DESIGN ASSIGNMENT

CS F241 : MICRO-PROCESSOR PROGRAMMING AND INTERFACING

Topic : Door Security Control

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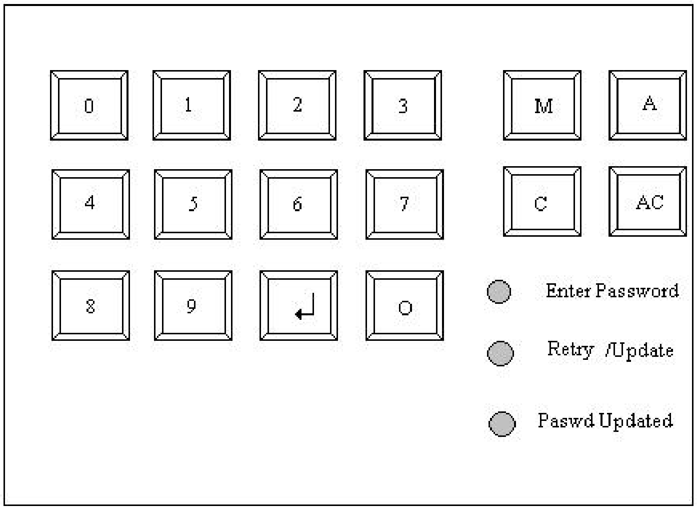
Chapter 1

Problem Statement

1.1 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 2 min, so that the person can leave the room.



1.2 User Interface

There are 3 sets of Passwords :
1.) User
2.) Master
3.) Alarm Off

1.3 Points

1.) 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 retyr/Update LED glows the user has to enter password of the day. This is a 12-digit value. Once this value has been accepted by the system, the Password Updated LED glows.

2.) 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 the password, on authentication the door opens for a period of 1 min. On failure, an alarm is sounded.

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

4.) 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.

5.) LCD shows the entry as asterisk when the password characters are entered.

Chapter 2

Solution

2.1 Assumptions

1.) If we press ’M’, ’O’, ’A’ key while writing a password, nothing will happen.

2.) If the user presses ’ENTER’ while updating the password (i.e. when he hasn’t completed typing all 12 characters), nothing will happen.

3.) First key pressed by the user should be ’M’ or ’O’.

4.) Default passwords for -
(i) USER = 123456123456
(ii) ALARM = 12345671234567

(iii) MASTER = 1234567812345678

5.) Alarm sounds continuously until 'A' is pressed.

6.) Motor runs for 5 seconds and the door opens for 1 minutes and then the motor works for 5 more minutes and then it closes.

2.2 Components used, Flowchart and Mappings

IC Code	**IC**	**Quanity**
8086	Micro-processor	1
74LS373	Octal Latch	3
74LS245	Bi-directional Buffer	4
74LS138	Decoder	1
2732	8K RAM	2
6116	2K ROM	2
8255A	Peripheral Device	2
L6203	Motor	1
LM016L	LCD	1
-	Relay Driven LEDs	3
-	Buzzer	1
-	Hex Pad	1
-	Push Button	1
-	NOR Gate	2
-	NOT Gate	3
-	AND Gate	1
-	OR Gate	10

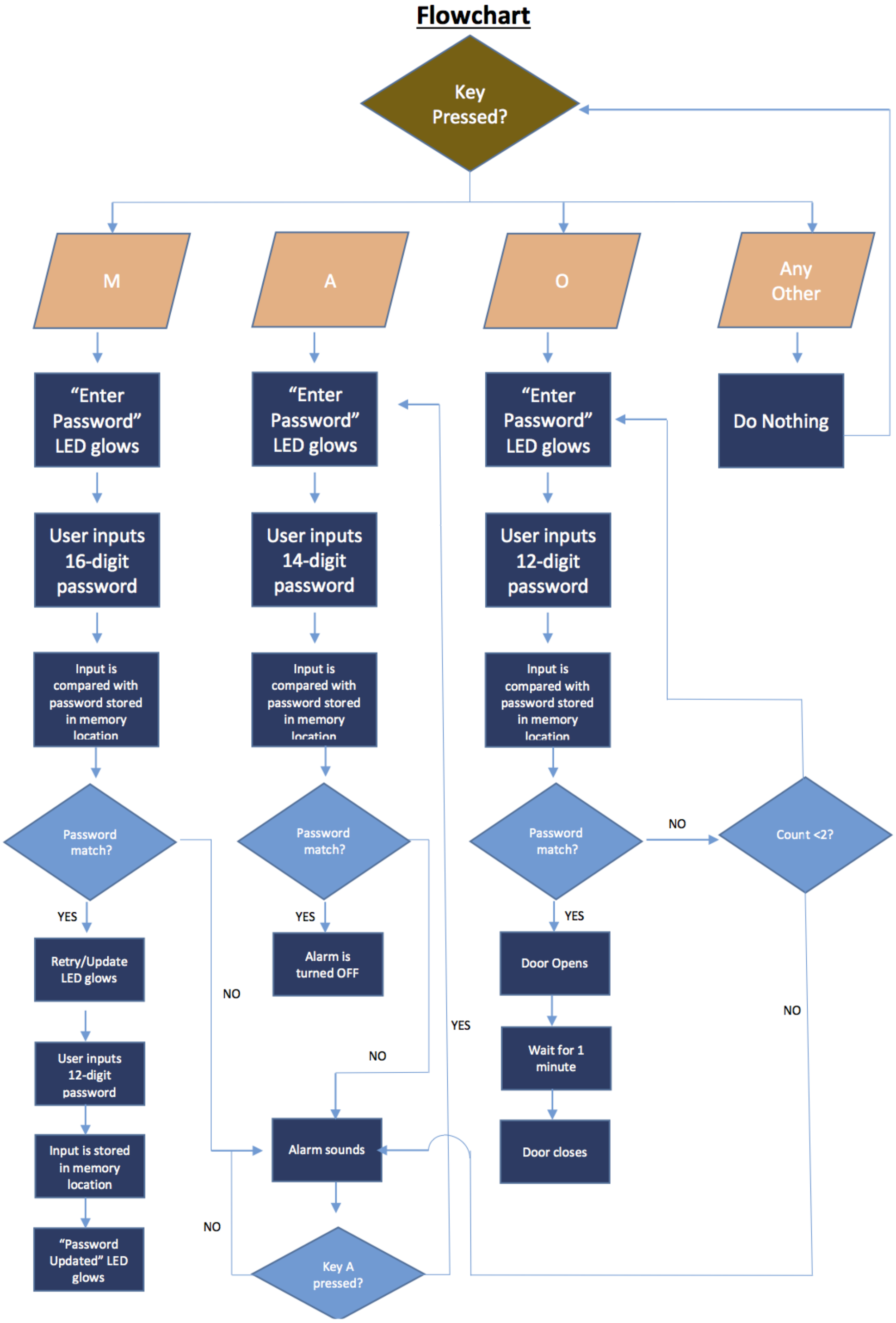
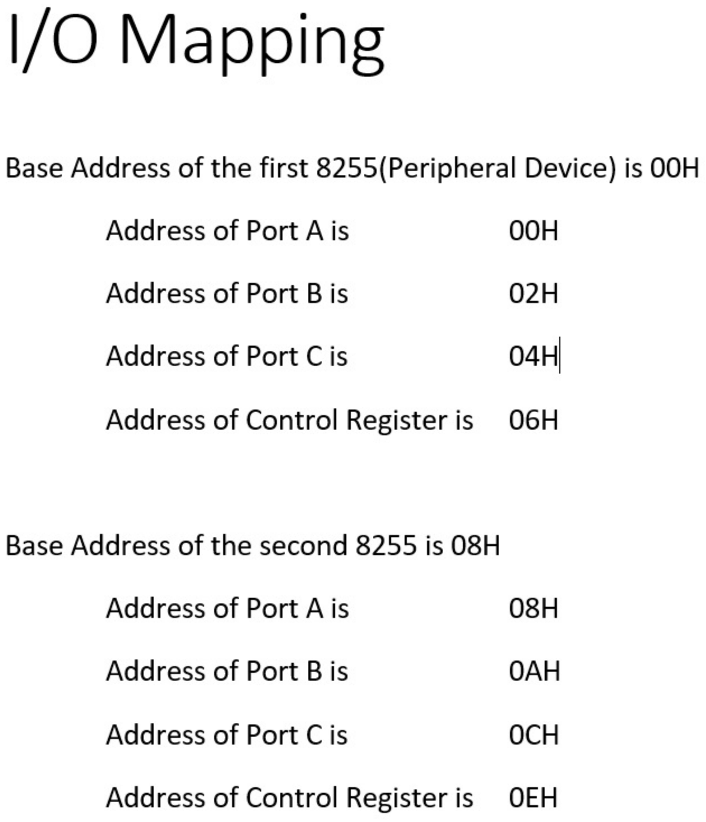

Flowchart
Key Pressed?
M
A
O
Any Other
"Enter Password" LED glows
"Enter Password" LED glows
"Enter Password" LED glows
Do Nothing
User inputs 16-digit password
User inputs 14-digit password
User inputs 12-digit password
Input is compared with password stored in memory location
Input is compared with password stored in memory location
Input is compared with password stored in memory location
Password match?
Password match?
Password match?
NO
Count <2?
YES
YES
YES
Retry/Update LED glows
Alarm is turned OFF
Door Opens
NO
YES
NO
User inputs 12-digit password
Wait for 1 minute
NO
Input is stored in memory location
Alarm sounds
Door closes
NO
"Password Updated" LED glows
Key A pressed?

Figure 2.1: This flowchart shows the working algorithm of the Door Security Control Panel.



I/O Mapping

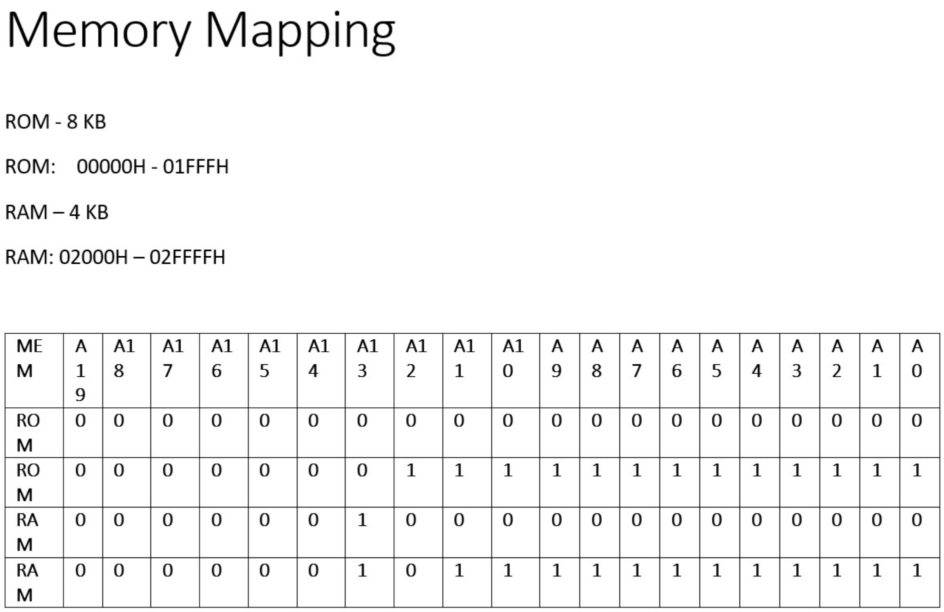
Base Address of the first 8255(Peripheral Device) is 00H

Address of Port A is	00H
Address of Port B is	02H
Address of Port C is	04H
Address of Control Register is	06H

Base Address of the second 8255 is 08H

Address of Port A is	08H
Address of Port B is	0AH
Address of Port C is	0CH
Address of Control Register is	0EH

Figure 2.2: Input / Output Mapping



Memory Mapping

ROM - 8 KB

ROM: 00000H - 01FFFH

RAM – 4 KB

RAM: 02000H – 02FFFFH

MEM	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
ROM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROM	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
RAM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
RAM	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1

Figure 2.3: Memory Mapping

2.3 Code

```
.MODEL TINY
.DATA
MASTER_PASSWORD DB 0EDH, 0EBH, 0E7H, 0DEH,
0DDH, 0DBH, 0D7H, 0BEH, 0EDH, 0EBH, 0E7H,
0DEH, 0DDH, 0DBH, 0D7H, 0BEH
;1,2,3,4,5,6 7 8 1 2 3 4 5 6 7 8

USER_PASSWORD DB 0EDH, 0EBH, 0E7H, 0DEH,
0DDH, 0DBH, 0EDH, 0EBH, 0E7H, 0DEH, 0DDH, 0DBH
;password=123456123456

ALARM_PASSWORD DB 0EDH,0EBH,0E7H,0DEH,0DDH
,0DBH,0D7H,        0EDH,0EBH,
0E7H,0DEH,0DDH,0DBH,0D7H
;password=12345671234567

USER_TEMP DB 13 DUP(0)
MASTER_TEMP DB 17 DUP(0)
ALARM_TEMP DB 15 DUP(0)


TABLE DB 77H, 7BH, 7DH, 7EH, 0B7H, 0BBH, 0BDH,
0BEH, 0D7H, 0DBH, 0DDH, 0DEH, 0E7H, 0EBH, 0EDH,
0EEH
;enter AC C      A O M 9 8 7 6 5 4 3 2 1 0
PORTA EQU 00H
PORTB EQU 02H
PORTC EQU 04H ; 8255
CREG EQU 06H
```

```
;assigning port addresses 8255-2 for lcd
porta2 equ 08h
portb2 equ 0Ah
portc2 equ 0Ch
command_address equ 0Eh


STACK1 DW 100 DUP(?)
TOP_STACK1 LABEL WORD

.CODE
.STARTUP

MOV AX,0010H
MOV DS,AX
MOV AX,0810H
MOV SS,AX


MOV AL,10011000B
;INITIALIZE first 8255 with PORT A(PUSH BUTTON)
and upper PORT C as inputs
OUT CREG,AL       ; PORT B and LOWER PORT C as outputs.
CALL DELAY_20MS
MOV AL,00000000B
OUT PORTB,AL
CALL DELAY_20MS

;MOV AL,10000000B
;OUT command_address,AL
CALL DELAY_20MS



; initialise hardware
; initialise the lcd
; check for busy status
; clear the screen
; display 'empty'
;call init_motor


;writing on the command register for initialization

CALL LCD_INIT ;calling lcd initialization



X9:     CALL KEYPAD
CMP AL,0BBH     ;CHECKING IF 'M' KEY IS PRESSED
JNZ X6
CALL MASTER
JMP X8

X6:     CMP AL,0B7H     ;CHECKING IF 'O' KEY IS PRESSED
JNZ X7
CALL USER
JMP X8

X7:     CMP AL,7EH ;CHECKING IF 'A' KEY IS PRESSED
JNZ X8
JMP X9

X8:     IN AL,PORTA     ;CHECKING IF PUSH BUTTON
IN ROOM IS PRESSED
AND AL,01H
CMP AL,01H
JNZ X9
CALL DELAY_20MS ;De Bounce Key press
IN AL,PORTA
AND AL,01H
CMP AL,01H
JNZ X9
CALL DOOR
JMP X9
.EXIT
```

```
PASS_UPDATE PROC NEAR ;PROCEDURE FOR
UPDATING PASSWORD
PUSHF
PUSH BX
PUSH CX
PUSH DX

LEA DI,USER_PASSWORD
MOV CX,0

X17: CALL KEYPAD
CMP AL,7DH ;CHECKING FOR 'C' KEY
JZ X18
JMP X19

X18: CMP CX,0
JZ X17
DEC DI
DEC CX
CALL BACKSPACE ;DELETING A SINGLE CHARACTER
JMP X17

X19: CMP AL,7BH ;CHECKING FOR 'AC' KEY
JNZ X20
CALL CLS                              ;DELETING ENTIRE DISPLAY
LEA DI,USER_PASSWORD
MOV CX,0
JMP X17

X20: CMP AL,7EH ;'A' key ignored
JZ X17
CMP AL,0B7H      ;'O' key ignored
JZ X17
CMP AL,0BBH      ;'M' key ignored
JZ X17
CMP AL,77H ;'enter key ignored'
JZ X17
```

```
CLD
STOSB
CALL ASTWRIT
INC CX ;takes new password
CMP CX,12
JNZ X17

CALL CLS
POP DX ; RESTORE CALLING PROGRAM REGISTERS
POP CX
POP BX
POPF
RET
PASS_UPDATE        ENDP


MASTER PROC NEAR ;PROCEDURE FOR MASTER MODE
PUSHF
PUSH BX
PUSH CX
PUSH DX
CALL CLS

MOV AL,00000001B ;Enter Password LED glows
OUT PORTB,AL
LEA SI,MASTER_PASSWORD
LEA DI,MASTER_TEMP
MOV CX,0

X10: CALL KEYPAD
mov al,00000000b
out portb,al;????????????????
CMP AL,7DH ;CHECKING FOR 'C' KEY
JZ X11
JMP X12

X11: CMP CX,0
```

```
JZ X10
DEC DI
CALL BACKSPACE
DEC CX
JMP X10

X12: CMP AL,7BH ;CHECKING FOR ’AC’ KEY
JNZ X13
LEA DI,MASTER_TEMP
CALL CLS
MOV CX,0
JMP X10

X13: CMP AL,7EH ;’A’ key ignored
JZ X10
CMP AL,0B7H ;’O’ key ignored
JZ X10
CMP AL,0BBH      ;’M’ key ignored
JZ X10
CMP AL,77H ;IF ’ENTER’ IS PRESSED
JZ X14
MOV [DI],AL
CALL ASTWRIT
INC DI
INC CX
CMP CX,11H
JNZ X10
DEC CX
JMP X10

X14: CMP CX,10H ;10h=16
JZ X15
CALL ALARM
JMP L2 ;JUMP TO EXIT

X15: LEA DI,MASTER_TEMP
MOV CX,16
CLD
```

```
REPE CMPSB
CMP CX,0
 JZ X16
CALL ALARM
JMP L2 ;JUMP TO EXIT

 X16: MOV AL,00000010B
OUT PORTB,AL ;Update/RESET LED glows
CALL PASS_UPDATE
MOV AL,00000100B ;PASSWORD UPDATED LED glows
OUT PORTB,AL

 L2:
POP DX ; RESTORE CALLING PROGRAM REGISTERS
POP CX
POP BX
POPF
RET
MASTER  ENDP


DOOR PROC NEAR ;PROCEDURE FOR OPENING DOOR
PUSHF
PUSH BX
PUSH CX
PUSH DX
MOV AL,00010000B
OUT PORTB,AL

MOV CX,250
 X36: CALL DELAY_20MS
LOOP X36

MOV AL,00000000B
OUT PORTB,AL

MOV CX,3000
 X37: CALL DELAY_20MS
```

```
LOOP X37

MOV AL,00100000B
OUT PORTB,AL

MOV CX,250
X38: CALL DELAY_20MS
LOOP X38

MOV AL,00000000B
OUT PORTB,AL

POP DX ; RESTORE CALLING PROGRAM REGISTERS
POP CX
POP BX
POPF
RET
DOOR ENDP



DELAY_20MS        PROC NEAR ;INTRODUCES A DELAY OF 20MS
MOV CX,5462
L1:       DEC CX
JNZ L1
RET
DELAY_20MS        ENDP


KEYPAD PROC NEAR
PUSHF
PUSH BX
PUSH CX
PUSH DX

X0:       MOV AL,00H ;CHECK FOR KEY RELEASE-TWO KEY LOCKOUT
OUT PORTC,AL
CALL DELAY_20MS
```

```
X1:        IN  AL,PORTC
CALL  DELAY_20MS
AND  AL,0F0H
CMP  AL,0F0H
JNZ  X1

CALL  DELAY_20MS  ;DEBOUNCE KEY  PRESS
MOV  AL,00H  ;KEYPRESS  CHECK
OUT  PORTC,AL
X2:        IN  AL,PORTC
AND  AL,0F0H
CMP  AL,0F0H
JZ  X2
CALL  DELAY_20MS
MOV  AL,00H          ;AGAIN  CHECK  FOR  KEYPRESS
OUT  PORTC,AL
IN  AL,PORTC
AND  AL,0F0H
CMP  AL,0F0H
JZ  X2

MOV  AL,0EH          ;CHECK  FOR  KEYPRESS  COLUMN  1
MOV  BL,AL
OUT  PORTC,AL
IN  AL,PORTC
AND  AL,0F0H
CMP  AL,0F0H
JNZ  X3

MOV  AL,0DH  ;CHECK  FOR  KEYPRESS  COLUMN  2
MOV  BL,AL
OUT  PORTC,AL
IN  AL,PORTC
AND  AL,0F0H
CMP  AL,0F0H
JNZ  X3

MOV  AL,0BH  ;CHECK  FOR  KEYPRESS  COLUMN  3
MOV BL,AL
OUT PORTC,AL
IN AL,PORTC
AND AL,0F0H
CMP AL,0F0H
JNZ X3

MOV AL,07H ;CHECK FOR KEYPRESS COLUMN 4
MOV BL,AL
OUT PORTC,AL
IN AL,PORTC
AND AL,0F0H
CMP AL,0F0H
JZ X2

X3:       OR AL,BL
MOV CX,0FH
MOV DI,00H
X4:       CMP AL,TABLE[DI]
JZ X5
INC DI
LOOP X4

X5:       POP DX ; RESTORE CALLING PROGRAM REGISTERS
POP CX
POP BX
POPF
RET
KEYPAD  ENDP


ALARM PROC NEAR ;PROCEDURE FOR ALARM MODE
PUSHF
PUSH BX
PUSH CX
PUSH DX
CALL CLS
```

```
MOV AL,00001001B ;to glow enter password
 led and keep the buzzer on????????????
OUT PORTB,AL
MOV CX,0
LEA SI,ALARM_PASSWORD
LEA DI,ALARM_TEMP

 X21: CALL KEYPAD
CMP AL,7DH ;CHECKING FOR 'C' KEY
 JZ X22
JMP X23

 X22: CMP CX,0
 JZ X21
DEC DI
CALL BACKSPACE
DEC CX
JMP X21

 X23: CMP AL,7BH ;CHECKING FOR 'AC' KEY
 JNZ X24
LEA DI,ALARM_TEMP
MOV CX,0
JMP X21

 X24: CMP AL,7EH ;'A' key ignored
 JZ X21
CMP AL,0B7H       ;'O' key ignored
 JZ X21
CMP AL,0BBH       ;'M' key ignored
 JZ X21
CMP AL,77H ;IF 'ENTER' IS PRESSED
 JZ X25
MOV [DI],AL
INC DI
CALL ASTWRIT
INC CX
CMP CX,15
```

```
JNZ X21
DEC CX
JMP X21

X25: CMP CX,14
JZ X26
CALL ALARM

X26: LEA DI,ALARM_TEMP
MOV CX,14
CLD
REPE CMPSB
CMP CX,0
JZ X27
CALL ALARM

X27: MOV AL,00000000B ;Alarm off
OUT PORTB,AL

POP DX; RESTORE CALLING PROGRAM REGISTERS
POP CX
POP BX
POPF
RET
ALARM ENDP


USER PROC NEAR  ;PROCEDURE FOR USER MODE
PUSHF
PUSH BX
PUSH CX
PUSH DX
CALL CLS

MOV AL,00000001B
OUT PORTB,AL
CALL DELAY_20MS
MOV CX,0
MOV DX,0
LEA SI,USER_PASSWORD
LEA DI,USER_TEMP

X34: INC DX

X28: CALL KEYPAD
CMP AL,7DH ;CHECKING FOR 'C' KEY
JZ X29
JMP X30

X29: CMP CX,0
JZ X28
DEC DI
CALL BACKSPACE
DEC CX
JMP X28

X30: CMP AL,7BH ;CHECKING FOR 'AC' KEY
JNZ X31
LEA DI,USER_TEMP
CALL CLS
MOV CX,0
JMP X28

X31: CMP AL,7EH
JZ X28
CMP AL,0B7H
JZ X28
CMP AL,0BBH
JZ X28
CMP AL,77H ;IF 'ENTER' IS PRESSED
JZ X32
MOV [DI],AL
CALL ASTWRIT
INC DI
INC CX
CMP CX,13
```

```
JNZ X28
DEC CX
JMP X28

X32: CMP CX,12
JZ X33
CMP DX,2
JNZ X34
CALL ALARM
JMP L3

X33: LEA DI,ALARM_TEMP
MOV CX,12
CLD
REPE CMPSB
CMP CX,0
JZ X35
CMP DX,2
JNZ X34
CALL ALARM
JMP L3

X35: MOV AL,00000000B
OUT PORTB,AL
CALL DOOR

L3:     POP DX ; RESTORE CALLING PROGRAM REGISTERS
POP CX
POP BX
POPF
RET
USER ENDP


LCD_INIT PROC NEAR
MOV AL, 38H     ;initialize LCD for 2 lines & 5*7 matrix
CALL COMNDWRT ;write the command to LCD
CALL DELAY_20MS ;wait before issuing the next command
CALL DELAY_20MS ;this command needs lots of delay
CALL DELAY_20MS
MOV AL, 0EH      ;send command for LCD on, cursor on
CALL COMNDWRT
CALL DELAY_20MS
MOV AL, 01 ;clear LCD
CALL COMNDWRT
CALL DELAY_20MS
MOV AL, 06 ;command for shifting cursor right
CALL COMNDWRT
CALL DELAY_20MS
RET
LCD_INIT ENDP


ASTWRIT PROC ;WRITES ASTERICK WHILE TYPING PASSWORD
PUSH DX ;save DX
PUSH AX
MOV DX,PORTA2 ;DX=port A address
MOV AL,'*'
OUT DX, AL ;issue the char to LCD
MOV AL, 00000101B ;RS=1, R/W=0, E=1 for H-to-L pulse
MOV DX, PORTB2 ;port B address
OUT DX, AL ;make enable high
MOV AL, 00000001B ;RS=1,R/W=0 and E=0 for H-to-L pulse
OUT DX, AL
POP AX
POP DX
CALL DELAY_20MS ;wait before issuing the next character
CALL DELAY_20MS ;wait before issuing the next character
RET
ASTWRIT ENDP ;writing on the lcd ends

CLS PROC
PUSH AX
MOV AL, 01 ;clear LCD
CALL COMNDWRT
CALL DELAY_20MS
CALL DELAY_20MS
POP AX
RET
CLS ENDP


BACKSPACE PROC NEAR
PUSH AX
MOV AL,10H ; SHIFT CURSOR TO LEFT
CALL COMNDWRT
CALL DELAY_20MS
CALL DELAY_20MS
MOV AL,' ' ; PRINT SPACE
CALL COMNDWRT
CALL DELAY_20MS
CALL DELAY_20MS
MOV AL,14H
CALL COMNDWRT
CALL DELAY_20MS
CALL DELAY_20MS
POP AX
RET
BACKSPACE ENDP

COMNDWRT PROC ;this procedure writes commands to LCD
MOV DX, PORTA2
OUT DX, AL  ;send the code to Port A
MOV DX, PORTB2
MOV AL, 00000100B ;RS=0,R/W=0,E=1 for H–To–L pulse
OUT DX, AL
NOP
NOP
MOV AL, 00000000B ;RS=0,R/W=0,E=0 for H–To–L pulse
OUT DX, AL
RET
COMNDWRT ENDP
END
```

2.4 Datasheets

1.) Motor
2.) LCD

2.5 Circuit Diagram

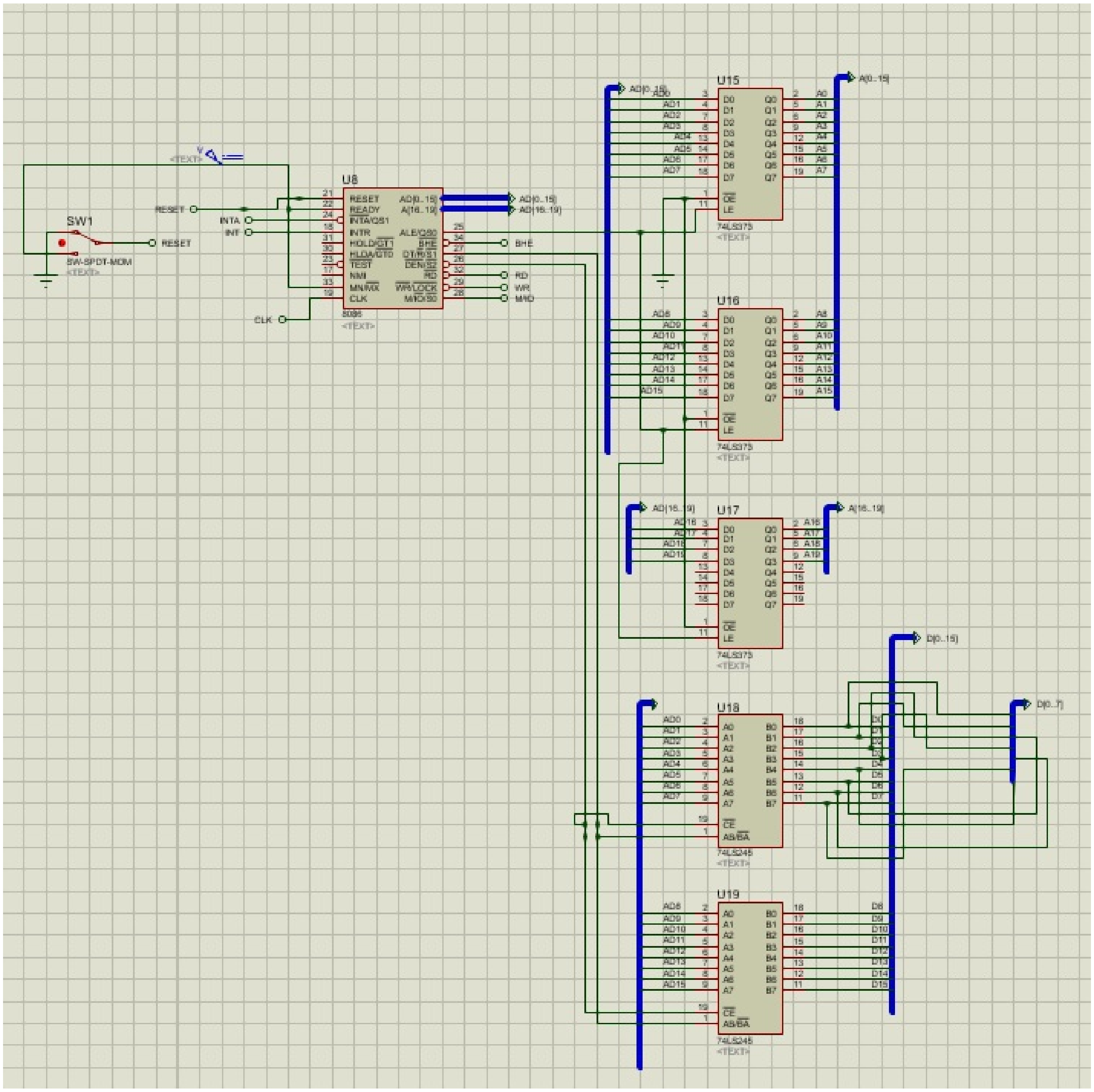


Figure 2.4: This diagram shows the Address and the Data Lines in the Circuit for the Door Security Control Panel.

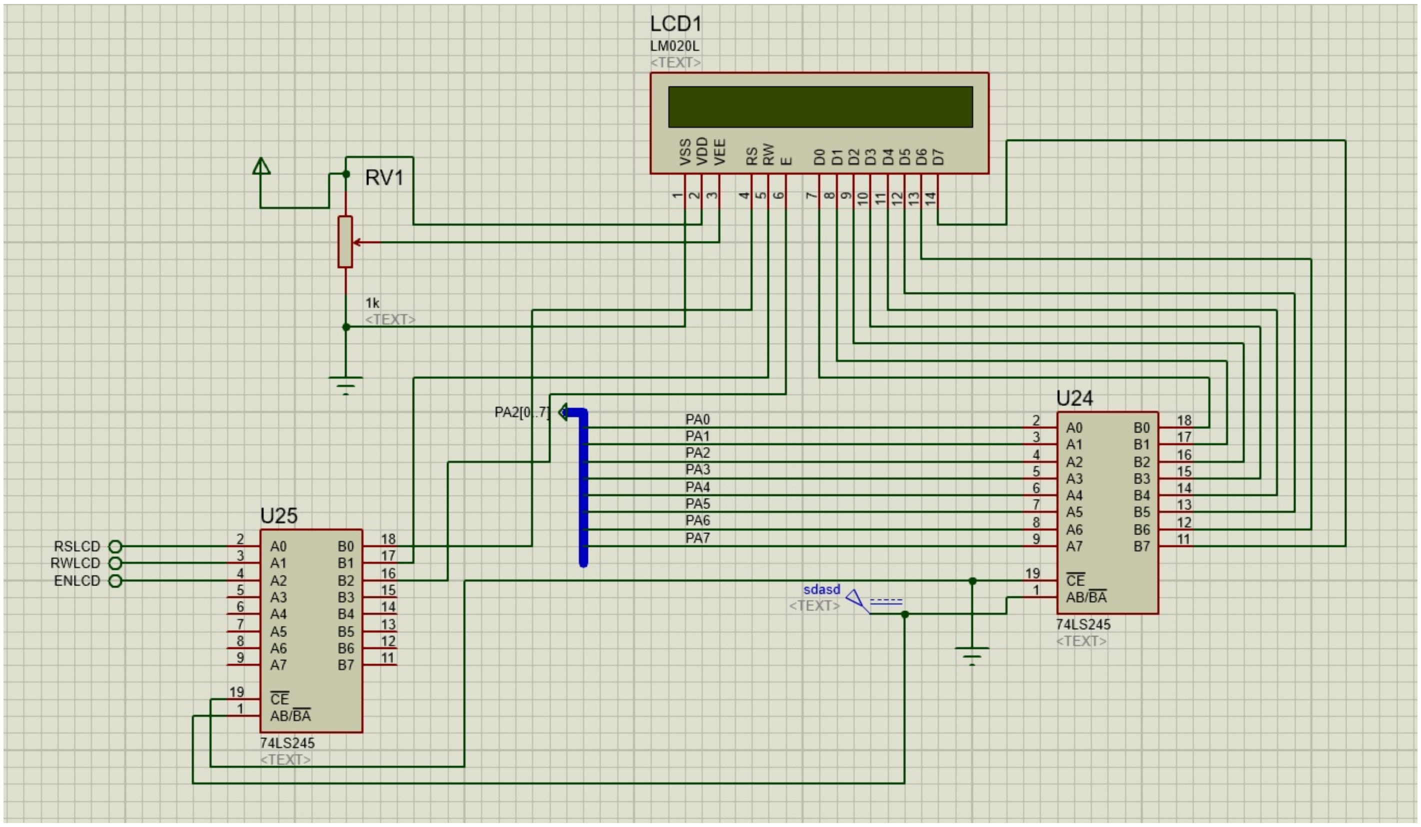


Figure 2.5: This diagram shows the Input/Output Interfacing for the Circuit used for the Door Security Control Panel.

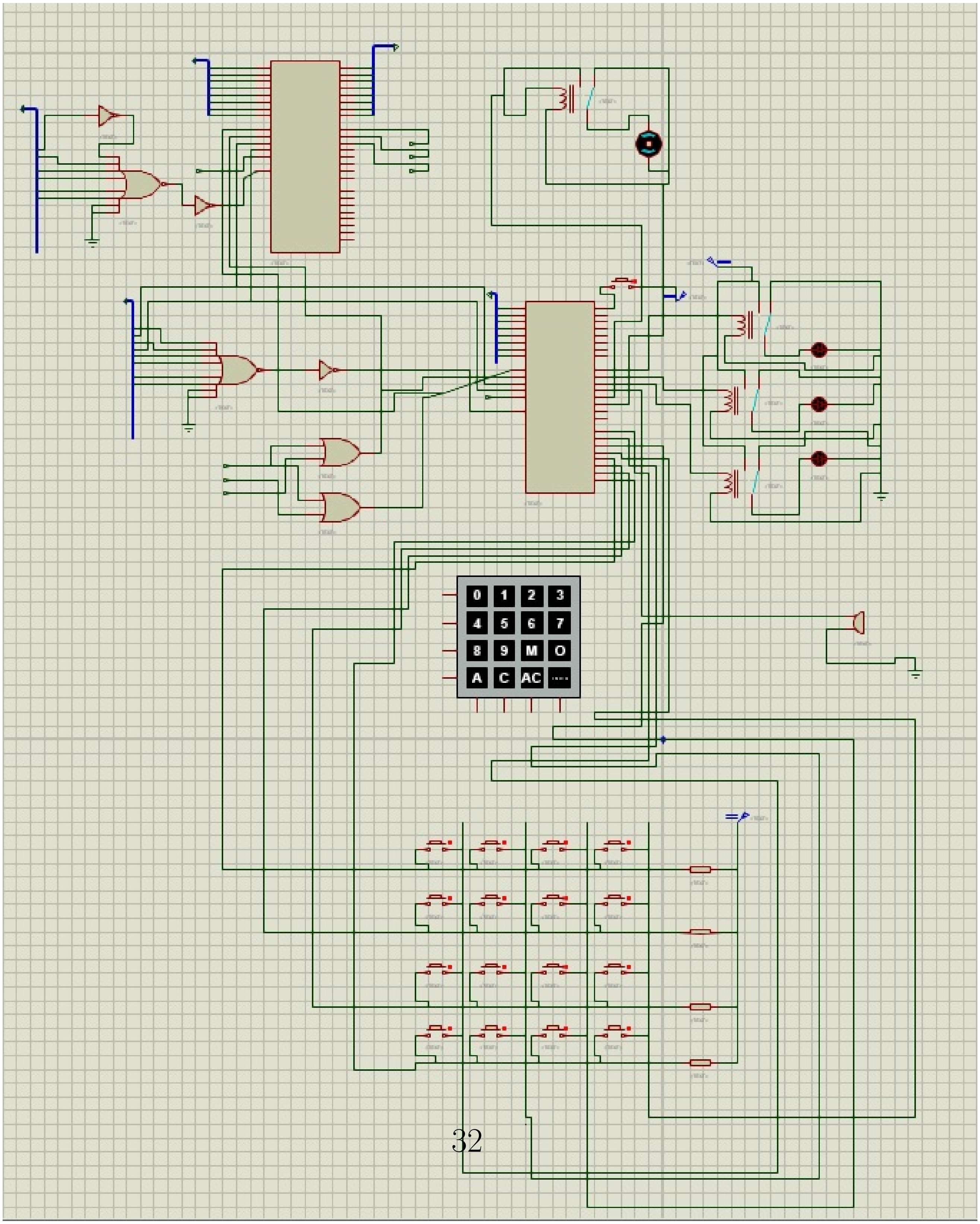


Figure 2.6: This diagram shows another Input/Output Interfacing for the Circuit used for the Door Security Control Panel

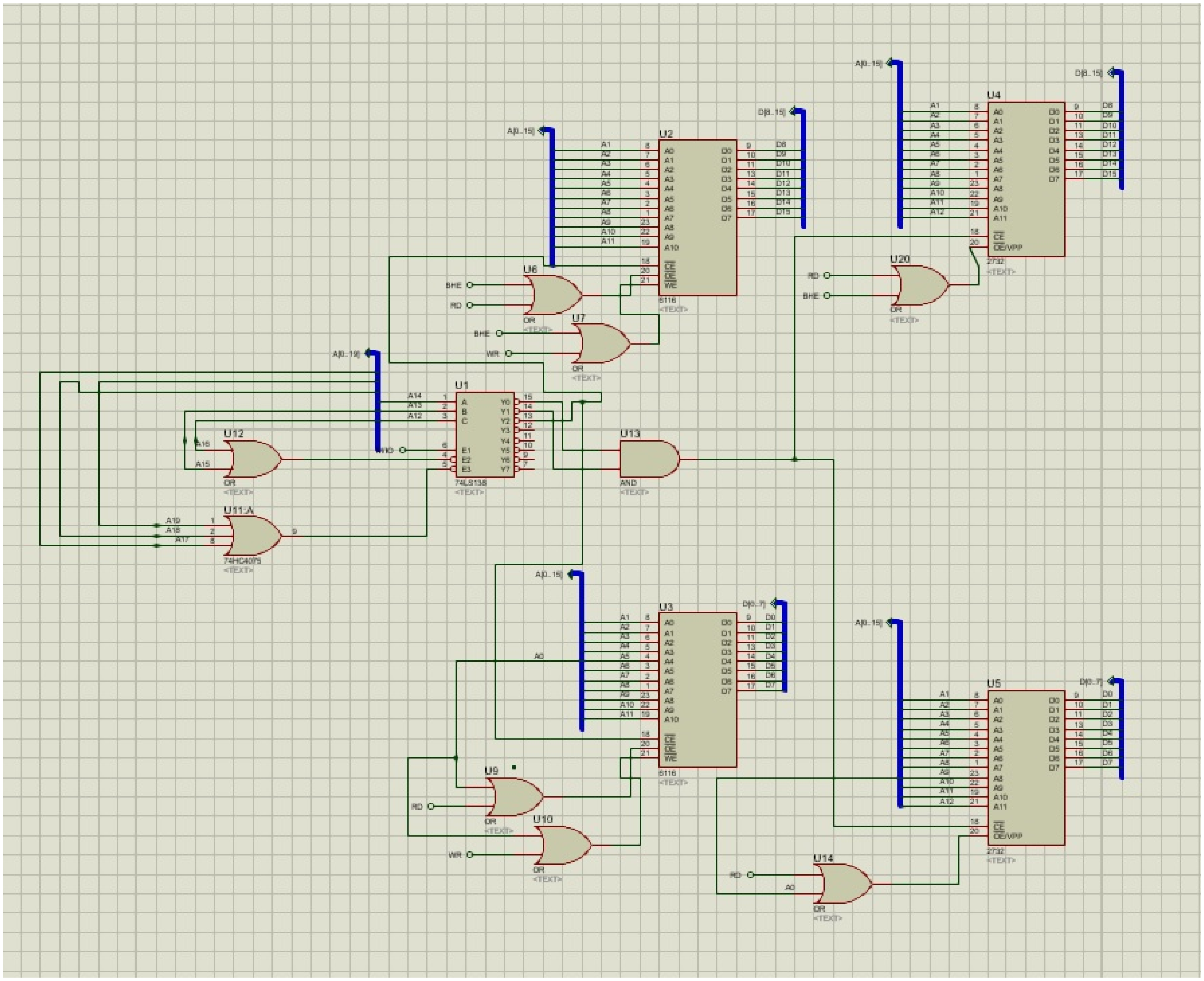


Figure 2.7: This diagram shows the Memory Interfacing for the Circuit used for the Door Security Control Panel.