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DOOR SECURITY CONTROL

CS/EEE F241:MICROPROCESSOR AND INTERFACING

Submitted by
Group 45

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CONTENTS

Sr No.		Page
1	User Requirements and Technical specifications	3
2	Assumptions and Justifications	6
3	Components	7
4	Address Map Memory Map I/O Map	8
5	Interrupts	10
6	Design	11
7	Flowchart Main Program Master Sequence User Sequence Alarm Sequence	12
8	Counter Calculations	17
9	Variations in Proteus Implementation	19
10	Firmware	20
11	List of Attachments	21

USER REQUIREMENTS AND TECHNICAL SPECIFICATIONS

Description

This system controls the opening and closing of a door based on password entry. If the password is correct the person can enter. Each person is given two chances to enter the correct password. On failure an alarm is sounded. Inside the room a button is available when the button is pressed the door opens for 1 Min, so that the person can leave the room.

User Interface

There are three set of passwords:

- (1) User
- (2) Master
- (3) Alarm off

The Master Mode

The Master password is used by the security Personnel for updating Password of the day. Pressing the M button activates this mode. The system glows Enter Password LED asking the personnel to enter the password. The master password is a 16-digit value. The master is given only a single chance to enter the password. If authenticated, the retry/Update LED glows. If there is a failure in authentication the alarm is sounded. When the retry/ Update LED glows the user has to enter the password of the day. This is a 12-digit value. Once this value has been accepted by the system the Passwd Updated LED glows.

The User Mode

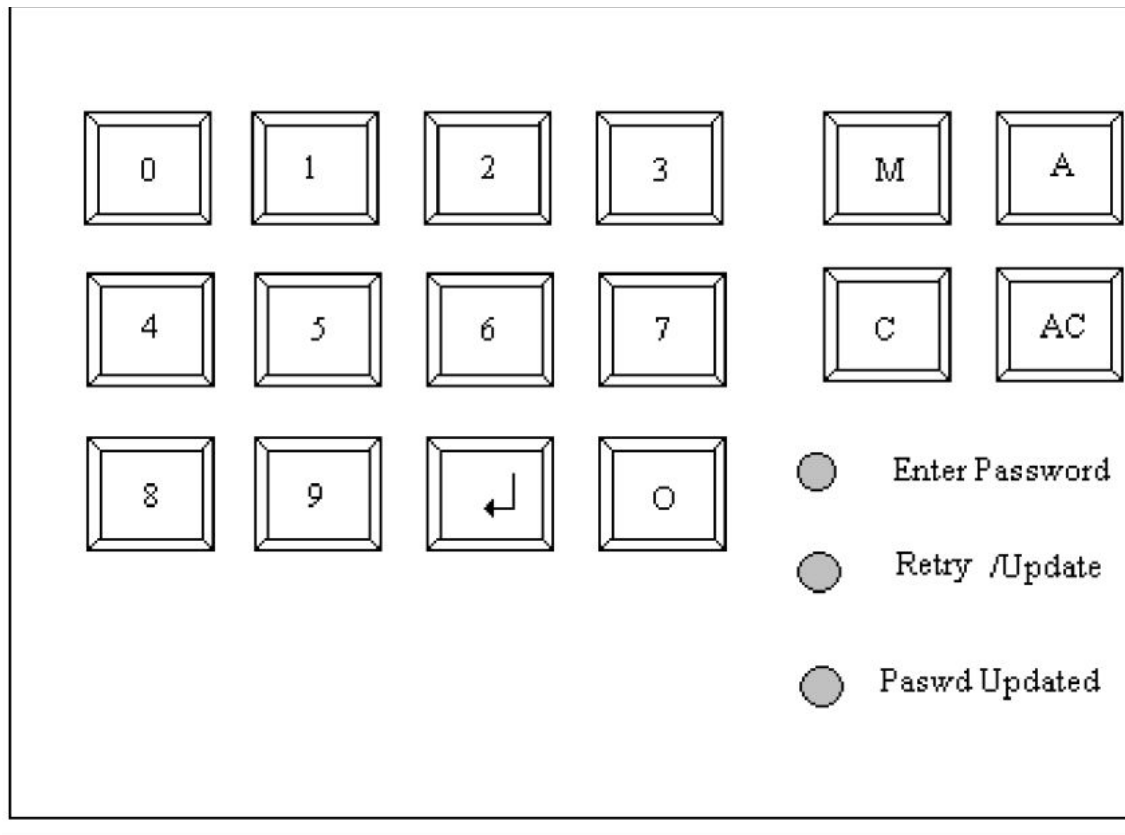
User has to press the O key when he wants to enter the room. The Enter Password LED prompts the user to enter the password. The user is given C/AC option as well. If the first attempt fails, the RETRY LED glows. The user is allowed to re-enter password, and on authentication, the door opens for a period of 1 Min. On Failure an ALARM is sounded.

The Alarm Mode

To Turn-off the Alarm the A button has to be pressed. Enter Password LED glows prompting the user to enter the 14-digit password for turning off the alarm, no retries are allowed. If authentication is successful then the alarm is turned off.

Switch Inside of the Room

To leave the room a button is available inside the room, when the button is pressed the door opens for 1 Minute so that the person can leave the room.



Technical specifications:

The stepper motor is connected to one of those latches which have a knob which rotates through 90 degrees to unlock it. The rotation of the knob back through 90 degrees in the opposite direction closes the latch. The door unlocks and the user will have to push it in-order to open the door. A user should not hold the door after entering as a door-closer is attached to the door in order to close the door after a user has entered through the door.

ASSUMPTIONS AND JUSTIFICATIONS

Assumptions:

1) The Master Password and Alarm Reset Password have been hard coded as:

MASTER PASSWORD : 1111111111111111

ALARM RESET PASSWORD : 99999999999999

2) The 24 hour clock starts running when 8086 is first switched on, and subsequently computes 24 hours count. Therefore, the first action to be performed is to set the Password of the Day by Master in Master Mode.

3) Only one person may open and pass the door at a time.

4) User will not try to open the door from inside or outside, at the 24 hour mark. Interrupt for 24 hour completion and 1 minute door close will NOT occur at the same time. Hence, there is no need for a priority resolver such as the interrupt controller 8259.

5) Once a particular mode has been selected, User/Master must complete the procedure, i.e. M or O or A pressed within execution of a particular mode will have no effect.

6) If the wrong alarm reset password is entered by the user, the system will not respond to keypad entry until power is cut.

COMPONENTS

- 8086 (16 Bit Microprocessor)
- 74LS373 (Octal Latch) -To demultiplex address bus
- 8284 (Clock Generator)
- 74LS245(Transceiver)- To demultiplex data bus
- 74155 (2-4 Decoder) -To create chip select signals for RAM and ROM
- 7432 (OR Gates)
- 2716(ROM Chips)- 4 chips of 2K memory are used to make odd and even banks of memory to interface with 8086 at the starting address of FFFF0h and 00000h where IVT is stored.
- 6116 (RAM Chips) -2 chips of 2K memory are used to form odd and even banks to interface with 8086 and this memory is used for storage of temporary data.
- 74138 (3-8 Decoder) -to create chip select signals for 8255(2) and 8253(2)
- 8253 (Programmable Interval Timer) -for 1min and 24hrs timer
- 8255 (Programmable Peripheral Interface) - to interface leds,stepper motor,lcd display and hex keypad to microprocessor.
- Hex-Keypad - to take input (made using matrix of switches)
- LM016I LCD Display -to display various commands and errors
- PSM 57-81 2P Stepper Motor(MAXIM) - provides enough torque required to rotate the knob of the latch.
- C503B LEDs (RED) - For status indication through LEDs
- C503B LEDs (BLUE) - To indicate alarm is ringing
- ULN2003A Darlington Transistor -to interface relay(for alarm) and stepper motor to 8255
- Push Button/Switch - switch inside the room to open the door in-order to go out.
- 74LS241 Octal Tri-state Buffer

- ALARM(Buzzer) - To indicate wrong password is entered

ADDRESS MAP

Memory Interfacing:

Size of ROM-2716 =2K

Size of RAM-6116 =2K

Total ROM size used=8K

Total RAM size used=4K

Address:

ROM1(even) = 00000h - 00FFEh

ROM1(odd) = 00001h - 00FFFh

ROM2(even) = FF000h - FFFFEh

ROM2(odd) = FF001h - FFFFFh

RAM(even) = 01000h - 01FFEh

RAM(odd) = 01001h - 01FFFh

I/O Mapping:

Address of 8255-1 port-A : 00h

Address of 8255-1 port-B : 02h

Address of 8255-1 port-C : 04h

Address of 8255-1 control register : 06h

Control word of 8255-1 : 88h

Address of 8255-2 port-A : 08h

Address of 8255-2 port-B : 0Ah

Address of 8255-2 port-C : 0Ch

Address of 8255-2 control register : 0Eh

Control word of 8255-2 : 89h

Address of 8253-1 count0 : 10h

Address of 8253-1 count1 : 12h

Address of 8253-1 count2 : 14h

Address of 8253-1 control register : 16h

Control word of 8253-1 count0 : 36h

Control word of 8253-1 count1 : 56h

Control word of 8253-1 count2 : 92h

Address of 8253-2 count0 : 18h

Address of 8253-2 count1 : 1Ah

Address of 8253-2 count2 : 1Ch

Address of 8253-2 control register : 1Eh

Control word of 8253-2 count0 : 34h

Control word of 8253-2 count1 : 5Ah

Control word of 8253-2 count2 : 94h

INTERRUPTS

NMI(Non-Maskable Interrupt)-In our implementation NMI is used for the 24 hour timer ,which helps the user to Update Day Pass every 24 hours.

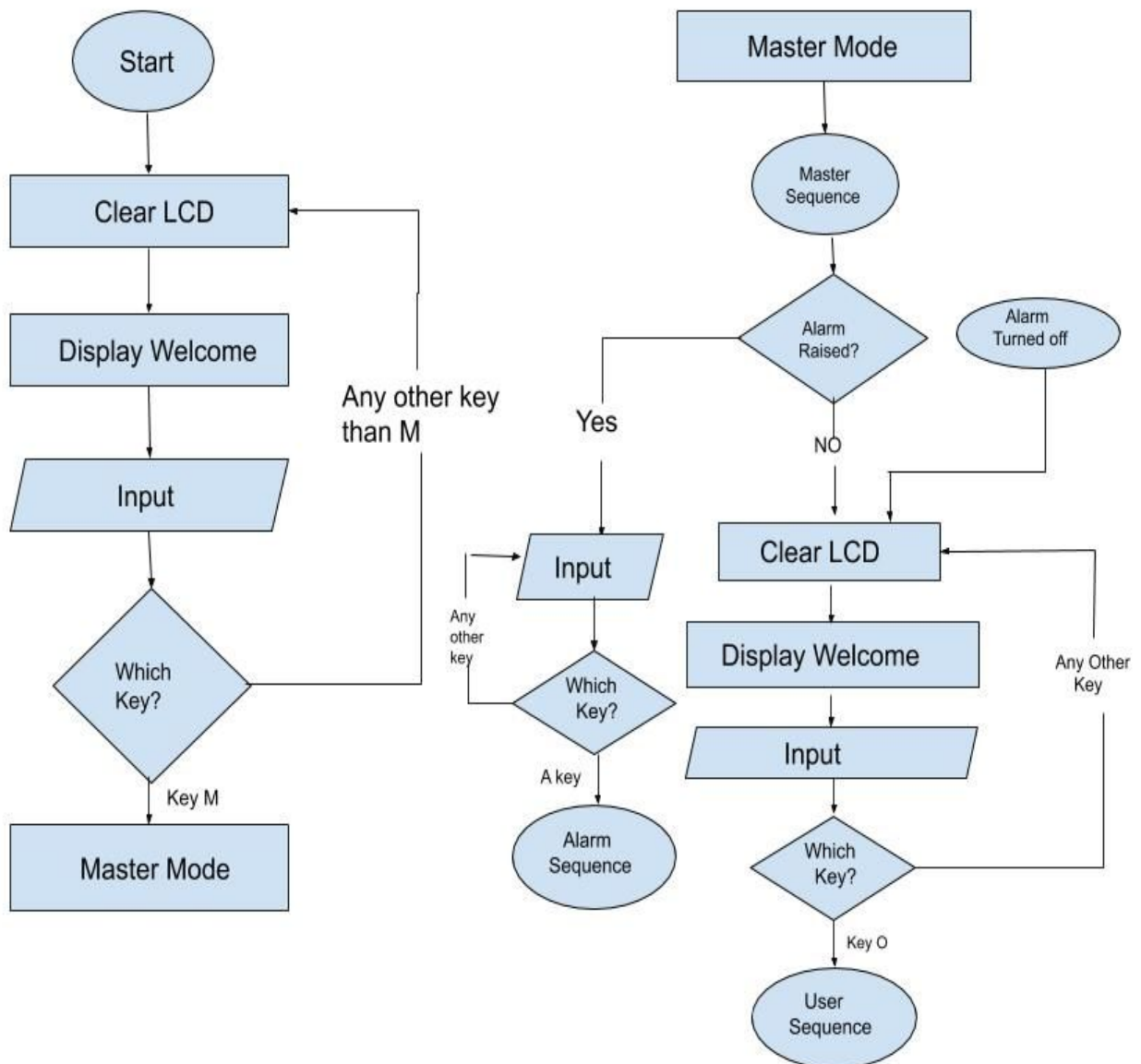
INT 80h- This interrupt is used for helping the user to open door from inside,as the push button is pressed.Octal Tri-state buffer is used to generate the interrupt vector.When 8086 sends a low interrupt acknowledge the Octal Tri-state buffer puts 80h on datalines.

Interrupt Vector No.	Physical Address	Contains
INT 02h (NMI)	00008h 0000Ah	IP2 CS2
INT 80h	00200h 00202h	IP128 CS128

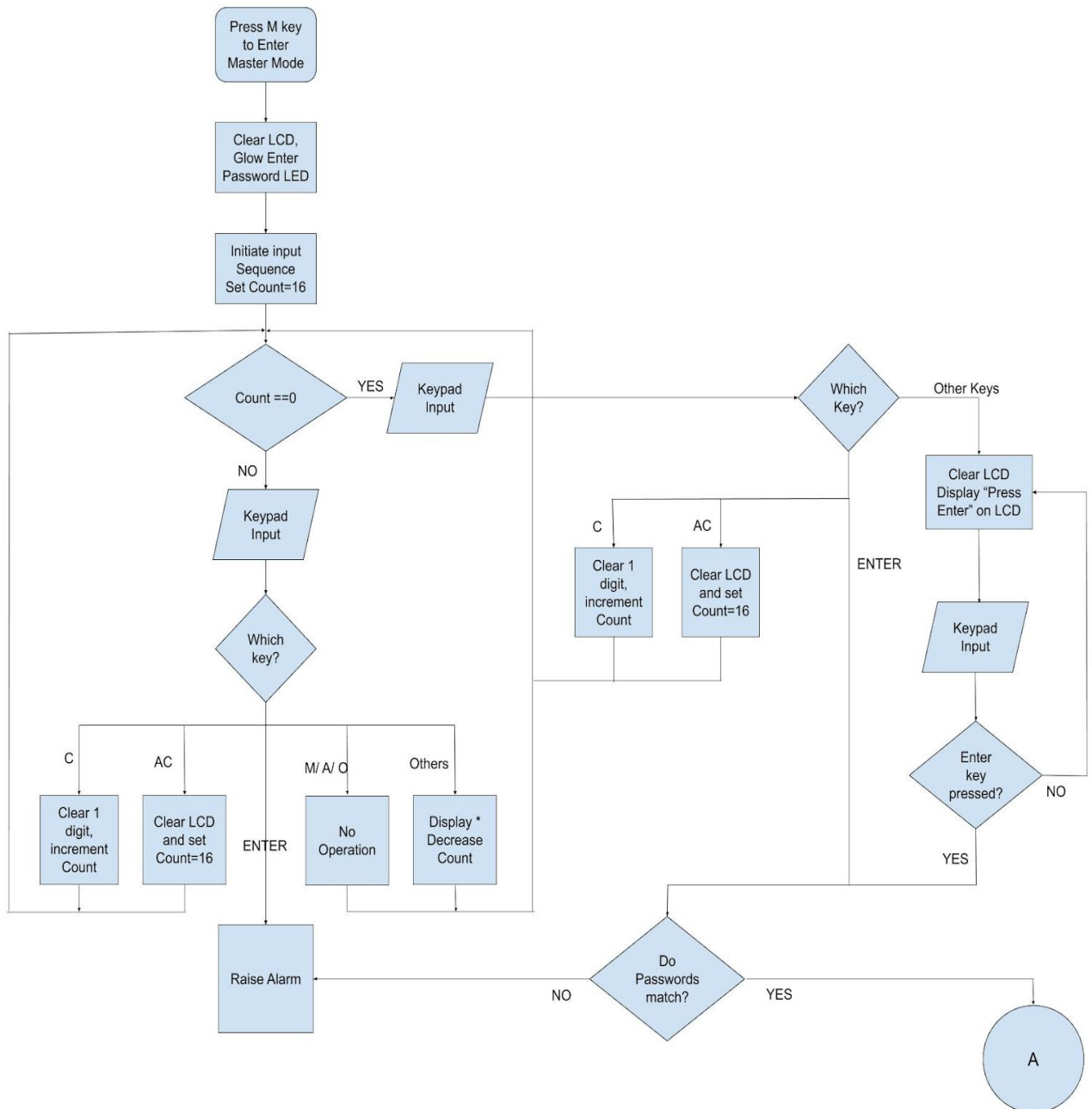
DESIGN

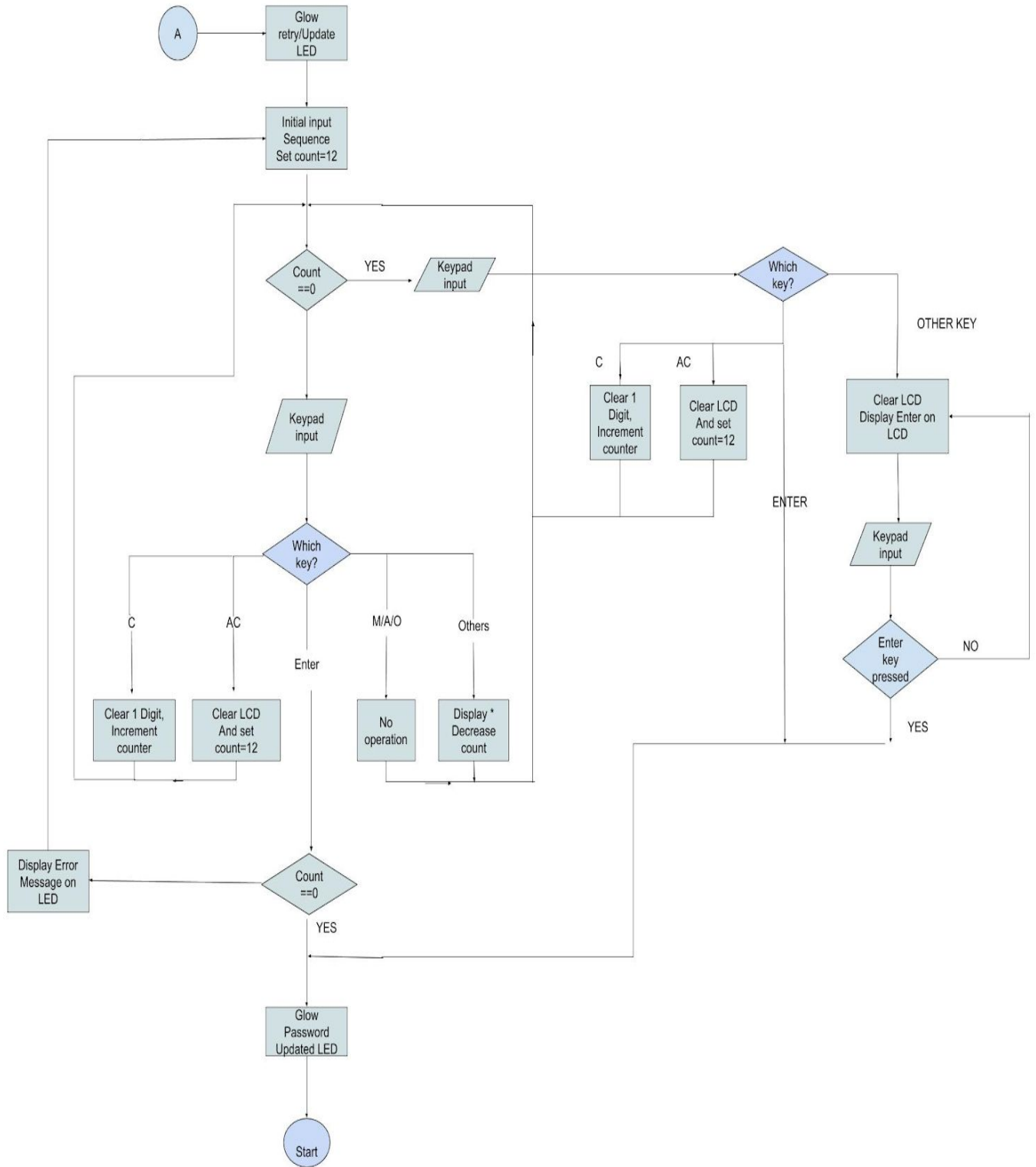
A file has been attached consisting of all the hardware designs in multiple parts.

FLOWCHART

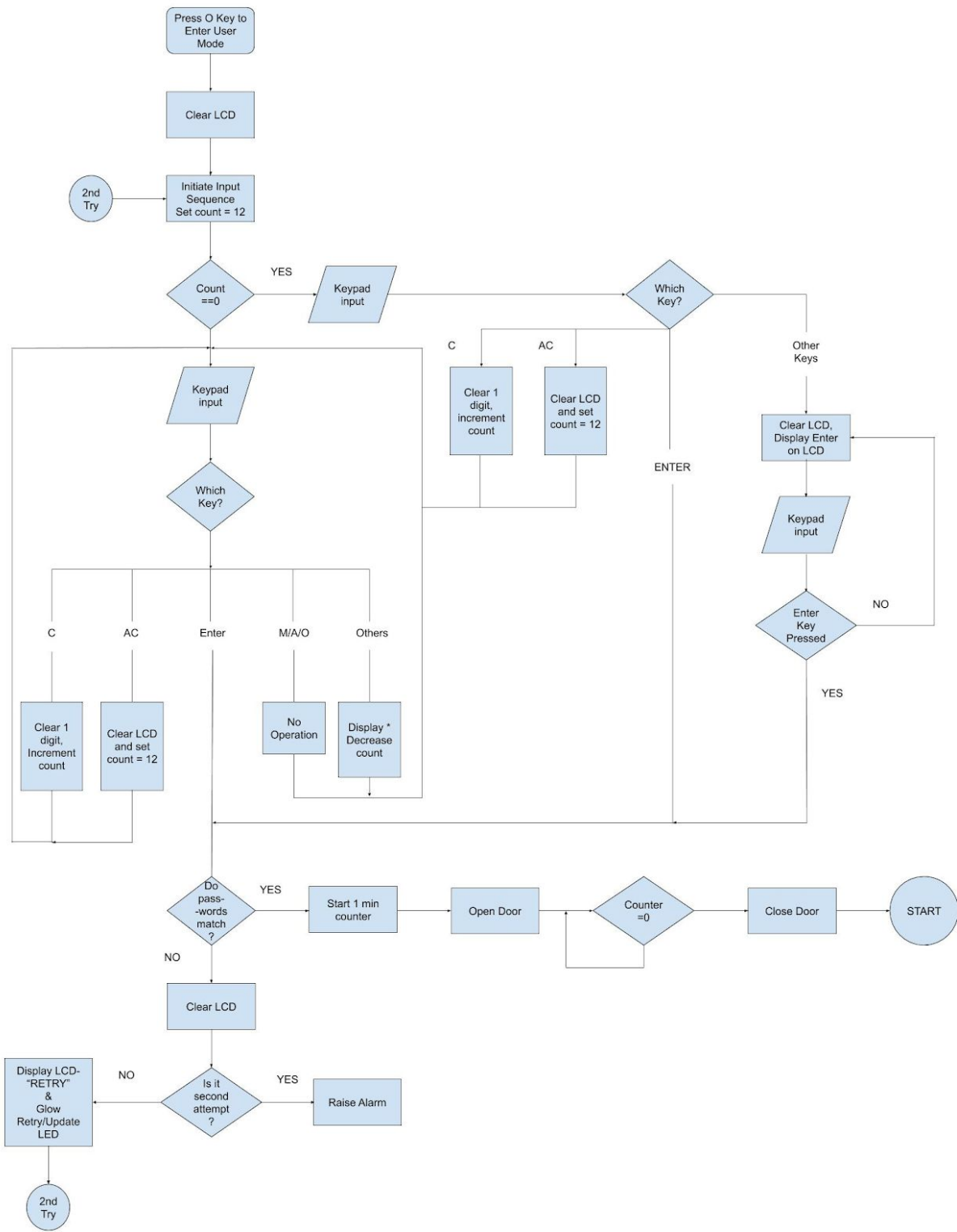


Master Sequence:

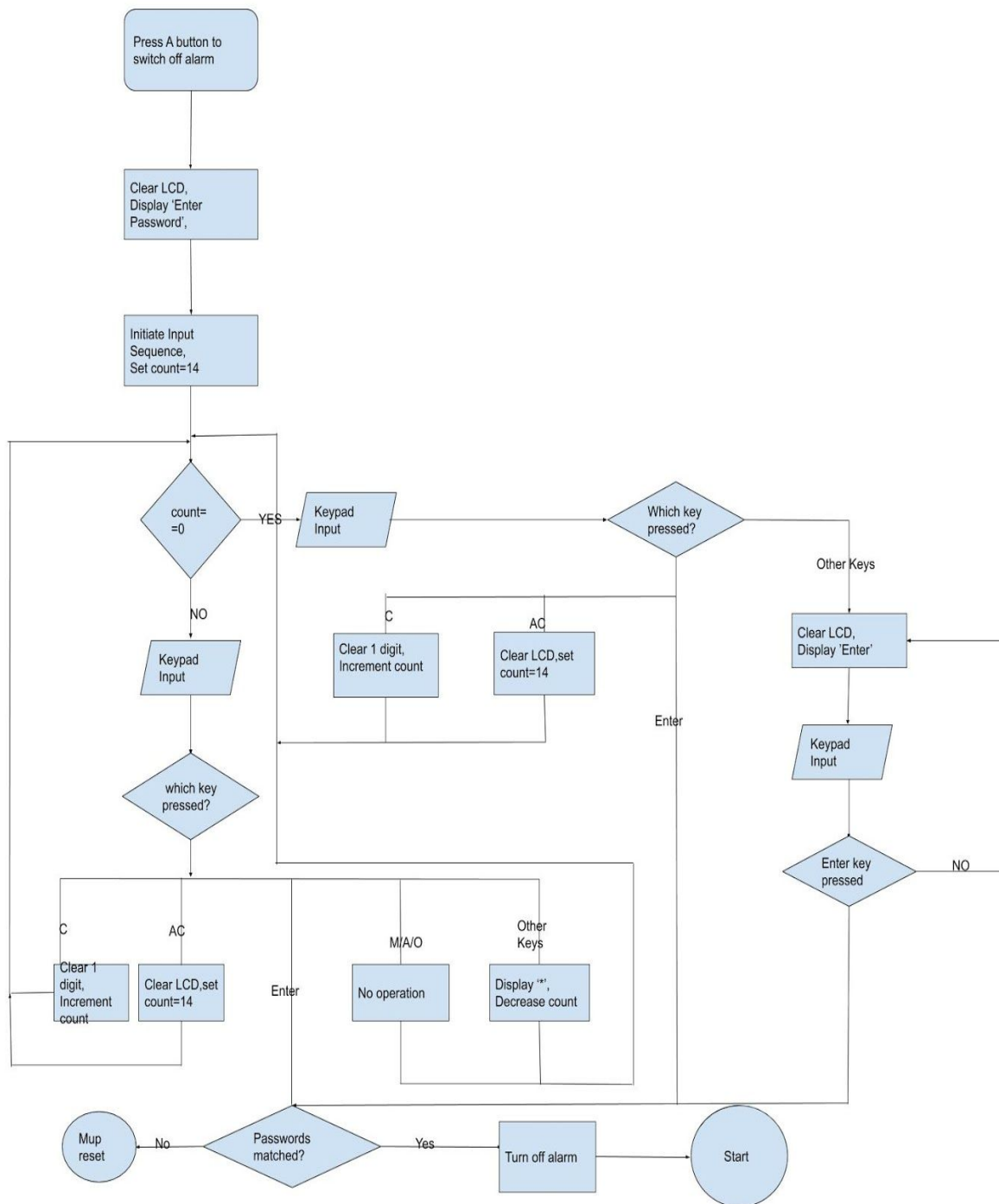




User Sequence:



Alarm Sequence:



COUNTER CALCULATIONS

A 2.5Mhz frequency signal is fed to 8253-1 counter 0 from 8284 p-clock. By giving a count =50000, the output frequency is made equal to 50 Hz.

$$\text{Out clock freq} = \text{In clock freq}/\text{count}$$

$$\text{Count} = 50,000$$

$$\text{Out clock freq} = 2.5\text{Mhz}/50000 = 50 \text{ Hz}$$

8253-1 counter 1 is also configured in Mode 3 (Rate Generator). The 50 Hz signal from 8253-1 counter 0 is fed to its clock. By loading a count equal to 100, the 50 Hz signal is reduced further to 0.5 Hz.

$$\text{Out clock freq} = 50\text{Hz}/100 = 0.5 \text{ Hz}$$

24-hour Timer: This timer Operation is implemented by 8253-2 counter 0. (Mode 2, Rate generator or Divide by N counter)

The clock to this counter is fed from the output of 8253-1 counter 1. The clock frequency applied to 8253-2 counter zero is 0.5Hz.

$$0.5*60*60*24 = 43200$$

Thus by loading a count of 43200 in this counter a 24 hour timer is implemented. The out pin of this counter is inverted and fed to NMI pin of 8086. At the end of 24 hours a LOW-to-HIGH pulse is generated at NMI which triggers INT 02h. In response, 8086 branches to ISR meant for INT 02h(Nmi_24hrtimer) and activates the Master Mode Key(M) on the Keypad. "UPDATE DAY PASS" is flashed on the LCD module and the code doesn't branch back until a new password for the user mode is set. On setting the new User password the system branches back to normal routine and the user is greeted with LCD flashing "WELCOME".

1-minute Timer: Here 8253-1 counter 2 is used. This counter is fed with a clock frequency of 0.5Hz from 8253-1 counter 1 out pin. 8253-1 counter 2 is configured in Mode 1(h/w re-Triggerable one shot timer).

$$0.5*60 = 30$$

Therefore we use a count of 30 in 8253-1 counter 2 to implement a 1 min timer. As soon as the open_door subroutine is called the timer is triggered by giving a LOW-HIGH-LOW pulse on its gate pin. On receiving this signal the out pin goes low(Logic 0).At the end of one minute,(count == 0) out pin goes high(Logic 1) and this out pin is polled at PC1 pin of 8255-2. At the end of 1 minute close_door subroutine is called and the door closes.

VARIATIONS IN PROTEUS IMPLEMENTATION

1. 2732 has been used instead of 2716 as 2716 is not available in Proteus.
2. A clock generator has been used instead of 8284 to give clock input to 8253 and 8086.

FIRMWARE

Implemented using EMU8086.

A compiled bin file has been attached for the same purpose.

LIST OF ATTACHMENTS

1. Complete Hardware Real World Design – **design.pdf**
2. Manuals
 - a.DARLINGTON TRANSISTOR ARRAY(ULN2003): **Darlington Pair - ULN2003.pdf**
 - b.LCD(LM016L): **LCD Display - LM016L.pdf**
 - c.Stepper Motor: **Stepper_Motor.pdf**
 - d.Relay(OMIH-SH-105D): **Relay - OMIH-SH-105D.pdf**
 - e.Tristate Buffer(74LS241): **Tristate Buffer - 74LS241.pdf**
3. Proteus File – **G45.dsn**
4. EMU8086 ASM File – **G45.asm**
5. Binary File after assembly – **G45.bin**