**INSTR F241**

MICROPROCESSORS

&

INTERFACING

**Design Assignment**

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**PROBLEM STATEMENT**

The following design of system secures a door using a set of three passwords:

1. MASTER (16-DIGIT)
2. USER (12-DIGIT)
3. ALARM OFF (14-DIGIT)

Also, a button will be provided to allow personnel inside outside the door. Pressing this button shall open the door for 1 minutes.

To assign the password(user) for the day the security personnel shall press the button M on the console. This will cause the ENTER PASSWORD LED to glow. Now, the MASTER password must be entered. Only ONE chance is allowed for the same. If authentication fails, alarm is sounded. Else the RETRY/UPDATE LED glows indicating that it is ready to accept the user password for the day. Once the password is set the PASSWORD UPDATED LED glows.

To enter the room a user must press the button U and the ENTER PASSWORD LED will glow. The user is then given two chances to enter the correct password. If he/she fails for the first time the RETRY/UPDATE LED will glow. If authentication fails again alarm is sounded else if, authentication is successful the door opens for 1 minute.

In case the alarm is sounded it can only be turned off by entering the ALARM OFF password after pressing the A button (which causes the ENTER PASSWORD LED to glow). No retries are allowed and only if authentication is successful does the alarm deactivate.

NOTE:-

1. AC/C (ALL CLEAR/ CLEAR) buttons can be used to edit the typed password.
2. LCD Display displays only asterisks.

**ASSUMPTIONS:**

1. UPDATE LED IS AUTOMATICALLY TURNED OFF AFTER A SPECIFIC DELAY.
2. STEPPER MOTOR TAKES ABOUT 30 SEC TO ROTATE COMPLETELY.
3. MATRIX KEYPAD DOESN’T HAVE A ‘O’ KEY. SO INSTEAD WE USE ‘U’ KEY.
4. C-CLEARS THE LAST LETTER.
5. AC- CLEARS THE ENTIRE PASSWORD.

**LIST OF COMPONENTS**

1. 74LS138 ACTIVE LOW-1:8 DECODER

2. 74LS241 OCTAL BUS BUFFER

3. 74LS245 OCTAL BUS TRANSCEIVER

4. 74LS373 OCTAL LATCH

5. 2732 ROM

6. 6116 RAM

7. 8255A PROGRAMMABLE PERIPHERAL INTERFACE

8. 8086 MICROPROCESSOR

9. 8253A CLOCK GENERATOR

10. ULN2003A ARRAY OF SEVEN NPN TRANSISTORS

11. BUTTON

12. BUZZER

13. KEYPAD

14. LED BLUE

15. LED GREEN

16. LED RED

17. LM016L LCD DISPLAY

18. MOTOR-STEPPER

19. NOT GATE

20. NAND GATE

21. XOR GATE

20. OMIH-SH-105D RELAY

21. OR GATE

22. SW-SPDT-MOM TWO WAY SWITCH

**COMPLETE ADDRESS MAPPING OF MEMORY AND I/O DEVICES**

**I/O MAPPING**

**8255A (1)**

PORT A : 00H

PORT B : 02H

PORT C : 04H

CONTROL REGISTER : 06H

**8255A (2)**

PORT A : 08H

PORT B : 0AH

PORT C : 0CH

CONTROL REGISTER : 0EH

**8253A**

COUNTER 0 : 10H

COUNTER 1 : 12H

COUNTER 2 : 14H

CONTROL REGISTER : 16H

**8253A**

COUNTER 0 : 10H

COUNTER 1 : 12H

COUNTER 2 : 14H

CONTROL REGISTER : 16H

**CODE**

#make\_bin#

#LOAD\_SEGMENT=FFFFh#

#LOAD\_OFFSET=0000h#

#CS=0000h#

#IP=0000h#

#DS=0000h#

#ES=0000h#

#SS=0000h#

#SP=FFFEh#

#AX=0000h#

#BX=0000h#

#CX=0000h#

#DX=0000h#

#SI=0000h#

#DI=0000h#

#BP=0000h#

JMP ST1

DB 5 DUP(0)

;IVT entry for NMI (INT 02h)

DW Nmi\_24hrtimer

DW 0000

DB 500 DUP(0)

;IVT entry for 80H

DW Switch\_intR

DW 0000

DB 508 DUP(0)

ST1: CLI

;intialize ds, es,ss to start of RAM

MOV AX,0200h

MOV DS,AX

MOV ES,AX

MOV SS,AX

MOV SP,0FFFEH

; INITIALIZATION OF 8255,8253 BEGINS HERE

STI

MOV AL,89h ; control word for 8255-2

OUT 0Eh,AL

MOV AL,88h ; control word for 8255-1

OUT 06h,AL

MOV AL,36h ;control word for 8253-1 counter 0

OUT 16h,AL

MOV AL,56h ;control word for 8253-1 counter 1

OUT 16h,AL

MOV AL,92h ;control word for 8253-1 counter 2

OUT 16h,AL

MOV AL,34h ;control word for 8253-2 counter 0

OUT 1eh,AL

MOV AL,5ah ;control word for 8253-2 counter 1

OUT 1eh,AL

MOV AL,94h ;control word for 8253-2 counter 2

OUT 1eh,AL

MOV AL,50h ;load count lsb for 8253-1 counter 0

OUT 10h,AL

MOV AL,0C3h ;load count msb for 8253-1 counter 0

OUT 10h,AL

MOV AL,64h ;load count for 8253-1 counter 1

OUT 12h,AL

MOV AL,5h ;load count lsb for 8253-1 counter 2 (1 minute Timer)

OUT 14h,AL

MOV AL,40 ;load count for 8253-2 LSB counter 0 (24 hour counter)

OUT 18h,AL

MOV AL,0 ;load count for 8253-2 MSB counter 0 (24 hour counter)

OUT 18h,AL

MOV AL,3 ;load count for 8253-2 counter 1 (Switch trigger counter)

OUT 1ah,AL

MOV AL,2 ;load count for 8253-2 counter 2

OUT 1ch,AL

;INITIALIZATION OF 8255,8253 ENDS HERE

MOV AL,00h ;default low output from 8255-2 upper port C

OUT 0ch,AL

CALL DELAY\_20ms ;LCD INITIALIZATION BEGINS

MOV AL,04h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,00h

OUT 02h,AL

MOV AL,38h

OUT 00h,AL

MOV AL,04h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,00h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,0Ch

OUT 00h,AL

MOV AL,04h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,00h

OUT 02h,AL

MOV AL,06h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,04h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,00h

OUT 02h,AL

MOV AL,4ch

OUT 00h,AL

CALL DELAY\_20ms ;LCD INITIALIZATION ENDS

MOV AX,0200h

MOV DS,AX

MOV SI,0000h

MOV AL,0bdh ;hard coding pass-word ; 9763106626976310

MOV [SI],AL

MOV AL,0d7h

MOV [SI+1],AL

MOV AL,0dbh

MOV [SI+2],AL

MOV AL,0e7h

MOV [SI+3],AL

MOV AL,0edh

MOV [SI+4],AL

MOV AL,0eeh

MOV [SI+5],AL

MOV AL,0dbh

MOV [SI+6],AL

MOV AL,0dbh

MOV [SI+7],AL

MOV AL,0ebh

MOV [SI+8],AL

MOV AL,0dbh

MOV [SI+9],AL

MOV AL,0bdh

MOV [SI+0ah],AL

MOV AL,0d7h

MOV [SI+0bh],AL

MOV AL,0dbh

MOV [SI+0ch],AL

MOV AL,0e7h

MOV [SI+0dh],AL

MOV AL,0edh

MOV [SI+0eh],AL

MOV AL,0eeh

MOV [SI+0fh],AL

ADD SI,000fh

INC SI

MOV AL,0bdh ;hard coding alarm pass-word ; 99999999999999

MOV [SI],AL

MOV AL,0bdh

MOV [SI+1],AL

MOV AL,0bdh

MOV [SI+2],AL

MOV AL,0bdh

MOV [SI+3],AL

MOV AL,0bdh

MOV [SI+4],AL

MOV AL,0bdh

MOV [SI+5],AL

MOV AL,0bdh

MOV [SI+6],AL

MOV AL,0bdh

MOV [SI+7],AL

MOV AL,0bdh

MOV [SI+8],AL

MOV AL,0bdh

MOV [SI+9],AL

MOV AL,0bdh

MOV [SI+0ah],AL

MOV AL,0bdh

MOV [SI+0bh],AL

MOV AL,0bdh

MOV [SI+0ch],AL

MOV AL,0bdh

MOV [SI+0dh],AL

ADD SI,000dh

INC SI

MOV AL,0ffh

OUT 08h,AL

;add code here to display "Command Key"

start: CALL clear\_LCD

CALL welcome\_msg

MOV BP,00h

CALL keypad\_input

CMP AL,0bbh

JZ master\_mode

JMP start

;press valid key

;add code here to display 'Invalid key'

x6: CALL clear\_LCD

CALL welcome\_msg

CALL keypad\_input

CMP AL,0b7h

JZ User\_mode

JMP x6 ;press valid key

master\_mode:

CALL intm

MOV BP,0abcdh

CMP AX,0abcdh

JNZ x6

x8: CALL keypad\_input

CMP AL,7Dh

JZ Alarm\_mode

JNZ x8

Alarm\_mode:

CALL inta

CMP DH,6h

JZ start

CMP DH,1h

JZ x6

JMP x70

User\_mode:

CALL intu

CMP AX,0abcdh

JZ x8

JNZ x6

;Intentionally Left Blank

x70:

stop: JMP stop

DELAY\_20ms PROC

MOV CH,5

X4: NOP

NOP

DEC CH

JNZ X4

RET

DELAY\_20ms ENDP

DELAY\_0.04s PROC

MOV CX,4fffh

X17: NOP

NOP

DEC CX

JNZ X17

RET

DELAY\_0.04s ENDP

DELAY\_max PROC

MOV CX,0ffffh

X16: NOP

NOP

DEC CX

JNZ X16

RET

DELAY\_max ENDP

;DELAY\_20ms

enter\_LCD PROC

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,50h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints P

MOV AL,52h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints R

MOV AL,45h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints E

MOV AL,53h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints S

MOV AL,53h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints S

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,45h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints E

MOV AL,4Eh

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints N

MOV AL,54h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints T

MOV AL,45h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints E

MOV AL,52h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints R

RET

enter\_LCD ENDP

intm PROC

CALL clear\_LCD

MOV AL,0feh

OUT 08h,AL ;glow enter pass LED

;byte by byte pass enter

MOV CX,16

;store the 16-bit entered pass after the hard coded pass word

enter\_16bit:

CALL keypad\_input

CMP AL,7eh

JZ pressc

CMP AL,7bh

JZ pressac

CMP AL,77h

JZ press\_enter

CMP AL,0bbh

JZ nop\_master

CMP AL,0b7h

JZ nop\_master

CMP AL,7dh

JZ nop\_master

MOV [SI],AL

CALL Print\_\*

INC SI

DEC CX

JNZ enter\_16bit

disp\_entermaster:

CALL keypad\_input

CMP AL,7eh

JZ pressc

CMP AL,7bh

JZ pressac

CMP AL,77h

JZ press\_enter

asd: CALL clear\_LCD

CALL enter\_LCD ;add code here to display 'PRESS ENTER' on lcd

CALL keypad\_input

CMP AL,77h

JZ press\_enter

JNZ asd

nop\_master: NOP

JMP enter\_16bit

pressc:

CALL clear\_1digit\_LCD

DEC SI

INC CX

JMP enter\_16bit

pressac:

CALL clear\_LCD

MOV CX,16

MOV SI,1eh;start of pass segment

JMP enter\_16bit

press\_enter:

CALL clear\_LCD

MOV AL,0ffh

OUT 08h,AL

CMP CX,0

JZ cmp\_pass

JMP raise\_alarm

;glow retry/update led

;byte by byte

day\_pass:

MOV SI,002Eh

MOV AL,0fdh

OUT 08h,AL

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL clear\_LCD

MOV CX,12

enter\_12bit:

CALL keypad\_input

CMP AL,7eh

JZ presscday

CMP AL,0bbh

JZ nop\_day

CMP AL,0b7h

JZ nop\_day

CMP AL,7dh

JZ nop\_day

CMP AL,7bh

JZ pressacday

CMP AL,77h

JZ press\_enterday

MOV [SI],AL

CALL Print\_\*

INC SI

DEC CX

JNZ enter\_12bit

disp\_enter:

CALL keypad\_input

CMP AL,7eh

JZ presscday

CMP AL,7bh

JZ pressacday

CMP AL,77h

JZ press\_enterday

asd1: CALL clear\_LCD

CALL enter\_LCD ;add code here to display 'PRESS ENTER' on lcd

CALL keypad\_input

CMP AL,77h

JZ press\_enterday

JNZ asd1

nop\_day:NOP

JMP enter\_12bit

presscday:

CALL clear\_1digit\_LCD

DEC SI

INC CX

JMP enter\_12bit

pressacday:

CALL clear\_LCD

JMP day\_pass

press\_enterday:

CALL clear\_LCD

MOV AL,0ffh

OUT 08h,AL

CMP CX,0

JNZ err\_msg

MOV AL,0fbh

OUT 08h,AL

CALL DELAY\_max

CALL DELAY\_max

MOV AL,0ffh

OUT 08h,AL

JZ end\_69h

err\_msg:

CALL error\_msg

JMP day\_pass

cmp\_pass:

CLD

MOV SI,0000h

MOV DI,001Eh

MOV CX,17

x5: MOV AL,[SI]

MOV BL,[DI]

DEC CX

JZ day\_pass

CMP AL,BL

JNZ raise\_alarm

INC SI

INC DI

JMP x5

raise\_alarm:

MOV DH,5h

MOV AL,0fh

OUT 08h,AL

MOV AX,0abcdh

end\_69h:

RET

intm ENDP

Print\_\* PROC

MOV AL,2Ah

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints \*

RET

Print\_\* ENDP

clear\_LCD PROC

MOV AL,00h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h ;Clear Display

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,04h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,00h

OUT 02h,AL

RET

clear\_LCD ENDP

keypad\_input PROC ;SubR for keypad entry,al has unique key input value.

x0: MOV AL,00h

OUT 04h,AL

x1: IN AL,04h

AND AL,0f0h

CMP AL,0f0h

JNZ x1

CALL DELAY\_20ms

MOV AL,00h ; Check for key press

OUT 04,AL

x2: ;in al,0ch

;cmp al,0fbh

;jz sta

IN AL,04h

AND AL,0F0h

CMP AL,0F0h

JZ x2

CALL DELAY\_20ms

MOV AL,00h ; Check for key press

OUT 04,AL

IN AL,04h

AND AL,0F0h

CMP AL,0F0h

JZ x2

MOV AL,0Eh ;Check for key press column 1

MOV BL,AL

OUT 04h,AL

IN AL,04h

AND AL,0f0h

CMP AL,0f0h

JNZ x3

MOV AL,0Dh ;Check for key press column 2

MOV BL,AL

OUT 04h,AL

IN AL,04h

AND AL,0f0h

CMP AL,0f0h

JNZ x3

MOV AL,0Bh ;Check for key press column 3

MOV BL,AL

OUT 04h,AL

IN AL,04h

AND AL,0f0h

CMP AL,0f0h

JNZ x3

MOV AL,07h ;Check for key press column 4

MOV BL,AL

OUT 04h,AL

IN AL,04h

AND AL,0f0h

CMP AL,0f0h

JZ x2

x3: OR AL,BL

RET

keypad\_input ENDP

inta PROC

MOV AL,00eh

OUT 08h,AL

MOV CX,14

MOV SI,3ah ;store the 16-bit entered pass after the hard coded pass word

enter\_14bit:

CALL keypad\_input

CMP AL,7eh

JZ pressc\_alarm

CMP AL,0bbh

JZ nop\_alarm

CMP AL,0b7h

JZ nop\_alarm

CMP AL,7dh

JZ nop\_alarm

CMP AL,7bh

JZ pressac\_alarm

CMP AL,77h

JZ press\_enter\_alarm

MOV [SI],AL

CALL Print\_\*

INC SI

DEC CX

JNZ enter\_14bit

disp\_enteralarm:

CALL keypad\_input

CMP AL,7eh

JZ pressc\_alarm

CMP AL,7bh

JZ pressac\_alarm

CMP AL,77h

JZ press\_enter\_alarm

asd2: CALL clear\_LCD

CALL enter\_LCD ;add code here to display 'PRESS ENTER' on lcd

CALL keypad\_input

CMP AL,77h

JZ press\_enter\_alarm

JNZ asd2

nop\_alarm: NOP

JMP enter\_14bit

pressc\_alarm:

CALL clear\_1digit\_LCD

DEC SI

INC CX

JMP enter\_14bit

pressac\_alarm:

CALL clear\_LCD

MOV CX,14

MOV SI,3ah;start of pass segment

JMP enter\_14bit

press\_enter\_alarm:

CALL clear\_LCD

MOV AL,0fh

OUT 08h,AL

CMP CX,0

JZ cmp\_pass\_alarm

JNZ x56

cmp\_pass\_alarm:

CLD

MOV SI,10h

MOV DI,3ah

MOV CX,14

REPE CMPSB

CMP CX,00h

JNZ x56

MOV AL,0ffh

OUT 08h,AL

ADD DH,1h

x56:

RET

inta ENDP

intu PROC

CALL clear\_LCD

MOV DL,1 ;flag for checking two inputs

MOV AL,0feh

OUT 08h,AL

MOV CX,12

MOV SI,48h ;store the 16-bit entered pass after the hard coded pass word

enter\_12bitu:

CALL keypad\_input

CMP AL,7eh

JZ pressc\_user

CMP AL,7bh

JZ pressac\_user

CMP AL,0bbh

JZ nop\_user

CMP AL,0b7h

JZ nop\_user

CMP AL,7dh

JZ nop\_user

CMP AL,77h

JZ press\_enter\_user

MOV [SI],AL

CALL Print\_\*

INC SI

DEC CX

JNZ enter\_12bitu

disp\_enter\_user:

CALL keypad\_input

CMP AL,7eh

JZ pressc\_user

CMP AL,7bh

JZ pressac\_user

CMP AL,77h

JZ press\_enter\_user

asd3: CALL clear\_LCD

CALL enter\_LCD ;add code here to display 'PRESS ENTER' on lcd

CALL keypad\_input

CMP AL,77h

JZ press\_enter\_user

JNZ asd3

nop\_user:

NOP

JMP enter\_12bitu

pressc\_user:

CALL clear\_1digit\_LCD

DEC SI

INC CX

JMP enter\_12bitu

pressac\_user:

CALL clear\_LCD

MOV CX,12

MOV SI,48h;start of pass segment

JMP enter\_12bitu

press\_enter\_user:

MOV AL,0ffh

OUT 08h,AL

CMP CX,0

JZ cmp\_pass\_user

JNZ wrong\_pass

cmp\_pass\_user:

CLD

MOV SI,2eh

MOV DI,48h

MOV CX,12

REPE CMPSB

CMP CX,00h

JNZ wrong\_pass

JZ open\_door\_user

wrong\_pass :

CALL clear\_LCD

MOV SI,48h

MOV CX,12

CMP DL,0

JZ raise\_alarm\_user

MOV AL,0fdh

OUT 08h,AL

CALL retry\_msg

CALL DELAY\_max

CALL DELAY\_max

CALL clear\_LCD

MOV CX,12

DEC DL

JMP enter\_12bitu

raise\_alarm\_user:

MOV DH,0

MOV AL,0fh

OUT 08h,AL

MOV AX,0abcdh

JMP end\_70h

open\_door\_user:

CALL open\_door

end\_70h:

RET

intu ENDP

ints PROC

CALL open\_door

; CALL DELAY\_0.04s

; mov al,00h

; out 0ch,al

RET

ints ENDP

open\_door PROC

CALL clear\_LCD

MOV AL,8ah

OUT 0Ah,AL

CALL DELAY\_20ms

MOV AL,0ah

OUT 0Ah,AL

x31: IN AL,0ch

CMP AL,0ffh

JNZ x31

CALL DELAY\_20ms

CALL close\_door

RET

open\_door ENDP

close\_door PROC

MOV AL,03h

OUT 0Ah,AL

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

CALL DELAY\_max

RET

close\_door ENDP

welcome\_msg PROC

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,57h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints W

MOV AL,45h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints E

MOV AL,4Ch

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints L

MOV AL,43h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints C

MOV AL,4Fh

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints O

MOV AL,4dh

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints M

MOV AL,45h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints E

RET

welcome\_msg ENDP

update\_msg PROC

MOV AL,55h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints U

MOV AL,50h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints P

MOV AL,44h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints D

MOV AL,41h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints A

MOV AL,54h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints T

MOV AL,45h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints E

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,50h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints P

MOV AL,41h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints A

MOV AL,53h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints S

MOV AL,53h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints S

MOV AL,57h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints W

MOV AL,4Fh

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints O

MOV AL,52h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints R

MOV AL,44h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints D

RET

update\_msg ENDP

clear\_1digit\_LCD PROC

MOV AL,00h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,10h ;shift left by 1

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,04h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,00h

OUT 02h,AL

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

CALL DELAY\_20ms

MOV AL,10h ;shift left by 1

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,04h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,00h

OUT 02h,AL

RET

clear\_1digit\_LCD ENDP

error\_msg PROC

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,45h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints E

MOV AL,4Eh

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints N

MOV AL,54h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints T

MOV AL,45h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints E

MOV AL,52h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints R

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,31h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints 1

MOV AL,32h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints 2

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,44h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints D

MOV AL,49h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints I

MOV AL,47h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints G

MOV AL,49h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints I

MOV AL,54h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints T

MOV AL,53h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints S

RET

error\_msg ENDP

retry\_msg PROC

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,0A0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,52h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints R

MOV AL,45h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints E

MOV AL,54h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints T

MOV AL,52h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints R

MOV AL,59h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Y

RET

retry\_msg ENDP

updateday\_msg PROC

MOV AL,55h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints U

MOV AL,50h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints P

MOV AL,44h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints D

MOV AL,41h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints A

MOV AL,54h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints T

MOV AL,45h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints E

MOV AL,0a0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,44h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints D

MOV AL,41h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints A

MOV AL,59h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Y

MOV AL,0a0h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints Space

MOV AL,50h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints P

MOV AL,41h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints A

MOV AL,53h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints S

MOV AL,53h

OUT 00h,AL

CALL DELAY\_20ms

MOV AL,05h

OUT 02h,AL

CALL DELAY\_20ms

MOV AL,01h

OUT 02h,AL ;prints S

RET

updateday\_msg ENDP

Nmi\_24hrtimer:

CALL clear\_LCD

CALL clear\_1digit\_LCD

CALL updateday\_msg

startnmi:

CALL keypad\_input

CMP AL,0bbh

JZ master\_mode

JMP startnmi

IRET

Switch\_intR:

CALL open\_door

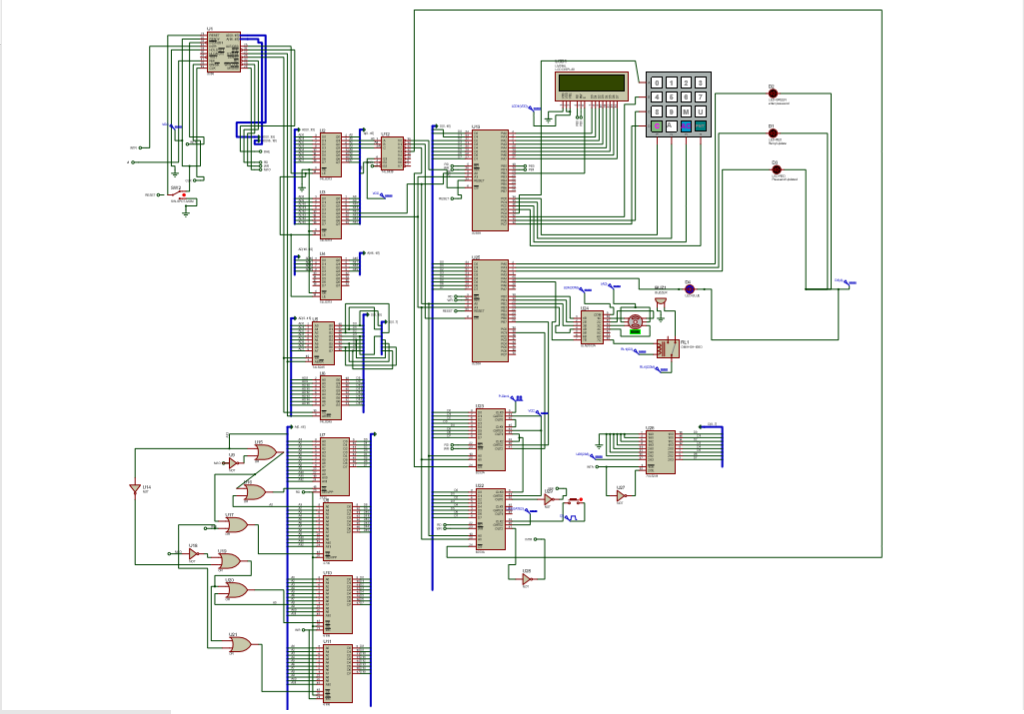
STI

CMP BP,0abcdh

JZ x6

JNZ start

**CIRCUIT DIAGRAM**

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