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Microcontroller and Embedded Systems on

“Automatic Room light Controller with Visitor Counter”

Submitted by

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ABSTRACT

In recent years, with the new advances in technology, people have been freed from tedious work and more work can be done in a short time. creativity plays a very important role in the improvement of our society and of our living standard. With the increase in standard of living, there is a sense of urgency for developing circuits that would ease the complexity of life and well to be precise, engineers like us are supposed to think creatively, innovate and make easier our daily tasks. One such example is "Automatic Room light Controller With Visitor Counter" recent pandemics like covid-19 has been a challenge on humankind to continue their businesses or even follow the guidelines such as social distancing, less human contact etc. while visiting a store or airports or even theatres, these guidelines to follow are really hard without technological 'intervention"

INTRODUCTION:

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. Automatic Room Light Controller with Visitor Counter is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately. Electricity is one of the most important resources in this century. We should conserve the electricity. But many times we come outside the room/hall and forget to turn off the lights/fan, thus the electricity is wasted. To overcome this we are going to implement a project called "Automatic room light controller with visitor counter". This project has 2 modules. First module is "Visitor counter" and the other module is "Automatic room light controller". Main concept behind this project is to measure and display the number of persons entering in any room like seminar hall, conference room. And when number of persons inside the room is zero, power supply inside the room will be turned off. This will help to save electricity. LCD display placed outside the room displays number of person inside the room. When somebody enters into the room then the counter is incremented by one and the light in the room will be switched ON and when any one leaves the room then the counter is decremented by one. The light will be only switched OFF until all the persons in the room go out. The total number of persons inside the room is also displayed on the LCD. The microcontroller does the above job. It receives the signals from the sensors, and this signal is operated under the control of program which is stored in ROM.

COMPONENTS USED :

1. Arduino uno
2. Ultrasonic sensor (x2)
3. Bread Board
4. LCD display
5. Jumper wires

Arduino uno

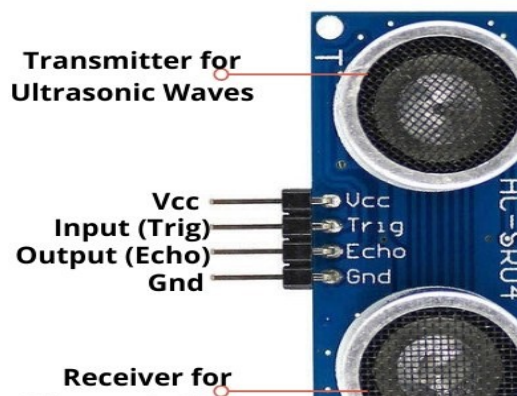
Arduino Uno is a microcontroller board based on the ATmega328P ([datasheet](#)). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your Uno without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.



Ultrasonic sensor

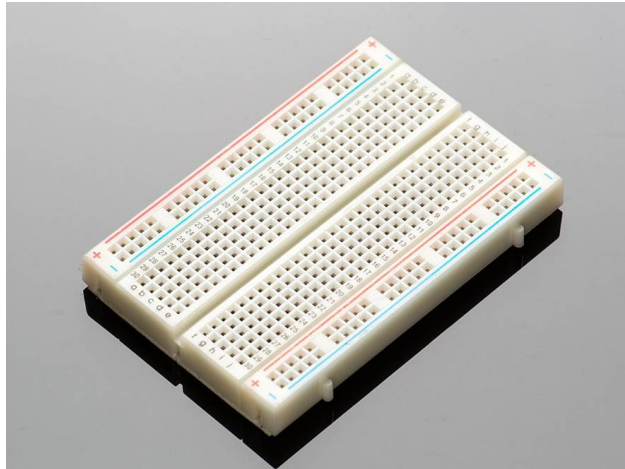
An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound. Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emissions of the sound by the transmitter to its contact with the receiver. The formula for this calculation is $D = \frac{1}{2} T \times C$ (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second).



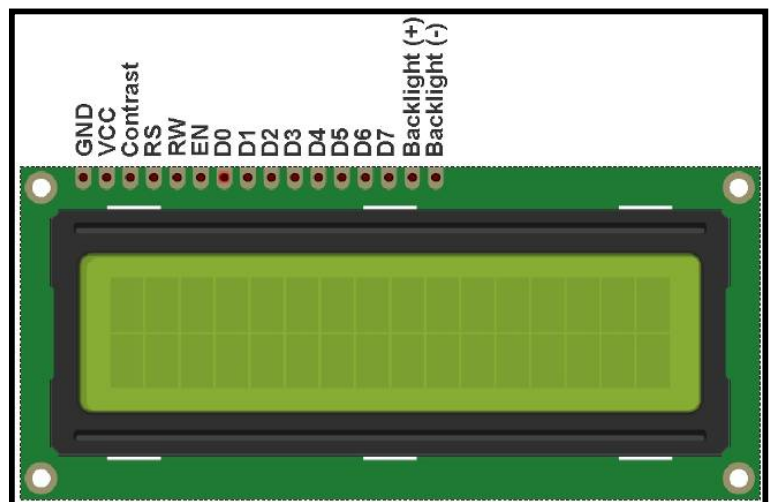
Bread Board

A **breadboard** is a widely used tool to design and test circuit. You do not need to solder wires and components to make a circuit while using a bread board. It is easier to mount components & reuse them. Since, components are not soldered you can change your circuit design at any point without any hassle. It consist of an array of conductive metal clips encased in a box made of white ABS plastic, where each clip is insulated with another clips. There are a number of holes on the plastic box, arranged in a particular fashion. A typical bread board layout consists of two types of region also called strips. Bus strips and socket strips. Bus strips are usually used to provide power supply to the circuit. It consists of two columns, one for power voltage and other for ground.



LCD display

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.



LIBRARIES USED

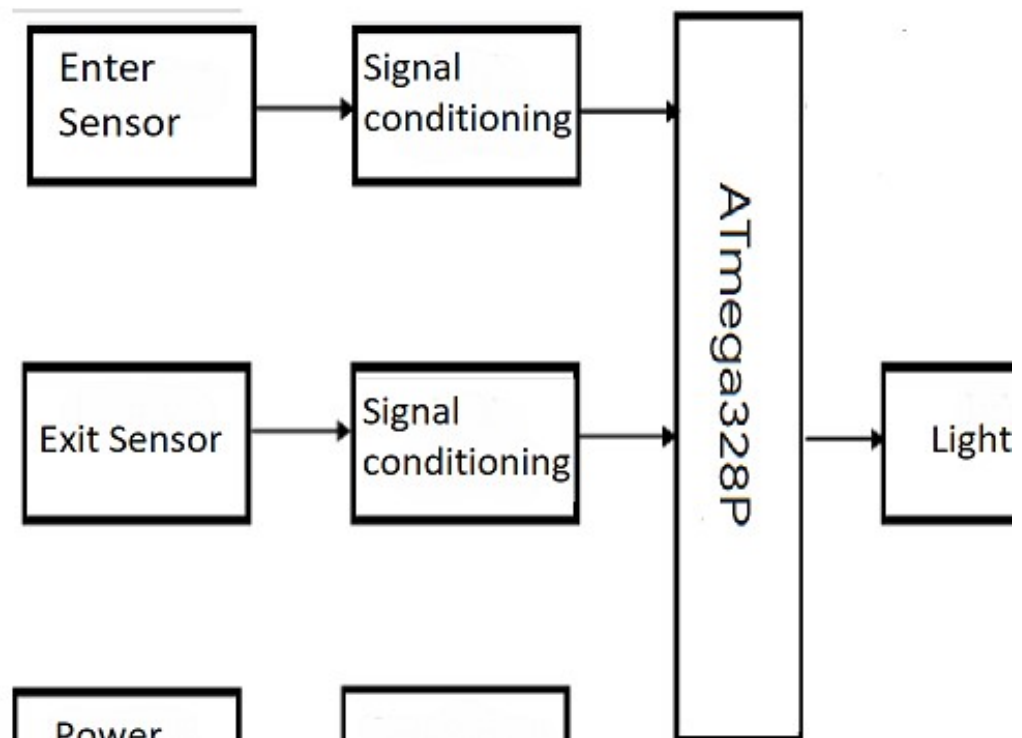
LiquidCrystal Library

This library allows an Arduino board to control LiquidCrystal displays (LCDs) based on the Hitachi HD44780 (or a compatible) chipset, which is found on most text-based LCDs. The library works with in either 4- or 8-bit mode (i.e. using 4 or 8 data lines in addition to the rs, enable, and, optionally, the rw control lines).

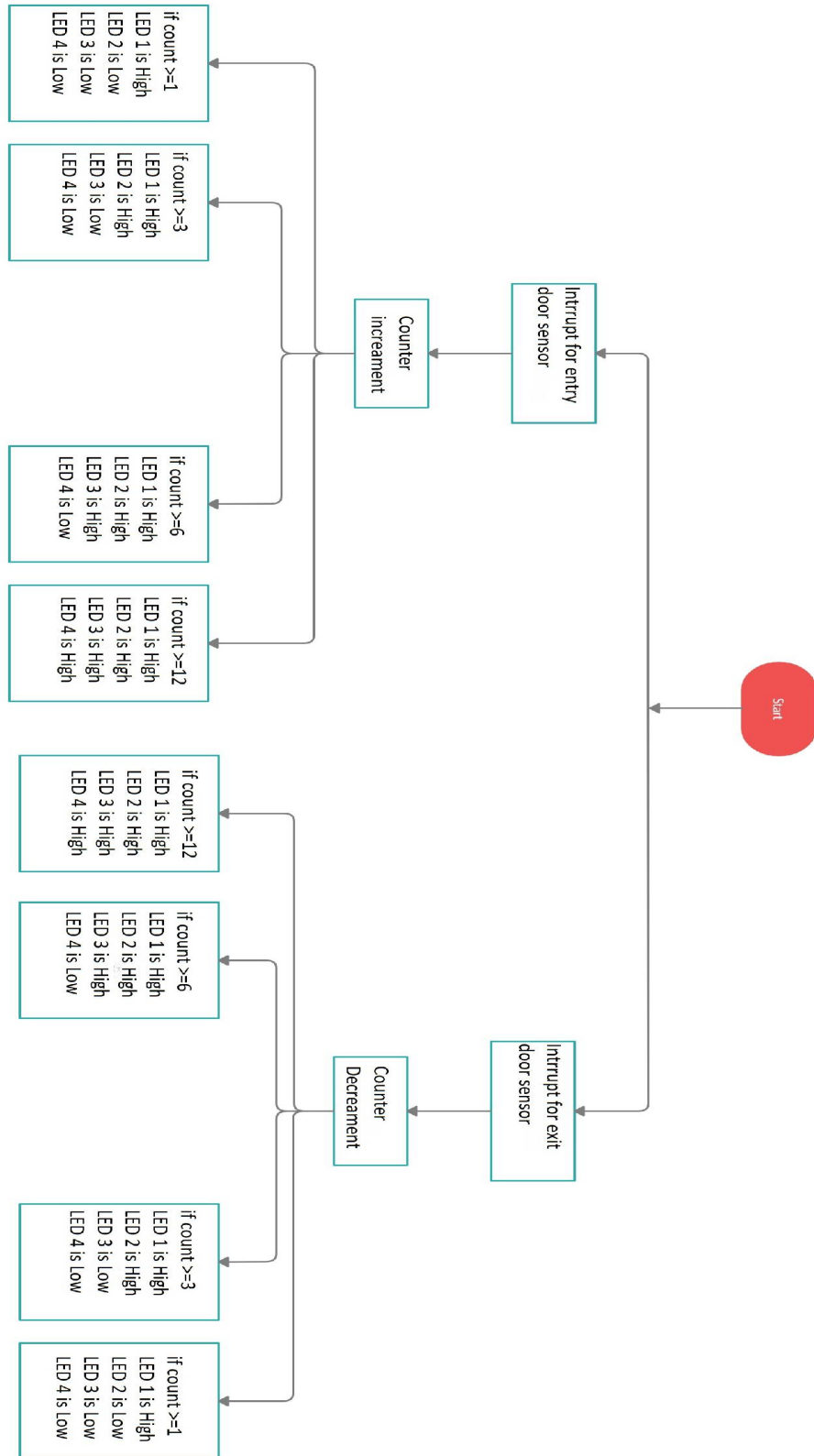
To use this library

#include <LiquidCrystal.h>

BASIC BLOCK DIAGRAM



FLOW CHART



CODE

- Assigning the pin numbers to the components

```
int trigin = 6;  
int trigout=10;  
int echoout=13;  
int echoin = 7;  
int led1 = A0;  
int led2 = A1;  
int led3 = 9;  
int led4 = 8;  
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
```

- When the signal sent by the sensor placed on the entry door catches an obstacle the code enters this if statement and the count variable which acts as counter is increased by one and it displays “WELCOME” and the number of people in the room

```
if (distanceInCm > 1 && distanceInCm < 10)  
{  
    count=count+1;  
    lcd.setCursor(0,0);  
    lcd.print("Welcome");  
    lcd.setCursor(0,1);  
    lcd.print(count);  
    delay(1000);  
}
```

- When the signal sent by the sensor placed on the exit door catches an obstacle the code enters this if statement and the count variable which acts as counter is decreases by one and it displays “Thankyou” and the number of people in the room

```
if (distanceoutCm > 1 && distanceoutCm < 10)  
{  
    if(count>0)  
    {  
        count=count-1;  
    }  
    lcd.setCursor(0,1);  
    lcd.print("Thankyou");  
    lcd.setCursor(0,0);  
    lcd.print(count);  
  
    delay(1000);  
}
```

- If there are no people in room then all the lights are turned off.

```
if(count==0)
{
    digitalWrite(led1, LOW);
    digitalWrite(led2, LOW);
    digitalWrite(led3, LOW);
    digitalWrite(led4, LOW);
}
```

- If the numbers of person in the room are one or more than one then the first light glows.

```
if(count>=1)
{
    digitalWrite(led1, HIGH);
    digitalWrite(led2, LOW);
    digitalWrite(led3, LOW);
    digitalWrite(led4, LOW);
}
```

- If the numbers of person in the room are three or more than three then the first and second lights glow.

```
if(count>=3)
{
    digitalWrite(led1, HIGH);
    digitalWrite(led2, HIGH);
    digitalWrite(led3, LOW);
    digitalWrite(led4, LOW);
}
```

- If the numbers of person in the room are six or more than six then the first and second lights glow.

```
if(count>=6)
{
    digitalWrite(led1, HIGH);
    digitalWrite(led2, HIGH);
    digitalWrite(led3, HIGH);
    digitalWrite(led4, LOW);
}
```

- If the numbers of person in the room are six or more than six then the first and second lights glow.

```
if(count>=12)
{
    digitalWrite(led1, HIGH);
    digitalWrite(led2, HIGH);
    digitalWrite(led3, HIGH);
    digitalWrite(led4, HIGH);
}
```

Complete Code

```
int trigin = 6;
int trigout=10;
int echoout=13;
int echoin = 7;
int led1 = A0;
int led2 = A1;
int led3 = 9;
int led4 = 8;
long duration, durationout,distanceInCm,distanceoutCm, inches,inchesout;
int i=0;
int count=0;
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
void setup()
{
  Serial.begin(9600);
  pinMode(trigin, OUTPUT);
  pinMode(echoin, INPUT);
  pinMode(trigout, OUTPUT);
  pinMode(echoout, INPUT);
  pinMode(led1, OUTPUT);
  pinMode(led2, OUTPUT);
  pinMode(led3, OUTPUT);
  pinMode(led4, OUTPUT);
  lcd.begin(16, 2);
}
void loop()
{

  digitalWrite(trigin, LOW);
  delayMicroseconds(2);

  digitalWrite(trigin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigin, LOW);

  duration = pulseIn(echoin, HIGH);

  distanceInCm = microsecondsToCentimeters(duration);

  inches = (distanceInCm / 2.54);
  if (distanceInCm > 1 && distanceInCm < 10)
```

```

{
count=count+1;
lcd.setCursor(0,0);
lcd.print("Welcome");
lcd.setCursor(0,1);
lcd.print(count);
delay(1000);
}

lcd.clear();
delay(100);

digitalWrite(trigout, LOW);
delayMicroseconds(2);

digitalWrite(trigout, HIGH);
delayMicroseconds(10);
digitalWrite(trigout, LOW);

durationout = pulseIn(echoout, HIGH);

distanceoutCm = microsecondsToCentimeters(durationout);

inches = (distanceoutCm / 2.54);
if (distanceoutCm > 1 && distanceoutCm < 10)
{
    if(count>0)
    {
        count=count-1;
    }

    lcd.setCursor(0,1);
    lcd.print("Thankyou");

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

    delay(1000);
}

lcd.clear();
delay(100);
if(count==0){
    digitalWrite(led1, LOW);
    digitalWrite(led2, LOW);
    digitalWrite(led3, LOW);
    digitalWrite(led4, LOW);
}
}

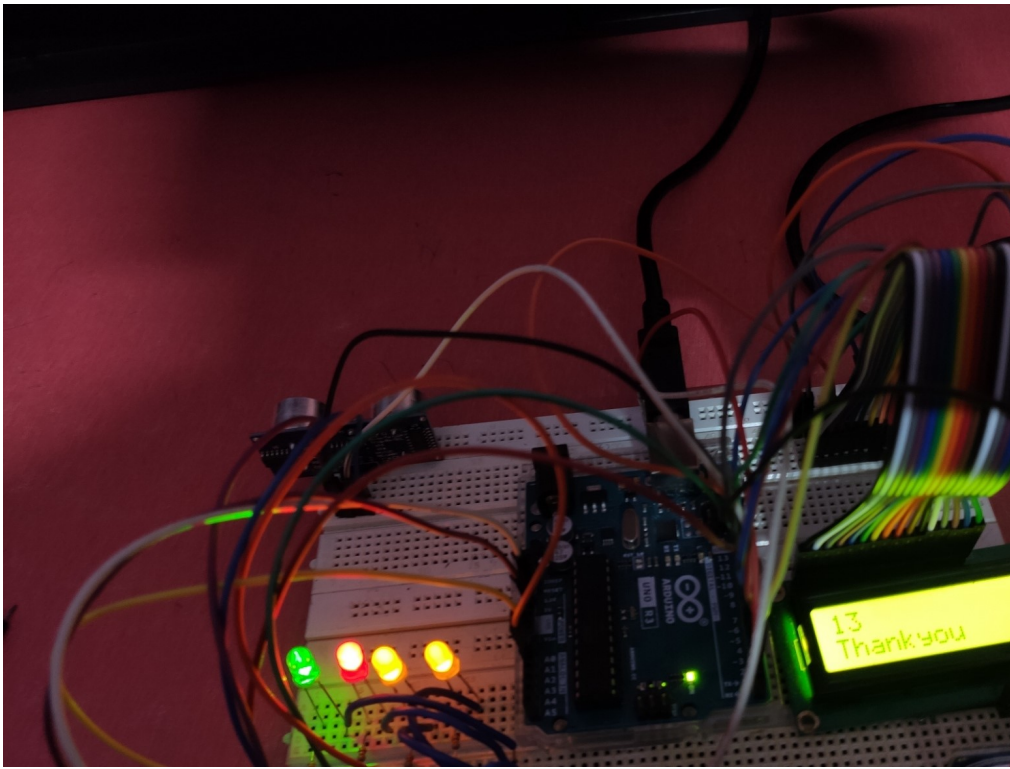
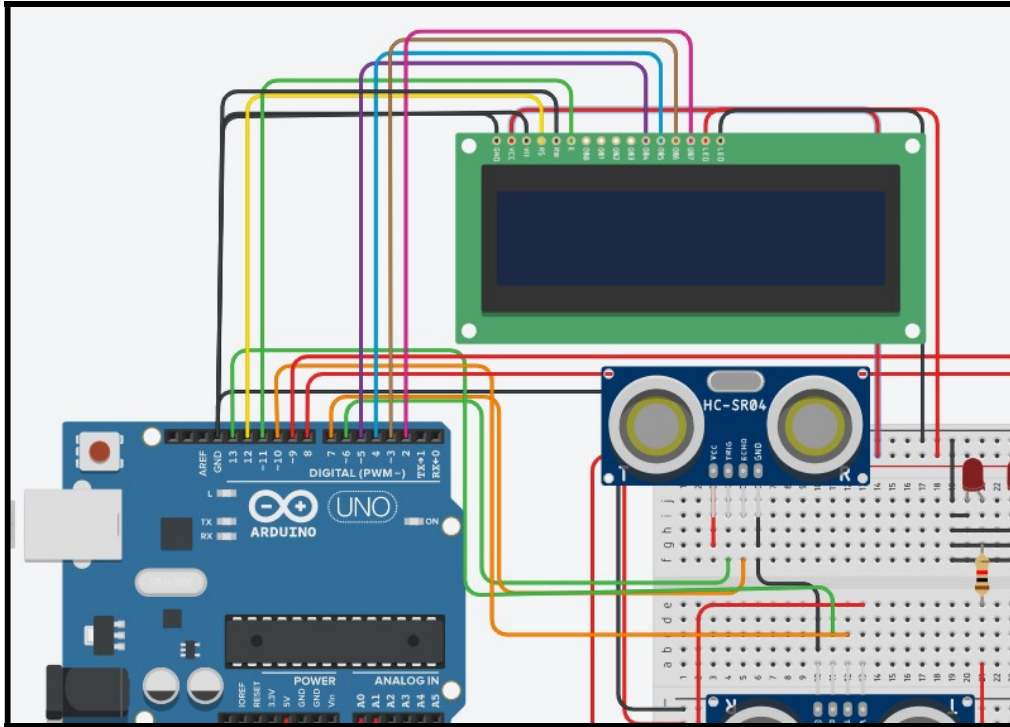
```

```

if(count>=1){
    digitalWrite(led1, HIGH);
    digitalWrite(led2, LOW);
    digitalWrite(led3, LOW);
    digitalWrite(led4, LOW);
}
if(count>=3){
    digitalWrite(led1, HIGH);
    digitalWrite(led2, HIGH);
    digitalWrite(led3, LOW);
    digitalWrite(led4, LOW);
}
if(count>=6){
    digitalWrite(led1, HIGH);
    digitalWrite(led2, HIGH);
    digitalWrite(led3, HIGH);
    digitalWrite(led4, LOW);
}
if(count>=12){
    digitalWrite(led1, HIGH);
    digitalWrite(led2, HIGH);
    digitalWrite(led3, HIGH);
    digitalWrite(led4, HIGH);
}
}
}
long microsecondsToCentimeters(long microseconds)
{
    return microseconds / 29 / 2;
}

```

CIRCUIT DIAGRAM



CASE STUDY

The device is set up in a grocery store where according to covid 19 prevention guidelines a maximum of 12 people are allowed into the store when the person gets into the shop the sensor at the door receives the signal and through a LED output a welcome message can be displayed to the customer we will be having 4 LED's to represent the number of people visiting the store.

LED1: turns on if one person is inside the shop

LED2: turns on if 3 customers are in the shop

LED3: turns on if 6 customers are in the shop

LED4: turns on at maximum capacity that is 12 people

All the LED's being on indicates that the maximum customers accommodating the store have been reached and the next customers are supposed to wait. Thereby adhering to safety protocols and guidelines and no man power involvement. This automation can easily save a lot of minutes even when used in boarding planes at airports. Considering a big amount of people (100-150 passengers), and even in movie theatres to just have an idea if there are vacant seats to be occupied or not

APPLICATIONS

Digital Visitor Counter can be used in various rooms like seminar hall, conference hall where the capacity of the room is limited and should not be exceeded. The project will display an actual number of persons inside the room.

“Automatic Room light Controller with Visitor Counter” can be used in classrooms, study rooms in colleges.

Automatic Room light Controller project can also be used in our home because many times we come out of our bedroom or any other room and we forgot to turn off the room light.

The Bidirectional person counter project can be used in Cinema halls, multiplex, malls as well as in temples to count the number of a person entering inside. So that these places should not get overcrowded to avoid congestion.

ADVANTAGES

- The main advantage of this project is that it helps in energy conservation. Because when there is nobody inside the room then lights are automatically turned off.
- Human efforts to count the number of persons are eliminated. Since this project does the automatic person counting with the help of two sensors installed on the door frame.

CONCLUSION

In our project, we have designed and implemented a Bidirectional Counter & Home Automation using the concept of Embedded System. The target users of the project can be any one right from a common man to any organization. Let's say if any one uses our project for Seminar Purpose then the track record of the persons attending the seminar will give the exact idea about the no. of candidate attending and leaving the seminar. This project is useful in developing countries and this project has a bright future. In this digital world Technology is very advanced and we prefer things to be done automatically without any human efforts. This project also helps to reduce human efforts. Also it is very useful to conserve resources. It is very useful in Schools, hospitals, malls, offices, auditoriums etc. This gives lots of knowledge of software as hardware.