is powered up, the eight LEDs connected to the microcontroller will glow. The procedure is repeated continuously and displayed a blinking movement to the LEDs. This process continues as long as the microcontroller module is powered up. Thus it can be concluded that the microcontroller system is fully functioning.

5.3 Keypad Module Testing

In order to test the performance of the keypad module, a circuit as shown in Figure 5.3 is constructed. The keypad encoder MM74C922 is used to simplify the program. The MM74C922 is used because this IC has internal bounce circuit which can prevent bouncing problem.

The Data Available (DA) pins on MM74C922 is connected to Port C (PC0) and the data output is connected to the LED at Port B (PB0-PB3). When DA output goes high, a valid key entry is available on the D0A-D0D. During this period, the LEDs will indicate the binary number representation from 0000 to 1111.

Figure 5.4 shows the simple program that used to test the keypad performance. When the button is keyed in binary number will be produced at Data output and its value is similar with the binary output representation of each key input as shown in Table 3.3. After several test, it can be concluded that the keypad is fully functioning.

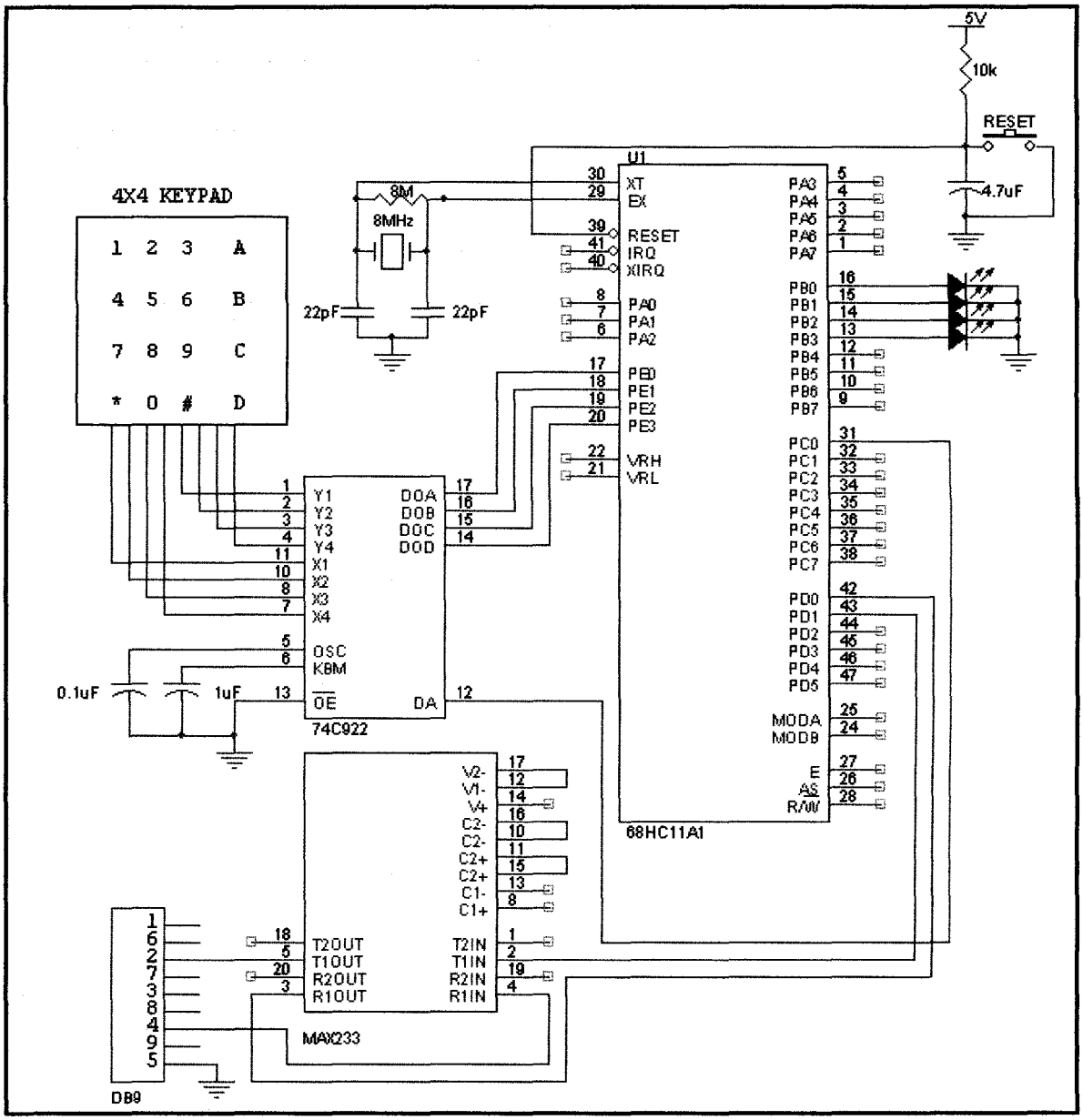

Figure 5.3: Hardware Connections for Keypad Testing

```
        ORG     $B600
        LDS     #$FF
        LDX     #$1000

        BCLR    7,X     $FF         ;initialize DDRC
SCAN    BRCLR   3,X     $01   SCAN  ;scan for DA=1
        LDAA    10,X                ;load data to PE
SCAN1   BRSET   3,X     $01   SCAN1 ;scan DA=0
        ANDA    #$0F
        STAA    4,X                 ;store data to PB
        BRA     SCAN

        END
```

Figure 5.4: Keypad Module Testing Program

5.4 Liquid Crystal Display (LCD) Module Testing

A circuit shown in Figure 5.5 is constructed to test the LCD functionality. Data line D0-D7 is connected to the Port B (PB0 to PB7) of microcontroller. Pin RS and E are connected to Port A (PA4 and PA5). Pin R/W* is connected to the ground. Figure 5.6 shows a simplified program that is developed to test the LCD panel.

When the program is executed, the LCD displays the word "FAJREN" on the first row and word "EA07092" on the second row of the panel LCD. Thus, it can be concluded that the LCD is fully functioning.

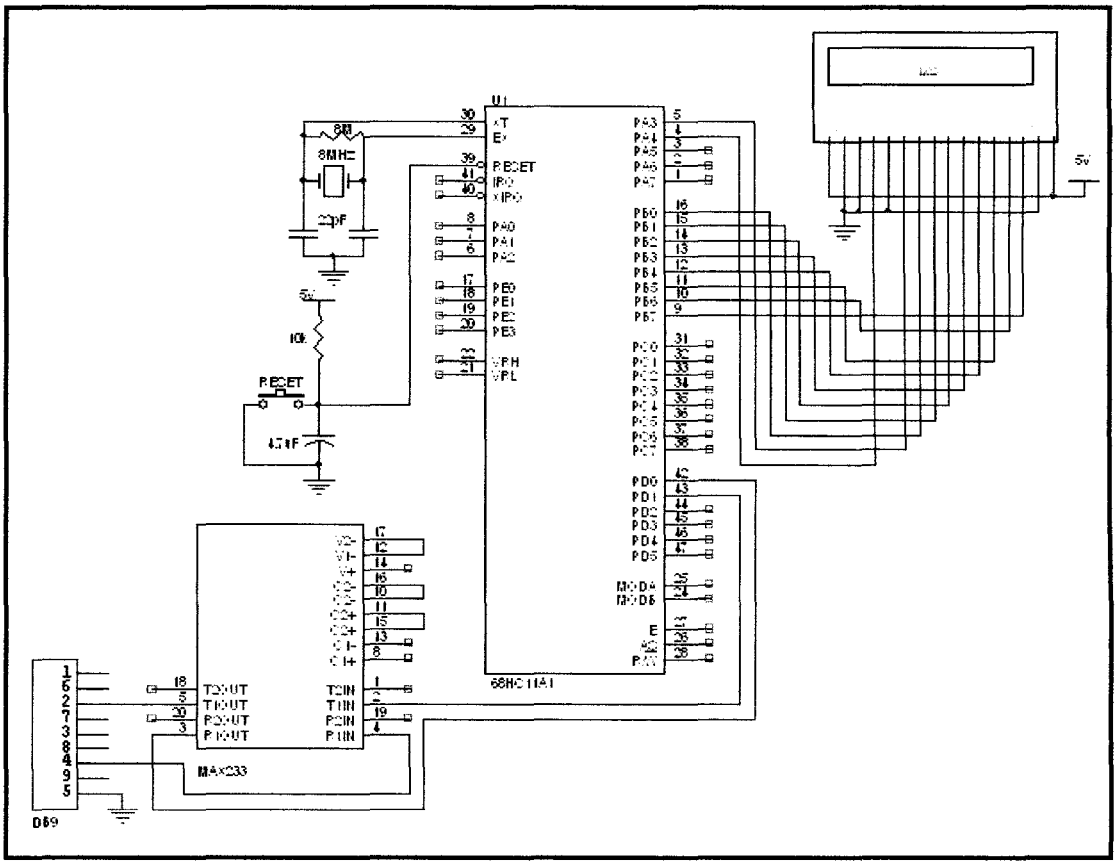

Figure 5.5: Hardware Connections for LCD Testing

```
        ORG     $B600
        LDS     #$FF
        LDS     #$1000

        LDY     #INI            ;initialize the LCD
NEXT    LDAA    0,Y
        BEQ     DSPLY
        BSR     INS
        INY
        BRA     NEXT

INS     BCLR    0,X     $10
        BSR     ENABLE
        RTS

DATA    BSET    0,X     $10
        BSR     ENABLE
        RTS
```

Figure 5.6: LCD Module Testing Program

```
ENABLE STAA    4,X
       BSET    0,X    $08
       BCLR    0,X    $08
       JSR     DELAY
       RTS

CHAR   LDAA    $0,Y
       JSR     DATA
       INY
       RTS

DSPLY  LDY     #DATA1          ;load index
       LDAA    #$80
STRT1  JSR     INS
       INCA
       PSHA
       JSR     CHAR
       PULA
       CMPA    #$87
       BEQ     ROW2
       BRA     STRT1

ROW2   LDY     #DATA2
       LDAA    #$C0
STRT2  JSR     INS
       INCA
       PSHA
       JSR     CHAR
       PULA
       CMPA    #$CF
       BEQ     ROW
       BRA     STRT2

ROW    BRA     ROW

DELAY  PSHX
       LDX       #$FFF
REPEAT DEX
       BNE       REPEAT
       PULX
       RTS

INI    FCB       $01,$02,$06,$0C,$14,$38,0
DATA1  FCC       " FAJREN "
DATA2  FCC       "EA07092"
       END
```

Figure 5.6: LCD Module Testing Program (Continued)

5.5 Electromagnetic Door Lock (EDC) Module Testing

A circuit shown in Figure 5.7 is constructed to test EDC module. A simple program is written based on the flow chart of Figure 4.4 and shown in Figure 5.8. When the program is executed, the relay connected to the EDC is activated every 7 seconds. Thus, it can be concluded that the relay and EDC is fully functioning.

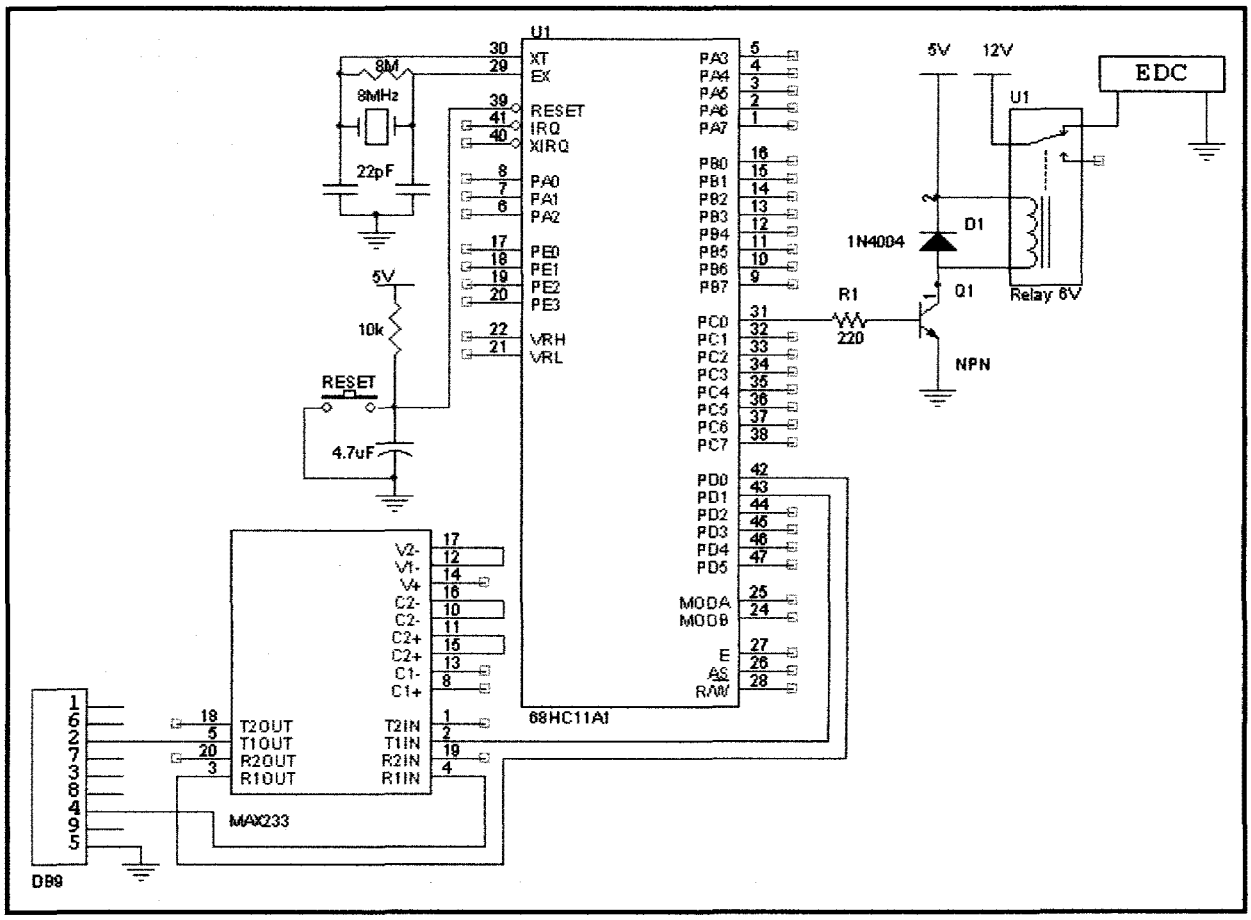

Figure 5.7: Hardware Connections for EDC Testing

```
        ORG     $B600
        LDS     #$FF
        LDX     #$1000

START   BSET    7,X   $FF     ;initialize DDRC
        LDAA    #$01          ;load data to ACCA
        STAA    3,X           ;store at Port C
        BSR     DELAY         ;call delay
        LDAA    #$00          ;load data to ACCA
        STAA    3,X           ;store at Port C
        BSR     DELAY         ;call delay
        BRA     START         ;go to start

DELAY   PSHX
        LDAB    #2
AGAIN   LDX     #0FFF
REPEAT  DEX
        BNE     REPEAT
        DECB
        BNE     AGAIN
        PULX
        RTS

        END
```

Figure 5.8: EDC Testing Program

5.6 Wireless Module Testing Algorithm

Circuit in Figure 5.9 and 5.10 are constructed to test the communication between receiver and transmitter. A simple program is written based on the flow chart of Figure 4.5 and 4.6.

Figure 5.11 and 5.12 show the listing program that is used for transmit and receive data. When the programs are executed, the receiver received the data that are sent by the transmitter provided both of them used the same address.

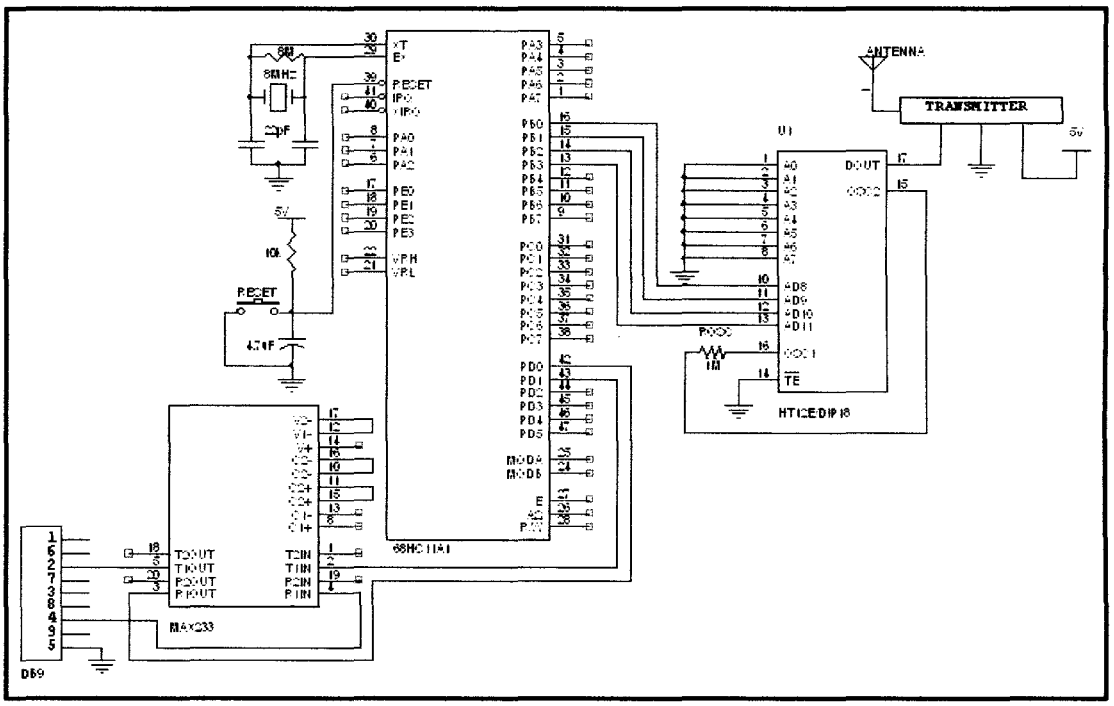

Figure 5.9: Hardware Connections for Transmitter

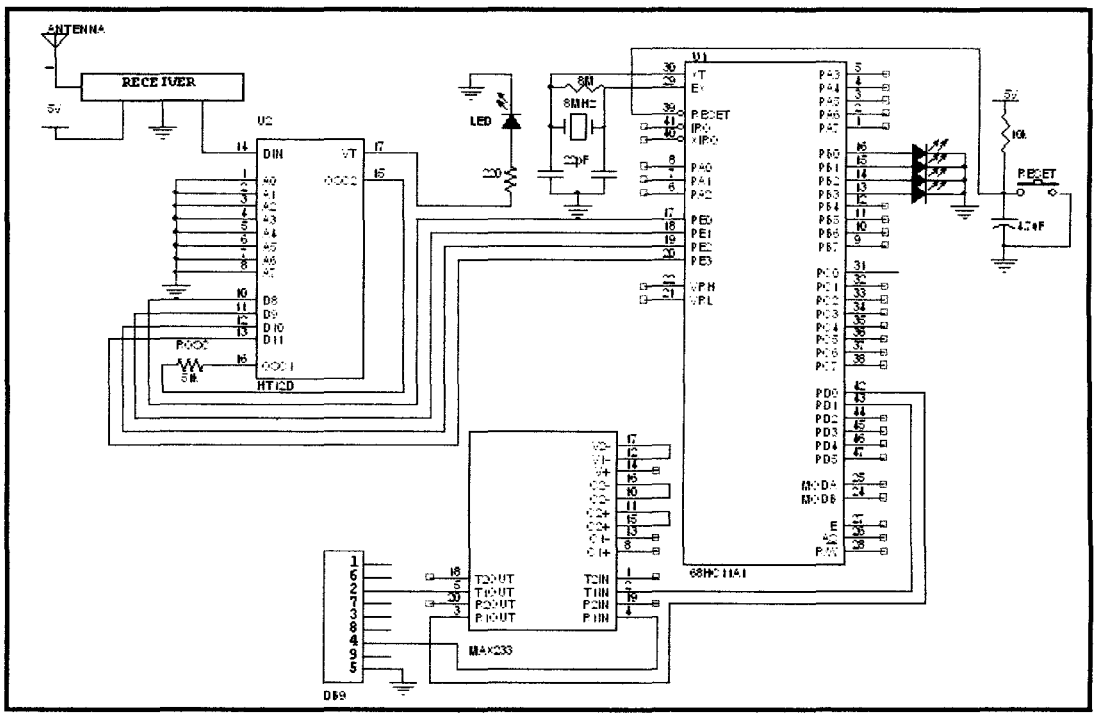

Figure 5.10: Hardware Connections for Receiver

```
        ORG     $B600
        LDS     #$FF
        LDX     #$1000

        LDAA      #$0F      ;load data to ACCA
        STAA      4,X       ;store at Port B
        BSR       DELAY     ;call delay

DELAY   PSHX
        LDX       #$FFF
REPEAT  DEX
        BNE       REPEAT
        PULX
        RTS

        END
```

Figure 5.11: Transmitter Testing Program

```
        ORG     $B600
        LDS     #$FF
        LDX     #$1000

SCAN    BRCLR   10,X $0F SCAN ;scan Port E
        LDAA    10,X          ;load data from portE
        ANDA    #$0F          ;OR data
        STAA    4,X           ;store to Port B
        BRA     SCAN          ;branch always scan

        END
```

Figure 5.12: Receiver Testing Program

CHAPTER 6

CONCLUSION AND FUTURE RECOMMENDATION

6.1 Conclusion

Overall, each module in this project is designed, constructed and tested successfully. The microcontroller MC68HC11A1 is capable of controlling the input and output device. The LCD and keypad is tested and can be used as input and output devices. The EDC also can be used to lock and unlock the door as required. All the user information is stored in the database.

In general, all individual modules are functioning properly. However, when the modules are integrated in a system, the system at multi entrance cannot communicate with the center microcontroller because of RF problem. For this reason there are only one entrance can functioning.

Future Recommendation

The ability of the system can be further enhanced for the future development. Some suggestions for further development are:

- Smart card security solution offer dramatic advancement in card security and functionality. Smart cards are small and tamper-resistant. They hold and transmit, and encrypt massive amount of data. It is better replacement for the entrance password.
- In order to produce user friendly environment, the speech IC and infrared sensor should be introduced in the system. The infrared sensor detects the present of the user and activated the system while the speech IC can be used as a guide to use the system.
- It is suggested the Zigbee technology should replace the RF because the Zigbee is more suitable.
- It also suggested this system should be replaced with the most sophisticated biometric authentication like finger print or iris scanner.

6.3 Costing and Commercialization

The overall of the whole project is based on the hardware development. Therefore the cost of the project depends on type of electronic devices. For this prototype, the estimate cost is about RM400.00. The cost is considered low if compared to the door security system that is available in the market. Since the products are highly on demand nowadays, it is highly recommended that the prototype to be upgrade and it can be commercialized in the future.

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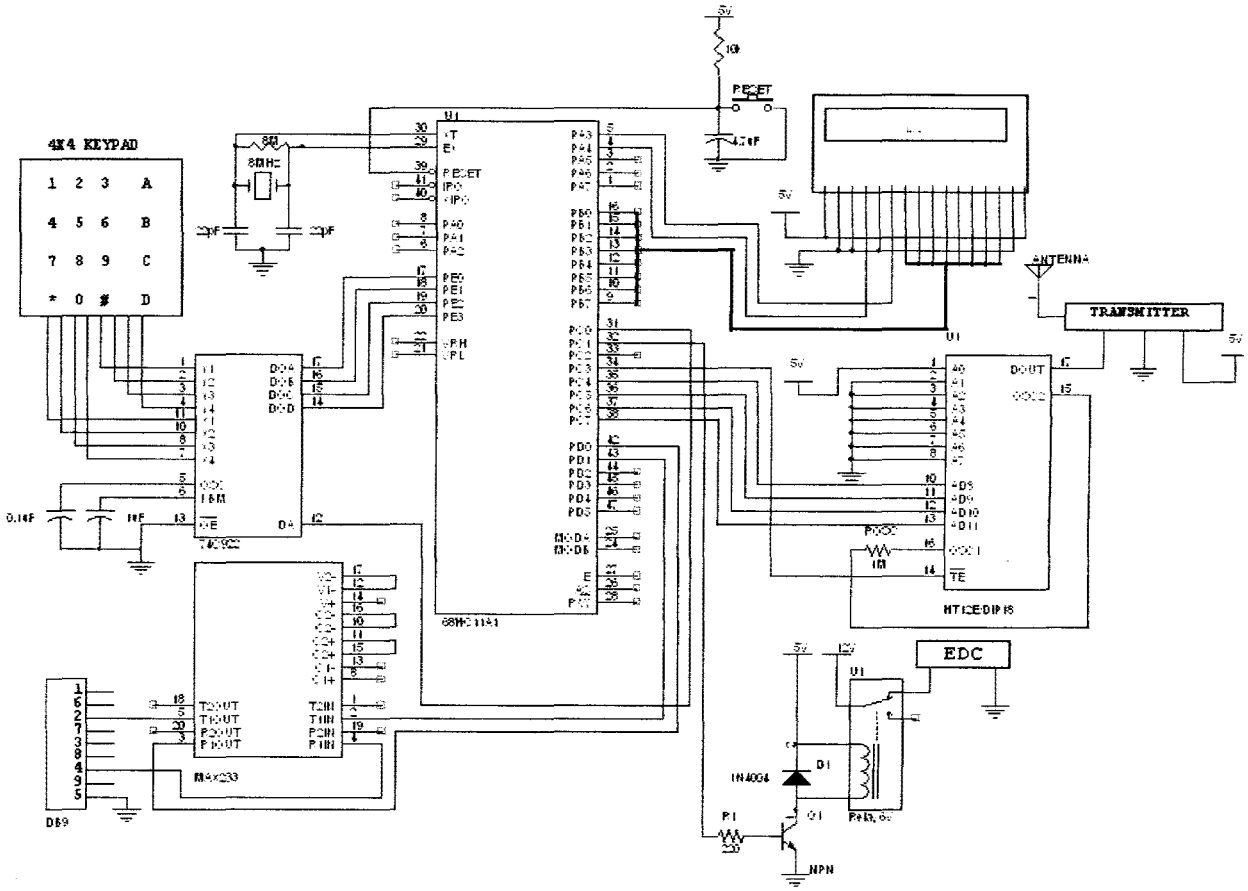
[8] Rozeha A. Rashid, Nur Hija Mahalin, Mohd Adib Sarijari, Ahmad Aizuddin Abdul Aziz, *Security System Using Biometric Technology: Design and Implementation of Voice Recognition System (VRS),* Department of Telecommunication and Optics, Faculty of Electrical Engineering Universiti Teknologi Malaysia

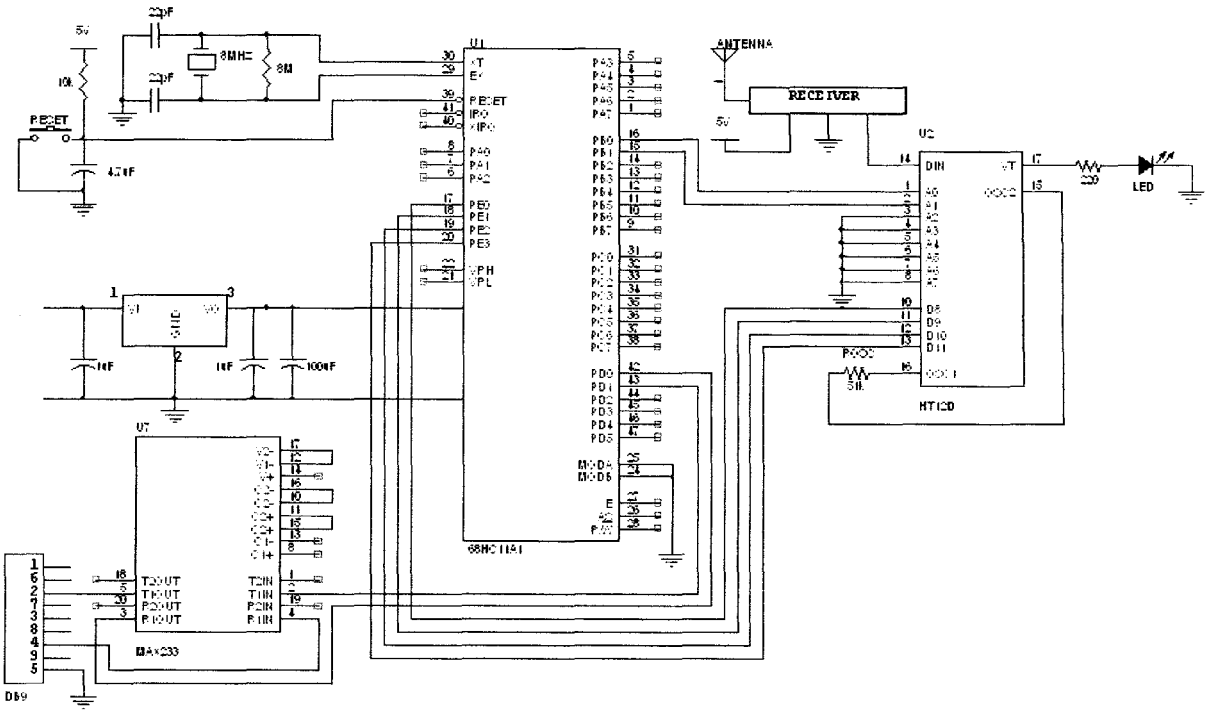
APPENDIX A

SCHEMATIC CIRCUIT DIAGRAM

A-1 Security System Transmitter Circuit



A-2 Security System Receiver Circuit



APPENDIX B

PROGRAM

B-1 Security System Program

```
        ORG    $B600
        LDS    #$FF
        LDX    #$1000

        LDAA   #$F0
        STAA   7,X
        CLR    $1003
MULA    LDY    #INI
NEXT    LDAA   0,Y
        BEQ    DISPLAY
        JSR    INSTRUCTION
        INY
        BRA    NEXT

DISPLAY       LDY    #DATA1
        LDAA   #$80
START1        JSR    INSTRUCTION
        INCA
        PSHA
        JSR    CHARACTER
        PULA
        CMPA   #$8F
        BEQ    SUN
        BRA    START1

SUN     LDY    #DATA2
        LDAA   #$C0
START2        JSR    INSTRUCTION
        INCA
        PSHA
        JSR    CHARACTER
        PULA
        CMPA   #$CF
        BEQ    SUNA
        BRA    START2

SUNA    BRA    SCAN

SCAN    LDAB   #3
LOOPING       JSR    READ_KEY
        CMPA   #0
        BEQ    SCAN1
        DECB
        BNE    LOOPING
        JMP    DISPLAY2
        BRA    SCAN

SCAN1   JSR    READ_KEY
        CMPA   #4
        BNE    SCAN2
        JSR    READ_KEY
        CMPA   #0
```

```
      BNE   DISPLAY2
      LDAA  #$50
      STAA  $1003
      JMP   DISPLAY1

SCAN2 CMPA  #2
      BNE   SCAN3
      JSR   READ_KEY
      CMPA  #6
      BNE   DISPLAY2
      LDAA  #$90
      STAA  $1003
      JMP   DISPLAY1

SCAN3 CMPA  #5
      BNE   SCAN4
      JSR   READ_KEY
      CMPA  #10
      BNE   DISPLAY2
      LDAA  #$D0
      STAA  $1003
      JMP   DISPLAY1

SCAN4 CMPA  #1
      BNE   SCAN5
      JMP   SCAN5
SCAN5 JSR   READ_KEY
      CMPA  #11
      BNE   DISPLAY2
      JMP   DISPLAY2


READ_KEY    BRCLR 3,X   $01   READ_KEY
      LDAA  10,X
RPET  BRSET 3,X   $01   RPET
      ANDA  #$0F
      RTS


DISPLAY1    LDY   #DATA3
      LDAA  #$C0
START22     JSR   INSTRUCTION
      INCA
      PSHA
      JSR   CHARACTER
      PULA
      CMPA  #$CF
      BEQ   SUNAA
      BRA   START22

SUNAA BSR   DELAY2
      CLR   $1003
      JMP   DISPLAY

DISPLAY2    LDAB  #3
LOOOP JMP   DISPLAY22
WEE   DECB
```

```
      BNE   LOOOP
LOPS  LDAA  #$20
      STAA  $1003
      JSR   READ_KEY
      CMPA  #3
      BNE   LOPS
      CLR   $1003
      JMP   DISPLAY

DISPLAY22   LDY   #DATA4
      LDAA  #$C0
START23     JSR   INSTRUCTION
      INCA
      PSHA
      JSR   CHARACTER
      PULA
      CMPA  #$CF
      BEQ   WEE
      BRA   START23


INSTRUCTION BCLR  0,X   $10
      BSR   ENABLE
      RTS

DATA  BSET  0,X   $10
      BSR   ENABLE
      RTS

ENABLE      STAA  4,X
      BSET  0,X   $08
      BCLR  0,X   $08
      JSR   DELAY
      RTS

CHARACTER   LDAA  $0,Y
      JSR   DATA
      INY
      RTS


DELAY2      LDAA  #10
LOOP1 LDY   #$FFFF
LOOP  DEY
      BNE   LOOP
      DECA
      BNE   LOOP1
      RTS

DELAY       PSHX
      LDX   #$FFF
REPEAT      DEX
      BNE   REPEAT
      PULX
      RTS

INI   FCB   $01,$02,$06,$0C,$14,$38,0
```

```
DATA1 FCC    "**SECURE AREA**"
DATA2 FCC    "INSERT PASSWORD"
DATA3 FCC    "ACCESS  GRANTED"
DATA4 FCC    "*ACCESS DENIED*"
      END
```

B2 Visual Basic Program

```
Dim vstoploop As Boolean

Private Sub SaveData()
Dim fnum As Integer
Dim txt As String

  ' Open the configuration file.
  On Error GoTo NoFile
  fnum = FreeFile
  Open App.Path & "\data.txt" For Append As fnum
  ' Save the text boxes.
  Write #fnum, Text2.Text
  ' Close the file.
  Close fnum
NoFile:
End Sub


Private Sub Command1_Click()
Dim BBB As String
Dim myminute As String
Dim myhour As String
Dim mydate As String
Dim mysecond As String



vstoploop = False
If MSComm1.PortOpen = False Then
  MSComm1.PortOpen = True
Else
End If

Do

  Do
    DoEvents
  Loop Until MSComm1.InBufferCount > 12 Or vstoploop = True
If vstoploop = True Then
Else

BBB = MSComm1.Input
mydate = Format(Date, "Long Date")
myhour = Hour(Now)
```

```
myminute = Minute(Now)
mysecond = Second(Now)

   Text2.Text = BBB + "" + mydate + " " + myhour + ":" + myminute + ":" + mysecond
   SaveData
   Text1.Text = BBB

   End If

Loop Until vstoploop = True

End Sub

Private Sub Command2_Click()
vstoploop = True
End Sub

Private Sub Command3_Click()
Form1.Show
Me.Hide
End Sub

Private Sub Form_Load()
Dim portnum As Integer
portnum = 6
MSComm1.CommPort = portnum
MSComm1.Settings = "9600,N,8,1"

vstoploop = False

If MSComm1.PortOpen = True Then
   MSComm1.PortOpen = False
Else
End If


End Sub
Private Sub Form_Unload(Cancel As Integer)

vstoploop = True

If MSComm1.PortOpen = True Then
   MSComm1.PortOpen = False
Else
End If


End Sub
```

```
Private Sub Timer1_Timer()
Label1.Caption = Format(Date, "Long Date") & " " & Format(Time(), "Long Time")
End Sub
```

APPENDIX C

DATA SHEETS

C-1 MC68HC11A1 Microcontroller

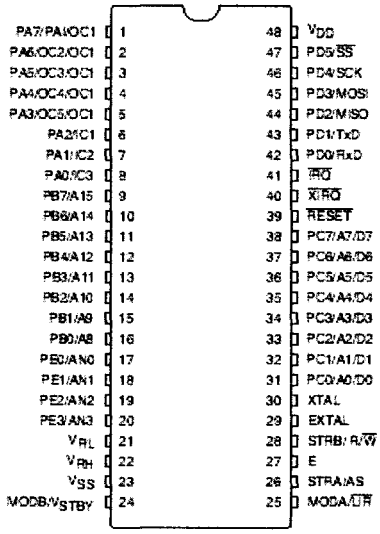


Figure 3 48-Pin DIP Pin Assignments

2 Operating Modes and Memory Maps

In single-chip operating mode, the MC68HC11A8 is a monolithic microcontroller without external address or data buses.

In expanded multiplexed operating mode, the MCU can access a 64 Kbyte address space. The space includes the same on-chip memory addresses used for single-chip mode plus external peripheral and memory devices. The expansion bus is made up of ports B and C and control signals AS and R/$\overline{W}$. The address, R/$\overline{W}$, and AS signals are active and valid for all bus cycles including accesses to internal memory locations. The following figure illustrates a recommended method of demultiplexing low-order addresses from data at port C.

HPRIO — Highest Priority I-Bit Interrupt and Miscellaneous **$103C**

	Bit 7	6	5	4	3	2	1	Bit 0
	RBOOT	SMOD	MDA	IRV	PSEL3	PSEL2	PSEL1	PSEL0
RESET:	—	—	—	—	0	1	0	1

RBOOT, SMOD, and MDA reset depend on conditions at reset and can only be written in special modes (SMOD = 1).

RBOOT — Read Bootstrap ROM
0 = Bootloader ROM disabled and not in map
1 = Bootloader ROM enabled and in map at $BF40–$BFFF

SMOD —Special Mode Select

MDA — Mode Select A

Inputs		Mode	Latched at Reset		
MODB	MODA		RBOOT	SMOD	MDA
1	0	Single Chip	0	0	0
1	1	Expanded Multiplexed	0	0	1
0	0	Special Bootstrap	1	1	0
0	1	Special Test	0	1	1

IRV — Internal Read Visibility
0 = No internal read visibility on external bus
1 = Data from internal reads is driven out through the external data bus

C-2 MC-550T Passive Infrared Motion Sensor

FAIRCHILD SEMICONDUCTOR

October 1987
Revised April 2001

MM74C922 • MM74C923
16-Key Encoder • 20-Key Encoder

General Description

The MM74C922 and MM74C923 CMOS key encoders provide all the necessary logic to fully encode an array of SPST switches. The keyboard scan can be implemented by either an external clock or external capacitor. These encoders also have on-chip pull-up devices which permit switches with up to 50 kΩ on resistance to be used. No diodes in the switch array are needed to eliminate ghost switches. The internal debounce circuit needs only a single external capacitor and can be defeated by omitting the capacitor. A Data Available output goes to a high level when a valid keyboard entry has been made. The Data Available output returns to a low level when the entered key is released, even if another key is depressed. The Data Available will return high to indicate acceptance of the new key after a normal debounce period: this two-key roll-over is provided between any two switches.

An internal register remembers the last key pressed even after the key is released. The 3-STATE outputs provide for easy expansion and bus operation and are LPTTL compatible.

Features

- 50 kΩ maximum switch on resistance
- On or off chip clock
- On-chip row pull-up devices
- 2 key roll-over
- Keybounce elimination with single capacitor
- Last key register at outputs
- 3-STATE output LPTTL compatible
- Wide supply range: 3V to 15V
- Low power consumption

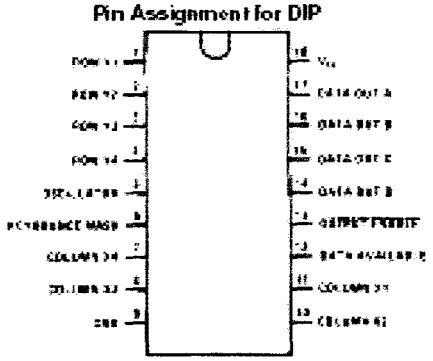
Ordering Code:

Order Number	Package Number	Package Description
MM74C922WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74C922N	N18B	18-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
MM74C923WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74C923N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

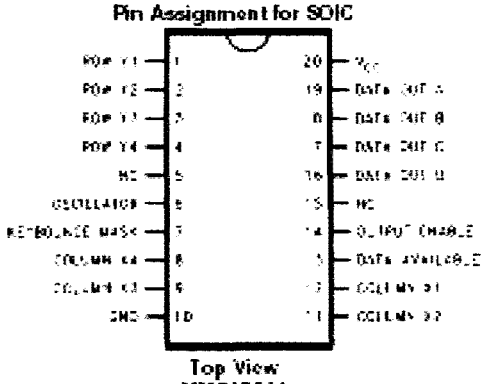
Connection Diagrams

Pin Assignment for DIP



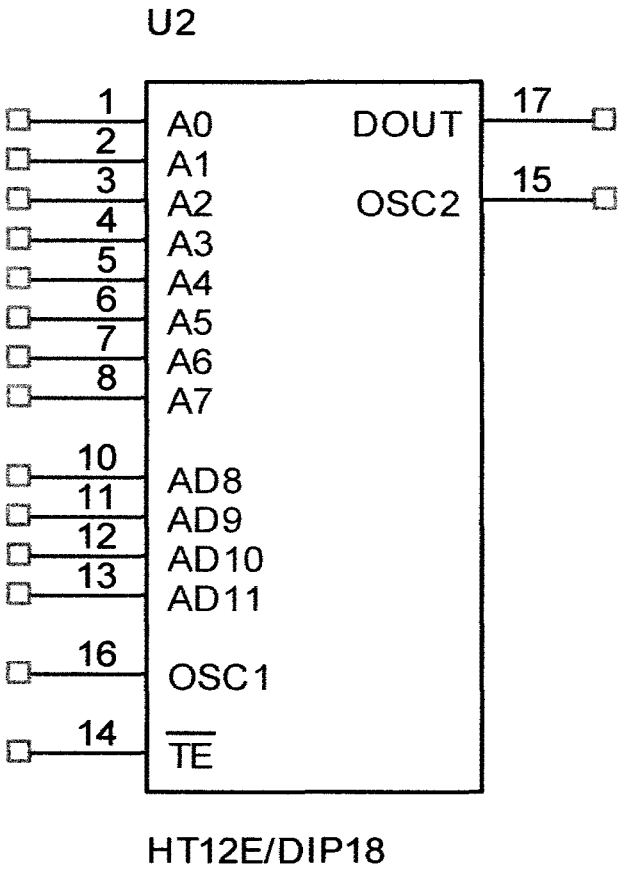
Top View
MM74C922

Pin Assignment for SOIC

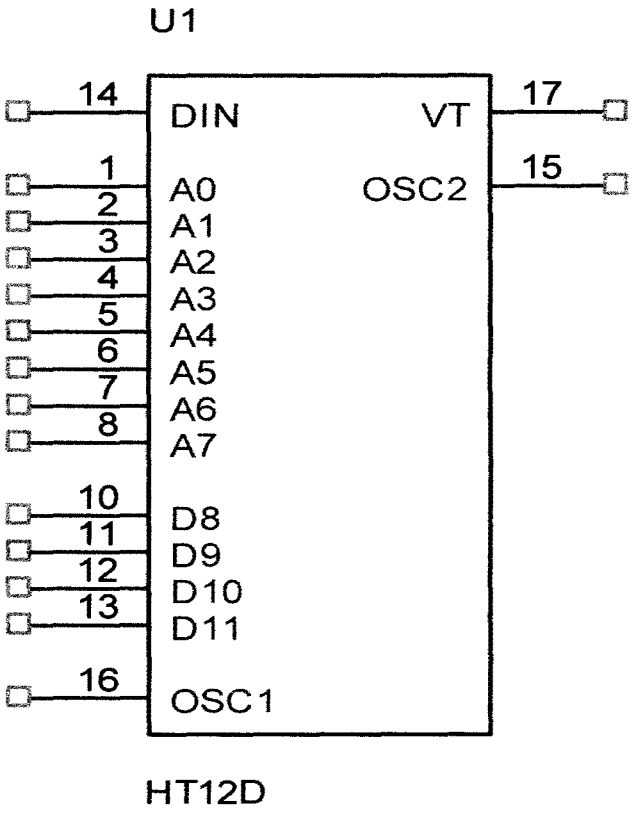


Top View
MM74C922

C-3 HT12E

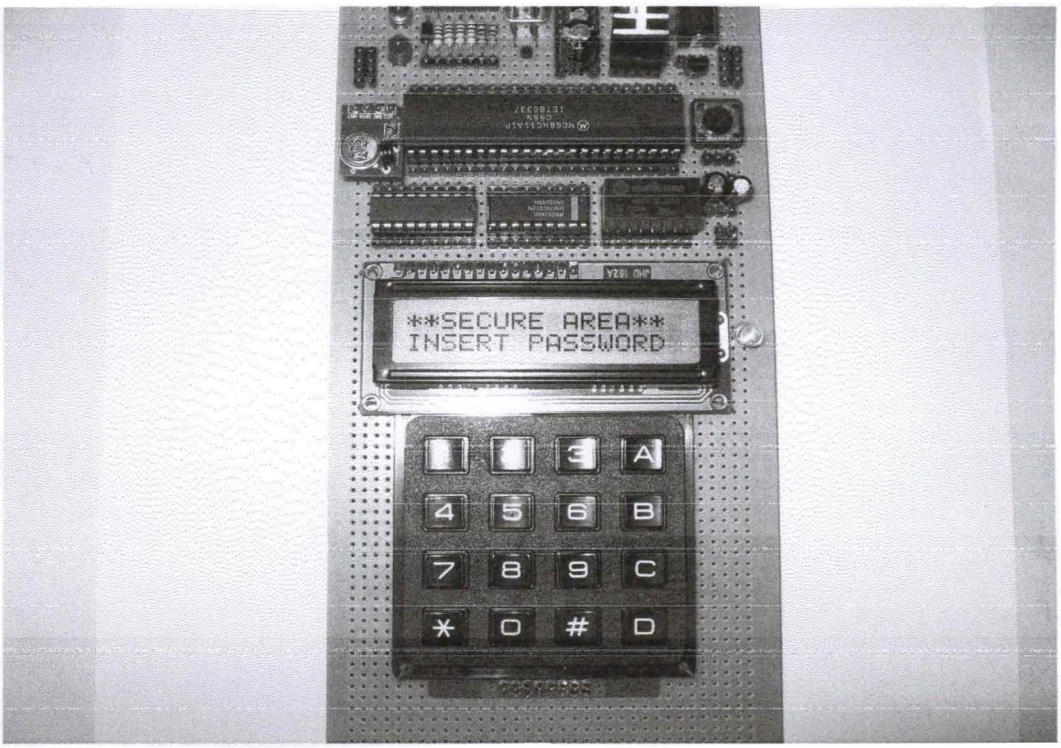

U2
1
A0
2
A1
3
A2
4
A3
5
A4
6
A5
7
A6
8
A7
10
AD8
11
AD9
12
AD10
13
AD11
16
OSC1
14
TE
DOUT
17
OSC2
15
HT12E/DIP18

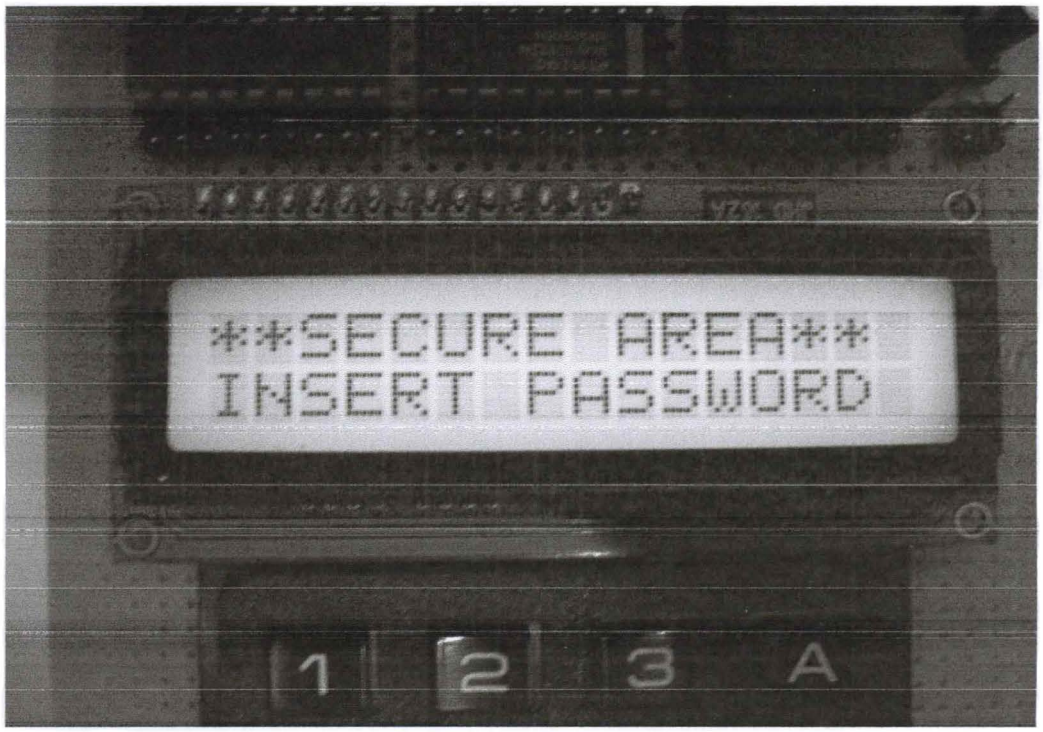
C-4 HT12D


U1
14
DIN
VT
17
1
A0
OSC2
15
2
A1
3
A2
4
A3
5
A4
6
A5
7
A6
8
A7
10
D8
11
D9
12
D10
13
D11
16
OSC1
HT12D

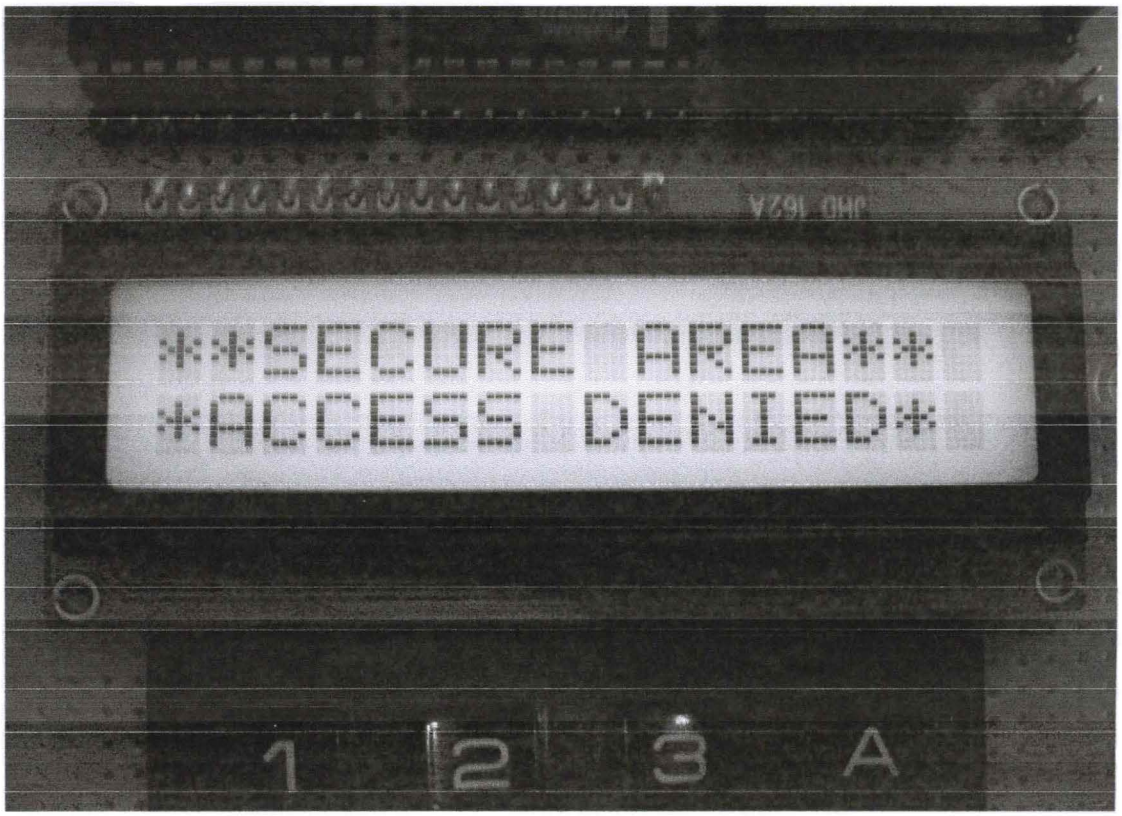
APPENDIX D

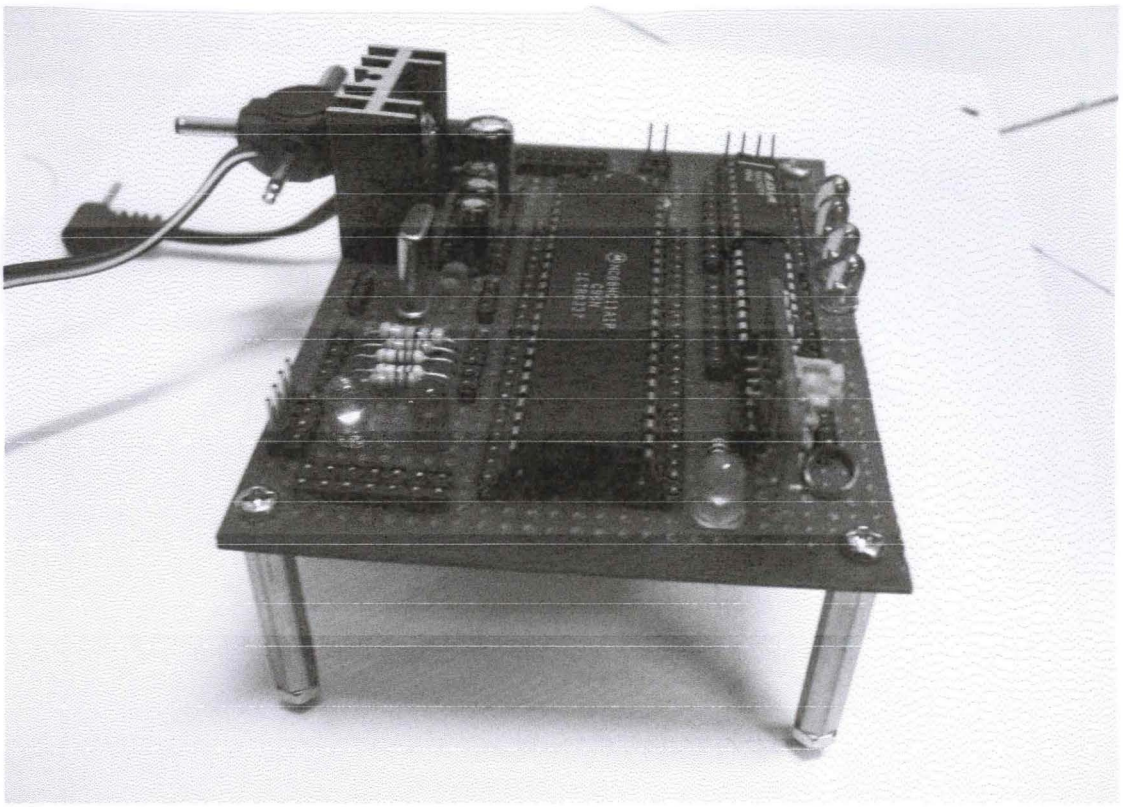
RESULT IMAGES

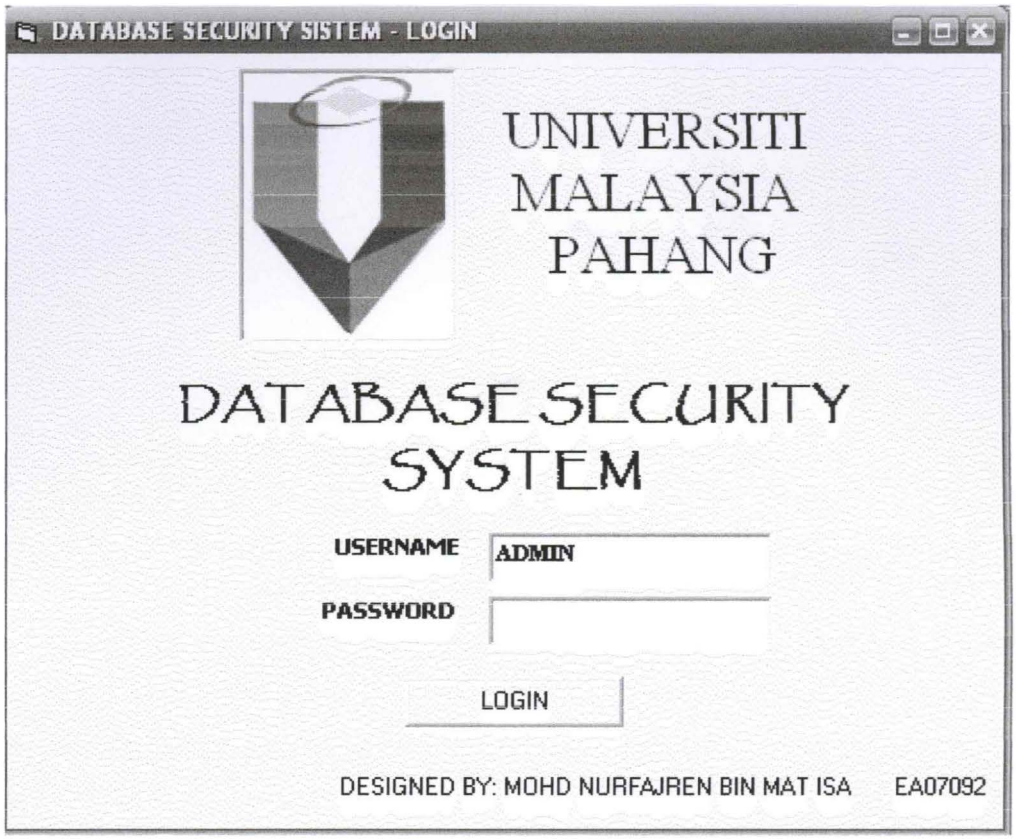

SECURE AREA
INSERT PASSWORD
3
A
4
5
6
B
7
8
9
C
*
0
#
D

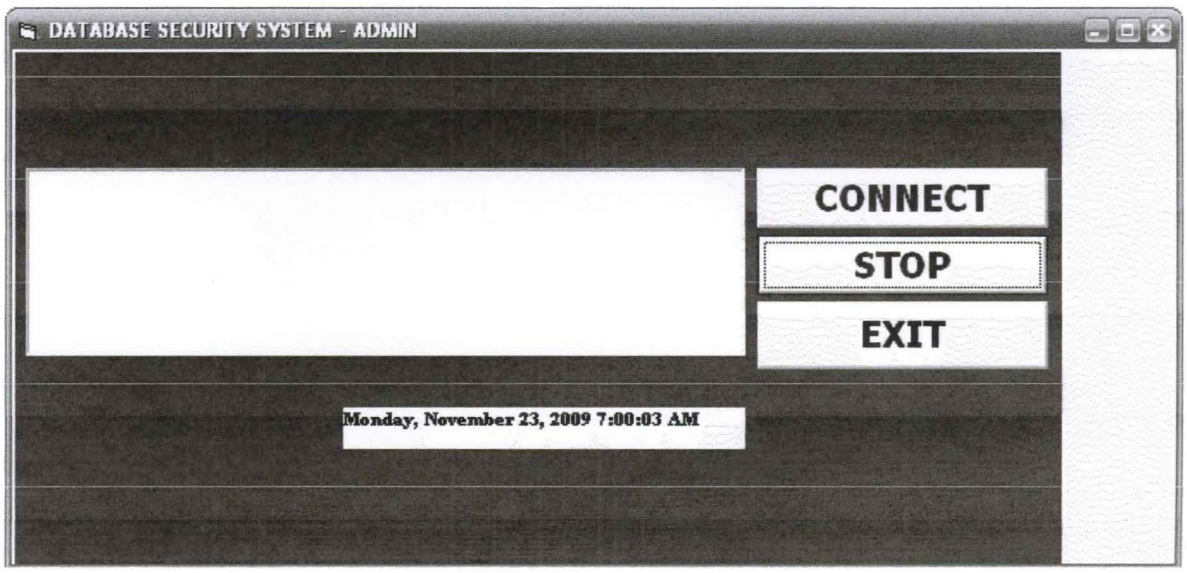

SECURE AREA
INSERT PASSWORD
1
2
3
A


SECURE AREA
ACCESS GRANTED
1
2
3
A


***SECURE AREA**
ACCESS DENIED
1
2
3
A




DATABASE SECURITY SISTEM - LOGIN
UNIVERSITI
MALAYSIA
PAHANG
DATABASE SECURITY
SYSTEM
USERNAME
ADMIN
PASSWORD
LOGIN
DESIGNED BY: MOHD NURFAJREN BIN MAT ISA
EA07092


DATABASE SECURITY SYSTEM - ADMIN
CONNECT
STOP
EXIT
Monday, November 23, 2009 7:00:03 AM