Smart Lighting System

CS/ECE/EEE/INSTR F241 - Microprocessor and Interfacing

BITS PILANI GOA CAMPUS

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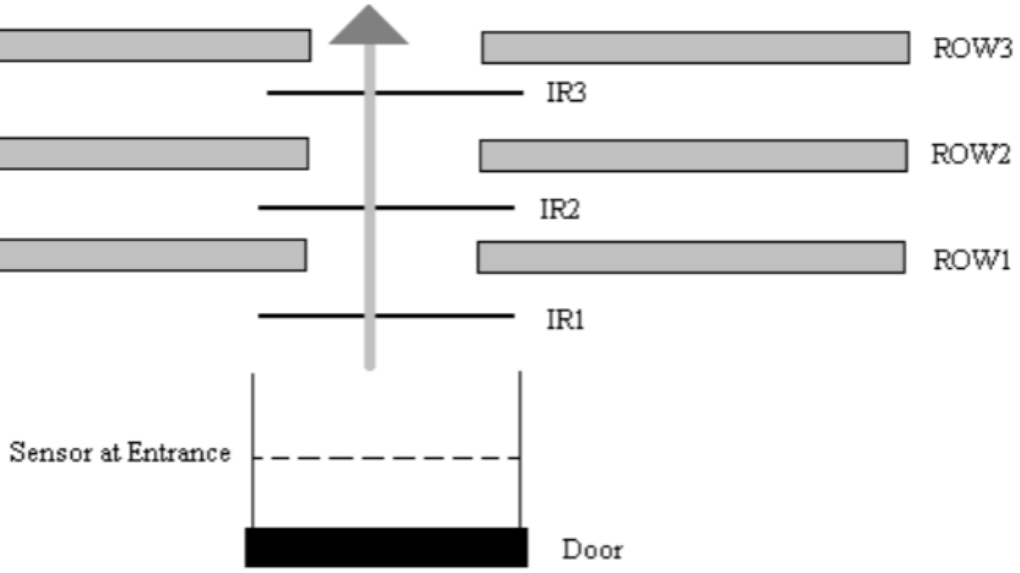
P13.Smart Lighting System Description:

This is a lighting system for a conference room. As the seats get filled the light should be turned on. The rows are filled from row1 onwards. There are 4 lights per row. As each row begins to get filled the lights get turned on. As each row empties completely, the light gets turned off. You Can assume there are at least 5 rows. Entry to the auditorium is restricted to a certain point in time. Exit can be at any point in time.

System Details:

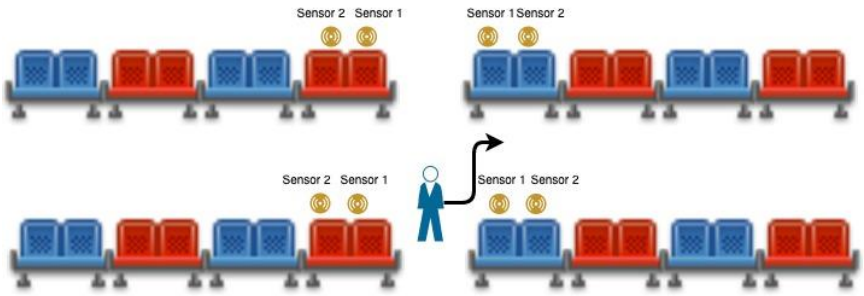


Specifications:

1. There are 2 IR proximity sensors present at the gate and at every row.

2. When a person passes through the sensors, the sensor gives a logic 1

3. If sensor 1 is triggered first, it is treated as an entry. If sensor 2 is triggered first, it is treated as an exit



Assumptions:

1. There is only one gate, through which both Entry and Exit occur.

2. When the people enter the room, they will occupy the rows in the order row1,row2,row3, and so on.

3. The maximum number of people who can sit in a row is 10.

4. We have a total of 6 rows

5. When people will be leaving the room, any person from any row may stand and go out of the room

6. Only one person can exit or enter, at a particular time.

7. When a person would be coming inside the room, he would simply come and sit and while leaving he would just stand up and go out, i.e., any person will not be making any transitions between rows inside the room.

Components Used and quantity:

1. Microprocessor 8086 -1

2. Decoder 74LS138 - 2

3. Programmable Peripheral Interface 8255A -1

4. Sensor - PIR Motion Detection Sensor Module [RKI-1370]

5. Octal Latch 74LS373 - 3

6. Bidirectional Buffer 74LS245 -2

7. Unidirectional Buffer 74LS244 - 1

8. Clock generator 8284A -1

9. ROM 2716 -4

10. RAM 6116 -2

11. AND 7408 - 2 ICs

12. OR 7432 - 1 IC

13. NOT 7404 -1 IC

14. LED common cathode configuration [TSSP530] - 4 per row; 24 total 17. 5V Battery (For Vcc)

Memory Organization:

The system uses 4KB of RAM and 8KB of ROM. RAM consists of two 2K chips and ROM consists of 4K chips. They are organized into odd and even bank to facilitate both byte and word size data transfers.

Read Only Memory (2732): Starting Address: 00000h, Ending Address: 01FFFh

Random Access Memory (6116): Starting Address: 02000h, Ending Address: 02FFFh

I/O Interfacing: (Using I/O mapped I/O)

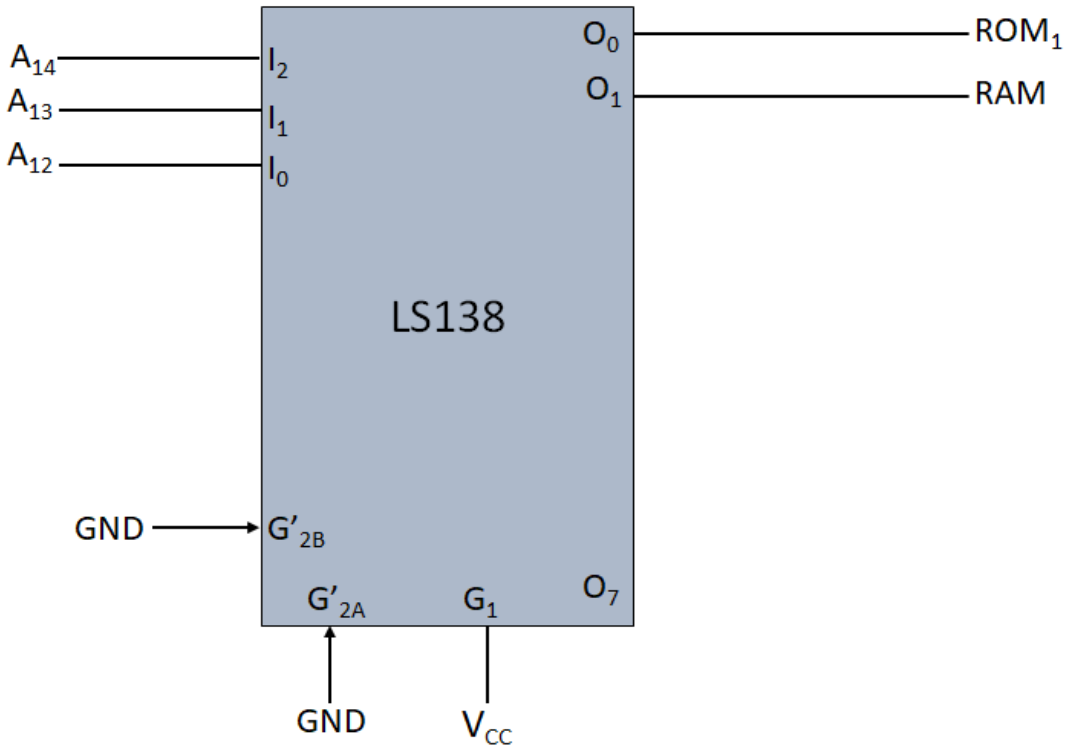
Mapping of 8255:

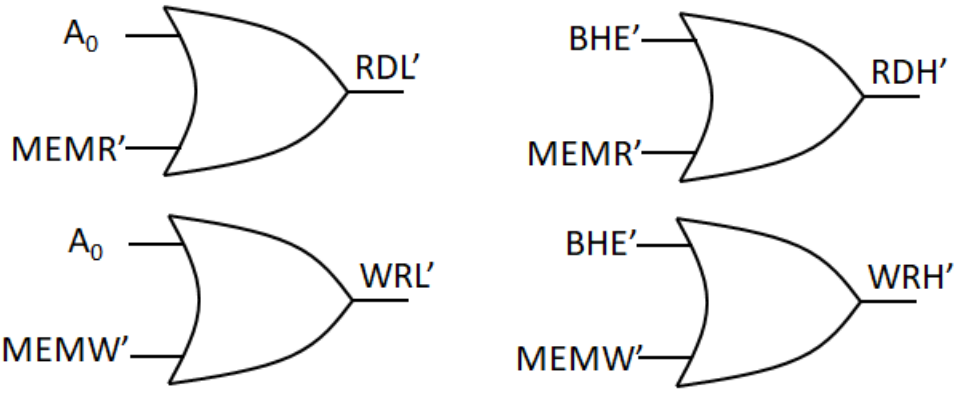
Port A: 00h (Input from sensors) Port B: 02h (Input from sensors) Port C: 04h (Output to LED) Control Register: 06h

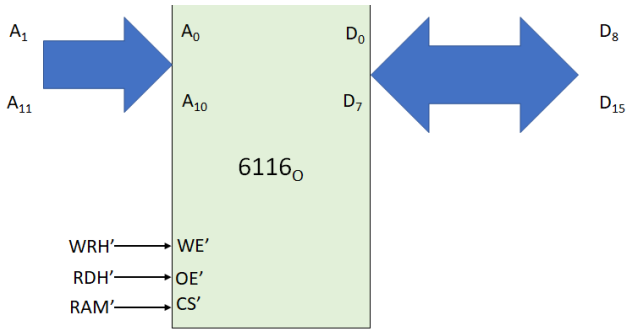
Hardware Circuit

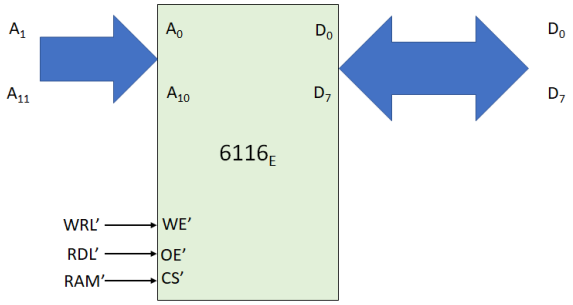
Memory Interfacing

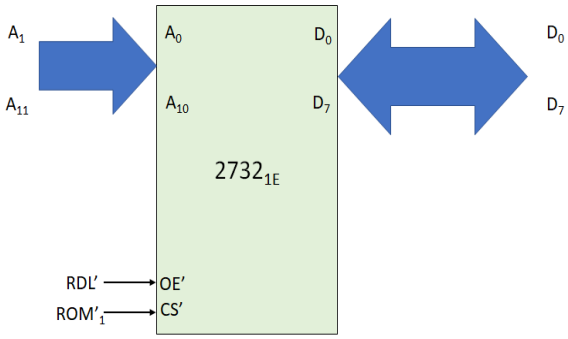
LS138

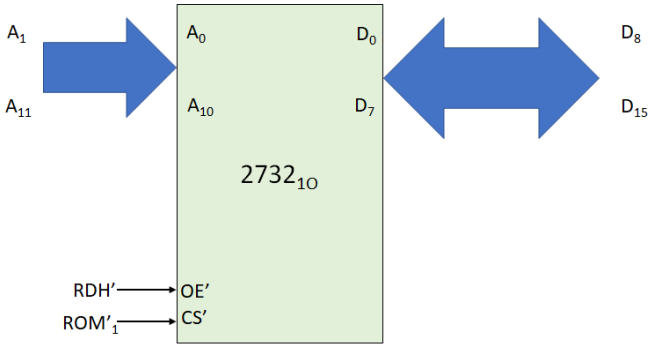




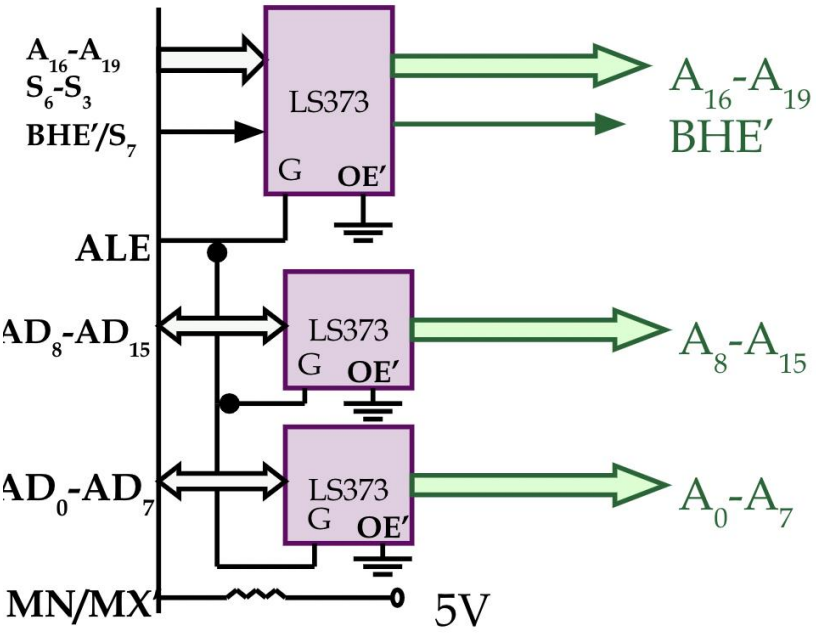

A1
A11
A0
A10
6116O
D0
D7
D8
D15
WRH'
RDH'
RAM'
WE'
OE'
CS'


A1
A11
A0
A10
6116E
D0
D7
D0
D7
WRL'
RDL'
RAM'
WE'
OE'
CS'

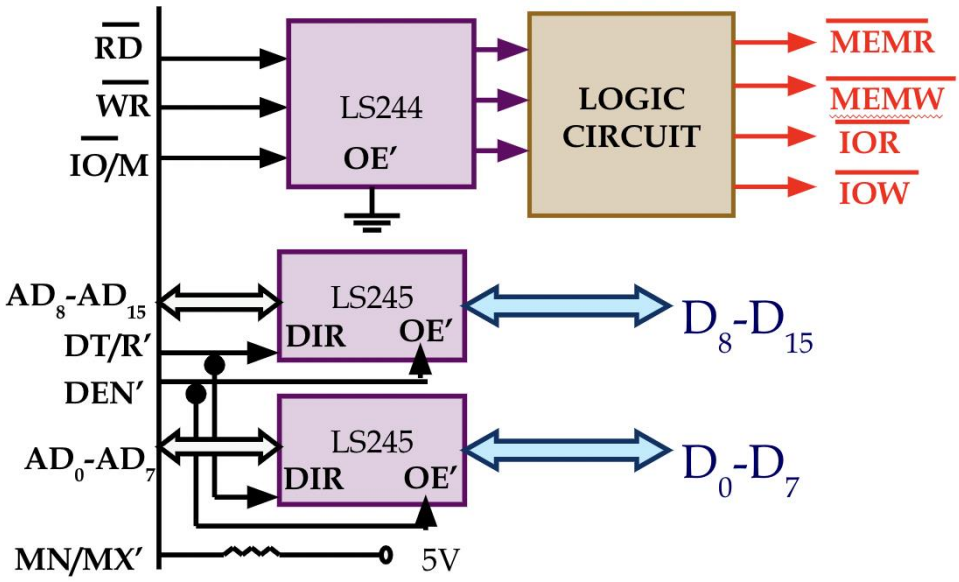

A1
A11
A0
A10
27321E
D0
D7
D0
D7
RDL'
ROM'1
OE'
CS'


A1
A11
A0
A10
27321O
D0
D7
D8
D15
RDH'
ROM'1
OE'
CS'

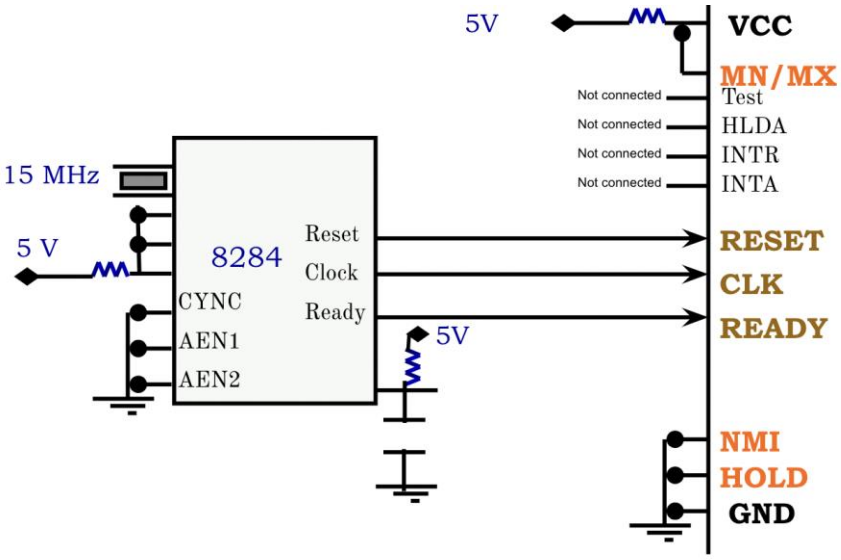
2)8086 System bus (Address)



3) System Bus of 8086 (data+control)

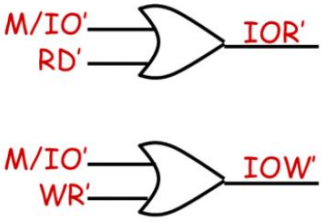


4) 8086 Inputs

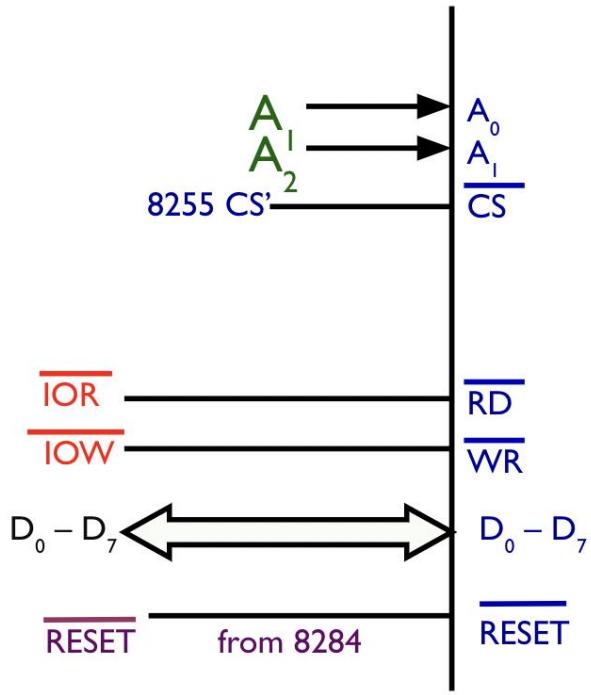


5) Logic circuit

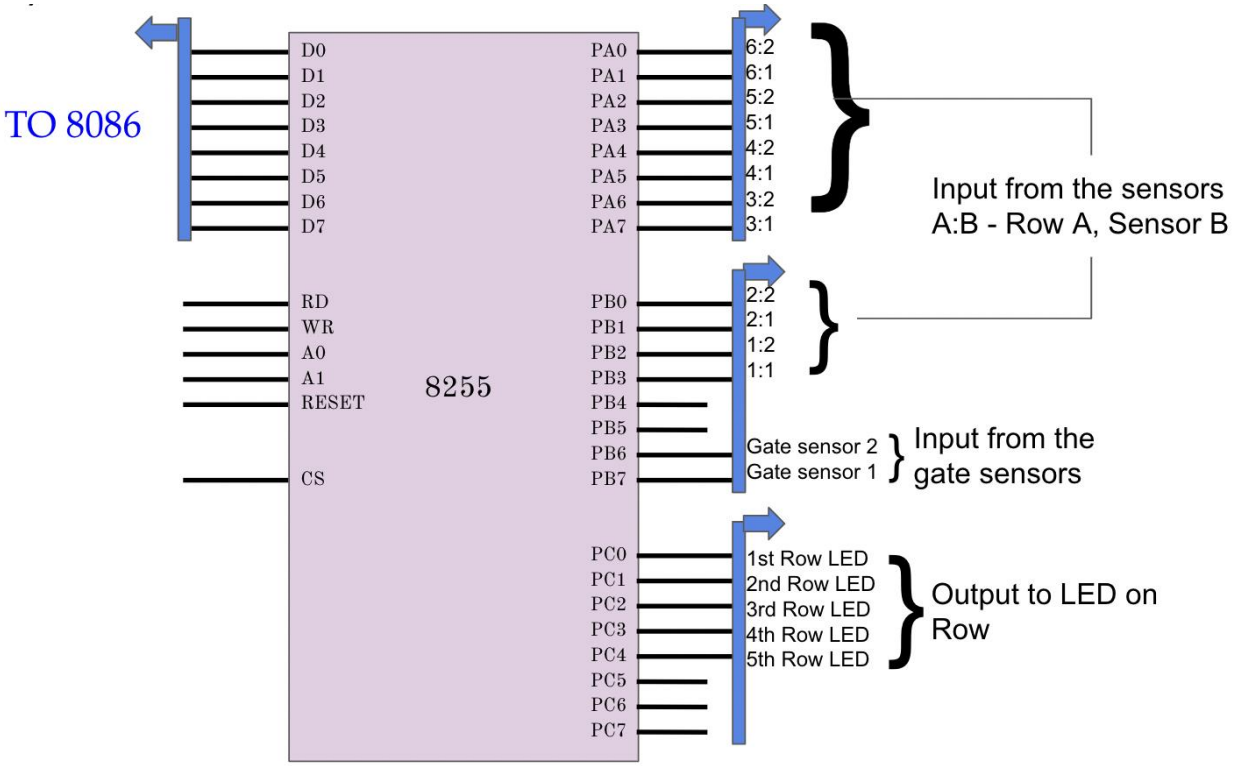
M / IO'	RD'	WR'	Bus Cycle
1	0	1	MEMR'
1	1	0	MEMW'
0	0	1	IOR'
0	1	0	IOW'



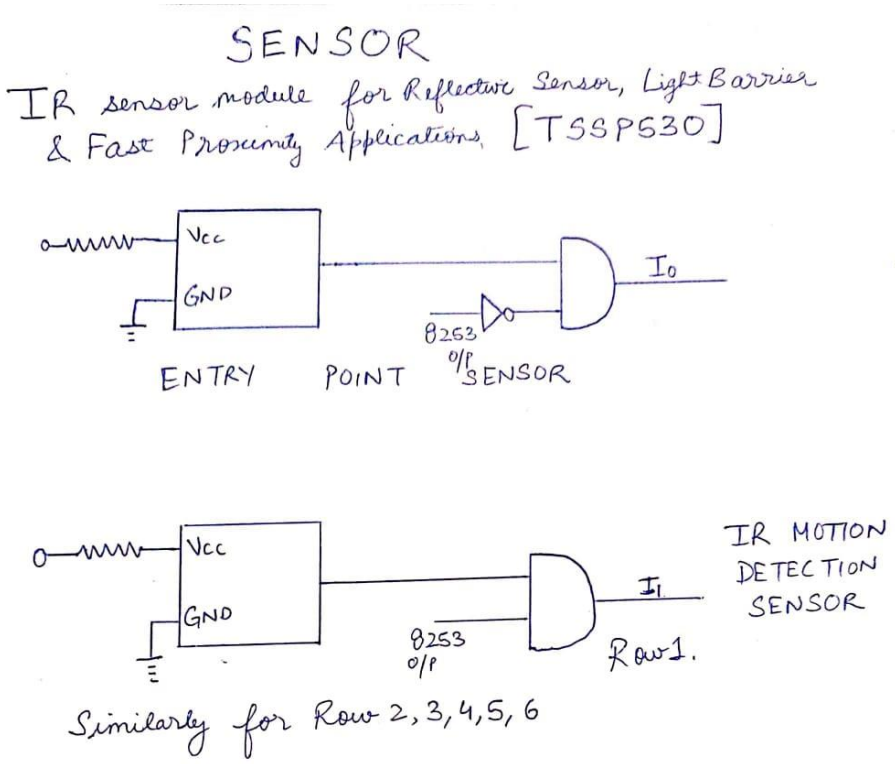
6) 8255 Interfacing to the processor



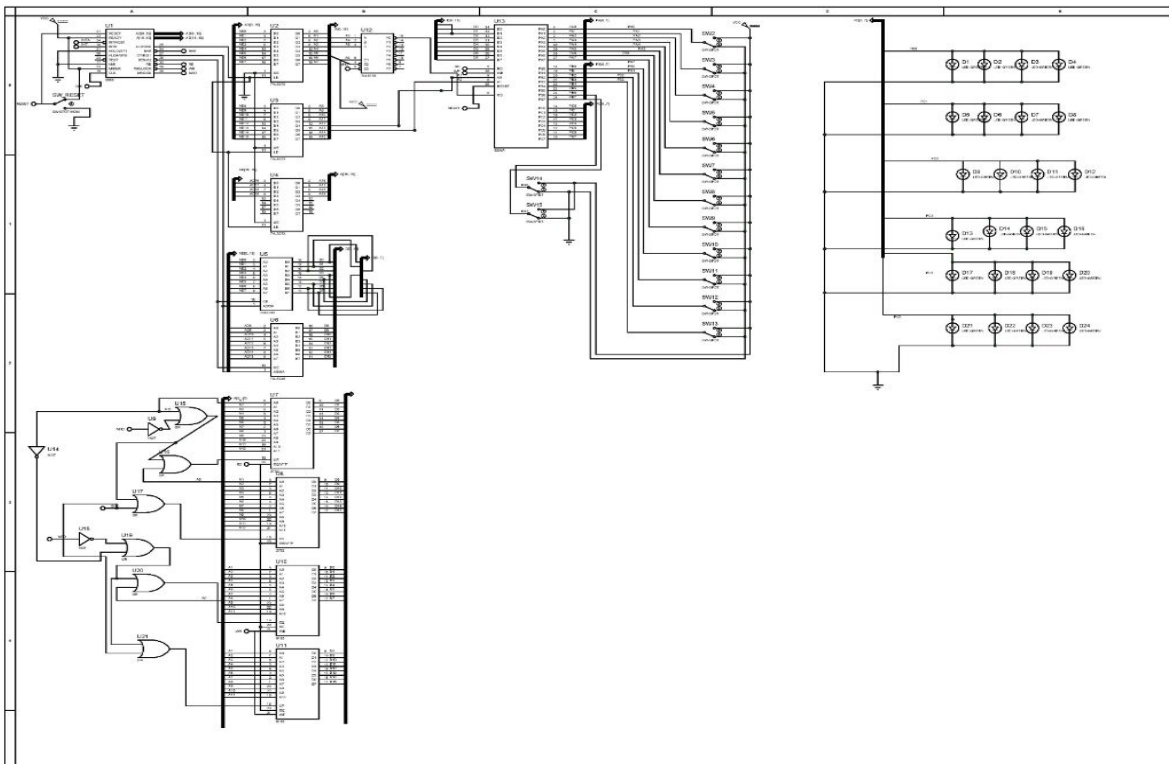
7) 8255 Logic



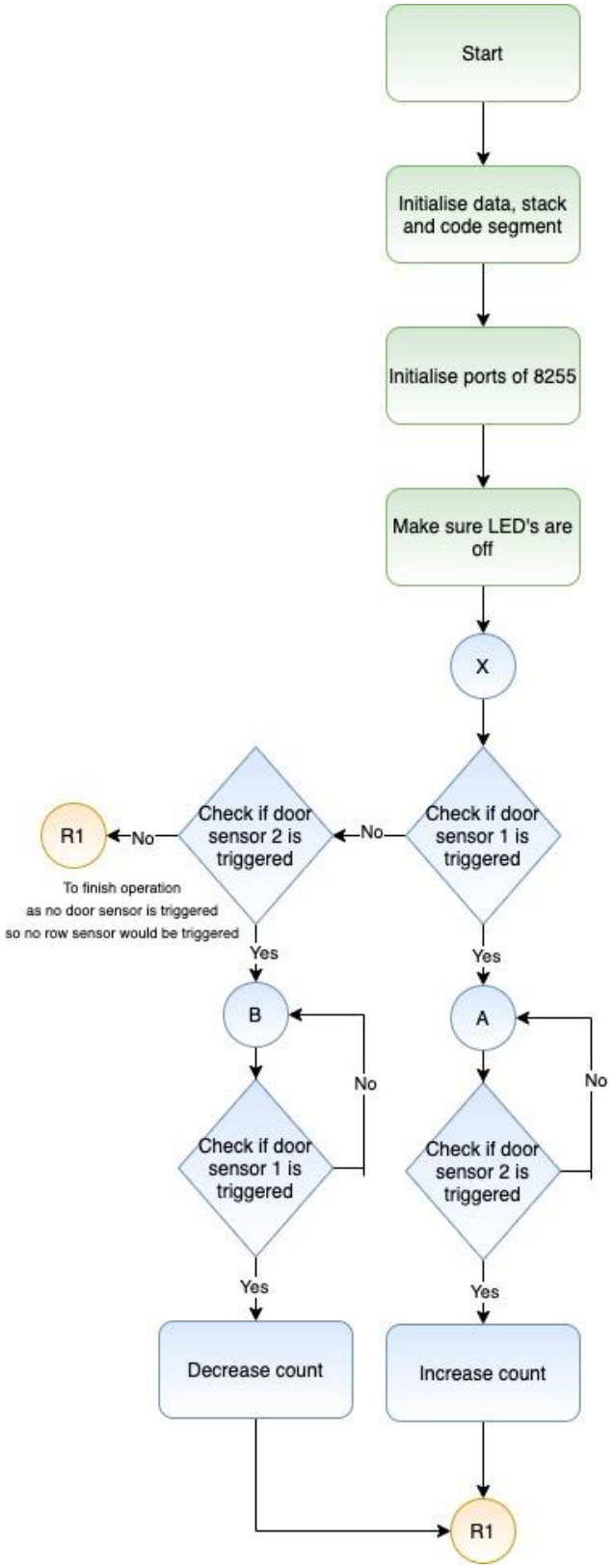
8) Sensor Diagram

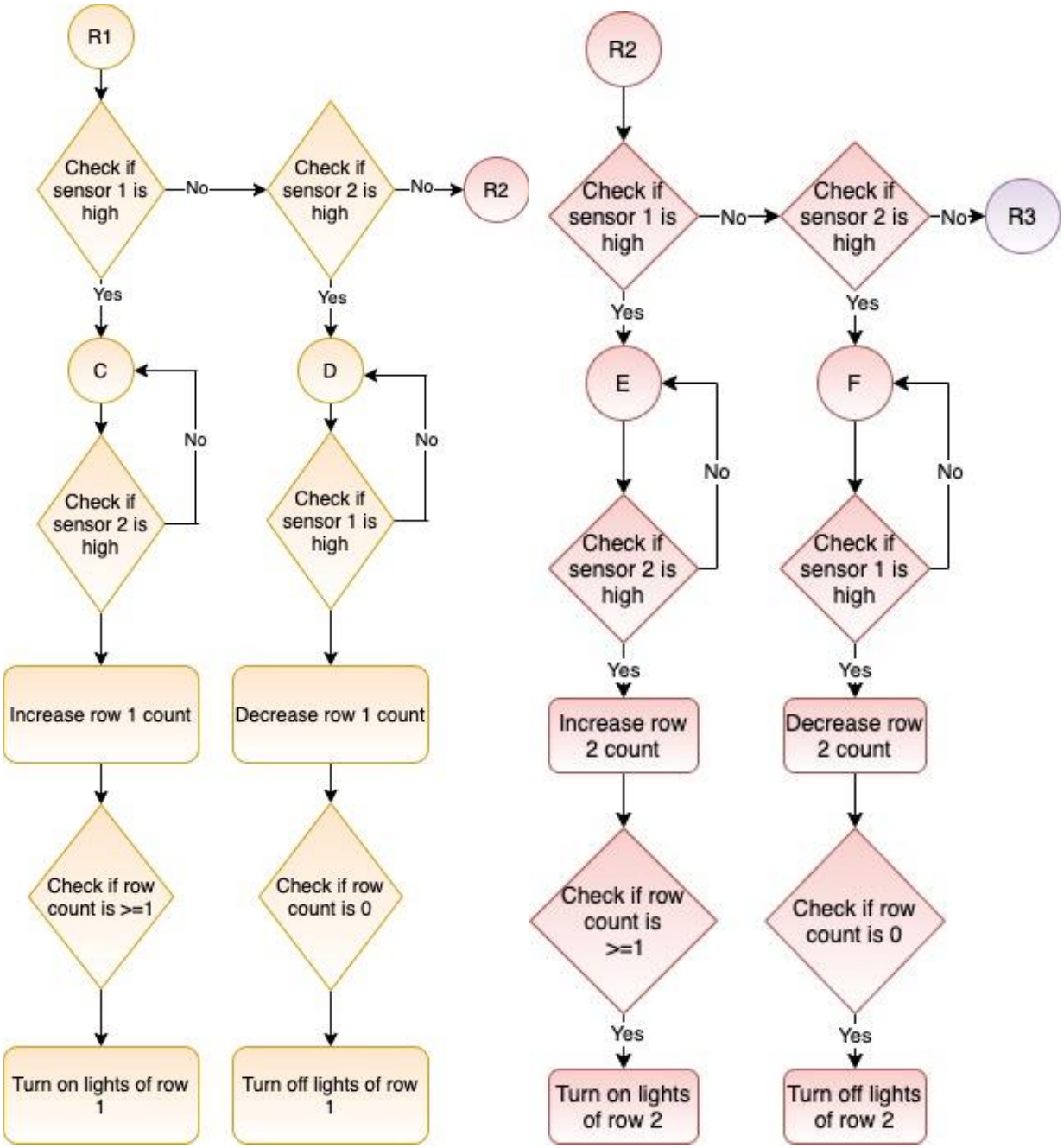


Circuit diagram



Flowchart


Start
Initialise data, stack and code segment
Initialise ports of 8255
Make sure LED's are off
X
Check if door sensor 1 is triggered
No
Check if door sensor 2 is triggered
No
R1
To finish operation as no door sensor is triggered so no row sensor would be triggered
Yes
Yes
A
B
No
No
Check if door sensor 2 is triggered
Check if door sensor 1 is triggered
Yes
Yes
Increase count
Decrease count
R1



Checking the Row sensors here

Similar flowchart to check for Row 3, Row 4, Row 5, and Row 6. After this, we restart execution and check from the beginning once the door sensor is triggered again.

Variations in Proteus implementation with justification:

1. IR sensors are modeled as switches due to the absence of an IR sensor library in Proteus.
2. Simulating a person walking through is done by turning the switches on and off immediately
3. Delay called after sensor1 at the door and every row (for entry) to give time for the person to trigger both sensors

Attachments:

Manuals:

The IR Sensor Module for Reflective Sensor, Light Barrier, and Fast Proximity Applications [TSSP530...]

- Used for Person or object vicinity activation and Fast proximity sensors.
- Supply voltage: 2.5 V to 5.5 V
- Suitable for fast (~ 5 ms) proximity sensor applications for ranges between 10 cm and 2 m

Design:

Attached in the zip as G48.dsn

Code:

Attached in the zip file as g48.asm

Binary file after assembly:

Attached as G48.bin