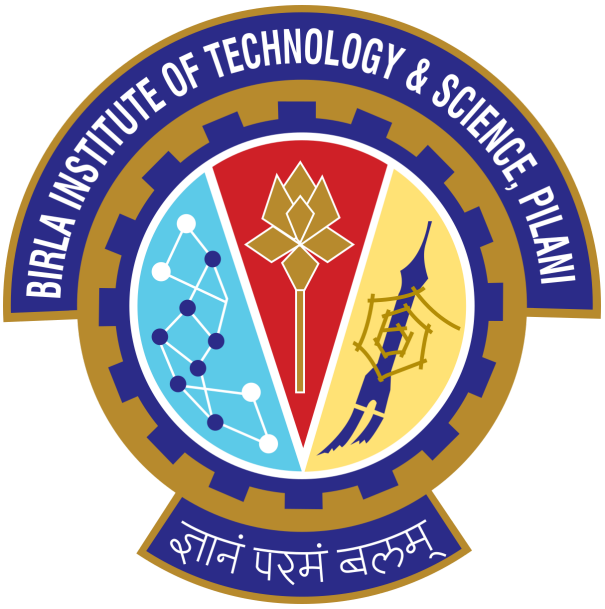
Smart Garage System



Design Assignment

Problem Number 19
Group 19

In partial fulfillment of the requirements of CS/EEE/ECE/INSTR F241,
Microprocessors, Programming and Interfacing

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(Manuals Attached at the end)

Problem Statement

Smart Garage System.

System Requirements

- The capacity of the garage is 2000 cars.
- System is used in underground parking lot of a hotel.
- Each user of the garage has a remote unit which he can use for opening and closing the garage door.
- Remote unit has only a single button.
- User is allowed to retrieve the car at any point of time
- A LCD Display is available indicating the number of cars in the garage.
- System runs from a standard power inlet available in the garage.
- When the number of cars reaches 2000, the LCD displays ”FULL”
- When there are no cars, the LCD displays “EMPTY”

System Specifications

- Remote unit button toggles the condition of the garage door- i.e. if the door is opened it is closed and vice versa.
- The remote unit is used for short distances only.
- A DC motor is used for opening and closing the door – The motor is a 50V -3 A motor.
- Maximum frequency input to the motor system cannot exceed 100 KHz.
- The system should be able to distinguish between a person and a car.
- A switch is available that can be closed only by the weight of a car.
- System is used in the hotel- so you can assume that a valet parking system is followed – this indicates that only one person leaves the garage after the car is parked and only a single person enters the garage to retrieve the car
- The system also has to distinguish between entry and exit. You have to develop a scheme to distinguish between entry and exit of person/car. [Hint: Use any number of IR sensor pairs as required]
- Whether a car enters or a valet enters the door remains open for a period of five minutes
- The door can close after 5 Minutes or when the valet uses the remote.
- The remote can be used inside as well as outside the garage.

Justifications:

1. 2 IR sensors are used to determine whether a car is entering or exiting the garage in order to maintain the count.

Assumptions:

1. When the system boots up the garage is empty.
2. The garage door is in closed position initially
3. The vehicle must halt for a few seconds while triggering both the IR sensors for the weight triggered switch to toggle.

Components Used

Chip Number/Details	Components	Purpose/Use	Quantity Used
8086	Microprocessor	It is the main processor and is used to control all the other devices in the system	1
8284 with crystal	Clock generator	It generates the clock signal for the 8086 and other clock-based devices in the system	1
8255	Programmable Peripheral Interface (PPI)	Acts as an interface between i/o devices and 8086	2
8259	Programmable Interrupt controller	8259 Interrupt Controller is designed to transfer the interrupt with highest priority to the CPU, along with interrupt address information.	1
8253	Programmable Interval Timer	Used for generating timer and providing PWM input to motor controller	1
2716	ROM Chips	ROM Chip is required to read memory.	4
6116	RAM chips	RAM chip used for stack and temporary storage of data.	2
LS138	3:8 Decoder	Used as an I/O decoder and Memory Decoder during I/O and memory mapping	2
LS373	Octal Latch	Used to de-multiplex and latch the Address Bus of the 8086	3
LS244	Octal 3-state buffer	Used to latch the Control Bus of the 8086	1
LS245	Bi-Directional Buffer (8 Bit)	Used to de-multiplex and latch the Data Bus of the 8086	2
QEE113	Plastic Infrared Light Emitting Diode	Used for detection of car entering/exiting	2

TSSP94038	IR Sensor module	Used for detecting IR beams from IRED	2
ST-TX01-ASK	Transmitter module	Used for transmitting radio frequencies in remote control	1
ST-RX02-ASK	Receiver module	Used for receiving radio frequencies in remote control	1
HT12D	Decoder	Decodes the data received by the RF Receiver	1
HT12E	Encoder	Encodes the data from the button and sends it to the RF Transmitter	1
JHD162A	LCD panel	Used for displaying the number of cars in the garage, present along with the display of ‘FULL’ and ‘EMPTY’.	1
50V 3A DC Motor	Available	Used to open/close the garage door	1
Weight Triggered Switch	Available	The switch gives HIGH output when triggered by the weight of a car and gives LOW output otherwise.	1
L298N	H-Bridge Motor Driver	Used to control operation and direction of the DC Motor	1

Address Map

Memory map

ROM1-07000H to 07FFFH
RAM1-08000H to 08FFFH
ROM2-09000H to 09FFFH

A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	Address	Memory
0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	7000H	
0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	7FFFH	ROM1
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8000H	
0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	8FFFFH	RAM1
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	9000H	
0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	9FFFFH	ROM2

Address lines A14-A12 can be used to decide the memory as seen in the figure above

I/O Map

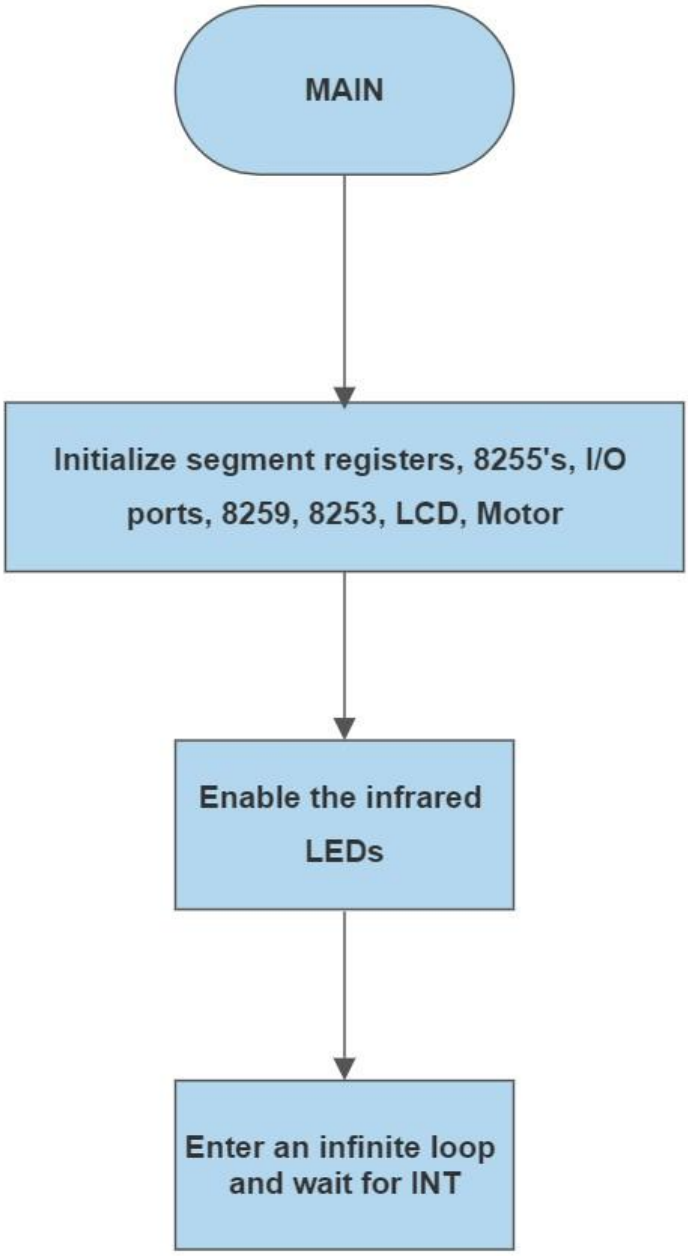
8255 - 80H to 86H
8255 - 88H to 8EH
8259 - 98H to 9AH
8253 - 90H to 96H

A7	A6	A5	A4	A3	A2	A1	A0	Address	Memory
1	0	0	0	0	0	0	0	80H	
1	0	0	0	0	1	1	0	86H	8255(1)
1	0	0	0	1	0	0	0	88H	
1	0	0	0	1	1	0	0	8EH	8255(2)
1	0	0	1	0	0	0	0	90H	
1	0	0	1	0	1	1	0	96H	8253
1	0	0	1	1	0	0	0	98H	
1	0	0	1	1	0	1	0	9AH	8259

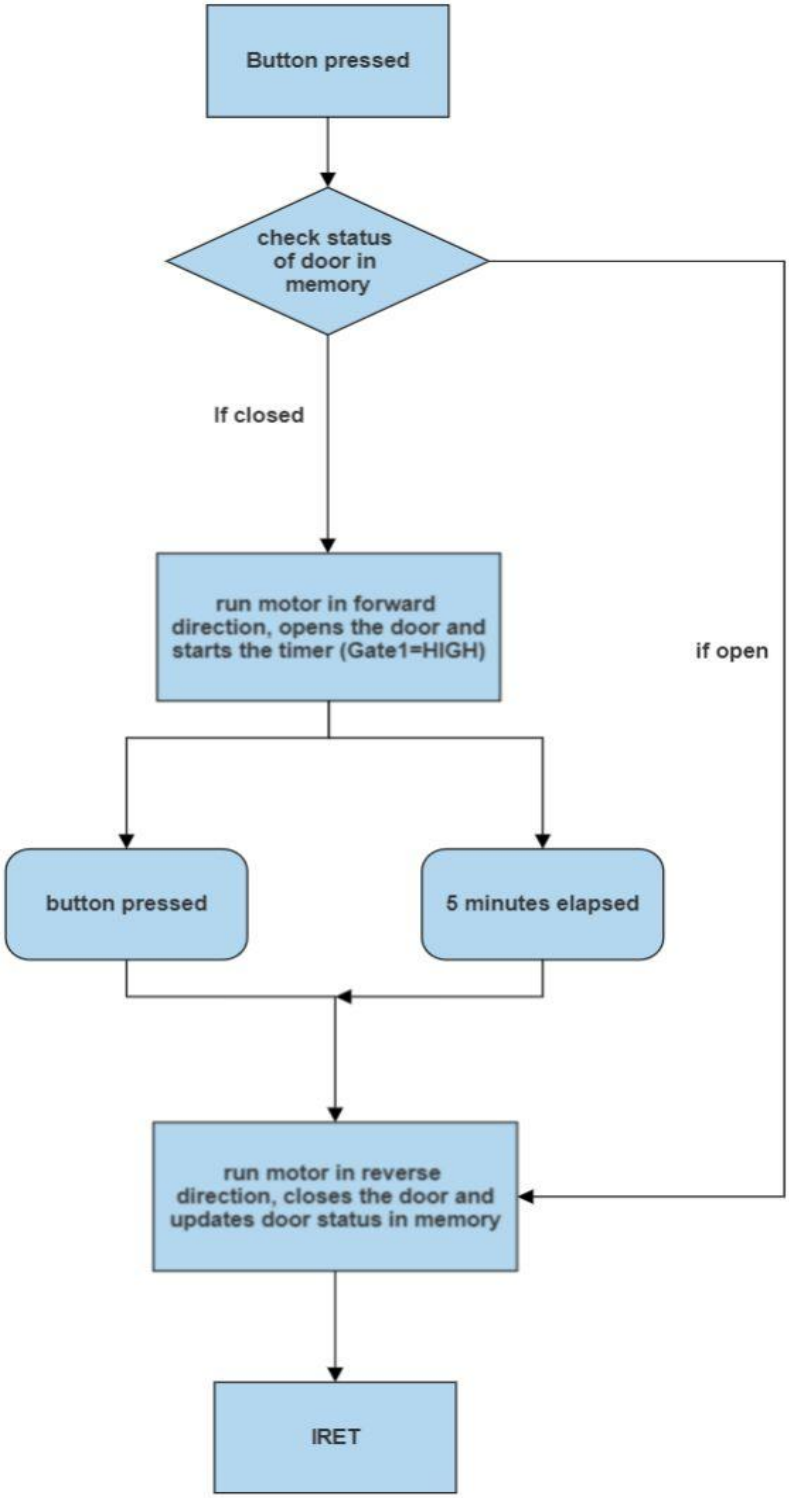
Address lines A5-A3 can be used to decide the peripheral device as seen in the figure above.

Flow Chart

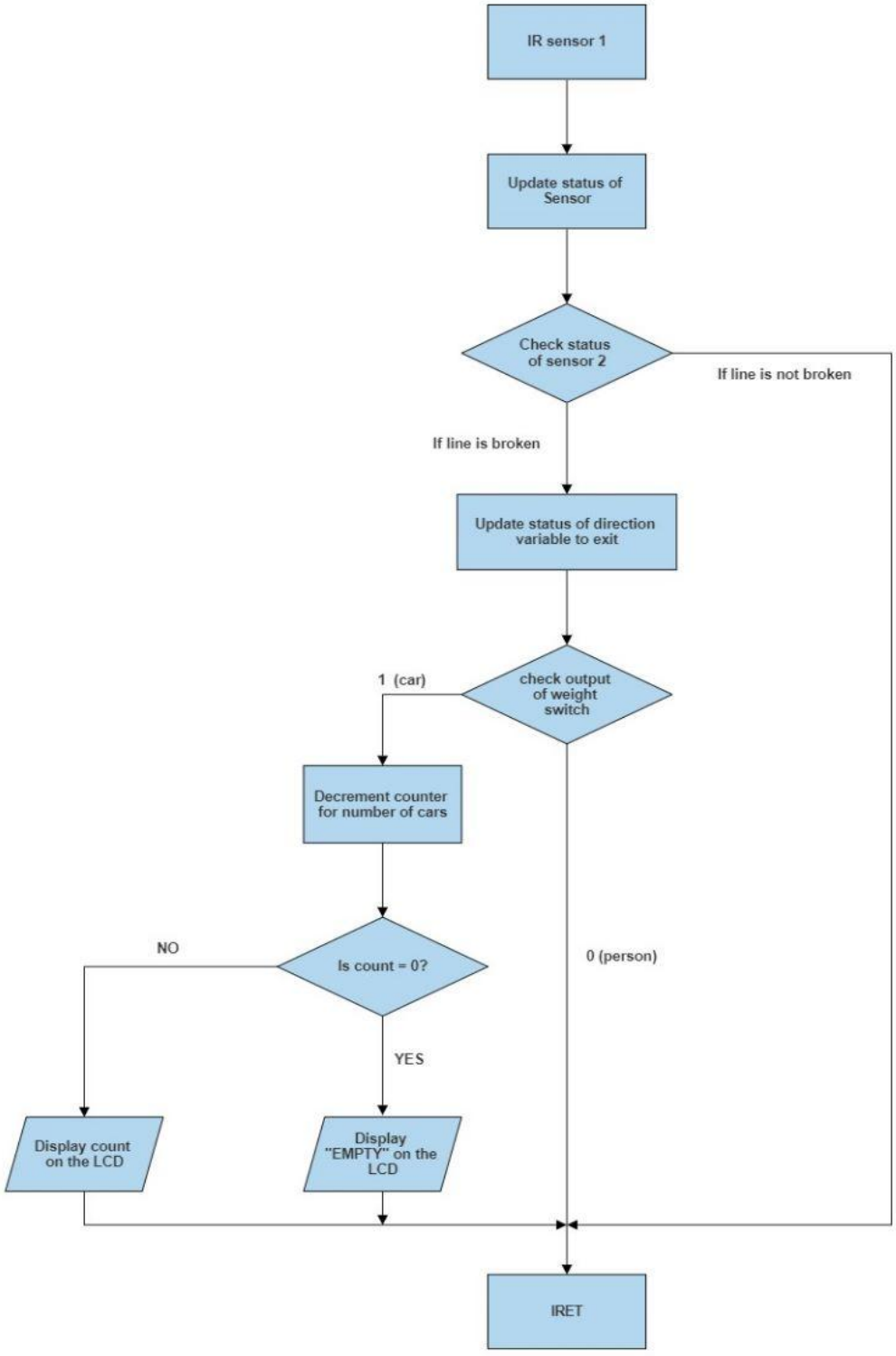
Main Program



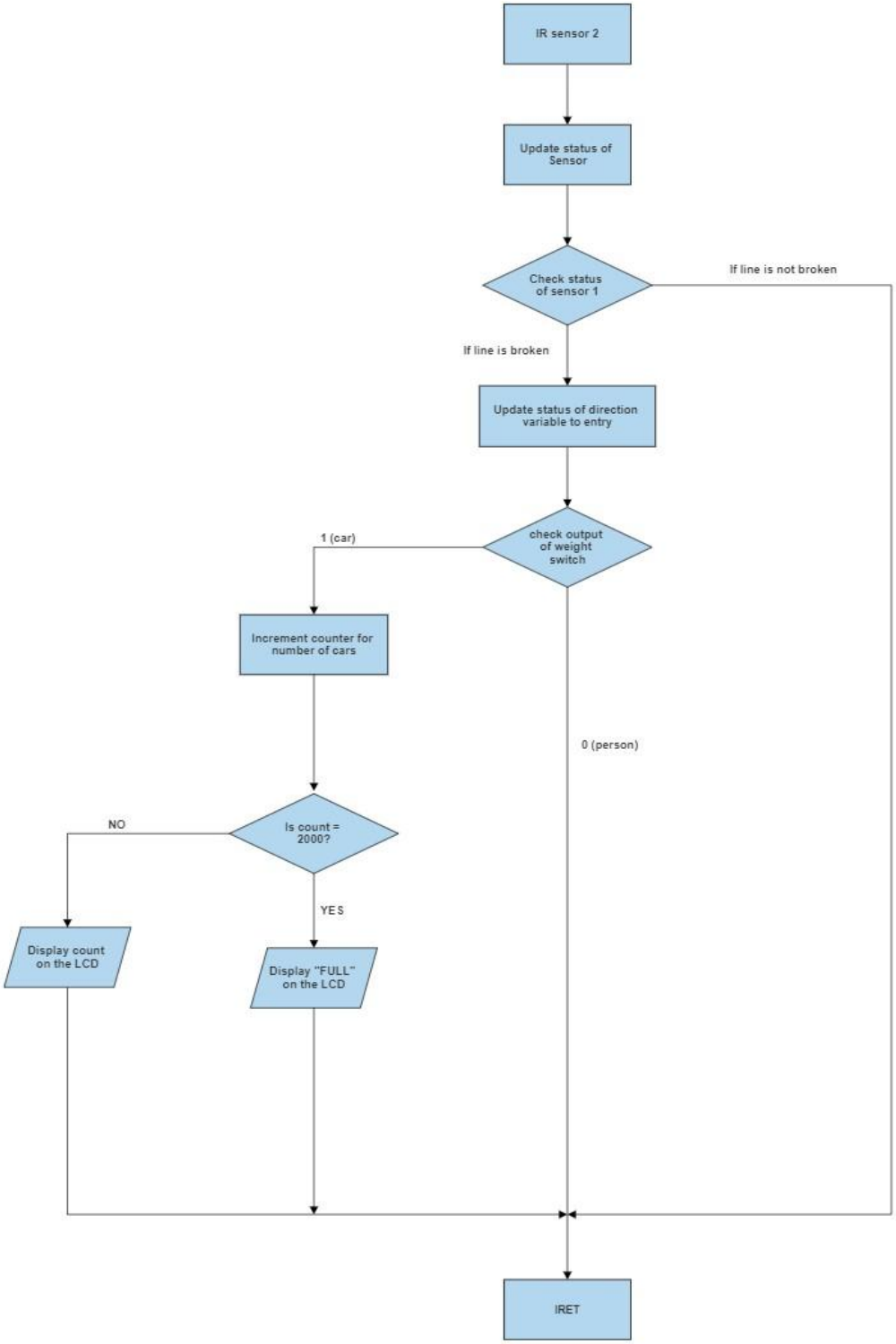
ISR for Button press



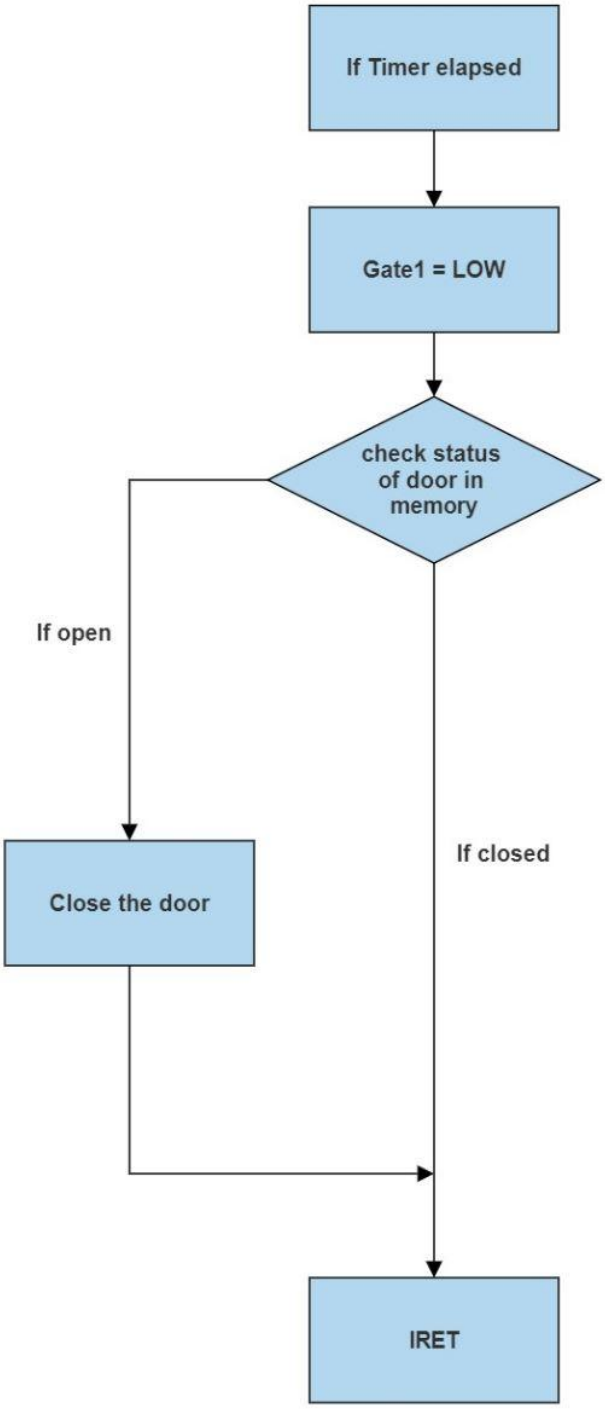
ISR for IR sensor 1



ISR for IR sensor 2



ISR for Timer



References and Sources

Lecture slides for the following components

- 8086
- 8253
- 8255
- 8259
- 8284
- 2716
- 6116
- LS138
- LS373
- LS245
- LS244

Manuals of the following components

- JHD162A
- QEE113 IRED
- TSSP94038 IR Sensor
- HT12D RF Decoder
- HT12E RF Encoder
- ST-RX02-ASK RF Receiver Module
- ST-TX01-ASK RF Transmitter Module
- L298N

List of Attachments

1. Complete hardware design with labeling on a chart paper.
2. Manuals of
    a. JHD162A
    b. QEE113 IRED
    c. TSSP94038 IR Sensor
    d. HT12D RF Decoder
    e. HT12E RF Encoder
    f. ST-RX02-ASK RF Receiver Module
    g. ST-TX01-ASK RF Transmitter Module
    h. L298N