SMART GARAGE SYSTEM

Submitted by: Group 93

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Contents

User Requirements & Technical Specifications

The User Requirements are as follows:

- 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”

The Technical Specifications are as follows:

- 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 a person/car. 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.

Assumptions & Justifications

Justification

1. None made

Assumptions

1. A car will not enter if the garage is full.
2. At a time, only one car will pass through the door.
3. The garage door takes 5 seconds to completely open or close.
4. If the 5-minute timer finishes or if the remote is pressed, if a car is starting it’s entry or exit, the door will be closed.
5. While the car is crossing the door, the door cannot be closed by the remote or by the 5-minute timer.

6. The count of LCD will be updated only if the car completely enters or exits the door.
7. The weight switch (load cell) is triggered only by the weight of a car. (Active high)

Components used with justification wherever required

- 8086
- 8255 – 1 nos. Provides I/O port for the other devices
- 8253 – 1 nos. Creates clock signals for 8086 and peripheral devices
- 6116 – 2 nos. Smallest RAM chip available is 2 K and we need an odd and even bank. We need RAM for stack and temporary storage of data
- 2732 – 4 nos. EPROM (4 KB). Read Only Erasable Programmable memory to store the code
- Motor – 1 nos. To open and close garage door
- L293D – 1 nos. Motor Driver. Acts as current amplifier for motor
- LM020L – 1 nos. LCD Display. Displays car count
- 0021000 (C-1) – 1 nos. Toggles garage door
- Sen-2698 – 2 nos. IR sensor. To find if a car is leaving or entering the garage so as to change the count of cars appropriately
- LS 138 – 2 nos. decoders
- LS 373 – 3 nos.octal latches
- LS 245 – 2 nos. 8-bit Bi-directional buffer

Address Map

Memory Map

ROM1_Even -> 00000h-01FFEh
ROM1_Odd -> 00001h-01FFFh
RAM1_Even -> 02000h-02FFEh
RAM2_Odd -> 02001h-02FFFh
ROM2_Even -> FE000h-FFFFEh
ROM2_Odd -> FE000h-FFFFFh

I/O Map

8255
PORT A -> 00h
PORT B -> 02h
PORT C -> 04h
CONTROL REGISTER -> 06h

Timer
COUNTER1 -> 08h
COUNTER2 -> 0Ah
COUNTER3 -> 0Ch
CONTROL REGISTER -> Oeh

Timer 2

COUNTER 1 -> 10h
COUNTER 2 -> 12h
COUNTER 3 ->14h
CONTROL REGISTER->16h

Assignment of Input Ports

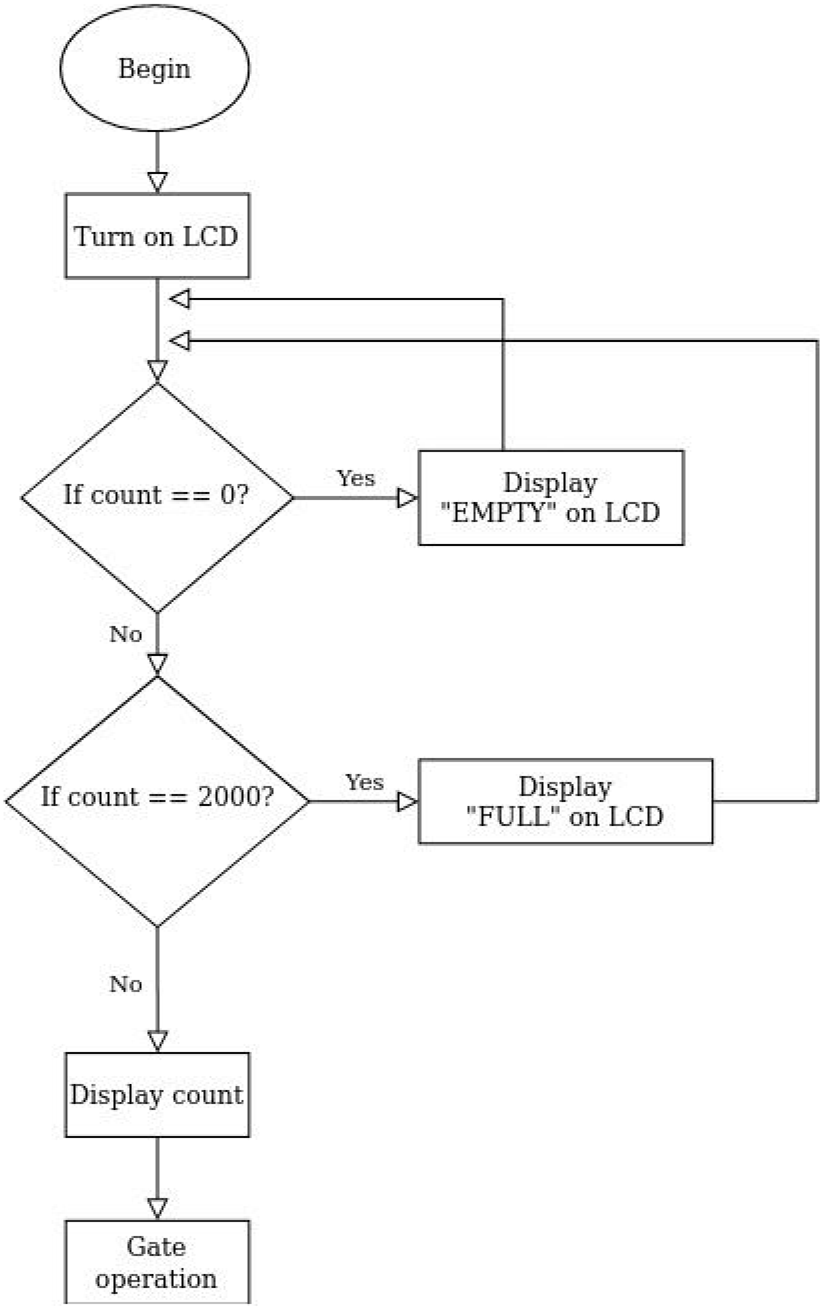
PA0->Remote Input
PA1->Outer_IR Input
PA2->Transducer(Weight Sensor)
PA3->Inner_IR Input
PA4->Remote Timer

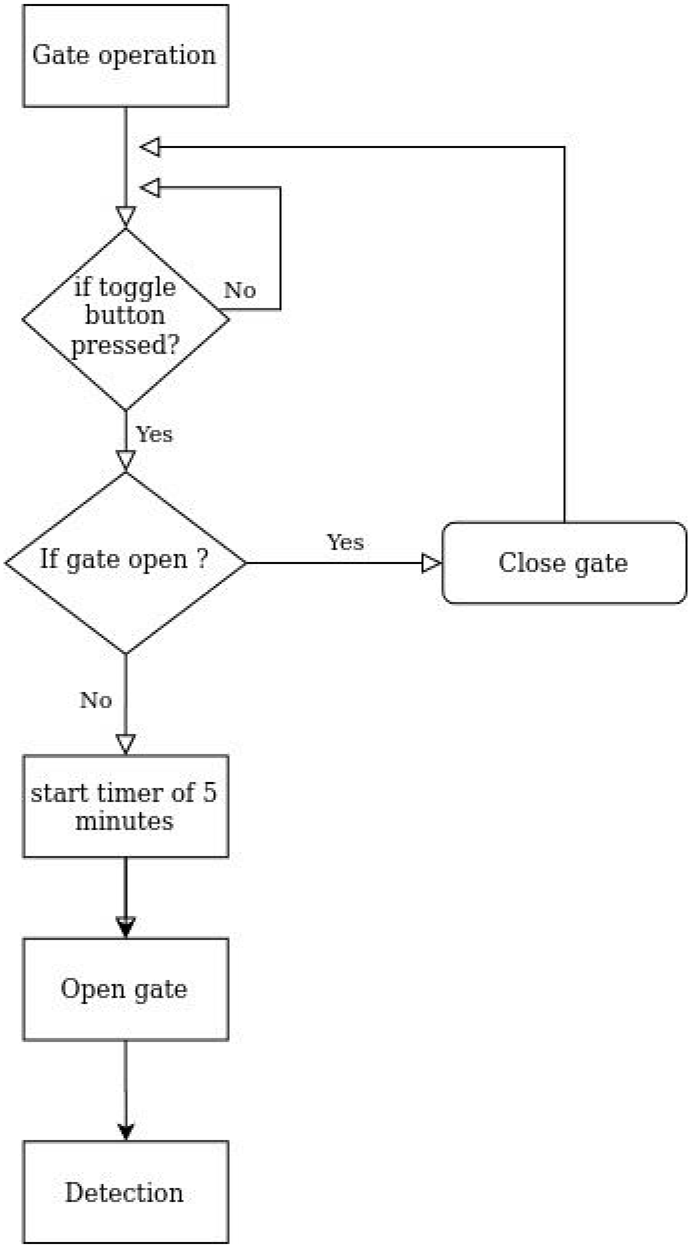
Design

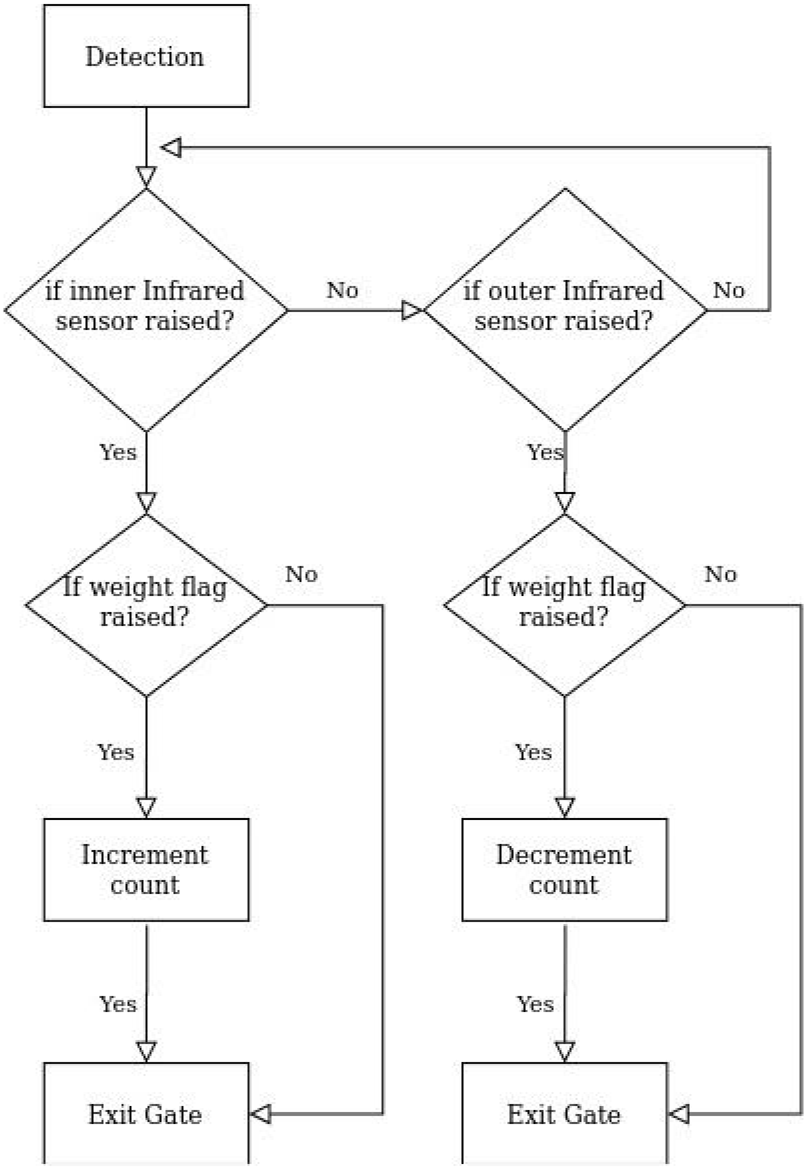
Complete design shown with proper labelling (design attached)

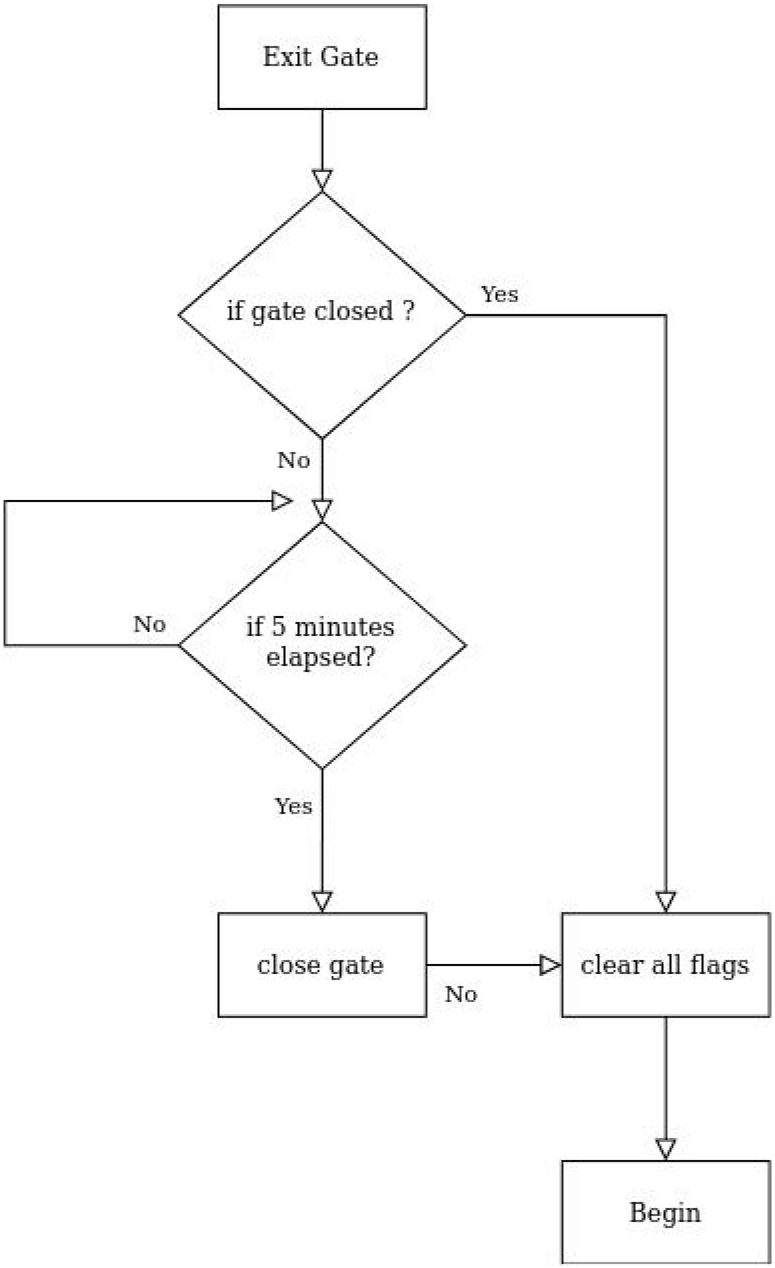
Flow Chart

Main Program




Gate operation
if toggle button pressed?
No
Yes
If gate open ?
Yes
Close gate
No
start timer of 5 minutes
Open gate
Detection


Detection
if inner Infrared sensor raised?
No
if outer Infrared sensor raised?
No
Yes
Yes
If weight flag raised?
No
If weight flag raised?
No
Yes
Yes
Increment count
Decrement count
Yes
Yes
Exit Gate
Exit Gate


Exit Gate
if gate closed ?
Yes
No
No
if 5 minutes elapsed?
Yes
close gate
No
clear all flags
Begin

Variations in Proteus Implementation with Justification

1. Using 8253 – as 8254 not available in Proteus.
2. 2732 is used as 2716 – not available in Proteus.
3. Switches used in place of IR(Infrared) sensors - as IR sensors not available in Proteus.
4. Switches used in place of Pressure transducer (for measuring weight) - as Pressure transducer sensors not available in Proteus.

Firmware

Implemented using emu8086 attached.

List of Attachments

1. Complete Hardware Real World Design – SmartGarage.pdf
2. Proteus 7 File – SmartGarage.dsn
3. Proteus 8 File - SmartGarage.pdsprj
4. EMU8086 ASM File – SmartGarage.asm
5. Binary File after assembly – SmartGarage.bin