Microprocessor and Assembly Language Course Project

Elevator Design

Instructor: Dr. Ghazvini

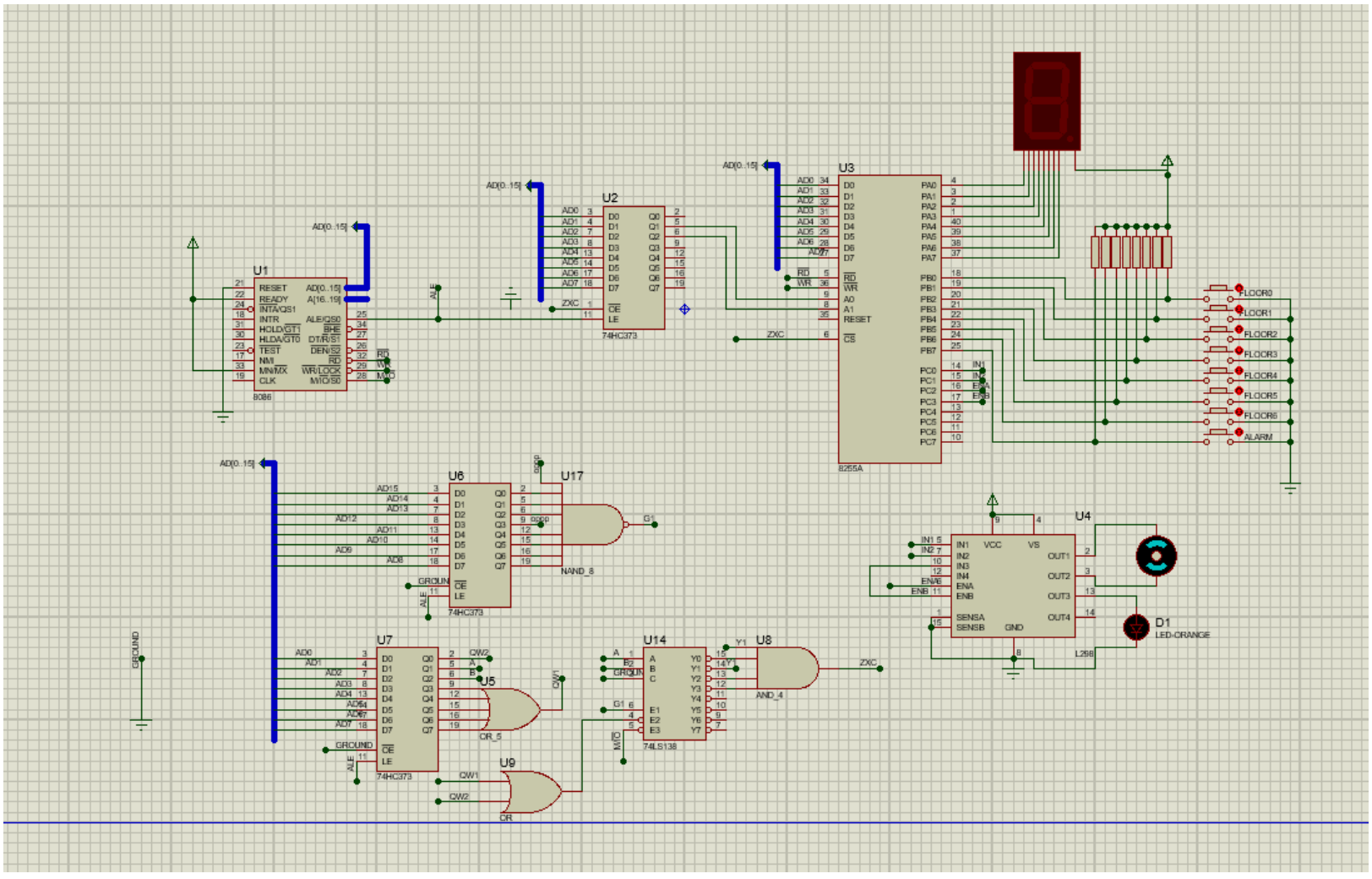
Group Members:

Mehdi Borhani Nejad
Babak Fathi
Esmaeil Bagheri

Project Description:
We want to design an elevator system for a 6-story building. This system should include an emergency button. When pressed, the elevator should stop immediately at its current location and remain stationary for a few seconds. The elevator should stay on the floor where it stopped, and the emergency light should turn on.

List of Components:

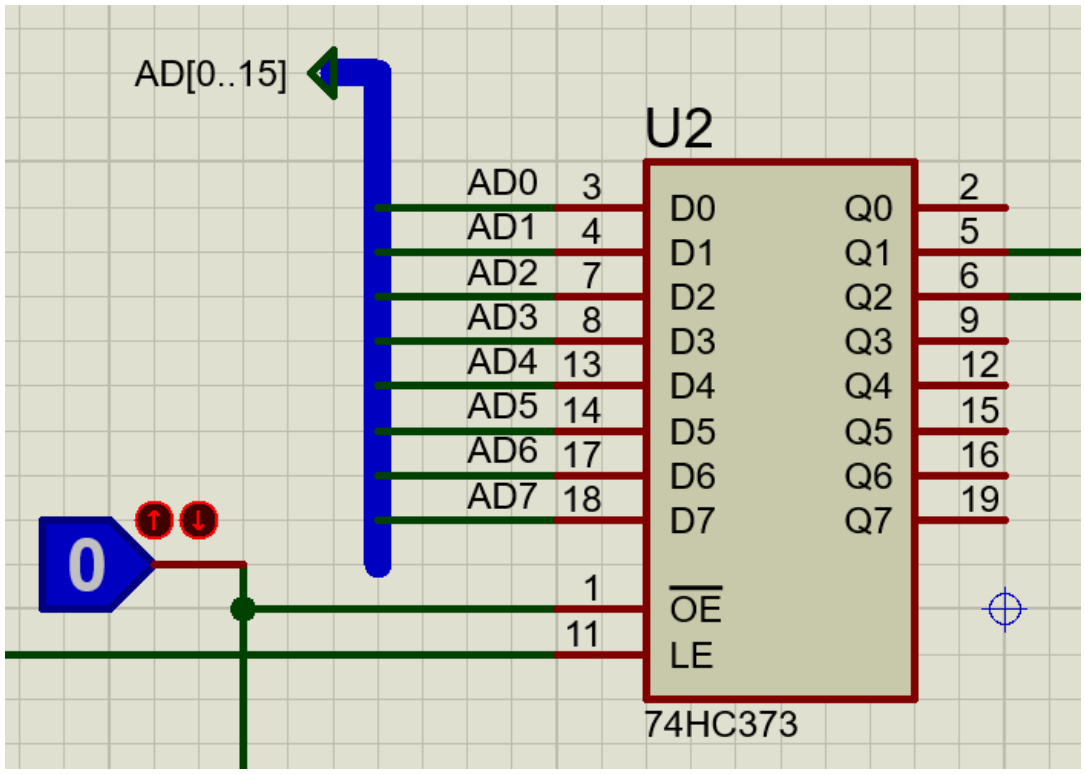
- **8086**
- **7seg**
- **74LS138**
- **8255A**
- **L298**
- **74HC373**



Project overview

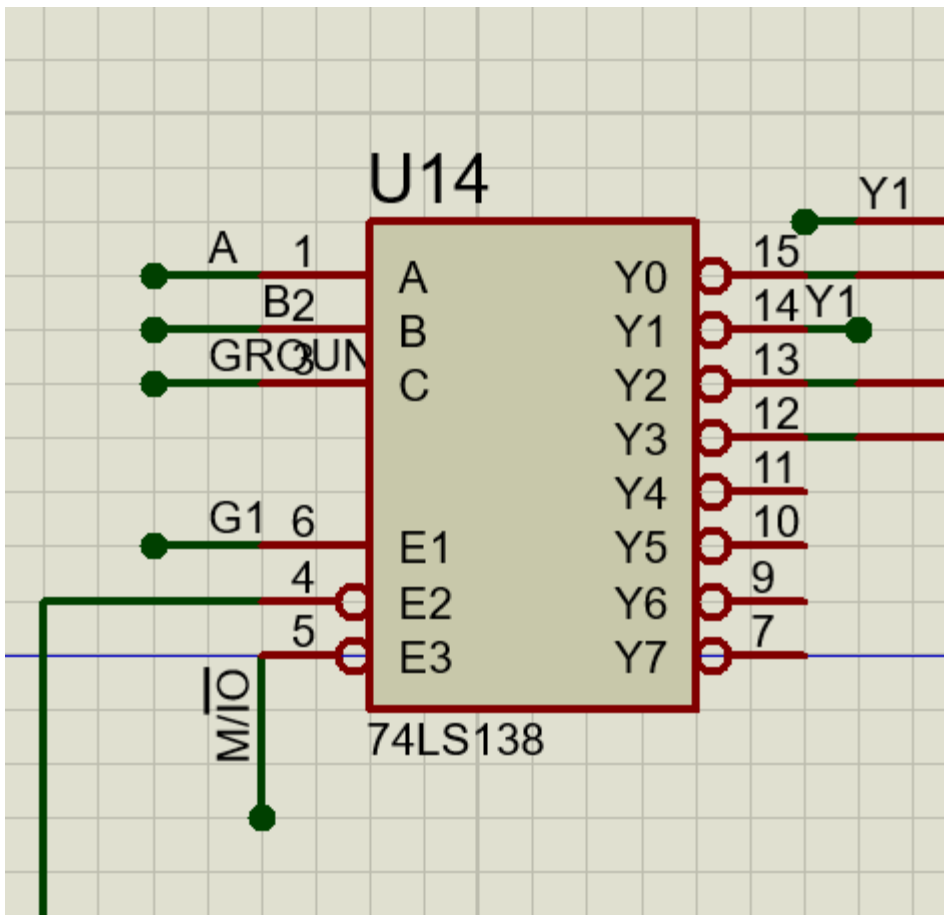
74HC373 (LATCH):

This latch has two pins: output enable and latch enable. The output enable pin is always connected to ground due to being active low, and the latch enable is activated when an address is placed on our databus.



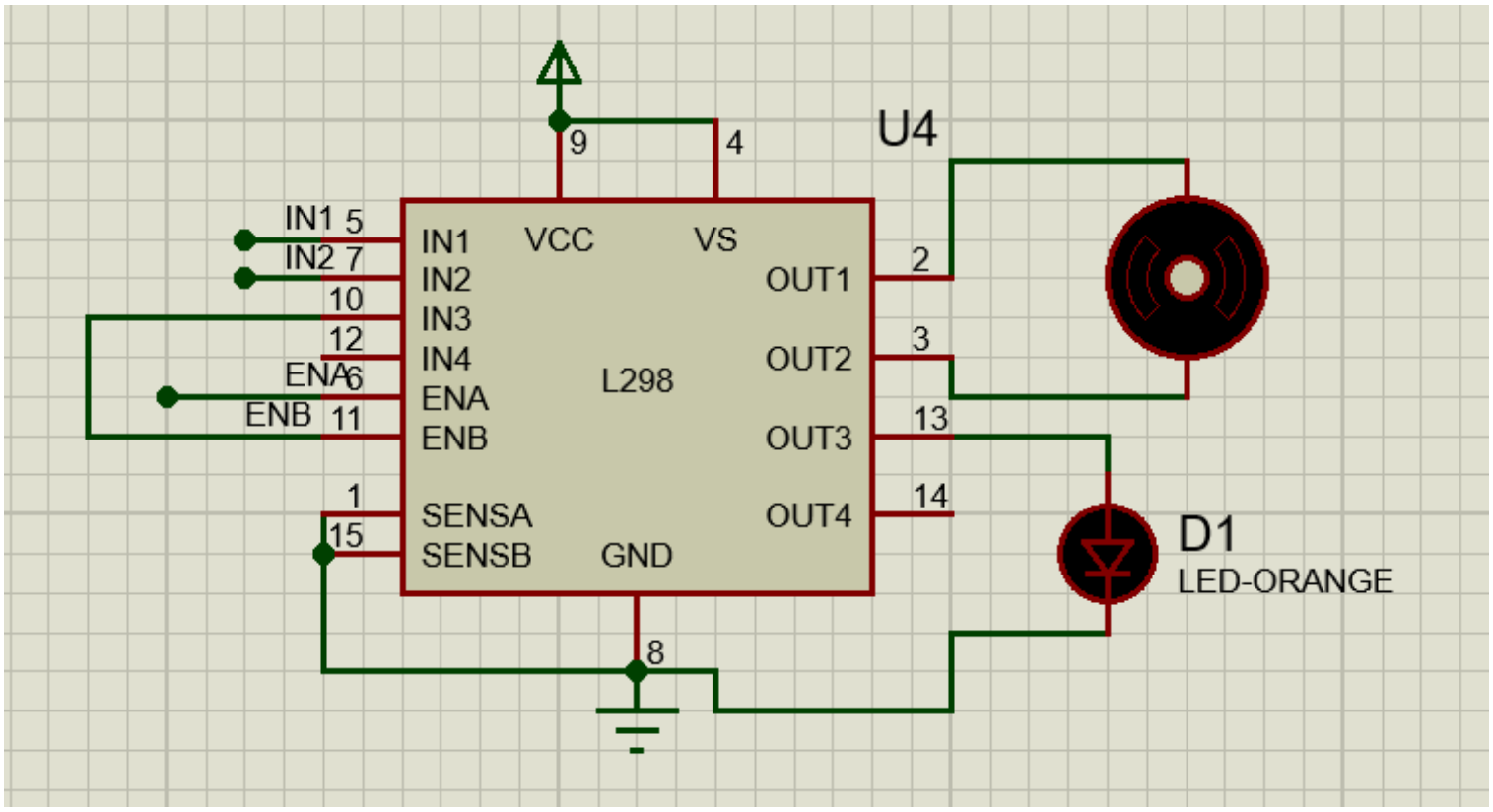
74LS138 (DECODER):

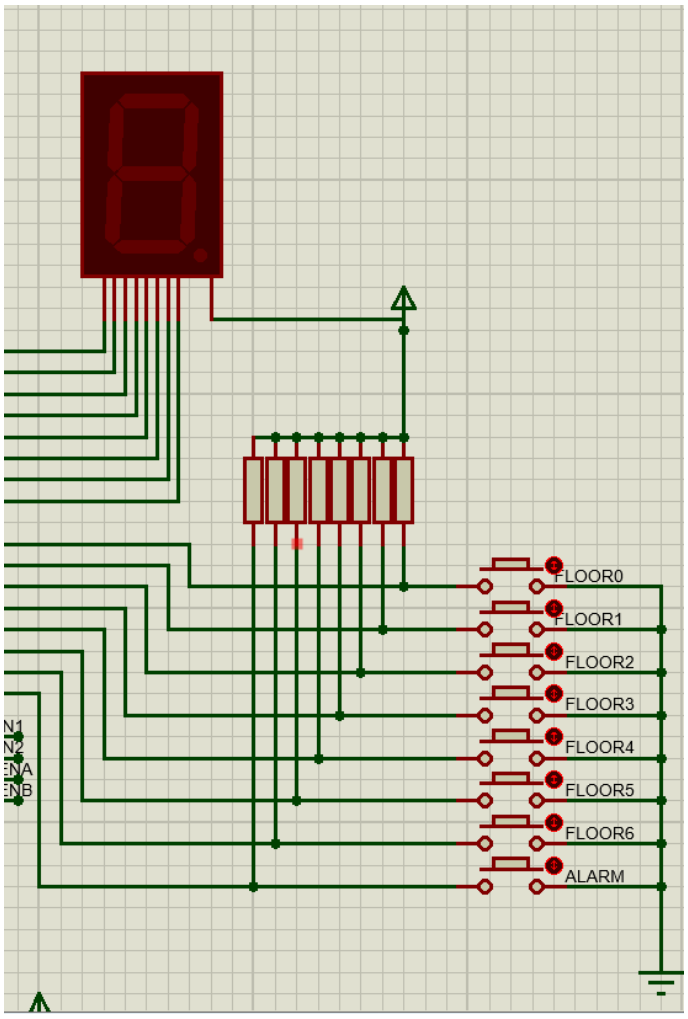
In this decoder, lines (A, B, C) are our selection lines that determine which I/O should start operating. Additionally, there are three enable lines in this decoder, with E2 being the most important one because it causes the decoder to start operating only through specific addresses.



L298:

This component is responsible for activating our motor when going up or down and activating the warning buzzer when the elevator's alarm button is pressed.





7seg:

This component is in the form of a common cathode, which turns on the corresponding segment when one of its lines becomes zero.

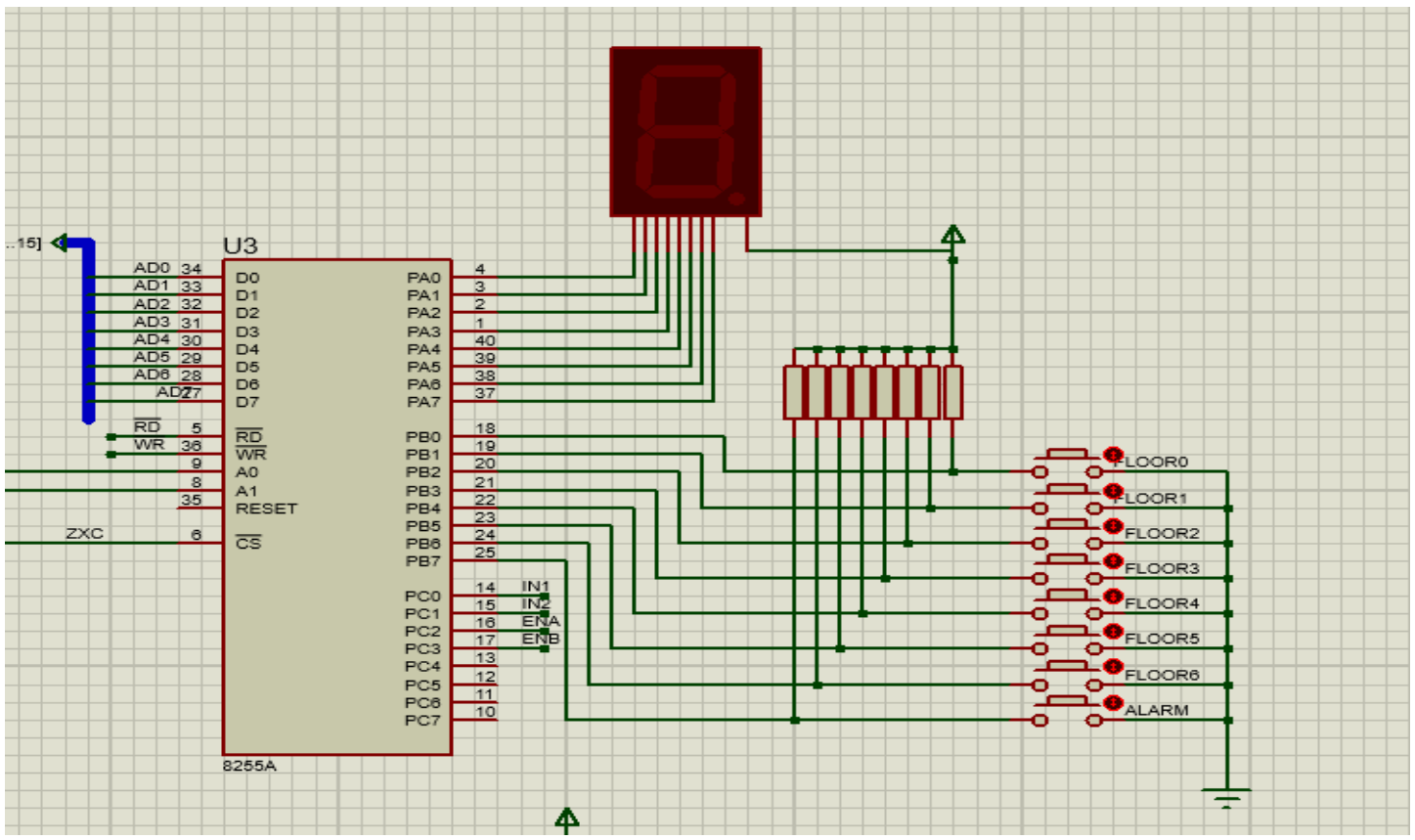
BUTTON:

Designed as pull-up, in this design when the button is pressed, its output value changes from 1 to 0.

8255:
The pin configuration of 8255 is shown in the figure below. In this chip, lines D0 to D7 are responsible for determining the state of the three I/O ports (A, B, C).

D7 (most significant bit): To specify that our system works as a simple input and output, we set it to 1.
D5_D6: Determining the operating mode of A from three existing modes, which we must consider as a simple input-output. Therefore, both of these are set to 0.
D4: Determines the use of A as input (1) or output (0).
D3_D0: PORTC can have both input and output roles. We divide its pins into two sections of low-value bits (PC0-3) and high-value bits (PC4-7). Pin D4 is responsible for determining the state of the four high-value bits, and D0 determines the state of the four low-value bits.
D2: Determines the operating mode of PORTB, which is set to 0 here because state 1 is used for HANDSHAKING, which is not applicable in this project.
D1: Determines whether PORTB is input or output.

A0_A1: These 2 pins are used to activate the ports in 8255, which have 4 states:
00-> Activating PORTA
01-> Activating PORTB
10-> Activating PORTC
11-> Activating the control pin



This section has been designed to correctly pick up the valid address when data is placed on the data bus. For this purpose, a fully decoding system has been used. We must follow the steps we learned in class for decoding addresses.

1.In this system, valid addresses are equal to (00, 02, 04, 06). When these are given, we notice that their eight most significant bits are equal to zero, which we connect to our first latch. Then, by taking a NAND of its outputs, we create a logic one that forms one of the enable pins of our decoder.

2.In our eight least significant bits, pins D3-7 and D0 also generate zero, which due to the active low nature of the enable pin, an OR is taken from them.

3.The other enable pin is connected to the M/IO pin of the 8086 processor.

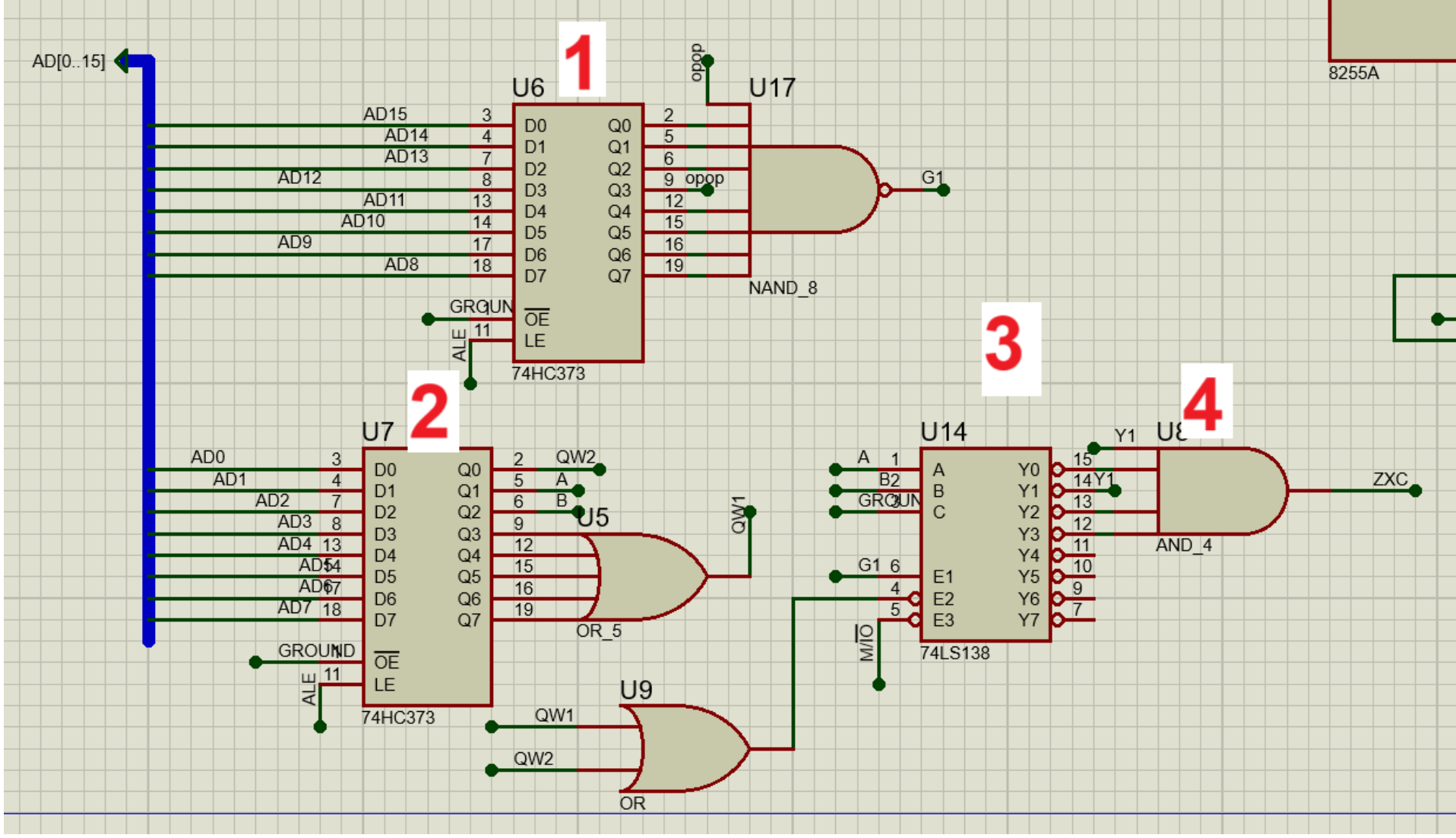
4.Pins D1, D2 form our valid address decoder by connecting to lines A, B, and the remaining C line is responsible for activating and deactivating the four least significant and four most significant bits. Since we only have 4 addresses, we connect the C pin to the ground so that when one of the four valid addresses is placed, one of the 4 upper lines is activated.

After the CS pin is activated with the address 06H, our control pin becomes active and specifies which of the ports (A, B, C) should be used as output or input through the D lines, which have been fully explained.

Control Line Settings
Elevator Project

D7,D6,D5,D4,D3,D2,D1,D0

10000010



8086 CODE

```
DATA SEGMENT
    PORTA EQU 00H
    PORTB EQU 02H                DEFINE VARIABLE;
    PORTC EQU 04H
    PORT_CON EQU 06H
    feli DW 0h
    maghsad DW 0h
    Table7Seg DB 0c0h, 0f9h,0a4h ,0b0h, 099h, 092h, 082h, 088h
  HERE WE DEFINE LOOKUP TABLE FOR DISPLAY NUMBERS IN 7SEGMENT;
 DATA ENDS

 CODE SEGMENT
    ASSUME DS:DATA  ;            USE DS AS DEFAULT SEGMENT;

START:


  MOV DX, PORT_CON
  MOV AL, 082h              ACTIVATING CONTROL PORT;
  OUT DX, AL

  MOV AL, 0c0h
  MOV DX, PORTA             SHOWING ZERO IN 7SEGMENT;
  OUT DX, AL
```

```
click:                          THIS FUNCTION COMPARE THE BUTTON INPUT
   MOV DX, PORTB                IN ORDER TO UNDREST6AND WHICH BUTTON IS USED;
   IN AL, DX



   CMP AL, 11111110B
   JZ F0
   CMP AL, 11111101B

   JZ F1
   CMP AL, 11111011B
   JZ F2
   CMP AL, 11110111B
   JZ F3
   CMP AL, 11101111B
   JZ F4
   CMP AL, 11011111B
   JZ F5
   CMP AL, 10111111B
   JZ F6
   CMP AL, 01111111B
   JZ ALARM
   JMP click
```

```
F0:                             COMPARING THE MAGSHAD AND FELI STATE TO UNDRESTAND
   MOV SI, OFFSET maghsad       THAT ELEVATER MUST GO DOWN OR UP;
   MOV BX, 0                    OTHER LEVEL ARE NOT WRITEN TO COMPACT THE CODE SIZE

   MOV [SI], BX
  MOV SI, OFFSET feli
   MOV CX, [SI]
   CMP BX, CX
   JG L6
   CMP BX, CX
   JL L8

   MOV AL, 11000000B
   MOV DX, PORTA
   OUT DX, AL
   JMP click
```

```
ALARM:
      mov dx,portc
  mov al,00001000B      TURN ON THE LED;
  out dx,al
   MOV AL, 088h      HERE WE PUSH CX AND MAKE A INTERNAL DELAY FUNCTION;
      PUSH CX
   MOV CX, 05FH
MOV DX, PORTA
out dx,ax
D2:
   nop
   LOOP D2
                              A LOOP TO CONSUME SPEND SOME TIME IN ALARM MODE;
   POP CX


   MOV SI, OFFSET feli
   MOV aX, [SI]
   MOV SI, OFFSET Table7Seg
   ADD SI, ax                 SHOWING FELI STATE IN 7SEGMENT AND START THE
   mov ax,[si]                AGAIN;
 OUT DX, Ax
      mov dx,portc
mov al,00000000B      WITH THIS INSTRUCTION WE DISABLE MOTOR ELEVATOR ;
                              AND ALARA LED THAT CONNECTED TO PORT_C;
out dx,al
 JMP click

 JMP START

L6:                        THIS FUNCTION IS FOR UNDRESTANDING HOW MUCH WE MUST ;
     mov dx,portc     GO DOWN BY USING SUB METHOD;
  mov al,00000110B       HERE WE TURN ON THE ELEVATOR MOTOR AND ELEVATOR;
                              STARTS GOING DOWN;
  out dx,al
   MOV SI, OFFSET maghsad
   MOV BX, [SI]
   MOV SI, OFFSET feli
   MOV CX, [SI]
   SUB BX, CX
   XCHG BX, CX
```

```
L7:                    GOING DOWN STEP BY STEP USING A LOOP;

  CALL DELAY      WE WILL DISCUSS ABOUT THIS FUNCTION LATER;
  INC BX
  MOV SI, OFFSET Table7Seg
  ADD SI, bx
  MOV AL, [SI]
  MOV DX, PORTA
  OUT DX, AL                  WE DISPLAY CURRENT FLOOR IN 7SEGMENT;
  MOV SI, OFFSET feli         HERE WE UPDATE VALUE OF FELI ;
  MOV aX, [SI]
  inc ax
  mov [si],ax
  LOOP L7
      mov dx,portc
 mov al,00000000B             WE ARRIVED TO THE DESIRED FLOOR AND DISABLE MOTOR;
 out dx,al
  JMP click

L8:                    HOW MUCH WE MUST GO UP BY COMPARING MAGSHA  AND FELI STATE
    mov dx,portc       USING ADD METHOD;
 mov al,00000101B      HERE WE TURN ON THE ELEVATOR MOTOR AND ELEVATOR;
 out dx,al             STARTS GOING UP;
  MOV SI, OFFSET maghsad
  MOV BX, [SI]         HERE WE LOAD MAGHSAD IN BX REGISTOR;
  MOV SI, OFFSET feli
  MOV CX, [SI]         HERE WE LOAD FELI IN CX REGISTOR;
  SUB cx,bx            WE CALCULATE DIFFERENCES BETWEEN FLOORS AND SAVE VALUVE IN CX FOR;
                       USING IT IN LOOP;
 MOV SI, OFFSET feli   HERE WE LOAD FELI IN BX REGISTOR AGAIN FOR USING IN L9 LABLE;
 MOV bx, [SI]
L9:                    GOING UP STEP BY STEP USING A LOOP;

  call delay
  MOV SI, OFFSET feli
  MOV aX, [SI]      WE HAVE CURRENT FLOOR IN AX;
  dec ax            WE REDUSE THE CURRENT FLOOR;
  mov [si],ax       WE UPDATE VALUE OF FELI;
  MOV SI, OFFSET Table7Seg
  ADD SI, ax

  MOV AL, [SI]
  MOV DX, PORTA       WE DISPLAY THE CURRENT FLOOR IN 7SEGMENT;
  OUT DX, AL
  LOOP L9             THIS LOOP RUNS AS MUCH AS THE DIFFERENCES BETWEEN THE FLOORS;
      mov dx,portc
 mov al,00000000B     WE DISABLE MOTOR;
 out dx,al
  JMP click
```

```
EXPLAINOF DELAY FUNCTIONS;
DELAY PROC NEAR
   PUSH CX
   MOV CX, 01FH

D1:   HERE WE READ PORT_B EVERY MOMENTS AND IF THE BUTTON WAS THE ALARM WE STOP;
      THE ELEVATOR ;
   MOV DX, PORTB
   in al,dx
   cmp al,07fh
   jz ALARM
   LOOP D1

   POP CX
   RET            WE MUST RETURN FROM THIS SUB FUNCTION;
DELAY ENDP

CODE ENDS     END OF THE PROJECT;
END START
```