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Smart Parking System

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Introduction

In this project we have designed and implemented a smart Parking system using several sensors and i/o devices. At the heart of the system is a PIC16F877A microcontroller.
This system senses the arrival and exit of cars on both floors ,provided that the number of cars on each floor doesn't exceed 15 cars ,the light on the ground floor turns on at night and off during the day ,but on the Basement floor the light are turn on for 60 seconds whenever a car enters

The code was written in MPLAB with assembly language and then tested in Proteus

System Requirements

Following are the requirements:

- Two Microcontroller PIC16F877A.
- Leds.
- Light Dependent Resistor.
- 7-segment displays.
- Obstacle Detection sensor.
- Oscillator 4MHz .
- Voltage regulator.

Subsystems

The system we divided into three subsystems. We show each subsystem below with their corresponding flowchart.

Light Dependent Resistor it is one type of resistor whose resistance varies depending on the amount of light falling its surface ,So when the light increases Resistance will be decreased. That means, In the daytime, the output resistance will be less compared to nighttime.

The input voltage range of the ADC is 5V (5– 0) ,This means that every value of the digital output represents an interval of 4.88mV (5I/1024),The table below shows the input value range and the respective digital output:

Input Range	Digital Output
0.00 V ≤ input voltage $< 4.88mV$	0
4.88mV ≤ input voltage $< 9.76mv$	I
9.76mV ≤ input voltage < .0146V	2
.	.
.	.
4.995V ≤ input voltage < 5V	1023

As long as the digital value is less than 511 (2.5Vin Analog),LED will be off, and if it is higher, the LED will light up on the ground floor.

There are two types of microcontrollers, the first is a transmitter and the second is a receiver, they are connected to each other serially, the flowchart shows how Transmitter works

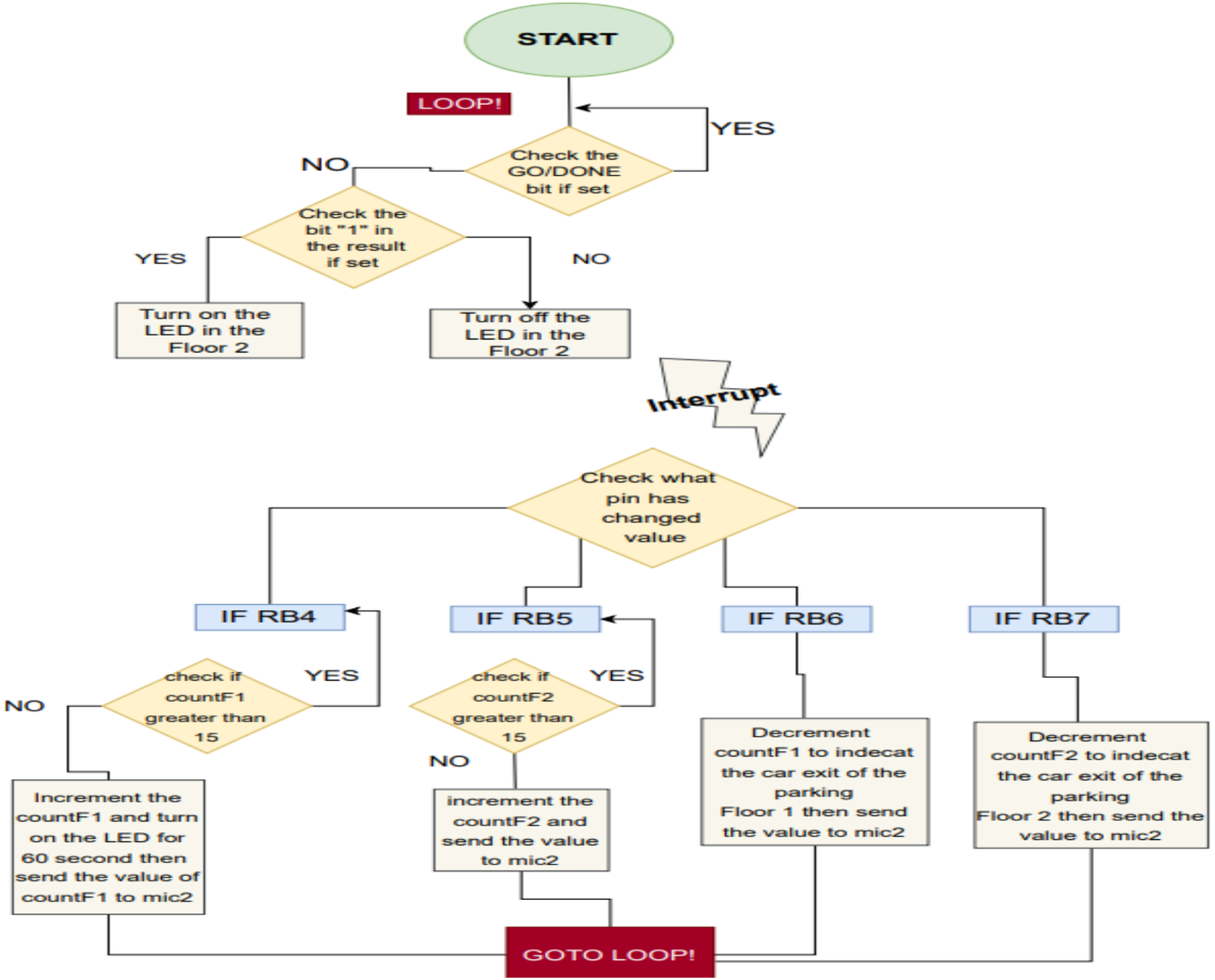

Figure.1. Flowchart of Transmitter

Transmitter

Four of the obstacle sensors are set on the RB4-RB7 because these pins if the input value changes from old value an interruption occurs, As RB4 and RB5 sense the entry of car to each floor, when entering the car, it is confirmed that the number of cars does not exceed 15 through the presence of a counter while the BR6 and BR7 sense that the car is exiting and decrement o the counter by one, when entering or exiting any car, the counter value is modified and the value is sent to receiver.

In the Basement floor, the lights are normally turned off and they are turned on for 60 seconds whenever a car enters the floor, to use 220 light bulbs, we use relay module to get this voltage.

Receiver

When the counter value is reached, it must be displayed in 7-segments displays and to determine which floor, we use a parity bit, whenever a floor reaches its maximum capacity, number 15 is flashed continuously, Figure.2 show how to display the number of care on 7-segment

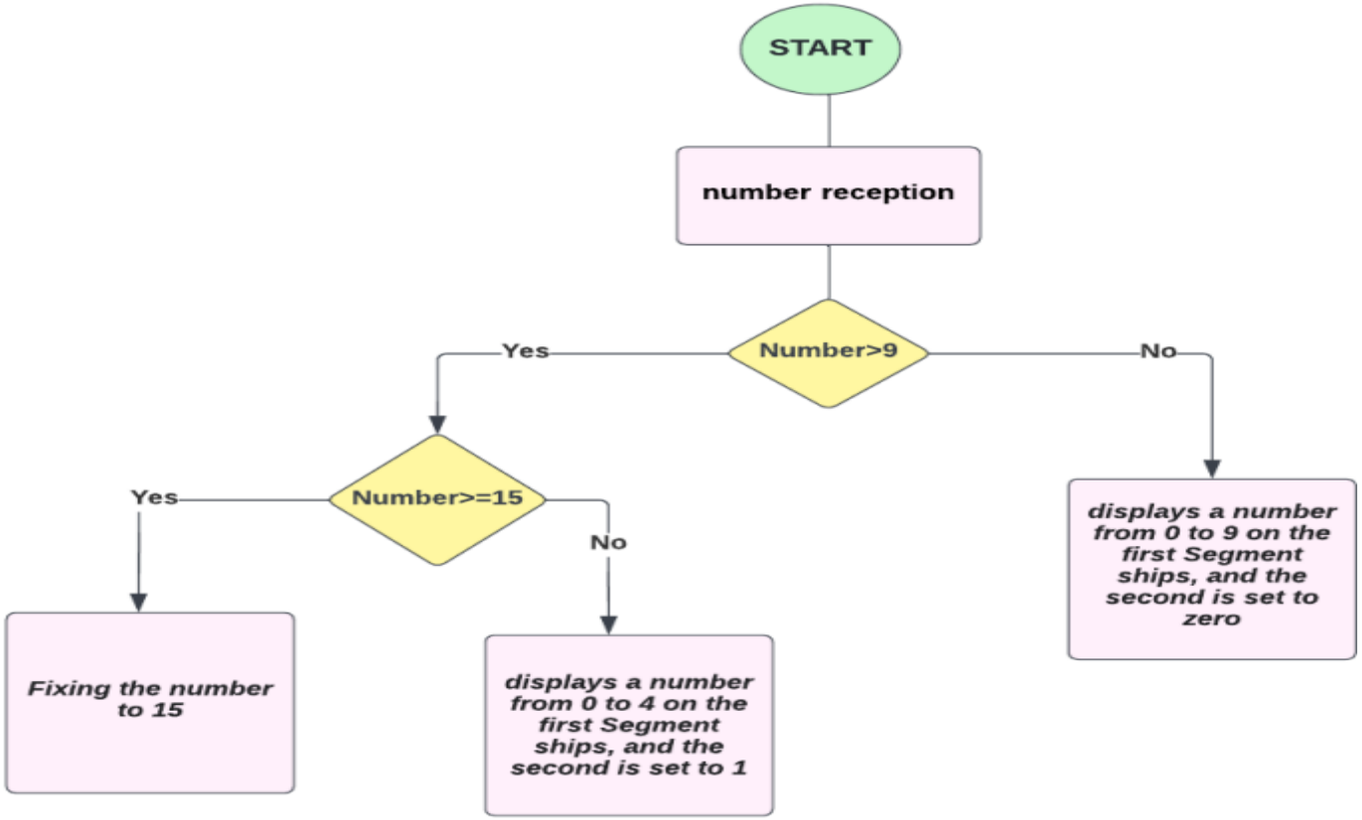

Figure.2 flowchart of Receiver

Circuit Diagram

When you press the push button RB5, this indicates that a car has entered, so the counter will increment by one, and because the light is far from the LDR, it means that it is night and the LED should light up as the figure.3 shows.

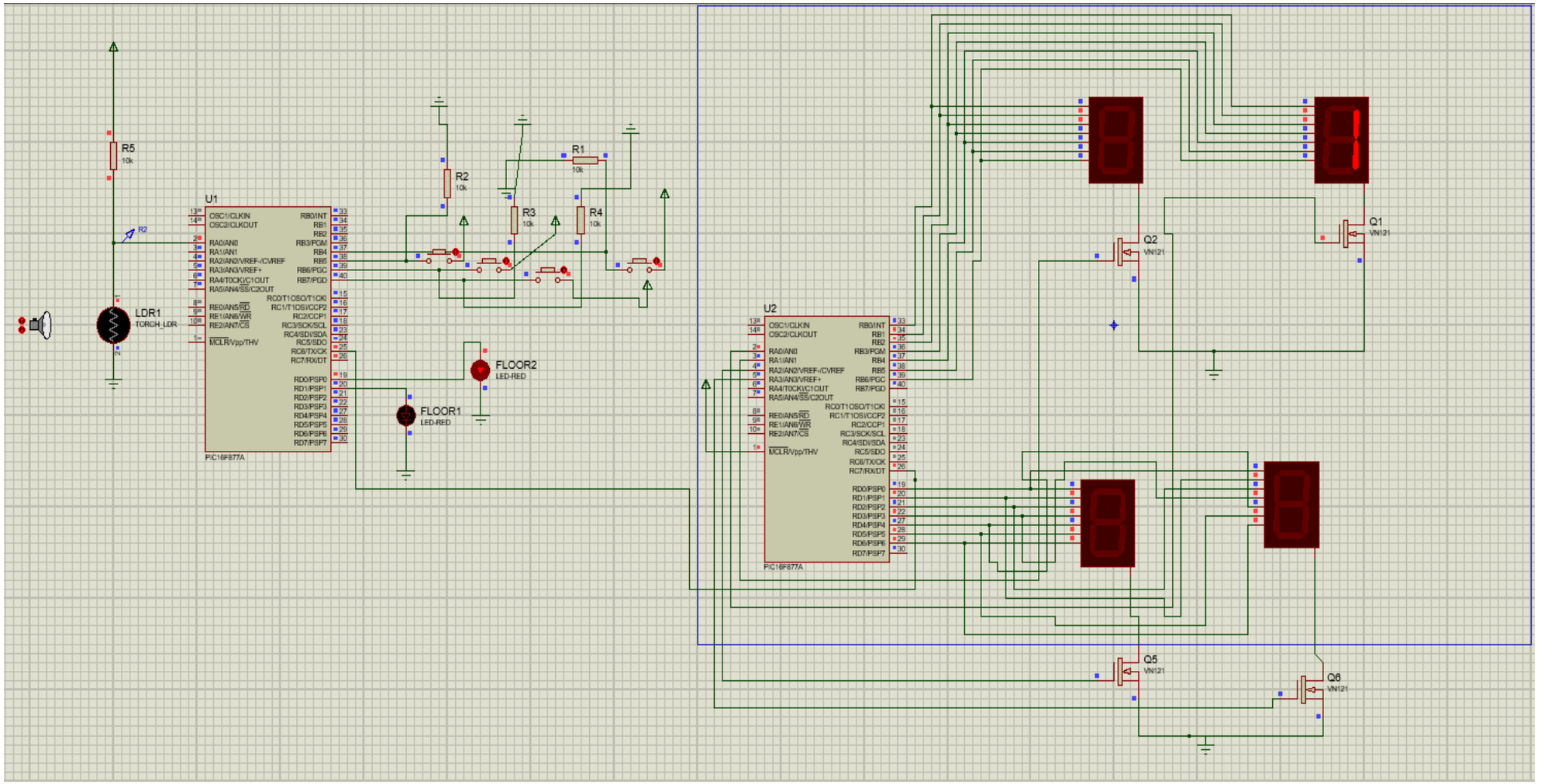

Figure.3 Ground floor test (Proteus)

When you press the push button RB4, this indicates that a car has entered, so the LED will light up and the counter will increment by one, as the figure.4 shows

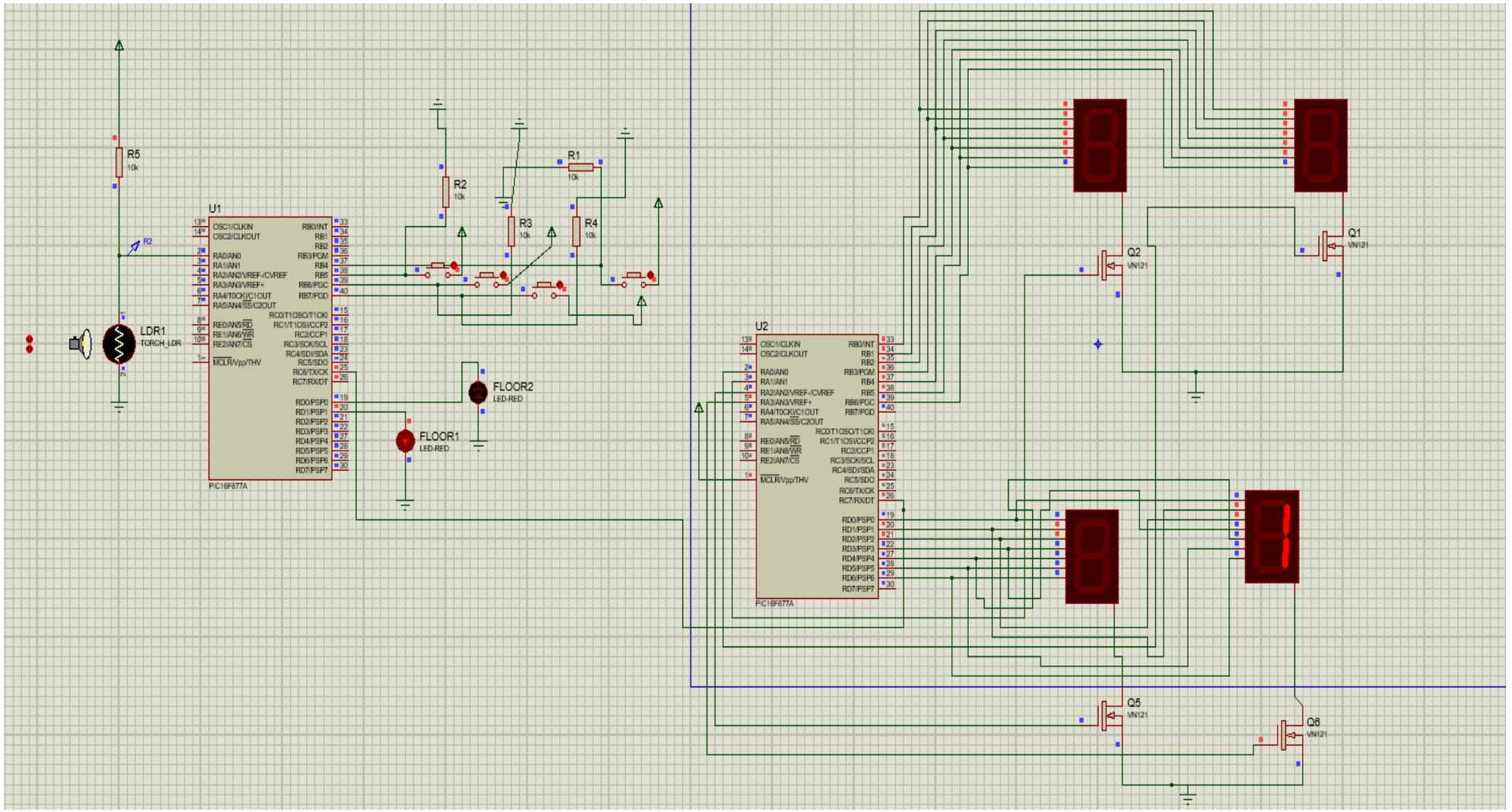

Figure.4 Basement floor test (Proteus)

Actual Hardware Implementation

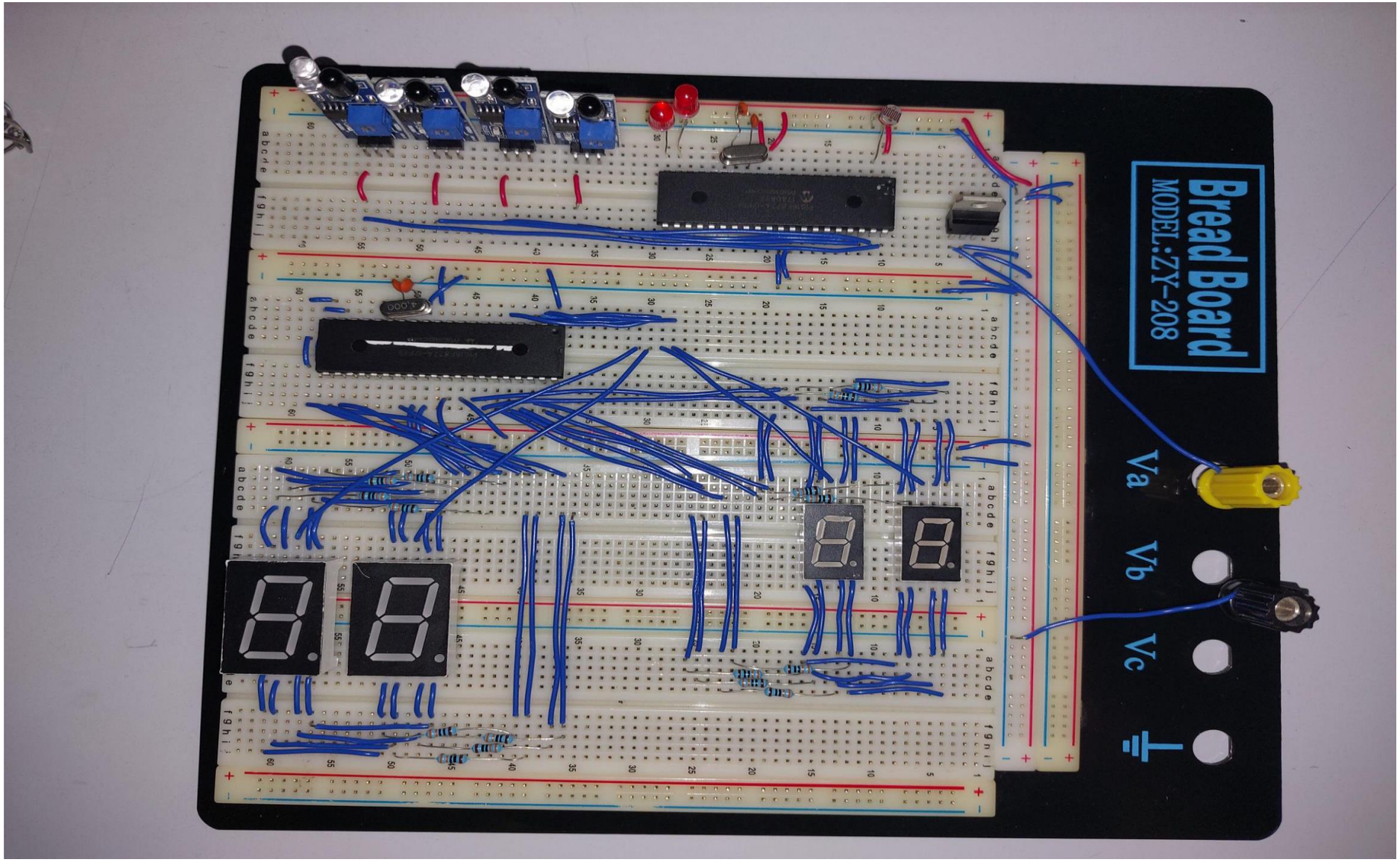

Figure.5 Actual hardware

Obstacle Detection sensor

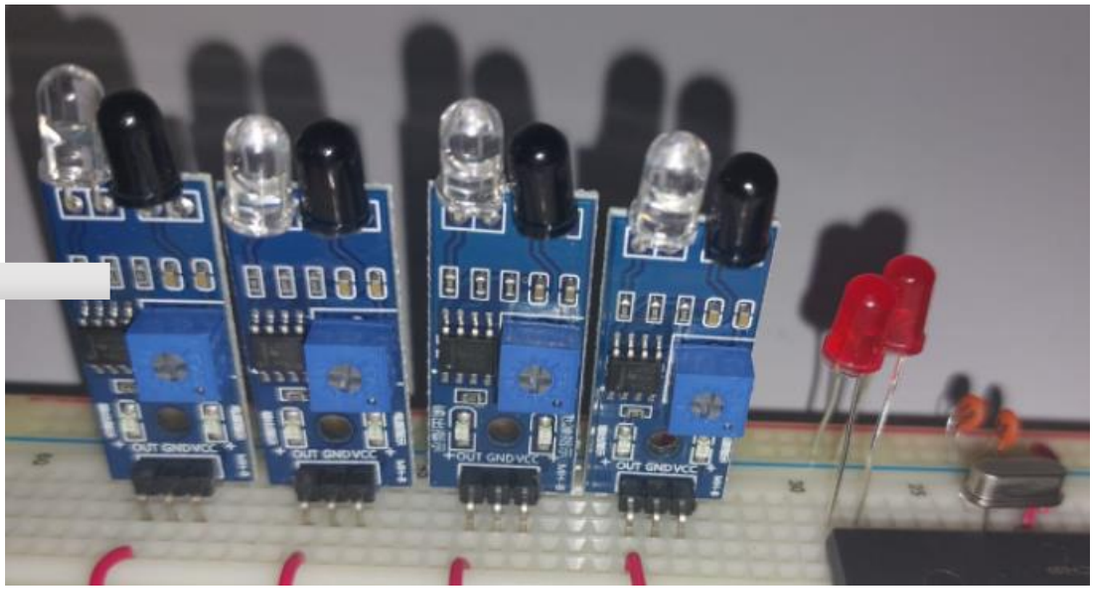

Figure.6 Obstacle Detection sensor

regulator

LDR

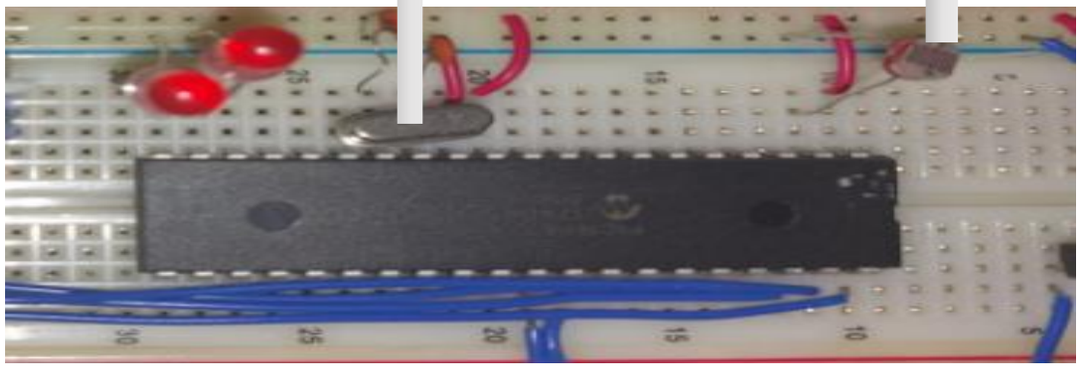

Figure.7 Regulator and LDR

Contributions of Each Student

- **Lena Alnosh**

Was in responsible for configuring and programming the Light dependent resistor and write the project report.

- **Aseel Abdel-qader**

Was in responsible for configuring and programming the 4 obstacle detection sensors and programming the led turned on for 60 seconds whenever a car enters.

- **Abeer Abu Khalaf**

Was responsible for configuring and programming four of 7 segments display and receive data from the transmitter.

Hardware implementation was worked on by team members.

Obstacles Faced

- **Software obstacles:**

  One of the problems we faced is how to determine which floor the data belongs to.

  After thinking, because the number of floors is 2, we only need one bit, so we decided to use the parity bit to determine this data to which floor

  We did not test the hardware, we will check it during the discussion.

- **Hardware obstacles:**

  The problem you are facing with your hardware is multiplexing of the 7-segment display, it needs a lot of jamming devices.

Conclusion.

The systems simulation works as expected in Proteus, all 7-segment display are working fine.

The proteus did not support the obstacle detection sensor, it was replaced with a switch only inside the proteus.

References

- Dr. Iyad Jafar, Starting with serial , Embedded Systems Course, Chapter 10.
- PIC16F877A datasheet.
- Embedded lab experiments.