A Report
On
A MICROPROCESSOR BASED SMART GARAGE SYSTEM
Hardware Design and ALP

Microprocessor Programming and Interfacing

Done By
Group No. 61 Project No. 20

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System to be designed: Smart Garage System

System Requirements:
- The capacity of the garage is 2000 cars.
- System is used in background parking lot 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, 3A motor.
- Maximum efficiency 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 no. of IR sensor pairs as required)
- Whether a car enters or a valet enters the door remains open for a period of 5min.
- The door can close after 5min or when the valet uses the remote.
- The remote can be used inside as well as outside the garage.

Assumptions:

- Minimum weight of a car is 650Kg and maximum weight is 2750Kg.
- No car or any person is standing below the door while it is closing.
- The door takes exactly 30 sec for closing and opening.
- Only one person or one car crosses the IR sensor at one time.
- When the system starts, the count in the garage is assumed to be zero.
- Second car enters or exit only after the first car has crossed both the sensors.
- Once the car or any person interrupts one sensor, it does not reiterate.

System Description:

Smart garage system keeps track of number of cars in the garage at any point of time. For knowing whether the car is entering or exiting the garage, the system uses 2 pairs of IR sensors and detectors, one placed on each side of the main entrance door. Depending on the sensor which is interrupted first, we can know whether the car is entering or exiting the garage and accordingly the counter is incremented or decremented. The count is displayed on the LCD screen. The door can be opened and closed by using a IR remote device provided to the user. The system also uses pressure transducers to distinguish between a car and any person entering the garage.

Hardware Description:

Name	Quantity
Intel 8086:Microprocessor (MPU)	1
Intel 8255:Programmable Peripheral interface device (PPI)	1
8253(Timer IC)	1
74LS373(Latch)	2
74LS245 (Bidirectional Buffer)	2
74LS138 (Decoder IC)	1
6116:2k RAM	2
2732:2k ROM	2
14TSSOP(OR gate IC)	3
7seg-common-anode	5
Switches	2
50V 3A Motor	1
L293D(Motor Driver)	1
ADC0808(Analog to Digital Converter)	1
7447(Decoder)	1
Not Gate	1

Flow Chart:

Flow chart for the given algorithm.
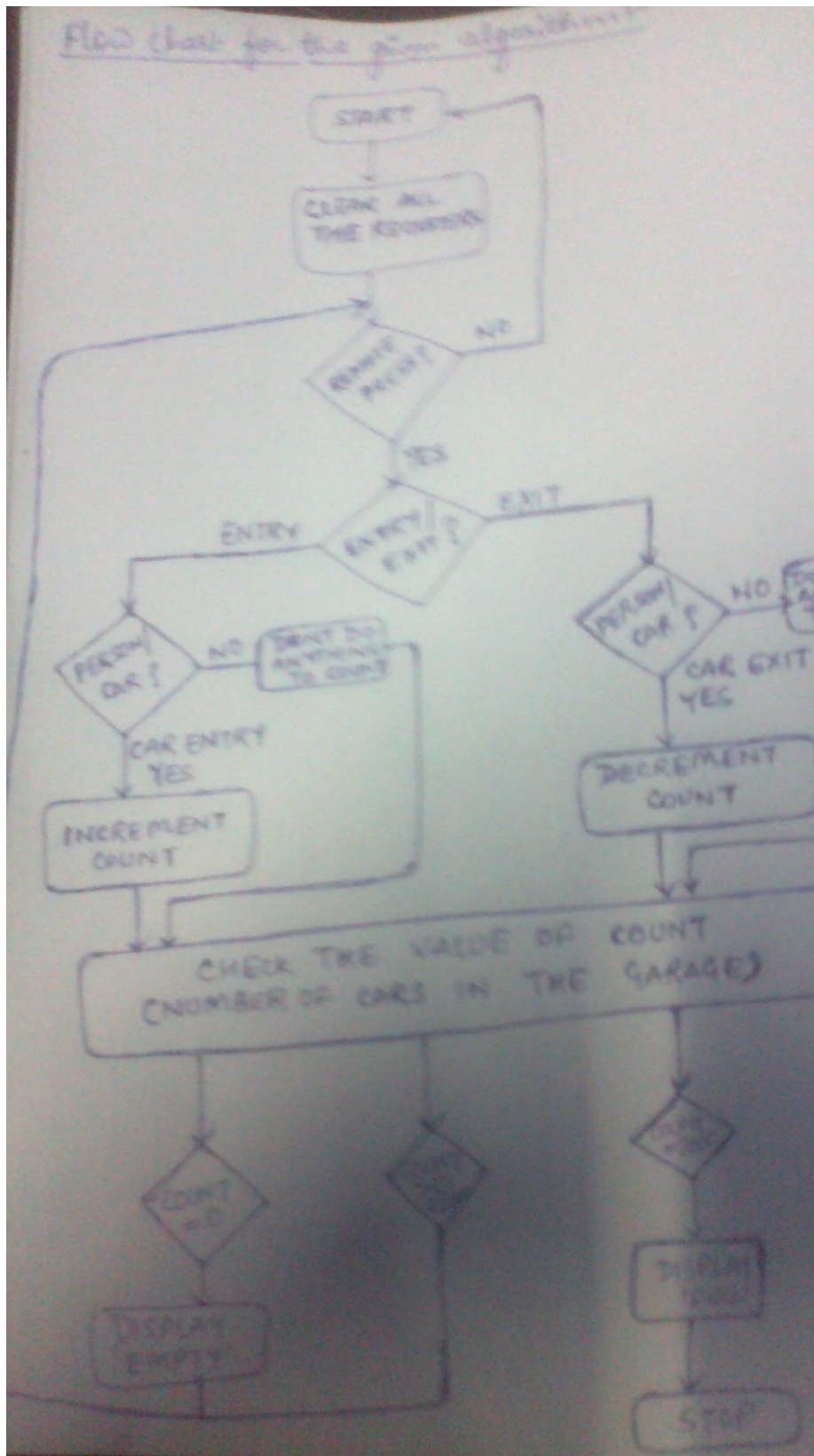
Algorithm:

- First of all when a person wants to enter into the garage or a car has to enter then remote will be pressed.
- As soon as remote is pressed, signal is sensed at port c of 8255.It will send the microprocessor signal which will be further given to the motor for opening the gate.
- The gate will take 30 seconds to open or close.
- The next challenge is to find out whether the car/person is entering or exiting the garage.
- Next to distinguish whether the car is entering the garage or the person, pressure transducer is introduced that will tell on the basis of weight experienced by it.
- If the car is entering then count will be incremented and if it is exiting the garage the count will be decremented.
- When count reaches 2000, that is the maximum capacity of garage then LCD will display 'FULL' and when there is no car in the garage then LCD will represent 'EMPTY'.
- As soon as the signal from the second IR sensor is received by the processor, it checks whether the remote is pressed again or not. While checking for the remote press, the processor also keep checking in loop , the IR sensor outputs to know whether any car is entering or exiting the garage and increments and decrements the count accordingly.
- If the remote is not pressed within 5minutes, the processor automatically sends a signal to motor through driver circuit, to close the door.

Memory addresses:

RAM: 00000H-00FFFH
      01000H-01FFFH
ROM: FF000H-FFFFFH

NAME OF THE PORT IN 8255A	ADDRESS OF THE PORT IN 8255A
PORT A	00H
PORT B	02H
PORT C	04H
CONTROL REGISTER	06H

COUNTERS IN 8253	ADRESSES OF COUNTERS TO ACCESS COUNTERS
COUNTER0	08H
COUNTER1	0AH
COUNTER2	0CH
CONTROL REGISTER	0EH

ALP Program:

```
.MODEL TINY
.486
.DATA
ORG 1000H
COUNT1 DW 0000H
DAT1 DB -1
DAT2 DB -1                          ; INTERFACING CIRCUTARY
                                   1. 8086 TO 8255-INITIALISATION OF 8255.
DISP1 DW 'FULL'
DISP2 DW 'EMPTY'
STORE DB 00H

.CODE
.STARTUP
        MOV AL,90H
        OUT 06H,AL                 ;CONTROL WORD OF 8255

LCD INITIALISATIONS DISPLAY:
        MOV AL,30H                 ;REPEAT THIS FOR 4 TIMES
        CALL OUTCMD
        CALL DELAY41               ;WAIT FOR 4.1 MS ATLEAST
        MOV AL,30H                 ;SECOND TIME
        CALL      OUTCMD           ;BUS FLAG STATUS CANNOT BE
CHECKED
        MOV AL,30H                 ;IN THIS TIME
        CALL OUTCMD

        MOV AL,00110000B
        CALL OUTCMD
        NOP                        ;CALL DELAY100
        MOV AL,08H                 ;DISPLAY OFF
        CALL OUTCMD
        MOV AL,01H                 ;CLEAR DISPLAY
        CALL OUTCMD
        MOV AL,0CH                 ;DISP ON
```

```
        CALL OUTCMD
        MOV AL,06H                      ;AUTOINCREMENT.SHIFT CURSOR
        CALL OUTCMD
X:      CALL LCD
        IN AL,00H
        AND AL,30H
        CMP AL,00H                      ;CHECKING FOR THE REMOTE
        JZ X
        MOV AL,80H                      ;GIVING THE DIR TO MOTOR AND THE
                                         ENABLE
```

SIGNAL FOR THE TIMER (SENDING SIGNAL TO MOTOR VIA PORTC.CONNECT PORTC TO MOTOR ENABLE SIGNALS AND GIVE PROPER DELAY AS PER THE CLOCK PROVIDED OF 10KHZ FROM 8086 INTERFACE)

```
        OUT 04H,AL
        CALL MOTOR              ;OPENING THE GARAGE
X1:     IN AL,00H
        AND AL,0C0H
        CMP AL,80H              ;CHECKING FOR THE IR SENSORS , WE
                                WILL BE LOOKING FOR PORT C PIN 6,7 AND
                                THEY ARE GOING TO BE CONNECTED TO
                                SWITCHES I/P WILL BE GIVEN TO MOTOR
                                ENABLE SIGNAL SO THAT MOTOR WORKS
                                FOR EVERY SWITCH PRESSED, EITHER FOR
                                EXIT OR ENTRY

        JZ ENTRY
        CMP AL,40H
        JZ EXIT
        JMP X1
ENTRY: CMP DAT2,-1
        JNZ X2
        IN AL,00H
        AND AL,08H              ;CHECKING FOR THE PRESSURE
                                 TRANSDUCER, 0000 1000

        CMP AL,08H
        JNZ X2
        INC DAT2
```

```
X2:     IN AL,00H
        AND AL,40H
        CMP AL,40H          ;CHECKING FOR THE ENTRY OF CAR INTO
                             GARAGE

        JNZ ENTRY
        CMP DAT1,0
        JNZ X3
        INC COUNT1
        MOV DAT1,-1
X3:     IN AL,00H
        AND AL,0F8H         ;WAITNG TILL THE CAR HAS
                             ENTERED

        CMP AL,00H
        JNZ X3
        CALL DELAY_5MIN     ; CALLING A DELAY OF 5 MIN
        CMP DAT2,0OH        ;CHECKS WHETHER A CAR HAS
                             ENTERED IN THIS SPAN OF 5 MIN

        JZ X1
        JMP X
EXIT:   CMP DAT2,-1
        JNZ X4
        IN AL,00H
        AND AL,08H          ;CHECKING FOR THE PRESSURE
                             TRANSDUCER

        CMP AL,08H
        JNZ X2
        DEC DAT2
X4:     IN AL,00H
        AND AL,80H
        CMP AL,80H          ;CHECKING FOR THE EXIT FROM THE
                             GARAGE

        JNZ EXIT
        CMP DAT2,0
        JNZ X5
        INC COUNT1
        MOV DAT2,-1
X5:     IN AL,00H
        AND AL,0F8H
        CMP AL,0
        JNZ X5
```

```
        CALL DELAY_5MIN         ;CALLING A DELAY OF 5 MIN

            CMP DAT2,00H            ;CHECKS WHETHER A CAR HAS
                                    ENTERED IN THIS SPAN OF TIME
            JZ X1
            JMP X

OUTCMD:
             PUSH AX
             MOV AL,80H
             OUT  06H,AL
             POP   AX
             OUT  02H,AL
             MOV AL,4
             OUT  04H,AL
             NOP
             NOP
             MOV AL,0
             OUT  DX,AL
             CALL        DELAY41
             RET


MOTOR :
        MOV AL,36H              ;SETTING THE MODE OF COUNTER0 TO
MODE 3>>>>>> AT 8254, SET CNT0 FROM CNTROLREGISTER
        OUT 0EH,AL
        MOV AL,5AH
        OUT 08H,AL                 ;INITIALIZING THE COUNTER0 WITH 2650,
                                    PUT VALUE 0A5AH IN CNTER0 VIA
                                     INSTRUCTIONS
        MOV AL,0AH
        OUT 08H,AL
        MOV AL,54H                 ;SETTING THE MODE OF COUNTER1 TO
                                    MODE 2, INITIALISE COUNTER2 OF 8254

        OUT 0EH,AL
        MOV AL,05H                 ;SETTING THE COUNTER1 WITH 5,PUT 5 IN
                                    CONTER1, PROGRAM COUNTER 1BY
                                    PUTTING AL=5, HERE WE ARE GIVING A
```

CLOCK TO MOTOR BY 8254

```
        OUT 0AH,AL
        CALL DELAY_30S
        RET
DELAY_5MIN:
        MOV CX,0FFFFH
        MOV DAT2,-1
        MOV DX,349
Y:      NOP
        NOP
        IN AL,00H
        MOV BL,AL
        AND AL,30H              ;CHECKS FOR THE PRESSING OF THE
                                 REMOTE
        CMP AL,00H
        JNZ Y1
        AND BL,0C0H
        CMP BL,0                ;CHECKING FOR THE ENTRY OF ANOTHER
                                 CAR OR MAN
        JNZ Y2
        LOOP Y
        MOV CX,0FFFFH
        DEC DX
        CMP DX,00H
        JNZ Y
Y1:     MOV AL,0C0H
        OUT 04H,AL
        CALL MOTOR              ;CLOSING THE GARAGE
        JMP Y3
Y2:     INC DAT2
Y3:
        RET
DELAY_30S:
D3:     MOV CX,015EAH
        LOOP D3

PROC TO WRITE DATA ON LCD:

        WRITE:
            MOV AL,BL           ;DATA SEND ON BL
```

```
        OUT  02H,AL
        MOV AL,2
        OUT  04H,AL
        NOP
        NOP
        MOV AL,06H
        OUT  04H,AL
        NOP
        NOP
        MOV AL,00H
        OUT 04H,AL
        CALL BUSY
        RET
```

PROC TO TEST BUSY AND RET IF NOT BUSY:

```
BUSY:
AGAIN:      MOV AL,92H
            OUT  06H,AL          ;MAKING PORT B INPUT PORT
            MOV  AL,01H
            OUT  04H,AL
            MOV AL,05H
            OUT  04H,AL
            NOP
            NOP
            IN AL,02H
            PUSH AX

            MOV AL,0
            OUT  04H,AL
            MOV AL,90H
            OUT  06H,AL
            POP AX
            SHL AL,1
            JC AGAIN
            RET
```

PROC FOR CLEAR DISPLAY:

```
CLS:
        MOV AL,1
        OUT  02H,AL
        MOV  AL,04H
        OUT  04H,AL
        NOP
        NOP
        MOV AL,00H
        OUT  04H,AL
        CALL DELAY41
        RET

PROGRAM STARTS:


LCD :
        MOV AX,COUNT1
        CMP AX,2000
        JNZ X10
        CALL FULL
X10:    CMP AL,0
        JNZ X11
        CALL EMPTY
X11:    CALL COUNT
RET

COUNT:
        CALL CLS
        CALL CENTER
        MOV CL,04H
        MOV  DX,COUNT1
X6:     DIV DL
        MOV  STORE,AL
        MOV  AH,00H
        AAM
        ADD AL,30H
        MOV BL,AL
        CALL WRITE
        MOV AL,STORE
        LOOP  X6
```

```asm
        RET

FULL:
            CALL CLS
            CALL CENTER
            MOV CL,4
            MOV SI,DISP1
X7:         LODSB
            MOV BL,AL
            CALL WRITE
            LOOP X7
RET

EMPTY:
            CALL CLS
            CALL CENTER
            MOV CL,5
            MOV SI,DISP2
X8:         LODSB
            MOV BL,AL
            CALLWRITE
            LOOP X8
RET
DELAY FOR 4.1 MSEC:
            DELAY_4.1MSEC
            MOV CX,80
X9:         LOOP X9
RET
COUNTER:
            MOV BL,29              ;PORTB SHOUL HAVE 0010 1001
            CALL  WRITE
            CALL  WRITE
            CALL WRITE
            CALL WRITE
            CALL  WRITE           ;CALL WRITE IS WRITTEN HERE
                                   5 TIMES TO WRITE ON EVERY LCD
RET
.EXIT
END
```