Automatic Room Light Controller with Bidirectional Visitor Counter

Introduction:

We built an Arduino based system which can automatically switch ON room lights when at least one person is present in the room. If room is empty, the lights will automatically get switch off. It also displays count of persons present in the room and when leaving the room. We build this system using Arduino and IR sensor module. Automatic Room Lights System using Arduino is a very useful project as you need not worry about turning ON and OFF the switches every time you want to turn on the lights. The main components of the Automatic Room Lights project are Arduino, PIR Sensor and the Relay Module. Out of the three components, the IR Sensor is the one in focus as it is the main device that helps in detecting humans and human motion. In fact, the Automatic Room Lights project can be considered as one major application of the IR Sensor.

Purpose:

The Automatic Room Lights using Arduino and IR Sensor, where the lights in the room will automatically turn ON and OFF by detecting the presence of a human. Such Automatic Room Lights can be implemented in your garages, staircases, bathrooms, etc. Where we do not need continuous light but only when we are present.
With the help of an automatic room light control system, you need not worry about electricity as the lights get automatically OFF when there is no person.

Software:

- Proteus

Components:

- Two IR Sensors
- Arduino UNO
- Relay module

- Bulb
- LCD 16x2 display
- Battery
- Jumper wires

# Components Details:

1. Arduino Uno R3:

Arduino is an open source programmable circuit board that can be integrated into a wide variety of makerspace projects both simple and complex. This board contains a microcontroller which is able to be programmed to sense and control objects in the physical world.

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). The R3 is the third, and latest, revision of the Arduino Uno.
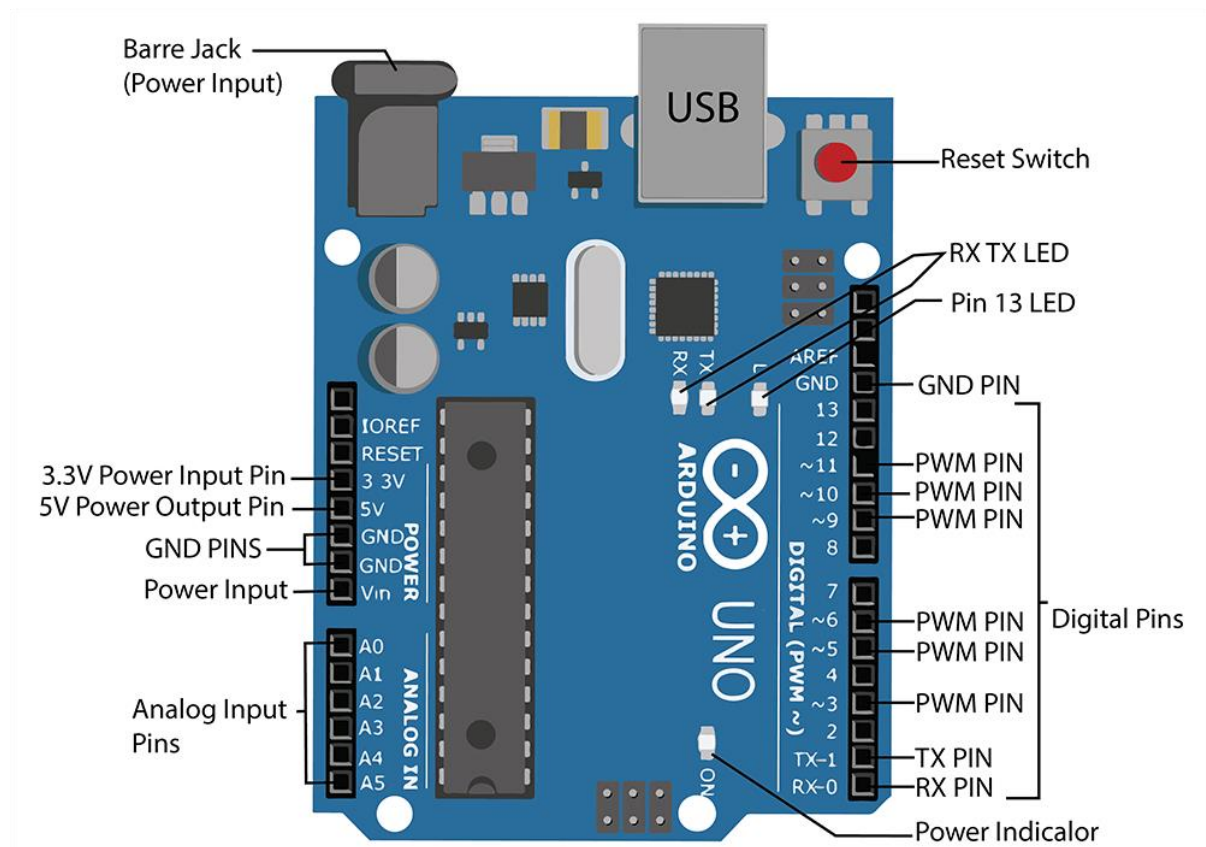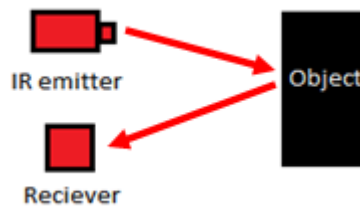
2. IR Sensor:

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment.
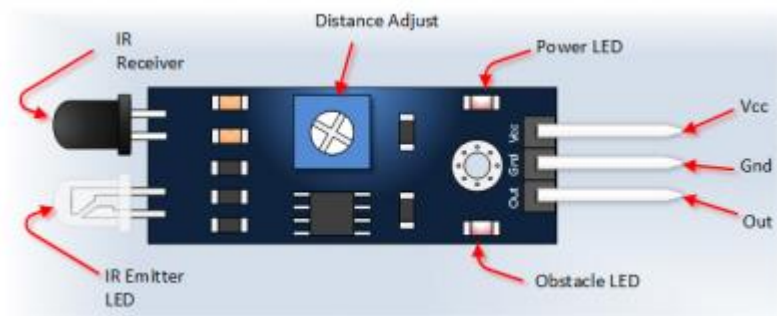
Working of IR sensor

The basic concept of IR sensor is to transmit an infrared signal, this signal bounces back from the surface of an object and signal is received at the infrared receiver.

IR Sensor Working Principle

They are commonly used in obstacle detection systems (such as in robots).

3. LCD 16*2:

An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates to a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.

16×2 LCD is named so because; it has 16 Columns and 2 Rows. It will have (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots. A Single character with all its Pixels is shown in the below picture.
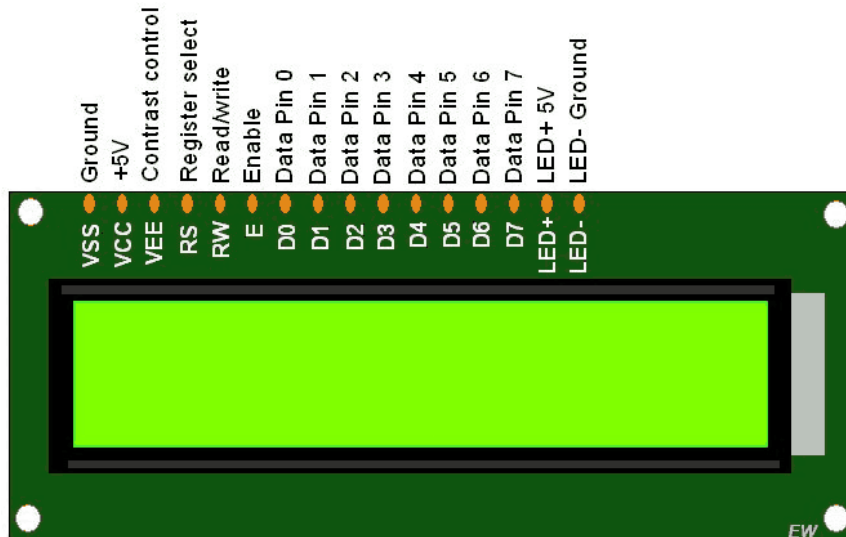
4. Relay:

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.
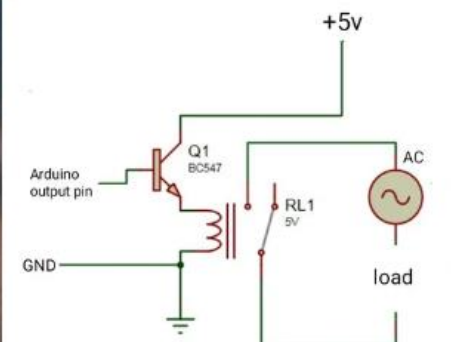
Working: It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energies the electromagnetic field which produces the temporary magnetic field. This magnetic field moves the relay armature for opening or closing the connections

5. BC 547 Transistor:

The BC547 transistor is an NPN transistor. A transistor is nothing but the transfer of resistance which is used for amplifying the current. A small current of the base terminal of this transistor will control the large current of emitter and base terminals. The main function of this transistor is to amplify as well as switching purposes. The maximum gain current of this transistor is 800A.

Pin1 (Collector): This pin is denoted with symbol 'C' and the flow of current will be through the collector terminal.

Pin2 (Base): This pin controls the transistor biasing.

Pin3 (Emitter): The current supplies out through emitter terminal.

BC-547	
1	Collector
2	Base
3	Emitter
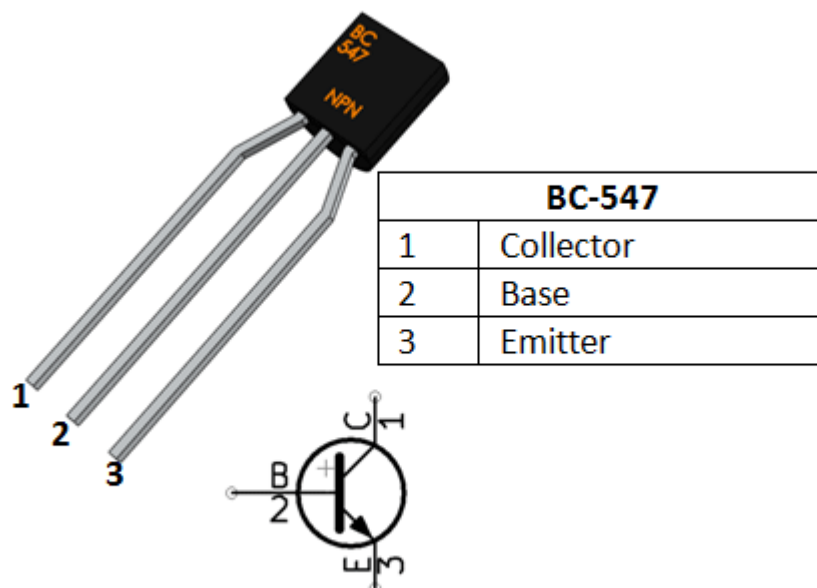
6. Resistor:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

Working:

This circuit is based on Arduino along with IR sensors and relay module.

We have used two IR sensors one for detecting person entering into the room and other for detecting person leaving (exit) the room.

Also, these IR sensors are also used to count the person entering and leaving the room. This person counting will help to automate the room's light. That means when the room is empty, the room's light will remain off. But if someone enters the room then the room's light will get turned ON automatically with person count displayed on LCD.

# Procedure:

Step 1: Circuit Diagram

First, we will make a circuit diagram. For this we will use Arduino because our visitor counter circuit will count the number of people and according to this it will perform its function. We will use 2 analog input pins of Arduino to take input from IR sensors and one digital output pin of Arduino to switch ON the relay. We will use 6 digital output pins to connect the LCD with Arduino.
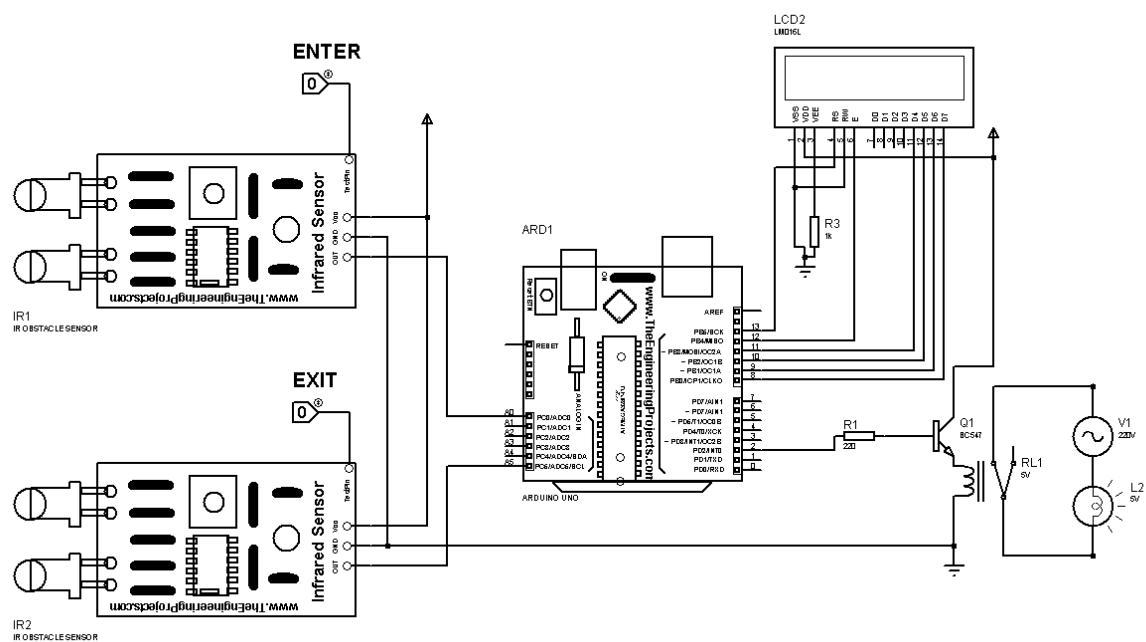
Step 2: Implementation on Proteus

In this we will implement it on Porteous.

- We will add libraries of Arduino and IR sensor.
- Then we will select all the components used in our circuit.
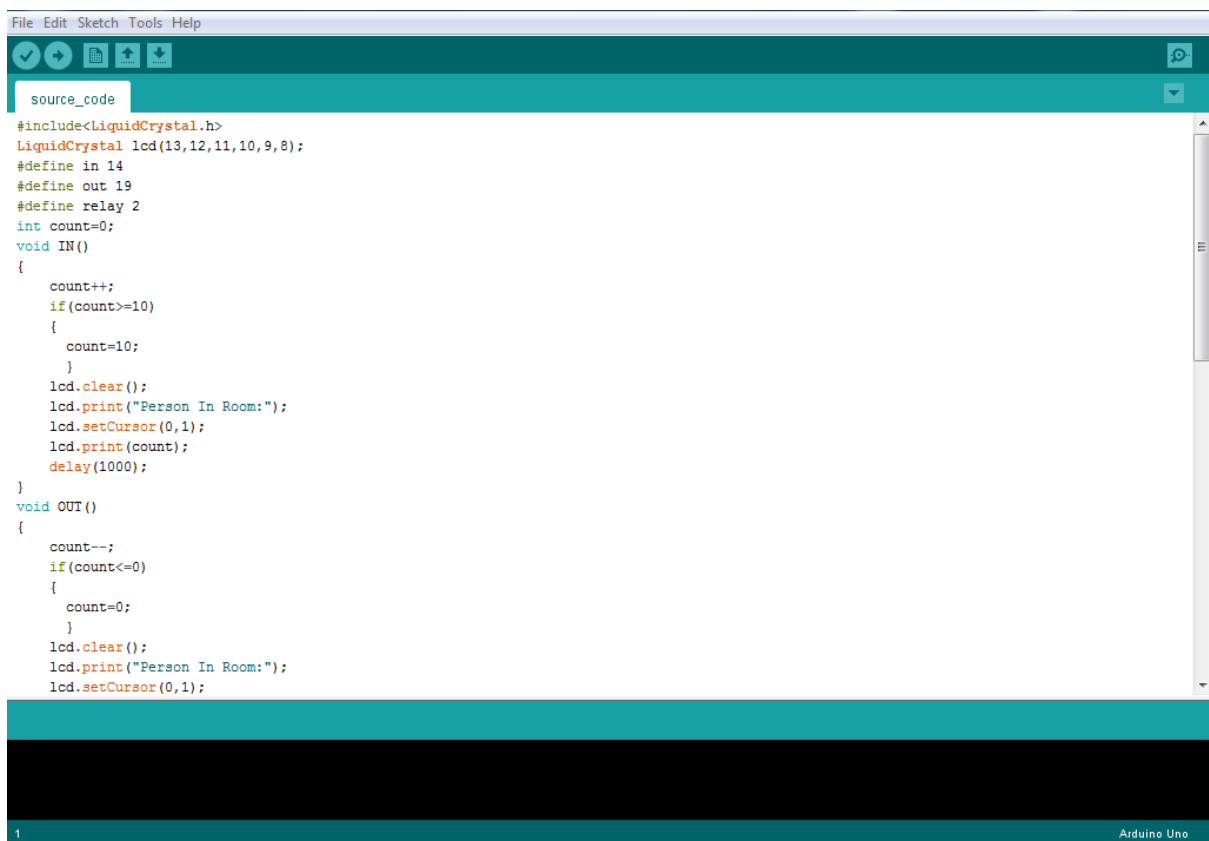- Then we will make the circuit on proteus with the help circuit diagram.
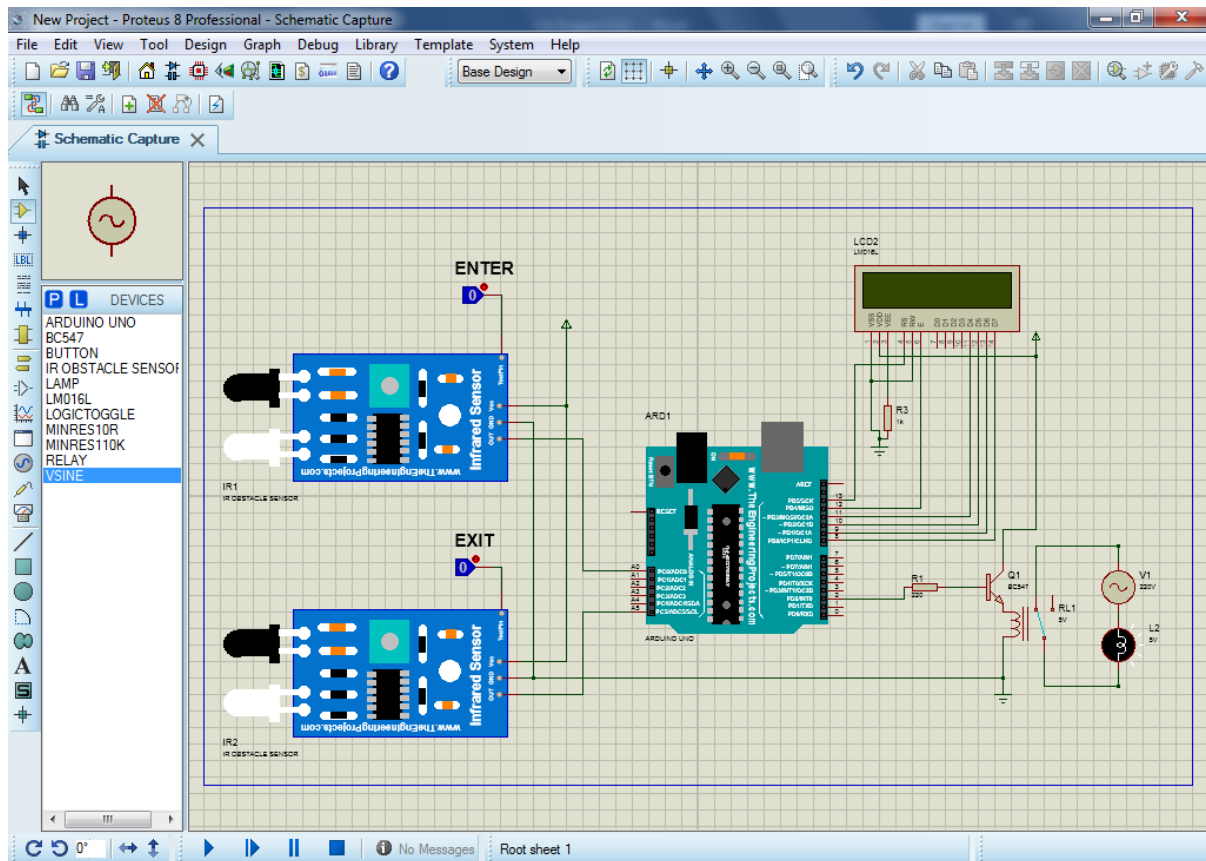
Step 3: The Code

Now write a code for Arduino using Arduino software. This code will count the number of visitors and will display on LCD.

Explanation of code:

We will add library for LCD i.e. **liquid crystal.h** library. Then we will define the 6 digital output pins of Arduino in sequence, to connect Arduino with LCD. We will define two input pins for IR sensor to take input from IR sensor, one output pin for relay to ON and OFF the relay. We will define a variable of integer type to count the visitor. Then we will make two functions. One **IN** function is for the entering visitor and Second **OUT** function is for the Exit/leaving visitor. Entering function (**IN**) will increment in count variable and will display total number of persons on LCD. And leaving function (**OUT**) will decrement in count variable and will display the number of persons leaving the room on LCD. Then comes second part of the code i.e. **void setup.** In this we will define LCD type which is 16x2. Then

we will define the mood of pins of Arduino (like input or output). The comes third part of the coding i.e. **void loop**. This will repeat infinite time. In this part the **IN** function will work when the person will enter the LCD will get switched on and similarly for the **OUT** function, when the person will leave/exit the room the light will stop glowing and it will print total remaining person in room.

File Edit Sketch Tools Help

source_code

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(13,12,11,10,9,8);
#define in 14
#define out 19
#define relay 2
int count=0;
void IN()
{
    count++;
    if(count>=10)
    {
      count=10;
      }
    lcd.clear();
    lcd.print("Person In Room:");
    lcd.setCursor(0,1);
    lcd.print(count);
    delay(1000);
}
void OUT()
{
    count--;
    if(count<=0)
    {
      count=0;
      }
    lcd.clear();
    lcd.print("Person In Room:");
    lcd.setCursor(0,1);
```

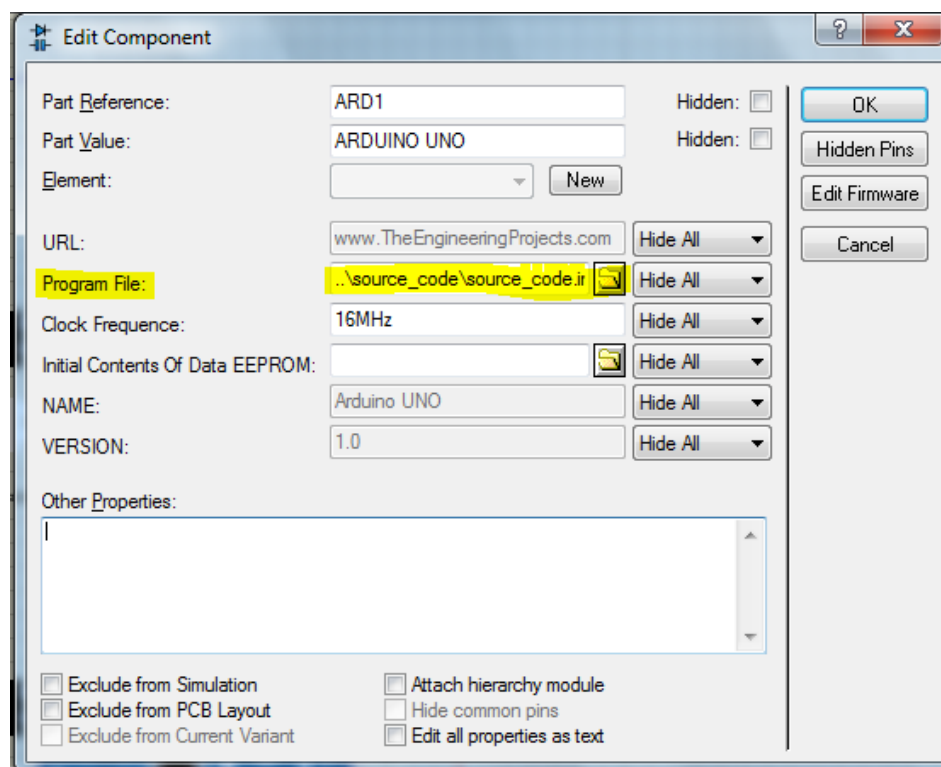1   Arduino Uno

Step 4: Uploading Code in Arduino

Then we will upload our code in Arduino.

- We will generate **.hex** file from Arduino software.
- Then we open Arduino in proteus, then select the file location and upload in Arduino.
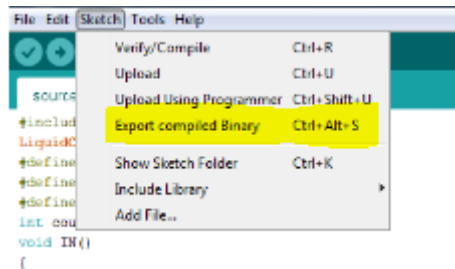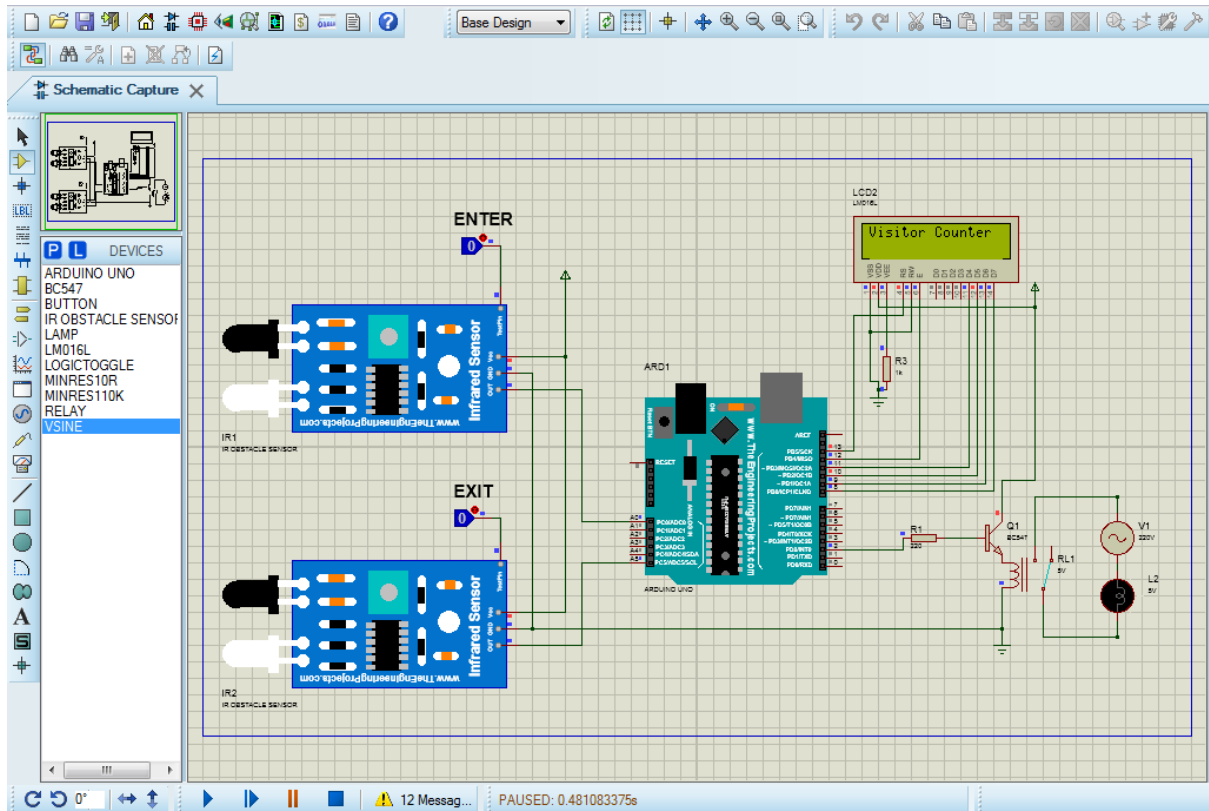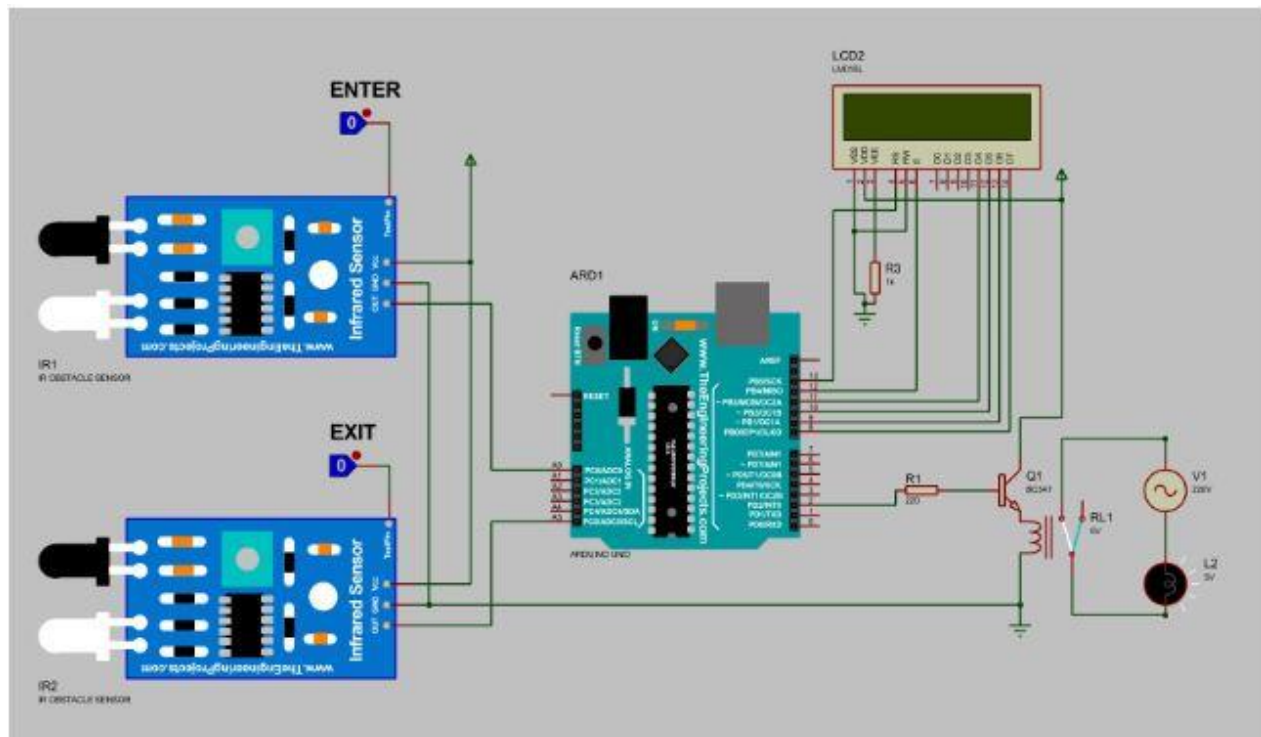
Step 5: Testing

In this step we will test our circuit. Start simulation and test circuit working using all possible inputs and check its output.

Circuit Diagram:

Code:

```
#include<LiquidCrystal.h>

LiquidCrystal lcd(13,12,11,10,9,8);

#define in 14

#define out 19

#define relay 2

int count=0;

void IN()

{

    count++;

    if(count>=10)

    {

      count=10;
```

```arduino
        }
    lcd.clear();
    lcd.print("Person In Room:");
    lcd.setCursor(0,1);
    lcd.print(count);
    delay(1000);
}
void OUT()
{
    count--;
    if(count<=0)
    {
      count=0;
       }
    lcd.clear();
    lcd.print("Person In Room:");
    lcd.setCursor(0,1);
    lcd.print(count);
    delay(1000);
}
void setup()
{
  lcd.begin(16,2);
  lcd.print("Visitor Counter");
  delay(2000);
  pinMode(in, INPUT);
  pinMode(out, INPUT);
  pinMode(relay, OUTPUT);
  lcd.clear();
  lcd.print("Person In Room:");
```
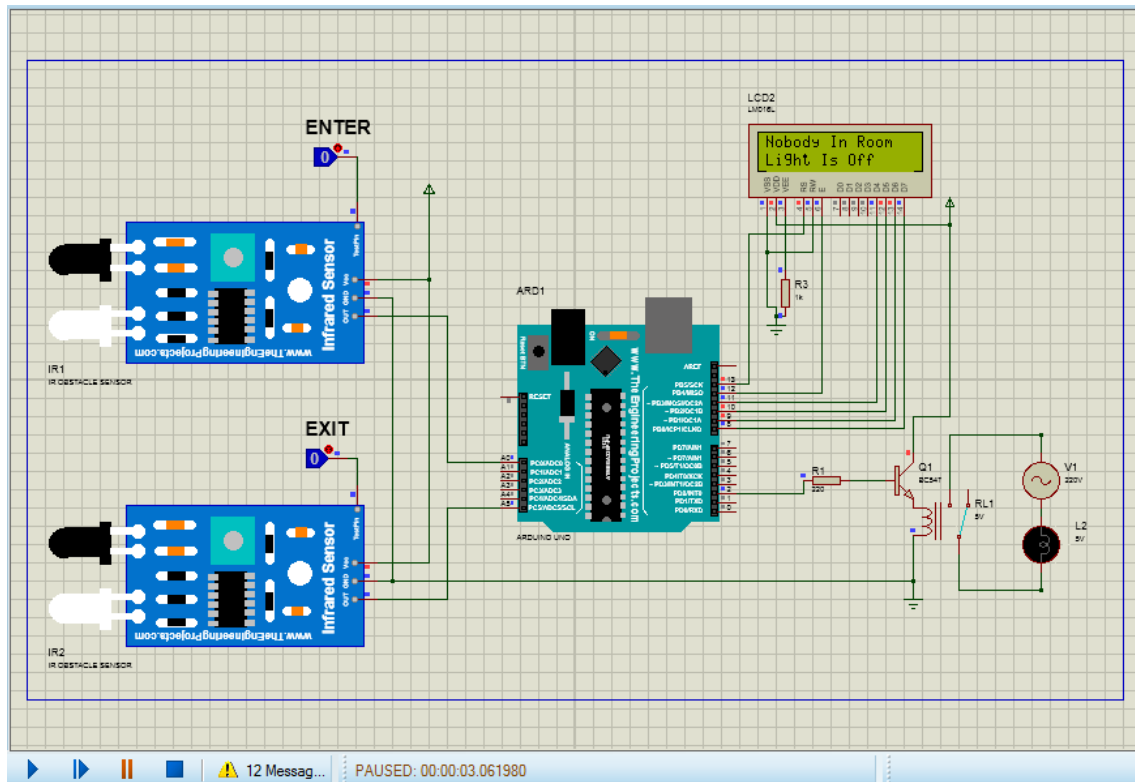
```
      lcd.setCursor(0,1);

      lcd.print(count);

}

void loop()

{


    if(digitalRead(in))

    IN();

    if(digitalRead(out))

    OUT();


    if(count<=0)

    {

      lcd.clear();

      digitalWrite(relay, LOW);

      lcd.clear();

      lcd.print("Nobody In Room");

      lcd.setCursor(0,1);

      lcd.print("Light Is Off");

      delay(200);

    }


    else

      digitalWrite(relay, HIGH);


}
```
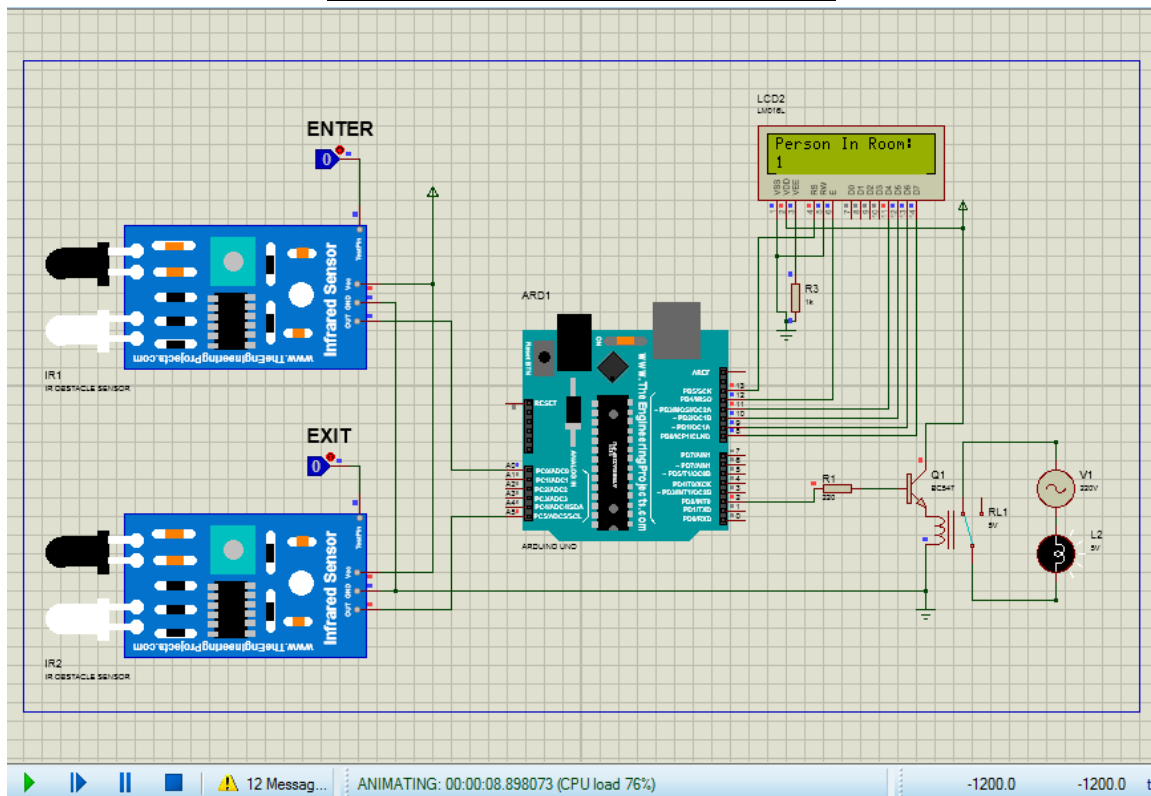
Outputs:

When no one in Room

When 1 Person enter in a Room

When 5 Persons enter in the Room