BIDIRECTIONAL VISITOR COUNTER

END-SEM PROJECT REPORT

Submitted by

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ABSTRACT

Bidirectional Digital visitor counter is a consistent circuit which is mainly designed to monitor the room appliances as well as count number of people entering in the arena very accurately and also avoids congestions in the different areas of usage.

When a person enters into the arena a counter is maintained for presenting the number of people and is updated by one and the appliances in the arena will be turned ON and when a person leaves the arena counter is maintained for presenting the number of people and i s decreased by one. The appliances will turned OFF when all the persons in the arena go out. The overall count of people inside the arena will be presented on Liquid crystal display.

When a particle passed through the Infrared Receiver's then the Infrared Rays falling on the receivers are obstructed. This obstruction is sensed by the Arduino Microcontroller. It also can manage fans based on relay provide, If the room reaches the maximum capacity then by using Wi-Fi module message is sent to authorities to limit the person entering the room.

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CHAPTER -2

5.1 Introduction:

Automation plays major role in the entire consumer needs of day to day life. Due to the emerging of IOT in different areas makes the automation easier and user oriented is designed. This project mainly designed to observe count of person entering the room, exiting the room and manages the appliances such as fans and bulbs based on the room capacity. Numbers of relays are used to handle the load of appliances. It also monitors the count if matches with room capacity the through Wi-Fi module alert message is given to authorities on mobile to manage person entering the room.

The Congestion control Bidirectional Digital visitor counter is a consistent circuit which is mainly designed to monitor the room appliances as well as count number of people entering in the arena very accurately and also avoids congestions in the different areas of usage. When a person enters into the arena a counter is maintained for presenting the number of people and is updated by one and the appliances in the arena will be turned ON and when a person leaves the arena counter is maintained for presenting the number of people and is decreased by one. The appliances will turned OFF when all the persons in the arena go out. The overall count of people inside the arena will be presented on Liquid crystal display. When a particle passed through the Infrared Receiver's then the Infrared Rays falling on the receivers are obstructed.

This obstruction is sensed by the Arduino Microcontroller. It also can manage fans based on relay provide, If the room reaches the maximum capacity then by using Wi-Fi module message is sent to authorities to limit the person entering the room. There by congestion is avoided.

5.2 Main Objective:

- The objective of this project is to make a microcontroller-based model to count number of persons visiting particular room. Here we can use PIR sensor and can know present number of persons.
- In today's world, there is a continuous need for automatic appliances with the increase in standard of living; there is a sense of urgency for developing circuits that would ease the complexity of life.
- Also-if at all one wants to know the number of people present in room so as not to have congestion. This circuit proves to be helpful.

5.3 Components Used:

- Arduino
- LCD
- POTENTIOMETER
- RESISTOR
- LED
- PIEZO BUZZER
- PIR SENSOR

5.4 Components Explanation

Arduino:

There are many varieties of Arduino boards that can be used for different purposes. Some boards look a bit different from the one below, but most Arduinos have the majority of thesecomponents in common:

1 . POWER (USB / BARREL JACK) :

- Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall powersupply (like this) that is terminated in a barrel jack. In the picture above the USB connection is labeled (1) and the barrel jack is labeled (2).
- The USB connection is also how you will load code onto your Arduino board. Moreon how to program with Arduino can be found in our Installing and Programming Arduino tutorial. o Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF)
- The pins on the Arduino are the places where you connect wires to construct a circuit.They usually have black plastic 'headers' that allow you to just plug a wire right into the board.
- The Arduino has several different kinds of pins, each of which is labeled on the boardand used for different functions:

- GND (3): Short for 'Ground'. There are several GND pins on the Arduino, any ofwhich can be used to ground your circuit.

- 5V (4) & 3.3V (5): The 5V pin supplies 5 volts of power, and the 3.3V pin supplies
  - 3.3 volts of power.

- Analog Pins (6): The area of pins under the 'Analog In' label (A0 through A5 on theArduino UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that can be read by the Arduino Board.

- Digital Pins (7): The digital pins (0 through 13 on the UNO). These pins can be usedfor both digital input and digital output.

- AREF Pins (9): Analog Reference and is used to set an external reference voltage(between 0 and 5 Volts) as the upper limit for the analog input pin.

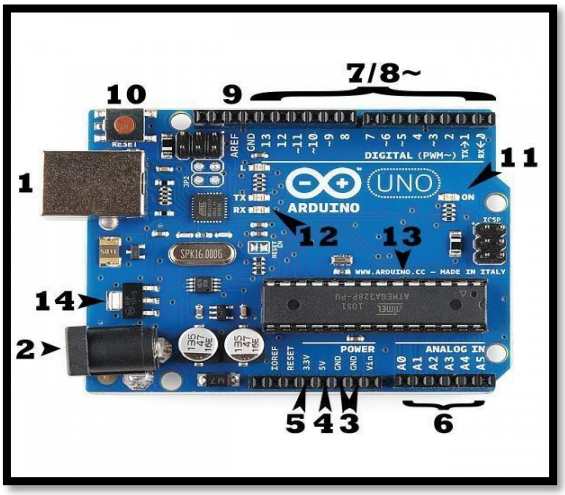


Fig-1

- The Arduino has a reset button (10). Pushing it will temporarily connect the reset pinto the ground and restart any code that is loaded on the Arduino.

- This LED (11) should light up whenever you plug your Arduino into a power source.

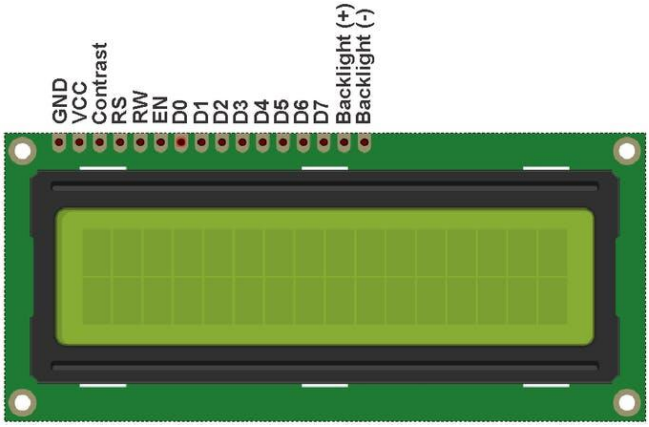
- TX is short for transmitting; RX is short for receiving. These pins are responsible forserial communication. There are two places on the Arduino UNO where TX and RXappear -- once by digital pins 0 and 1, and a second time next to the TX and RX indicator LEDs (12).

- The IC or Integrated Circuit (13) is the brain of our Arduino. The main IC on the Arduino is different from board type to board type but is usually from the AT megaline of ICs from the ATMEL company.

- The voltage regulator (14) is not something the user can interact with on the ArduinoUno. The voltage regulator controls the amount of voltage that is let into the Arduinoboard

LCD (16x2):

An electronic device that is used to display data and the message is known as LCD 16×2. As the name suggests, it includes 16 Columns & 2 Rows so it can display 32 characters (16×2=32) in total & every character will be made with 5×8 (40) Pixel Dots. So the total pixels within this LCD can be calculated as 32 x 40 otherwise 1280 pixels.



16 X2 displays mostly depend on multi-segment LEDs. There are different types of displays available in the market with different combinations such as 8×2, 8×1, 16×1, and 10×2, however, the LCD 16×2 is broadly used in devices, DIY circuits, electronic projects due to less cost, programmable friendly & simple to access.

Specifications of LCD 16X2:

The specifications of LCD 16X2 are discussed below.

- The operating voltage of this display ranges from 4.7V to 5.3V
- The display bezel is 72 x 25mm
- The operating current is 1mA without a backlight

LCD 16X2 Pin Configuration:

The pin configuration of LCD 16 X 2 is discussed below so that LCD 16×2 connection can be done easily with external devices.

Pin1 (Ground): This pin connects the ground terminal.

Pin2 (+5 Volt): This pin provides a +5V supply to the LCD

Pin3 (VE): This pin selects the contrast of the LCD.

Pin4 (Register Select): This pin is used to connect a data pin of an MCU & gets either 1 or 0. Here, data mode = 0 and command mode =1.

Pin5 (Read & Write): This pin is used to read/write data.

Pin6 (Enable): This enables the pin must be high to perform the Read/Write procedure. This pin is connected to the data pin of the microcontroller to be held high constantly.

Pin7 (Data Pin): The data pins are from 0-7 which are connected through the microcontroller for data transmission. The LCD module can also work on the 4-bit mode through working on pins 1, 2, 3 & other pins are free.

Pin8 – Data Pin 1

Pin9 – Data Pin 2

Pin10 – Data Pin 3

Pin11 – Data Pin 4

Pin12 – Data Pin 5

Pin13 – Data Pin 6

Pin14 – Data Pin 7

Pin15 (LED Positive): This is a +Ve terminal of the backlight LED of the display & it is connected to +5V to activate the LED backlight.

Pin16 (LED Negative): This is a -Ve terminal of a backlight LED of the display & it is connected to the GND terminal to activate the LED backlight.

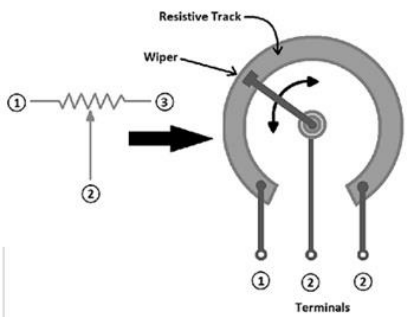
Potentiometer:

The potentiometer is three terminals device connected to a sliding electrical contact. If only two terminals are used it acts as a variable resistor or rheostat and if three-terminal are used then a voltage divider.

Potentiometers are variable resistors that were first invented to amplify radio signals. You could find it in an old radio or a stereo system as a volume control. Earlier it was named ‘multiplier’ by Charles William Siemens and but nowadays it is commonly called ‘POT’. It is used today in both electrical and physical applications and is an integral part of electronic circuits, motor controls, and many other areas.

Working:

In this three-terminal device in which one end is called an end terminal and the other two ends are main terminals that are internally connected together. The resistance between the main terminal remains constant and the end terminal’s resistance can be adjusted with a sliding contact that moves along an axis between the main terminals.



Piezo Buzzer:

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

Specifications:

The specifications of the buzzer include the following.

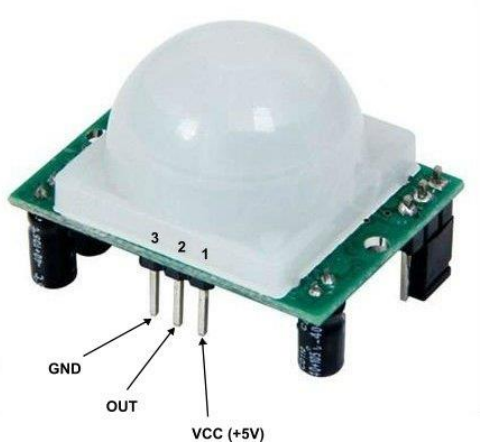
- Color is black
- The frequency range is 3,300Hz
- Operating Temperature ranges from – 20° C to +60°C
- Operating voltage ranges from 3V to 24V DC
- The sound pressure level is 85dBA or 10cm
- The supply current is below 15mA

PIR Sensor:

A passive infrared sensor is an electronic sensor that measures infrared light radiating from objects. PIR sensors mostly used in PIR-based motion detectors. Also, it used in security alarms and automatic lighting applications.

PIR sensors allow you to sense motion. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses.

The below image shows a typical pin configuration of the PIR sensor, which is quite simple to understand the pinouts. The PIR sensor consist of 3 pins,

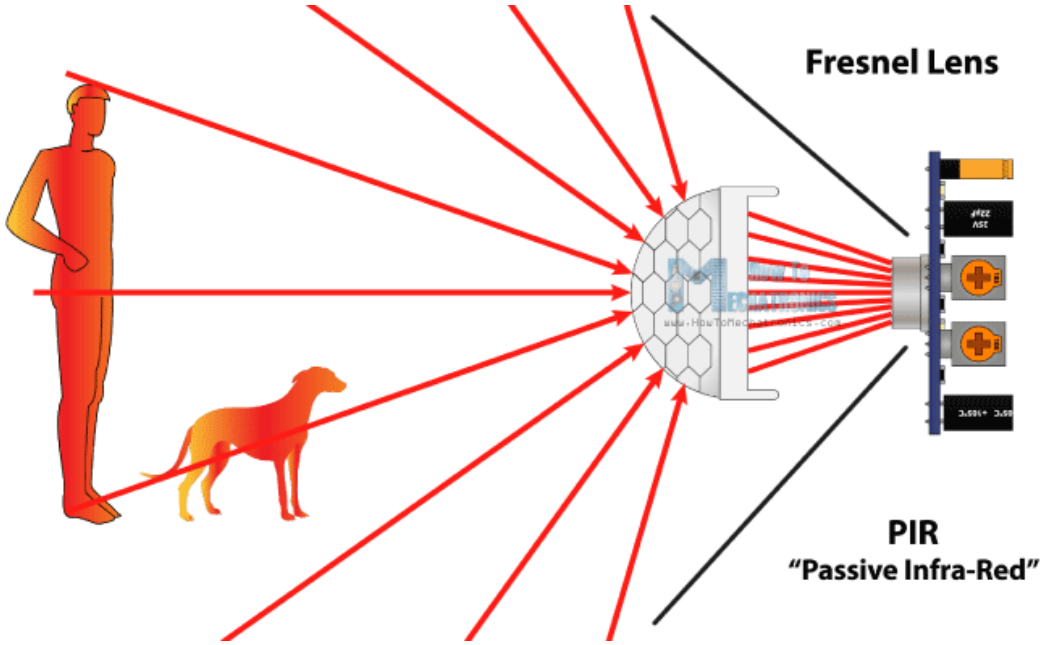


- Pin1 corresponds to the drain terminal of the device, which connected to the positive supply 5V DC.

- Pin2 corresponds to the source terminal of the device, which connects to the ground terminal via a 100K or 47K resistor. The Pin2 is the output pin of the sensor. The pin 2 of the sensor carries the detected IR signal to an amplifier from the

- Pin3 of the sensor connected to the ground.

Generally, PIR sensor can detect animal/human movement in a requirement range. PIR is made of a pyroelectric sensor, which is able to detect different levels of infrared radiation. The detector itself does not emit any energy but passively receives it.



It detects infrared radiation from the environment. Once there is infrared radiation from the human body particle with temperature, focusing on the optical system causes the pyroelectric device to generate a sudden electrical signal.

Simply, when a human body or any animal passes by, then it intercepts the first slot of the PIR sensor. This causes a positive differential change between the two bisects. When a human body leaves the sensing area, the sensor generates a negative differential change between the two bisects.

PIR Sensor Working Principle

The passive infrared sensor does not radiate energy to space. It receives the infrared radiation from the human body to make an alarm. Any object with temperature is constantly radiating infrared rays to the outside world. The surface temperature of the human body is between 36° C - 27 ° C and most of its radiant energy concentrated in the wavelength range of 8 um-12 um.

Passive infrared alarms classified into infrared detectors (infrared probes) and alarm control sections. The most widely used infrared detector is a pyroelectric detector. It uses as a sensor for converting human infrared radiation into electricity. If the human infrared radiation is directly irradiated on the detector, it will, of course, cause a temperature change to output a signal. But in doing all this, the detection distance will not be more. In order to lengthen the detection distance of the detector, an optical system must be added to collect the infrared radiation. Usually, plastic optical reflection system or plastic Fresnel lens used as a focusing system for infrared radiation

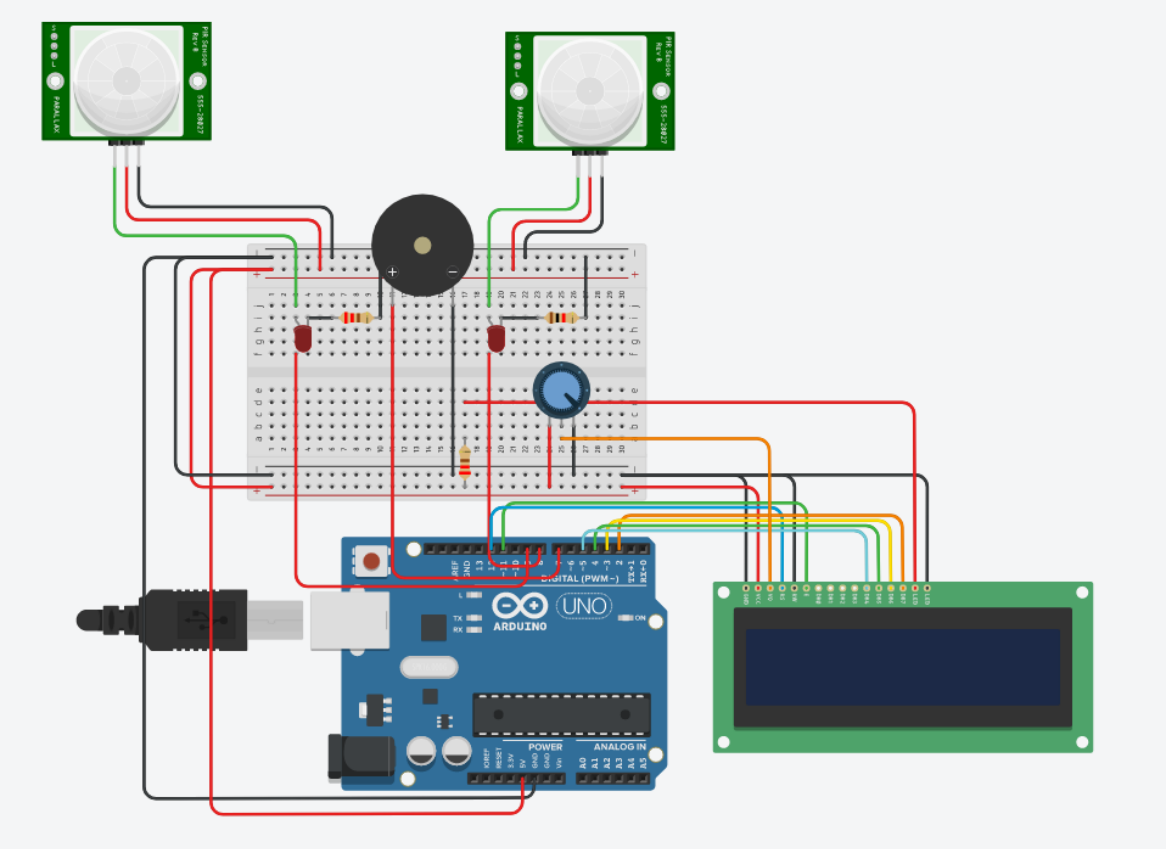
Range of PIR Sensor:

- Indoor passive infrared: Detection distances range from 25 cm to 20 m.
- Indoor curtain type: The detection distance ranges from 25 cm to 20 m.
- Outdoor passive infrared: The detection distance ranges from 10 meters to 150 meters.
- Outdoor passive infrared curtain detector: distance from 10 meters to 150 meters

5.5 Working Principle:

- In this project, two PIR sensors have been used to keep track of the entry and exit of the persons.
- Whenever any person passes through sensor 1 and later sensor 2, it will be treated as entry and count will be incremented.
- Similarly, if any person passes through sensor 2 and later sensor 1, it will be treated as exit and count will be decremented.
- If count exceed the limit of the area or hall, then buzzer makes sound and message will be displayed as room over-crowded.

5.6 Circuit Diagram and Arduino Code:



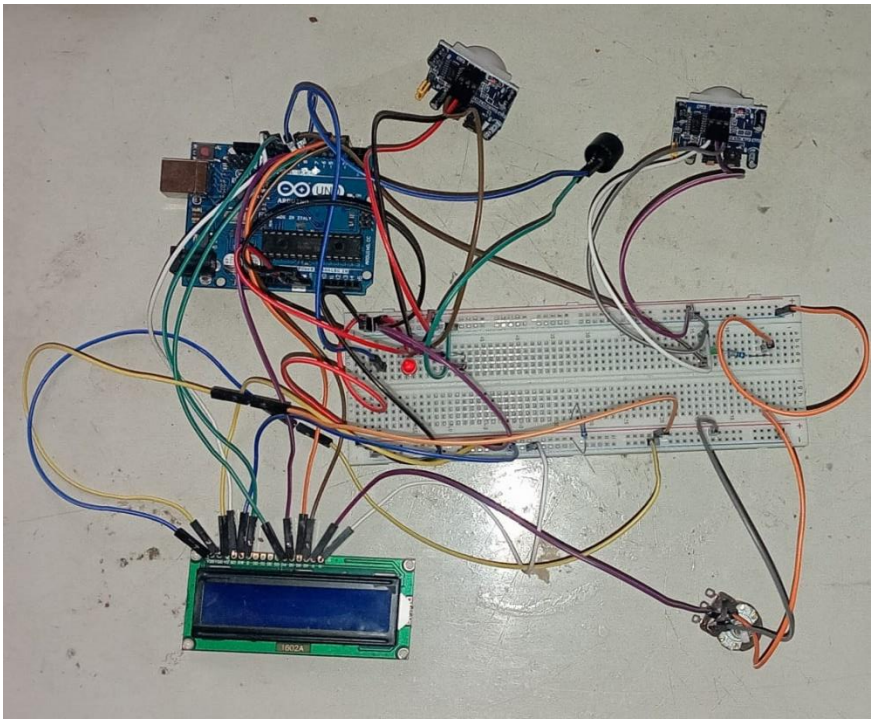
Arduino Code:

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(12,11,5,4,3,2);

const unsigned int NOTE_C4 = 262;
const unsigned int NOTE_E4 = 330;
const unsigned int NOTE_G4 = 392;

const int PIR1_PIN = 8;
const int PIR2_PIN = 9;
const int PIEZO_PIN = 7;
const bool SERIAL_PRINT = true;

int visitors = 0;
int lastRIPdetected = 0;
bool b_PIR1_active = false;
bool b_PIR2_active = false;

void setup()  {
  lcd.begin(16,2);

  pinMode(PIR1_PIN, INPUT);
  pinMode(PIR2_PIN, INPUT);
  pinMode(PIEZO_PIN, OUTPUT);

  Serial.begin(9600);
  DisplayMsg("Visitor counter", "Welcome", SERIAL_PRINT);
}

// -------- Message display on LCD and Serial (optional) ------
void DisplayMsg(String s1, String s2, bool ab_serial_print) {

  lcd.clear();

  lcd.setCursor(0, 0);
  lcd.print(s1);

  lcd.setCursor(0, 1);
  lcd.print(s2);

  if (ab_serial_print)
    Serial.println(s1 + ". " + s2);
}
```

```
// -------- Increase/Decrease visitors ---------
void UpdateVisitorsCounter(int x){
int duration=100;

  visitors = visitors + x;

  lastRIPdetected = 0;  // reset detected PIR

  if (x>0)
    PlayNote(NOTE_G4, duration);
  else
    PlayNote(NOTE_C4, duration);

}

// -------- Play note ---------
void PlayNote(int note, int duration) {
  tone(PIEZO_PIN, note, duration);
  delay(duration * 1.3);
  noTone(PIEZO_PIN);
}


void loop() {

  // ----------- check PIR1 -----------------
  if (digitalRead(PIR1_PIN) == HIGH) {

    if ( !b_PIR1_active ) {
      b_PIR1_active = true;

      if (lastRIPdetected == 0 && !b_PIR2_active) {  // new start
        lastRIPdetected = 1;

        DisplayMsg("In PIR1", "Visit started", SERIAL_PRINT);

      } else if (lastRIPdetected == 2) { // if we were in PIR2 before
        UpdateVisitorsCounter(-1);

        DisplayMsg("Visitor exited", "Visitors:" + String(visitors), SERIAL_PRINT);
      }
    }
  }else
    b_PIR1_active = false ;  // reenable PIR1
```

```
 // ---------- check PIR2 ----------------
 if (digitalRead(PIR2_PIN) == HIGH ) {
  if ( !b_PIR2_active ) {
    b_PIR2_active = true;
         if (lastRIPdetected == 0 && !b_PIR1_active) { // new start
      if (visitors > 0) {
        lastRIPdetected = 2;
        DisplayMsg("In PIR2", "Exit started", SERIAL_PRINT);
      } else
        DisplayMsg("No more visitors", "to exit", SERIAL_PRINT);
    } else if (lastRIPdetected == 1) {  // if we were in PIR1 before
      UpdateVisitorsCounter(1);
      DisplayMsg("Visitor entered", "Visitors:" + String(visitors), SERIAL_PRINT);
    }
  }
 } else
  b_PIR2_active = false; // reenable PIR2

}
```

Hardware design:



5.8 Conclusion:

- Finally, we conclude that the proposed system will count visitors effectively and efficiently by reducing the rate at which error occurs when counting visitors.
- As the project was to design and construct a device that would count and display the exact number of people in a building, the following recommendation however should be considered to ensure effective operation of the digital bidirectional visitor counter
- The sensors should be positioned at the entrance in a way not to attract visitor's attention.