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UNIVERSITY OF WOLVERHAMPTON

HERALD COLLEGE KATHMANDU

4CS016 - Embedded Systems Programming

Report for Mini-Project (Bi-Directional Visitor Counter)

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Acknowledgement

Respected module leader and teachers, I am Hitesh Thapa from Level 4 Semester II. I express my profound thanks to my teacher, Mr. Sumanta Silwal sir and module leader, Dr. Sarah Slater for giving me this opportunity to work on a Mini-Project as it covers 50% of my module grade. Once again thank you for all the support and help while working on this mini project.

Introduction

I have made one simple Bi-Directional Visitor Counter. What it does is, it shows the number of people entered inside a room. It uses two PIR Motion Sensor to detect the people movement. One PIR recognizes the person entering and another PIR confirms that the person has entered inside a room and displays it on LCD screen. And when person exits, the LCD screen will show the remaining people inside a room. If there are no people to exit, then it tells us there are no people inside the room.

Tools Used:

The tools which I have used for this project are:

1. Arduino UNO
   This will act as brain of my project as it is used to control all the other components and this microcontroller is used for coding to run the other components as required.

2. Two PIR Motion Sensors
   This sensor is used to detect the presence of person entering/exiting a room.

3. 10k-ohm Potentiometer
   This potentiometer is used to regulate the resistance value for LED screen.

4. 1602 LCD Screen
   This LCD Screen is used to display our output in screen.

5. 220-ohm Resistor
   This resistor is used for the LED anode of my LCD screen.

6. Two Breadboards(Long and Mini)
   They are used to act as a bridge between pins of Arduino UNO and Pins of components. Without breadboard it would be very difficult to connect all the components

7. Piezo Buzzer
   This Piezo buzzer is used to alert or give signal when the person has entered/exited the room. It will produce a beeping noise.

8. Few Male-to-Male and Male-to-Female jumper wires for connections of components.

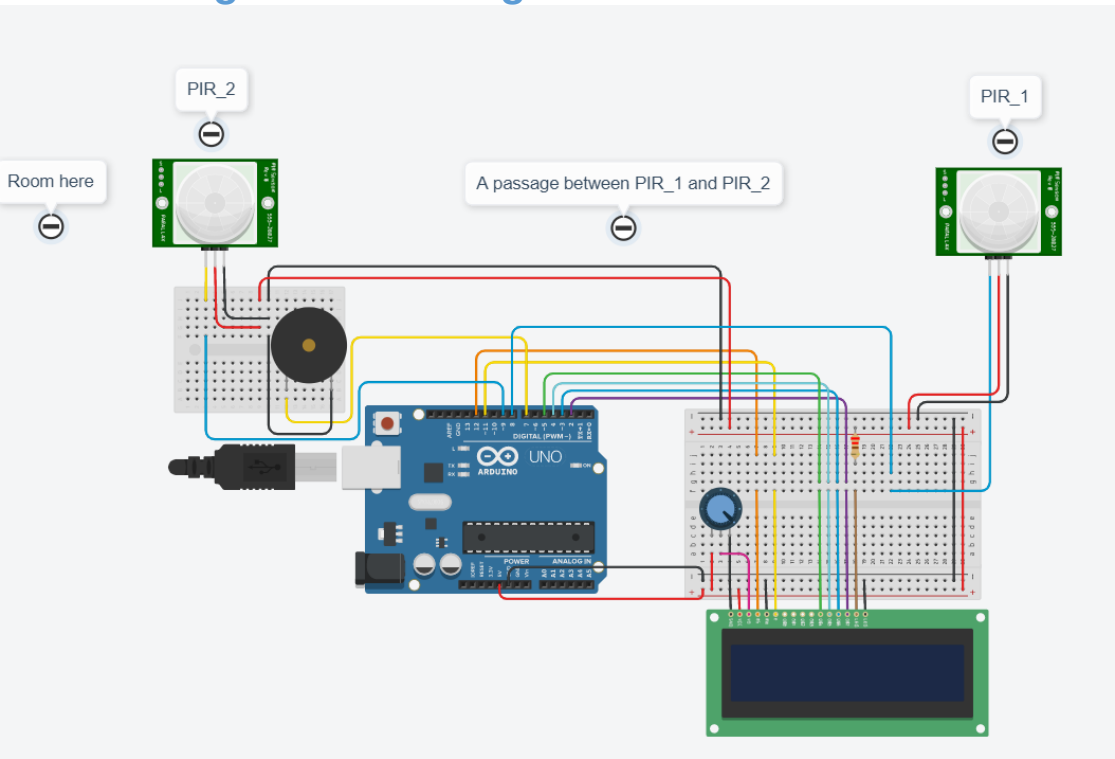
Working Principle

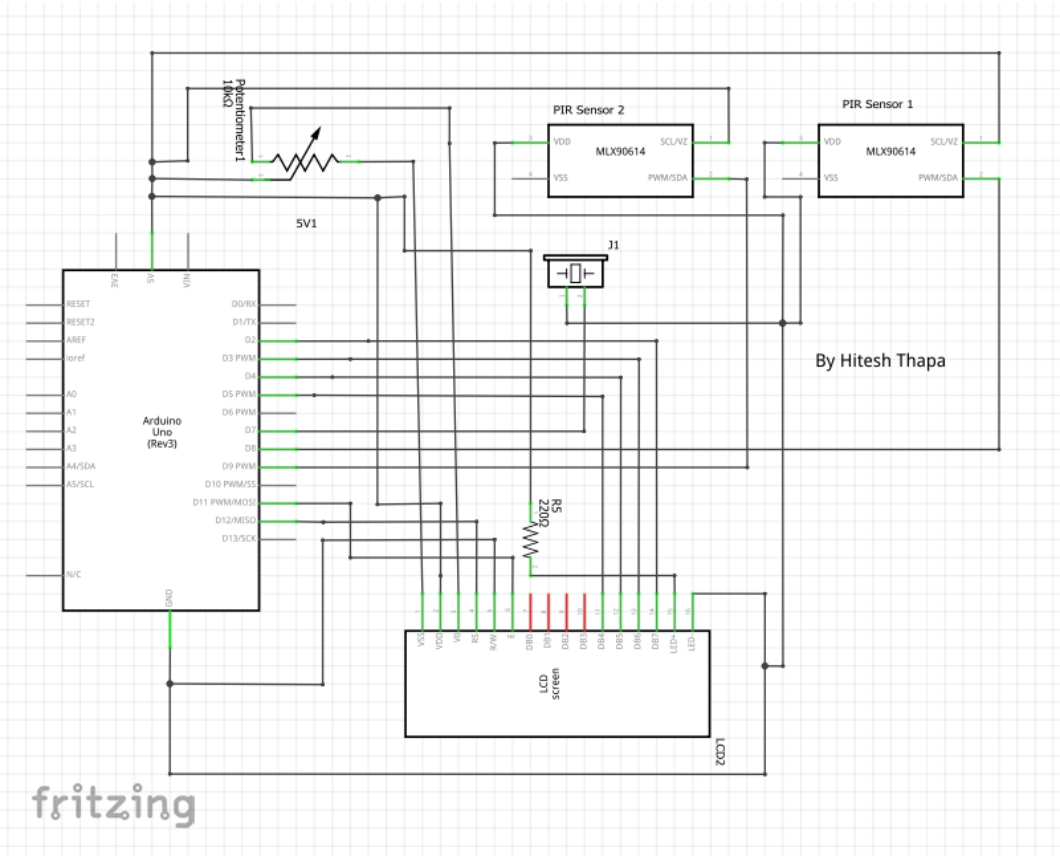
Pin 9 EXIT, PIN 8 Enter. The working principle for this project is that, when the person presence is detected in the first PIR i.e., PIR_1 connected to the Pin no 8 of Arduino, then the data is sent to the Arduino which then the output will be displayed as “Visitor Entering”. After that person will move to the next PIR i.e., PIR_2 connected to the Pin no 9 of Arduino, then this will confirm that the person has entered inside the room and the visitor count code will be executed and after that “Visitor Entered” along with “Visitor No:” will be displayed as output in the LCD screen.

Same goes when person exits. At first PIR_2 will be activated with message “Visitor Exiting” on the LCD screen and after reaching to the next PIR i.e., PIR_1 will be activated with message “Visitor Exited” along with “Visitor No:” will be displayed on the LCD screen. After exiting the room, the total no of visitor count will be subtracted and the remaining no of people will be displayed. And when there is 0 visitor, it will display “No visitors inside”.

The piezo buzzer is used to make a beeping noise after when the person has exited/entered inside the room.

Circuit Diagram & Fritzing Schematic



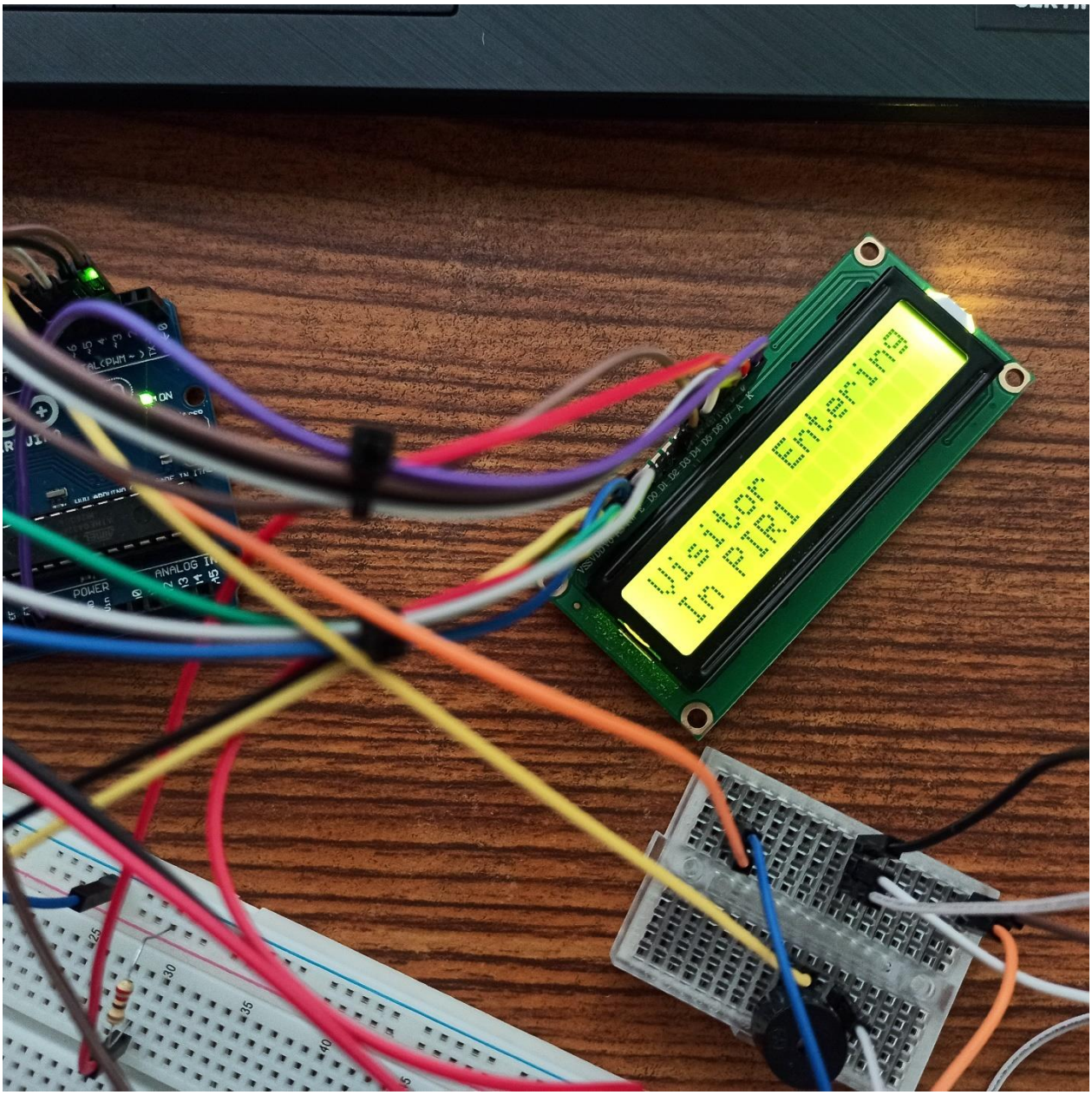


Program Code

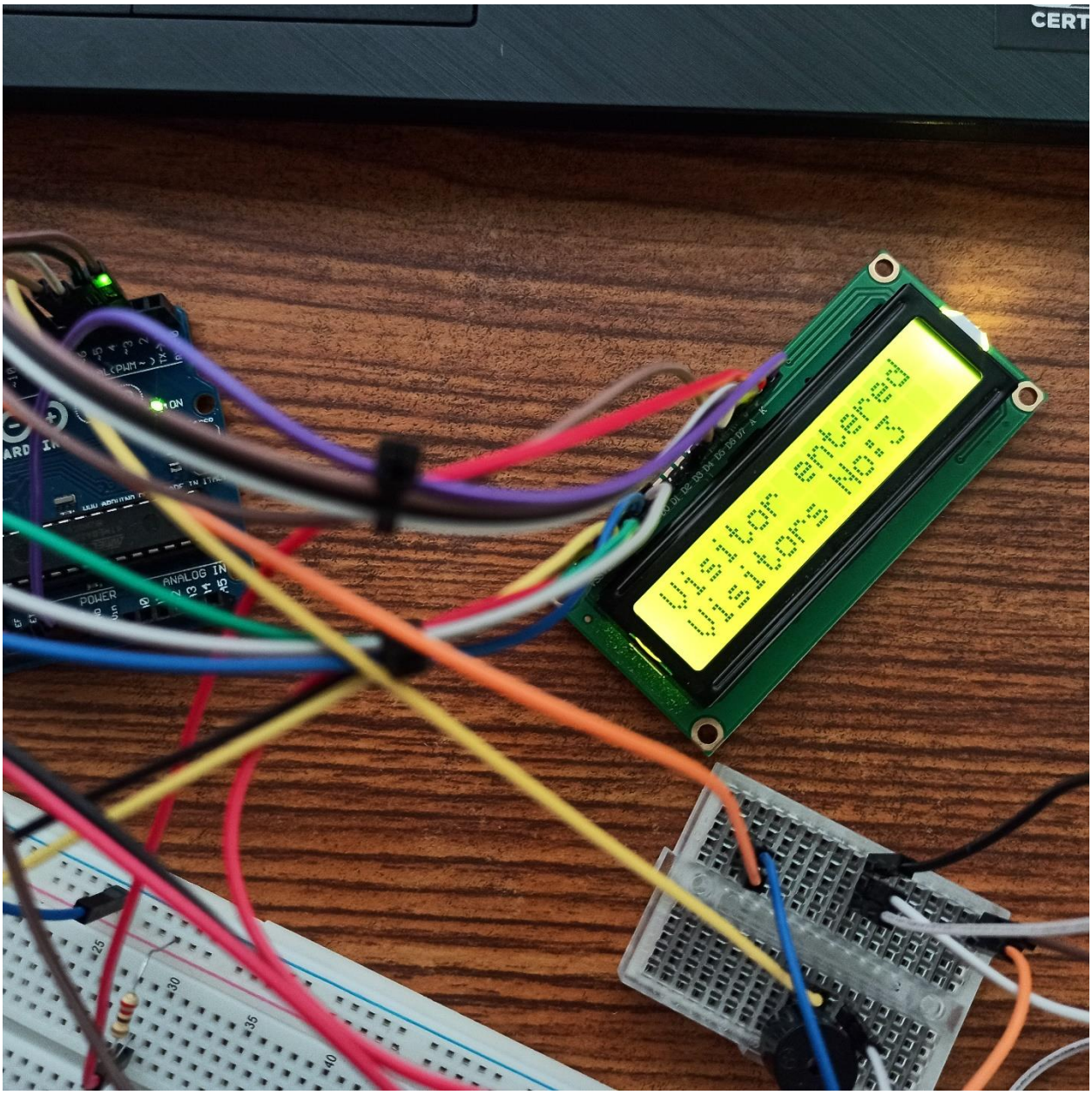
```
#include <LiquidCrystal.h>

//Buzzer tones
#define NOTE_E5  659
#define NOTE_D6  1175
LiquidCrystal lcd(12,11,5,4,3,2);

const int PIR_1 = 8; //Entrance
const int PIR_2 = 9; //Exit
const int PIEZO_PIN = 7; //Buzzer
const bool SERIAL_PRINT = true;
int visitor_in = 0;
int visitor_out = 0;
bool PIR_1_ON = false;
bool PIR_2_ON = false;

void setup()  {
  lcd.begin(16,2);
  pinMode(PIR_1, INPUT);
  pinMode(PIR_2, INPUT);
  pinMode(PIEZO_PIN, OUTPUT);
  Serial.begin(9600);
  DisplayMsg("Visitor counter", "by HiteshThapa", SERIAL_PRINT);
}

//For output message display on LCD Screen and Serial Output
void DisplayMsg(String s1, String s2, bool serial_output) {
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print(s1);
  lcd.setCursor(0, 1);
  lcd.print(s2);
  if (serial_output)
    Serial.println(s1 + ". " + s2);
}

//For Entered/Exited
void visitors_count(int x){
int duration=100;
  visitor_in = visitor_in + x;
  visitor_out = 0;  // reset detected PIR
  if (x>0)
    PlayNote(NOTE_E5, duration);
  else
    PlayNote(NOTE_D6, duration);
}
```

```
// Piezo buzzer noise
void PlayNote(int note, int duration) {
  tone(PIEZO_PIN, note, duration);
  delay(duration * 1.3);
  noTone(PIEZO_PIN);
}

void loop() {
  //For First PIR
  if (digitalRead(PIR_1) == HIGH) {
    if ( !PIR_1_ON ){
      PIR_1_ON = true;
      if (visitor_out == 0 && !PIR_2_ON){  // new start
        visitor_out = 1;
        DisplayMsg("Visitor Entering", "In PIR1", SERIAL_PRINT);
      }
      else if (visitor_out == 2){ // if we were in PIR2 before
        visitors_count(-1);
        DisplayMsg("Visitor exited", "Visitors No:" + String(visitor_in), SERIAL_PRINT);
      }
    }
  }
  else
    PIR_1_ON = false ;  // reenable PIR1
  //For Second PIR
  if (digitalRead(PIR_2) == HIGH ) {
    if ( !PIR_2_ON ) {
      PIR_2_ON = true;
      if (visitor_out == 0 && !PIR_1_ON){ // new start
        if (visitor_in > 0) {
          visitor_out = 2;
          DisplayMsg("Visitor Exiting", "In PIR2", SERIAL_PRINT);
        }
        else
          DisplayMsg("No visitors", "inside", SERIAL_PRINT);
      }
      else if (visitor_out == 1) {  // if we were in PIR1 before
        visitors_count(1);
        DisplayMsg("Visitor entered", "Visitors No:" + String(visitor_in), SERIAL_PRINT);
      }
    }
  }
  else
    PIR_2_ON = false; // reenable PIR2
}
```

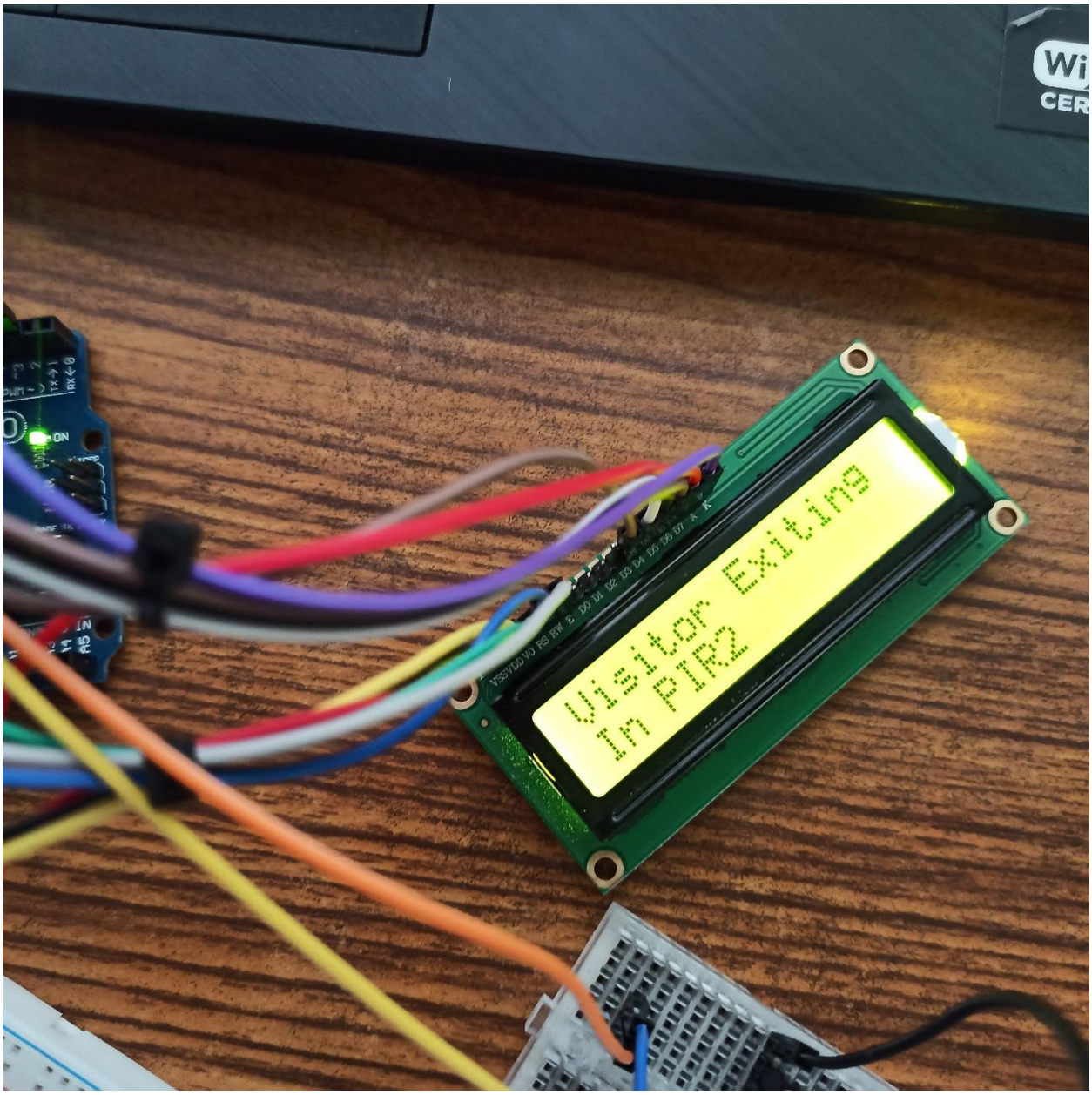
Testing:



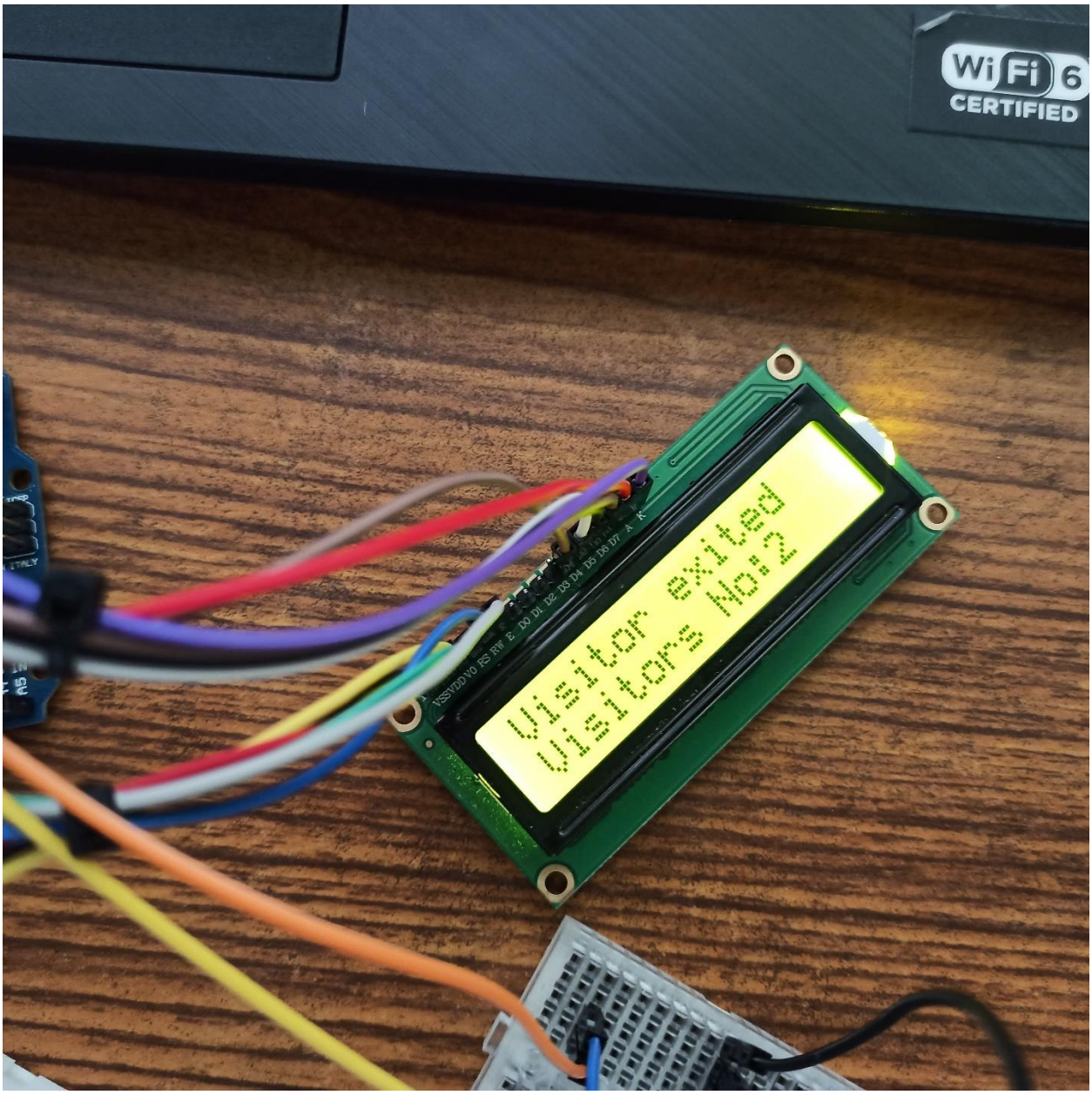
When the person movement is detected at PIR_1, it displays “Visitor Entering in PIR1”



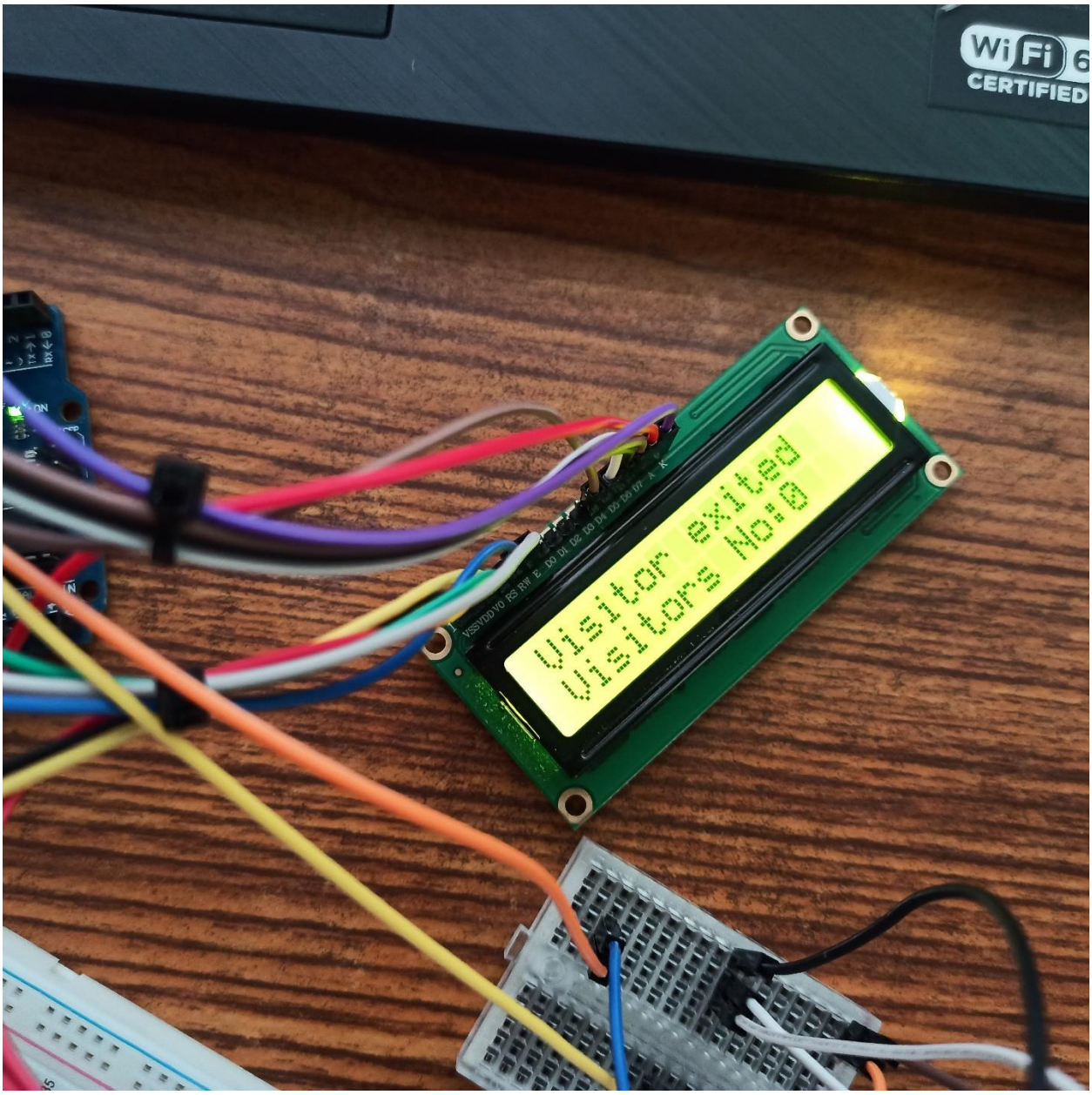
When person passes from PIR_1 to PIR_2 then the visitor number will be recorded and “Visitors Entered” will be displayed with total no of visitors.



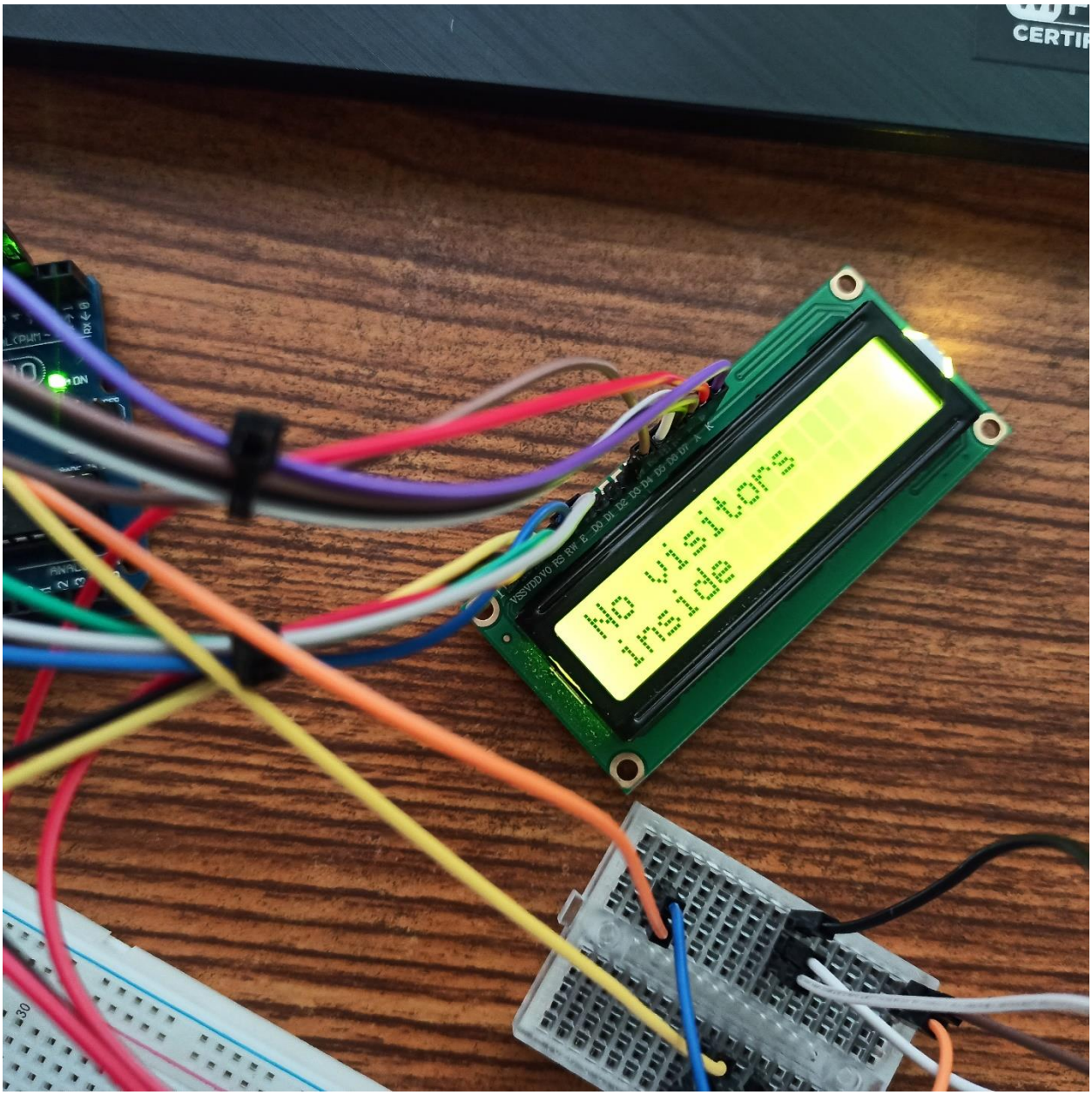
If person movement is detected at PIR_2 then the “Visitor Exiting in PIR2” will be displayed.



When the person passes from PIR_2 to PIR_1 then the “Visitor Exited” will be displayed and total no of visitor will be deduced by 1 and the remaining no of visitor will be displayed.



In case of 0 or no visitors inside a room then the “No visitors inside” will be displayed. Below is the picture of that output.


No visitors
inside

Conclusion

At the end, I was successful with the project and completed it on time. I was able to do this project with the help of all the workshops which I have learnt and able to do it on my own.

At the times during COVID-19 it is very important to keep the social distancing and create less gathering among the people. This project will help to know how many people are inside the room and take the actions accordingly. This is helpful and crucial to maintain certain amount of people inside a room. This will stop the unwanted mass gathering and keep the persons in the room by looking at the total no of people and limit the numbers accordingly.

I have used real hardware to know the full potentiality of this module. I did this because, as we were studying this whole module as well as this semester at online, it was difficult to understand on simulation and wanted to try using real hardware.

Below is the link for my project:
Bi-Directional Visitor Counter