Birla Institute of Technology and Science, Pilani

A REPORT

ON

Smart Lighting System (Group 4 – Problem 13)

2018A7PS0112G Bhavyam Kamal
2018A7PS0686G Pranav Pateriya
2018A7PS0173G Nitish Silswal
2018A7PS0117G Aditya Mishra
2018A7PS0535G Saubhagya Shukla

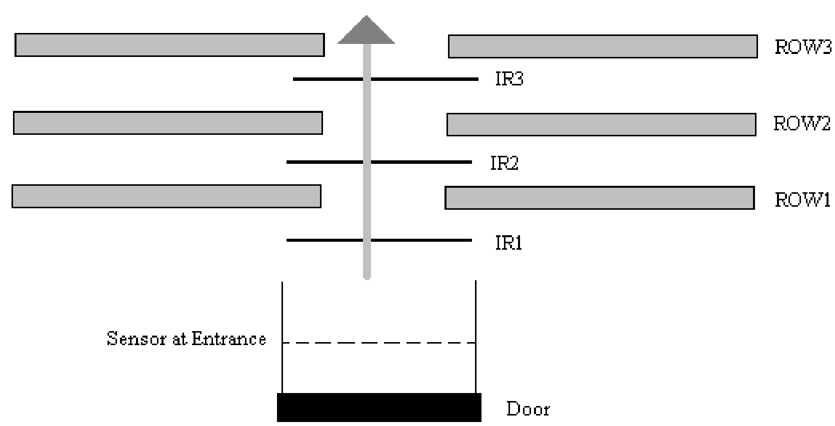
INDEX

PROBLEM STATEMENT

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 rows empties completely the light gets turned off. You
can assume there are atleast 5 rows. Entry to the auditorium is restricted to a certain point of time. Exit can be at any point of time.

System Details:



HARDWARE DEVICES

CHIP NUMBER	CHIP	QUANTITY REQUIRED	USE
8086	Microprocessor	1	Central Processing Unit
6116	RAM 2K	2	Random access memory which contains DS,SS
2732	ROM 4K	2	Read only memory which contains entire code (CS)
74LS373	8 Bit Latch	3	To latch address bus
74LS245	8 Bit Buffer	2	To buffer data bus (bidirectional)
74LS138	3:8 Decoder	1	Used for select signals
8255	Programmable Peripheral Interface	1	Input and Output ports
8284	Clock Timer	1	For stable clock signal
LED	Common Cathode Configuration	20	For lighting

MAPPING

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

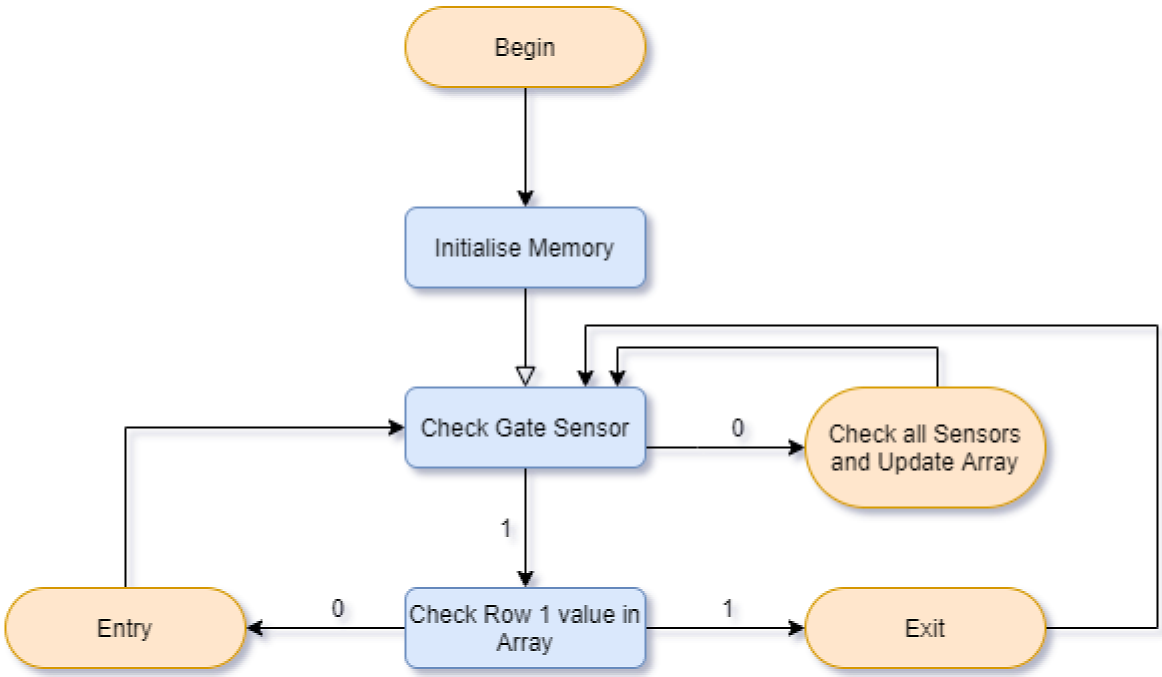
Random Access Memory (6116): Starting Address: 02000h, Ending Address: 02FFFh

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

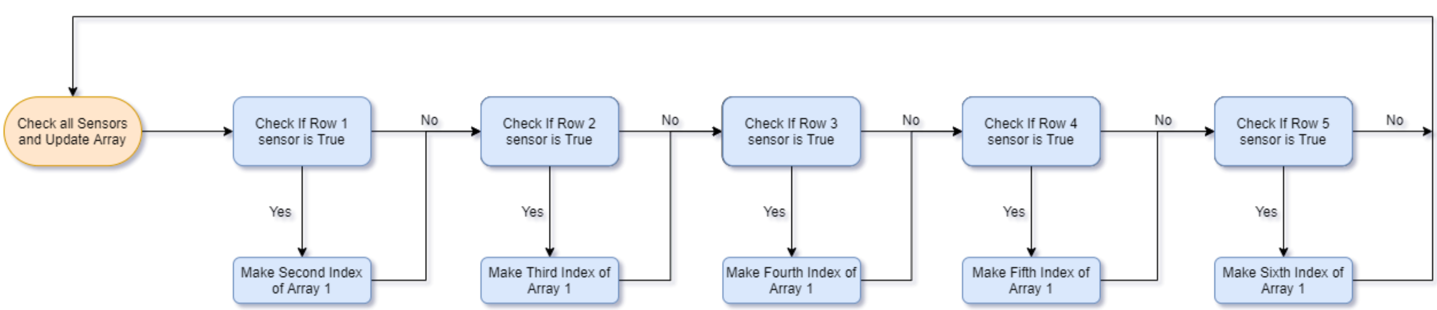
I/O Mapping:

8255-0 Port	Address	Usage
Port A	00000H	Input from Sensors
Port B	00002H	Not Used
Port C	00004H	Output to LEDs
CWR	00006H	Control Register

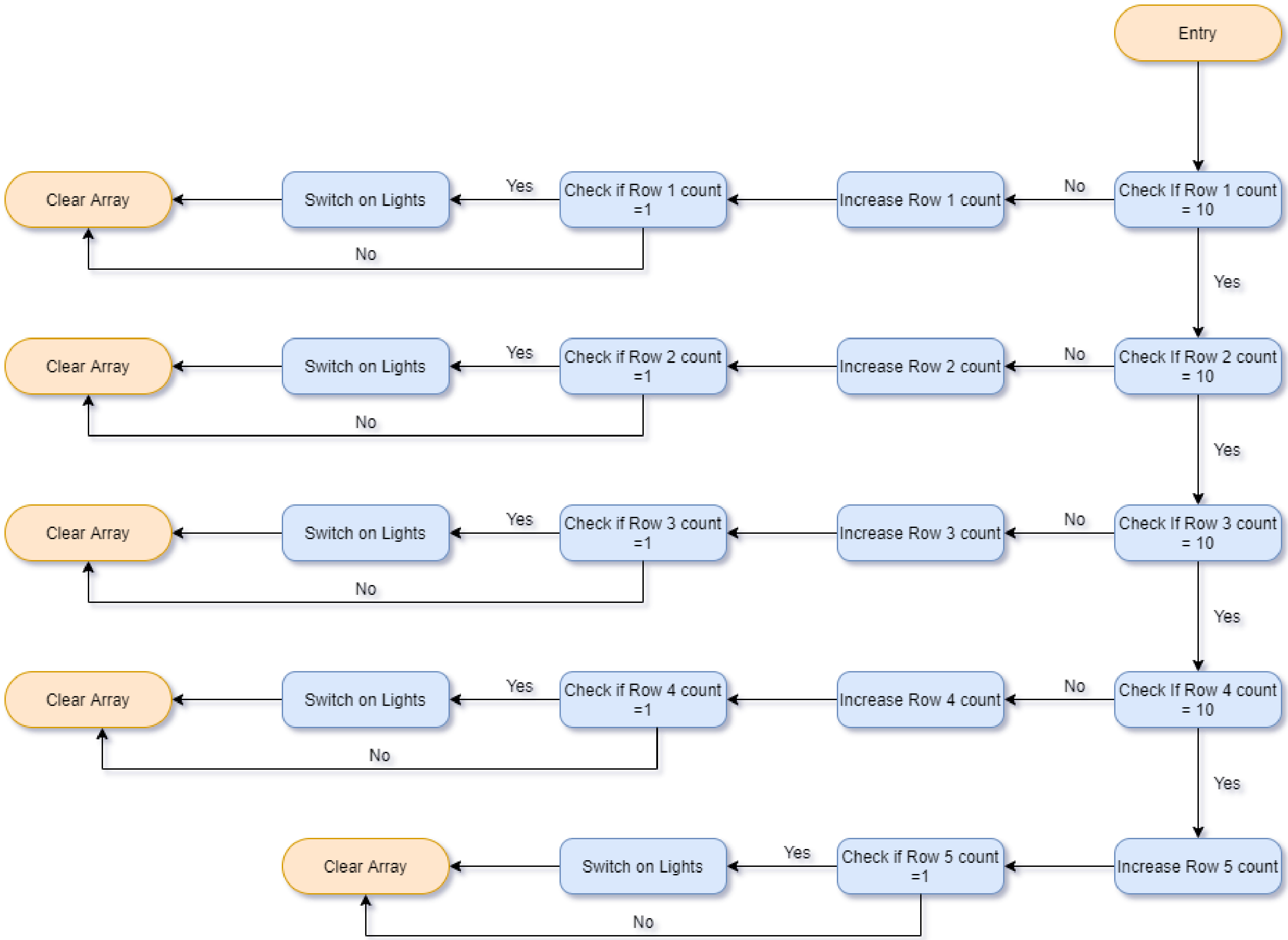
FLOWCHART

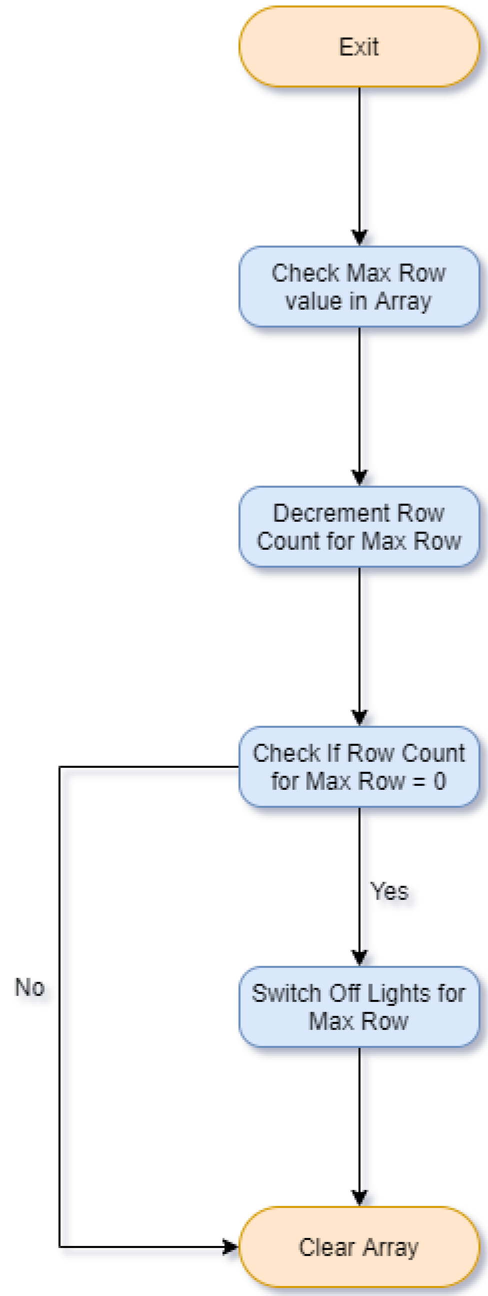


Begin
Initialise Memory
Check Gate Sensor
0
Check all Sensors and Update Array
1
Entry
0
Check Row 1 value in Array
1
Exit



Check all Sensors and Update Array
Check If Row 1 sensor is True
No
Yes
Make Second Index of Array 1
Check If Row 2 sensor is True
No
Yes
Make Third Index of Array 1
Check If Row 3 sensor is True
No
Yes
Make Fourth Index of Array 1
Check If Row 4 sensor is True
No
Yes
Make Fifth Index of Array 1
Check If Row 5 sensor is True
No
Yes
Make Sixth Index of Array 1


Entry
Check If Row 1 count = 10
No
Increase Row 1 count
Check if Row 1 count =1
Yes
Switch on Lights
Clear Array
No
Yes
Check If Row 2 count = 10
No
Increase Row 2 count
Check if Row 2 count =1
Yes
Switch on Lights
Clear Array
No
Yes
Check If Row 3 count = 10
No
Increase Row 3 count
Check if Row 3 count =1
Yes
Switch on Lights
Clear Array
No
Yes
Check If Row 4 count = 10
No
Increase Row 4 count
Check if Row 4 count =1
Yes
Switch on Lights
Clear Array
No
Yes
Increase Row 5 count
Check if Row 5 count =1
Yes
Switch on Lights
Clear Array
No


Exit
Check Max Row value in Array
Decrement Row Count for Max Row
Check If Row Count for Max Row = 0
Yes
No
Switch Off Lights for Max Row
Clear Array

CODE

```
;MAIN PROGRAM
COUNTER DW 00H
RCOUNTER DB 00H,00H,00H,00H,00H,00H ;Maintains an array of which sensors have been activated till gate sensor is activated
LSTATUS DB 0                                ;Maintains a status of lights
MAXROW DB 00H                                      ;Max # of the row that was pressed during exit
SEATS DB 00H,00H,00H,00H,00H,00H       ;Individual Row Count for all rows

;8255-0
PORTA0 EQU 00H
PORTB0 EQU 02H
PORTC0 EQU 04H
COMMAND_ADDRESS0 EQU 06H

JMP   ST1
DB    1001 DUP(0)

ST1:
; INTIALIZE DS, ES,SS TO START OF RAM
MOV     AX,02000H
MOV     DS,AX
MOV     ES,AX
MOV     SS,AX
MOV     SP,02FFEH

;intialise porta  as input & b& c as output
     mov     al,00110110b
     out     0eh,al
     mov     al,4
     out     08h,al
     mov     al,0
     out     08h,al
```

```
	mov	al,90h
			out			06h,al

MOV SEATS,00H
MOV SEATS+1,00H
MOV SEATS+2,00H
MOV SEATS+3,00H
MOV SEATS+4,00H
MOV RCOUNTER,00H
MOV RCOUNTER+1,00H
MOV RCOUNTER+2,00H
MOV RCOUNTER+3,00H
MOV RCOUNTER+4,00H
MOV RCOUNTER+5,00H
MOV LSTATUS,00H
MOV MAXROW,00H
;;CHECK FOR ENTRY THROUGH GATE
X1: IN AL,00H
   AND AL,80H
   CMP AL,80H
   JNE X2

        JMP X7                          ; X7 is the sequence where gate emits code 1 aka it is interrupted



;; this is the code for the Check all sensors and update array part of code
        ;;CHECK FOR Sensor Interrupt IN ROW1
        X2: IN AL,00H
                AND AL,40H
                CMP AL,40H
                JNE X3
```

```
        MOV CX, 0D000h
        W3:
                NOP
                NOP
                NOP
                NOP
                NOP
        LOOP W3

        ADD RCOUNTER+1,1
        CMP RCOUNTER+1,0
        JE  X1
        CMP RCOUNTER+2,0
        JNE X1

        MOV MAXROW,1

;;CHECK FOR Sensor Interrupt IN ROW2
X3: IN AL,00H
        AND AL,20H
        CMP AL,20H
        JNE X4

        MOV CX, 0D000h
        W4:
                NOP
                NOP
                NOP
                NOP
                NOP
        LOOP W4
```

```
        ADD RCOUNTER+2,1
        CMP RCOUNTER+2,0
        JE  X1
        CMP RCOUNTER+3,0
        JNE X1

        MOV MAXROW,2

;;CHECK FOR Sensor Interrupt IN ROW3
X4: IN AL,00H
        AND AL,10H
        CMP AL,10H
        JNZ X5

        MOV CX, 0D000h
        W5:
                NOP
                NOP
                NOP
                NOP
                NOP
        LOOP W5

        ADD RCOUNTER+3,1
        CMP RCOUNTER+3,0
        JE  X1
        CMP RCOUNTER+4,0
        JNE X1

        MOV MAXROW,3
```

```
;;CHECK FOR Sensor Interrupt IN ROW4
X5: IN AL,00H
        AND AL,08H
        CMP AL,08H
        JNE X6

        MOV CX, 0D000h
        W6:
                NOP
                NOP
                NOP
                NOP
                NOP
        LOOP W6

        ADD RCOUNTER+4,1
        CMP RCOUNTER+4,0
        JE  X1
        CMP RCOUNTER+5,0
        JNE X1

        MOV MAXROW,4

;;CHECK FOR Sensor Interrupt IN ROW5
X6: IN AL,00H
        AND AL,04H
        CMP AL,04H
        JNE X1                          ; X1 is the sequence that checks the gate

        MOV CX, 0D000h
        W7:
                NOP
```

```
                NOP
                NOP
                NOP
                NOP
        LOOP W7

        ADD RCOUNTER+5,1
        CMP RCOUNTER+5,0
        JE      X1

        MOV MAXROW,5

        JMP X1


;; Check row 1 array value
X7: MOV RCOUNTER,1
    CMP RCOUNTER+1,1
    JE Y1                           ; Y1 is the sequence for exit

    JMP Z1                          ; Z1 is the sequence for entry


;; Entry Sequence
    ;; Check if Row1 count is 10
    Z1:     CMP SEATS,10
            JNE Z2

    ;; Check if Row2 count is 10
    Z3: CMP SEATS+1,10
            JNE Z4
```

```
;; Check if Row3 count is 10
Z5: CMP SEATS+2,10
        JNE Z6

;; Check if Row4 count is 10
Z7: CMP SEATS+3,10
        JNE Z8

;; Increment Row 5
Z9: SUB RCOUNTER+1,1
        SUB RCOUNTER+2,1
        SUB RCOUNTER+3,1
        SUB RCOUNTER+4,1
        ADD SEATS+4,1
        CMP SEATS+4,0
        JLE C2                          ;C2 is the sequence that clears the array RCOUNTER's gate value

        MOV AL,LSTATUS              ;Load current status of lights into al so they dont get changed
        MOV BL,00001000b            ;Make sure the light in 5th row is on by or with current status
        OR  AL,BL
        OUT 04H, AL                     ;Output now condition to port C
        MOV LSTATUS,AL              ;Update current status of lights

        JMP C2

Z2: SUB RCOUNTER+1,1
        ADD SEATS,1
        CMP SEATS,0
        JLE C2                          ;C2 is the sequence that clears the array RCOUNTER's gate value

        MOV AL,LSTATUS              ;Load current status of lights into al so they dont get changed
        MOV BL,10000000b                ;Make sure the light in 1st row is on by or with current status
```

```
        OR  AL,BL
        OUT 04H, AL                         ;Output now condition to port C
        MOV LSTATUS,AL              ;Update current status of lights

        JMP C2

Z4:     SUB RCOUNTER+1,1
        SUB RCOUNTER+2,1
        ADD SEATS+1,1
        CMP SEATS+1,0
        JLE C2                              ;C2 is the sequence that clears the array RCOUNTER's gate value

        MOV AL,LSTATUS              ;Load current status of lights into al so they dont get changed
        MOV BL,01000000b            ;Make sure the light in 2nd row is on by or with current status
        OR  AL,BL
        OUT 04H, AL                         ;Output now condition to port C
        MOV LSTATUS,AL              ;Update current status of lights

        JMP C2

Z6:     SUB RCOUNTER+1,1
        SUB RCOUNTER+2,1
        SUB RCOUNTER+3,1
        ADD SEATS+2,1
        CMP SEATS+2,0
        JLE C2                              ;C2 is the sequence that clears the array RCOUNTER's gate value

        MOV AL,LSTATUS              ;Load current status of lights into al so they dont get changed
        MOV BL,00100000b            ;Make sure the light in 3rd row is on by or with current status
        OR  AL,BL
        OUT 04H, AL                         ;Output now condition to port C
        MOV LSTATUS,AL              ;Update current status of lights
```

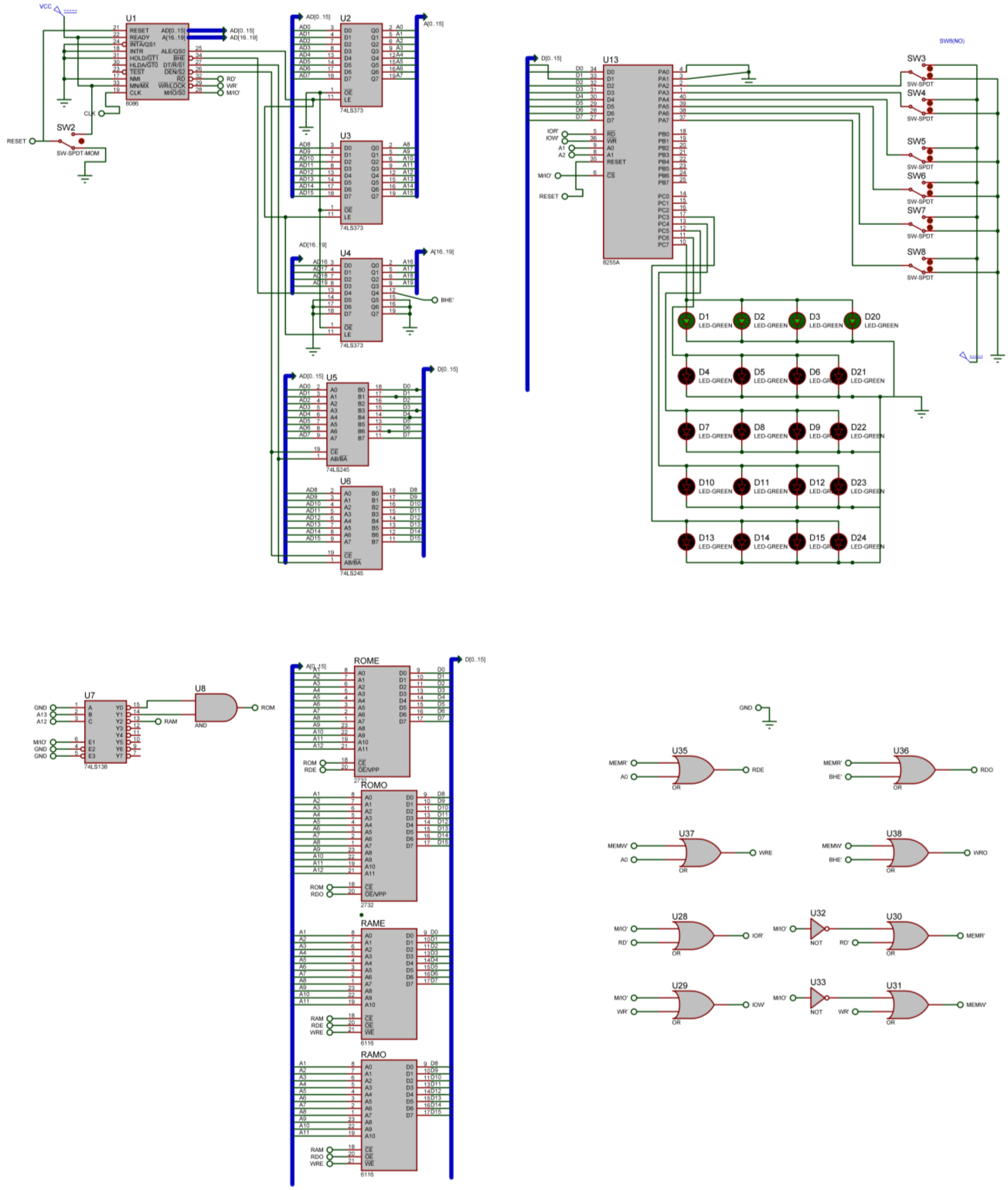
```
        JMP C2

    Z8: SUB RCOUNTER+1,1
        SUB RCOUNTER+2,1
        SUB RCOUNTER+3,1
        SUB RCOUNTER+4,1
        ADD SEATS+3,1
        CMP SEATS+3,0
        JLE C2                          ;C2 is the sequence that clears the array RCOUNTER's gate value

        MOV AL,LSTATUS              ;Load current status of lights into al so they dont get changed
        MOV BL,00010000b            ;Make sure the light in 4th row is on by or with current status
        OR  AL,BL
        OUT 04H, AL                     ;Output now condition to port C
        MOV LSTATUS,AL              ;Update current status of lights

        JMP C2


;; Clear Array
C1: MOV RCOUNTER,0
    MOV RCOUNTER+1,00h
    MOV RCOUNTER+2,00h
    MOV RCOUNTER+3,00h
    MOV RCOUNTER+4,00h
    MOV RCOUNTER+5,00h
    MOV MAXROW,00h
  MOV CX, 0D000h
  W2:
    NOP
    NOP
```

```
    NOP
    NOP
    NOP
  LOOP W2
        JMP X1


C2: MOV RCOUNTER,0
        MOV MAXROW,00h

  MOV CX, 0D000h
  W1:
    NOP
    NOP
    NOP
    NOP
    NOP
  LOOP W1
        JMP X1


;;Exit Sequence
        ;; Decrement the row count for max row value
        Y1:     CMP MAXROW,1                        ;Check MaxRow Value
                JNE Y2

                SUB SEATS,1                         ;Subtract Row Count of MaxRow
                CMP SEATS,0                         ;Check If the count has become 0
                JNE C1

                MOV AL,LSTATUS                      ;Load Current state of Lights in AL
                MOV BL,01111111b                            ;conserve all values except row LEDs
```

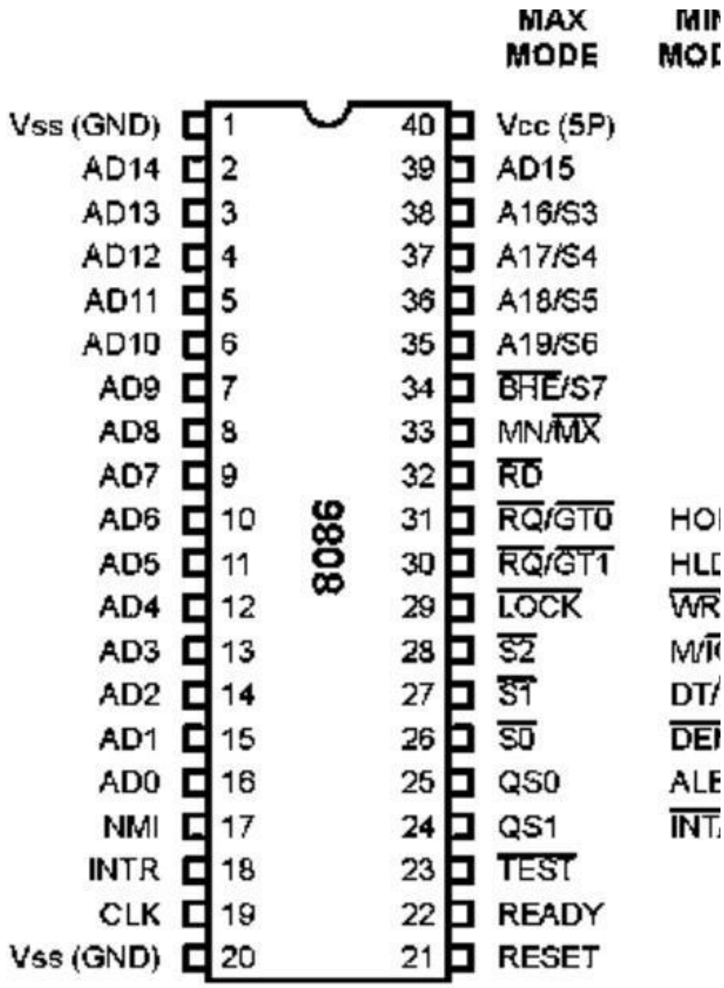
```
        AND AL,BL
        OUT 04H,AL                          ;Output to port C
        MOV LSTATUS,AL                      ;Update status of Lights

        JMP C1

Y2: CMP MAXROW,2
        JNE Y3

        SUB SEATS+1,1
        CMP SEATS+1,0
        JNE C1

        MOV AL,LSTATUS
        MOV BL,10111111b
        AND AL,BL
        OUT 04H,AL
        MOV LSTATUS,AL

        JMP C1

Y3: CMP MAXROW,3
        JNE Y4

        SUB SEATS+2,1
        CMP SEATS+2,0
        JNE C1

        MOV AL,LSTATUS
        MOV BL,11011111b
        AND AL,BL
        OUT 04H,AL
```

```
        MOV LSTATUS,AL

        JMP C1

Y4: CMP MAXROW,4
        JNE Y5

        SUB SEATS+3,1
        CMP SEATS+3,0
        JNE C1

        MOV AL,LSTATUS
        MOV BL,11101111b
        AND AL,BL
        OUT 04H,AL
        MOV LSTATUS,AL

        JMP C1

Y5:     SUB SEATS+4,1
        CMP SEATS+4,0
        JNE C1

        MOV AL,LSTATUS
        MOV BL,11110111b
        AND AL,BL
        OUT 04H,AL
        MOV LSTATUS,AL

        JMP C1
```

CIRCUIT DIAGRAM



REFERENCES



PIR SENSOR

The PIR (Passive Infra-Red) Sensor is a pyroelectric device that detects motion by sensing changes in the infrared (radiant heat) levels emitted by surrounding objects. This motion can be detected by checking for a sudden change in the surrounding IR pattern. When motion is detected the PIR sensor outputs a high signal on its output pin. This logic signal can be read by a microcontroller or used to drive an external load. PDF Documentation Attached