TOPIC:

SOCIAL DISTANCING SYSTEM INCORPORATING LASER DIODES WITH AUTOMATIC DOOR CONTROL SYSTEM FOR BOTH INCOMING AND OUTGOING

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Motivation:

About Coronovirus:
As we know that Coronavirus disease (COVID-19) is an infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2). COVID-19 has affected millions of people and has claimed the lives of millions of people from all over the world leaving many innocents helpless and became a big question mark on their survival. People may develop mild to moderate illness and may need special treatment or hospitalization. The incubation period of this virus could be up to 2 weeks and during this period, the person may not experience any symptoms but could still be Contagious and may be a virus carrier and easily spread it when he/ she does not take any precautionary measures. Now, According to the World Health Organization, coronavirus is mainly transmitted through droplets generated when an infected person coughs, sneezes, or exhales. These droplets are too heavy to hang in air, so they quickly fall on the surfaces below.

A person could contract this disease if he/ she breathes in the virus while an infected person/ virus carrier within close proximity sneezes or

coughs, or by touching a contaminated surface and then his/ her eyes, nose or mouth.

About Project:

Now as evident from the description above major chunk of this infection could be stopped if people follow guidelines for social distancing that is deliberately increasing the physical space between people to avoid spreading illness. But sometimes people do not practice it when standing in queues and that made me to come up with this innovative idea.

Introduction:

Now, in my project I have tried to build an innovative solution to this challenging problem which could eventually be the reason for survival of many. In this prototype I have used only 3 laser diodes that is at max only 3 people can stand in a queue at any point in time and as soon as people would leave it would get updated.

Description:

In this project, people are supposed to stand in the appropriate positions which are at least 1 meter away from each other. This distance can be changed according to your preferences but it has to be more than 1 meter.

If the person does not stand in the proper place, the person will be notified and he/ she can follow social distancing properly. I have used an LCD display module to display the number of people standing in the queue and the occupied slots. If a slot is not occupied, that slot number will not be displayed in the LCD.

As this project is about how to be safe from Corona and it's well known that it spreads quickly due to contact with the surfaces, so to make the whole process contact less, I have also used the automatic door control method for both entrance and exit so that people could be secured from all possible entry points of viruses.

Components Required:

1. **Arduino Uno R3:** Arduino Uno is an open-source micro controller board based on the Microchip ATMega328P micro controller and developed by Arduino.cc. It is equipped with various digital and analog input/output pins, capable of interfacing with other circuits and is programmable with Arduino IDE.

2. **HC-SR04 Ultrasonic Distance Sensor:** It uses SONAR to determine the distance of an object in front of it. It can measure the distance between 2cm to 400 cm with high accuracy.
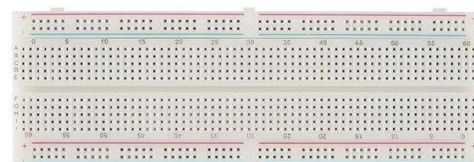
3. **Servo** "servos", as devices that machine with **Motor(x2)**: Servo motors or they are known, are electronic rotate and push parts of a precision. They are generally used for rotating specific parts by a specific angle with high accuracy and precision.

4. **Breadboard**: A breadboard is a solder less rectangular plastic board with a bunch of tiny holes in it.These holes let us easily insert electronic components to prototype an electronic circuit.

5. **IR sensor**: An infrared sensor is an electronic device, that emits and receives infrared rays in order to sense some aspects of the surroundings. An IR sensor detects a body's motion.

6. **Laser Diode:** The laser diode emits a small intense focused beam of visible red light that can be used in various ways to control light dependent systems.

7. **Base shield:** Base shield gets directly attached to the Arduino board and connect various components like LCD directly to it saving lot of Arduino pins for more use.

8. **RGB Backlight LCD**: It is an display which enables us on any color background be changed by changing Green and Blue color.

RGB LCD to write a text which could values of Red,

9. **Photoresistor**: A photoresistor is a sensor that changes its resistance when light shines on it. The resistance generated varies depending on the light striking at his surface. A high intensity of light incident on the surface will cause a lower resistance.
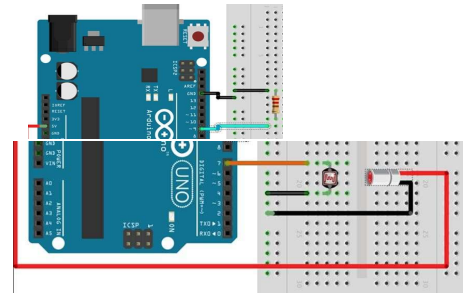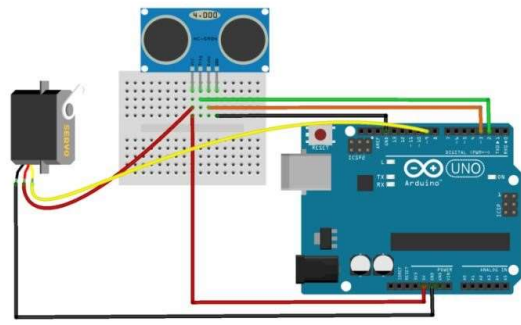
10. **Resistors and Jumper Wires**

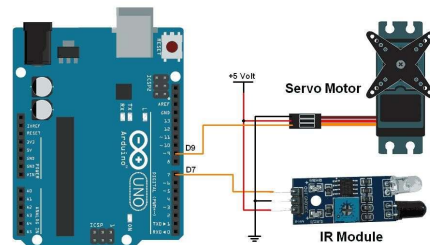*Circuit diagrams of different parts shown individually:*

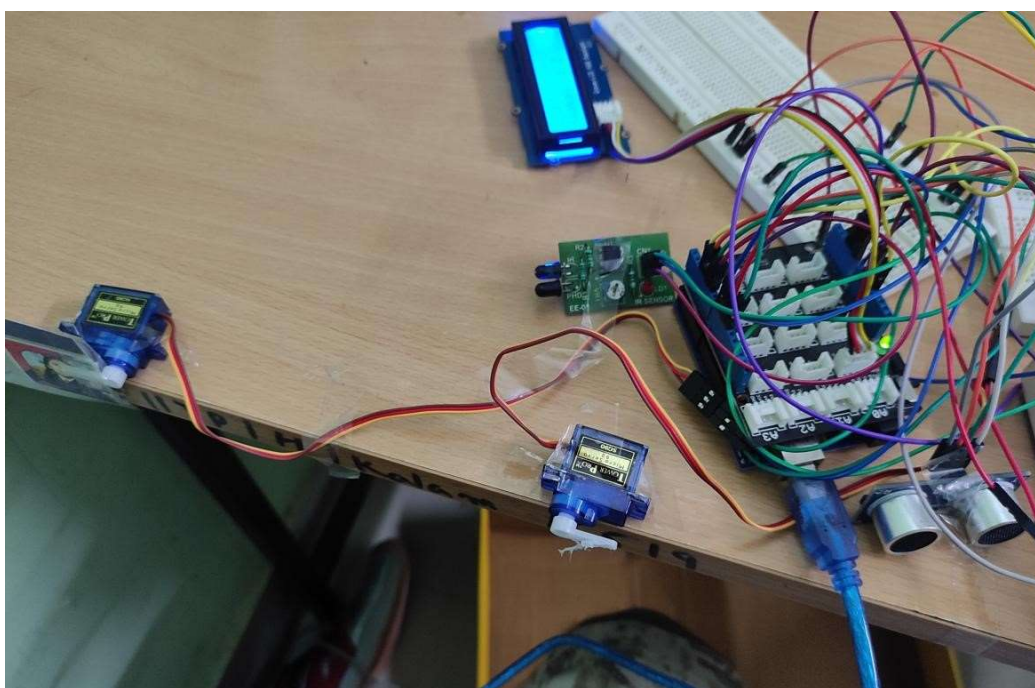*Photoresistor with Laser diode*:

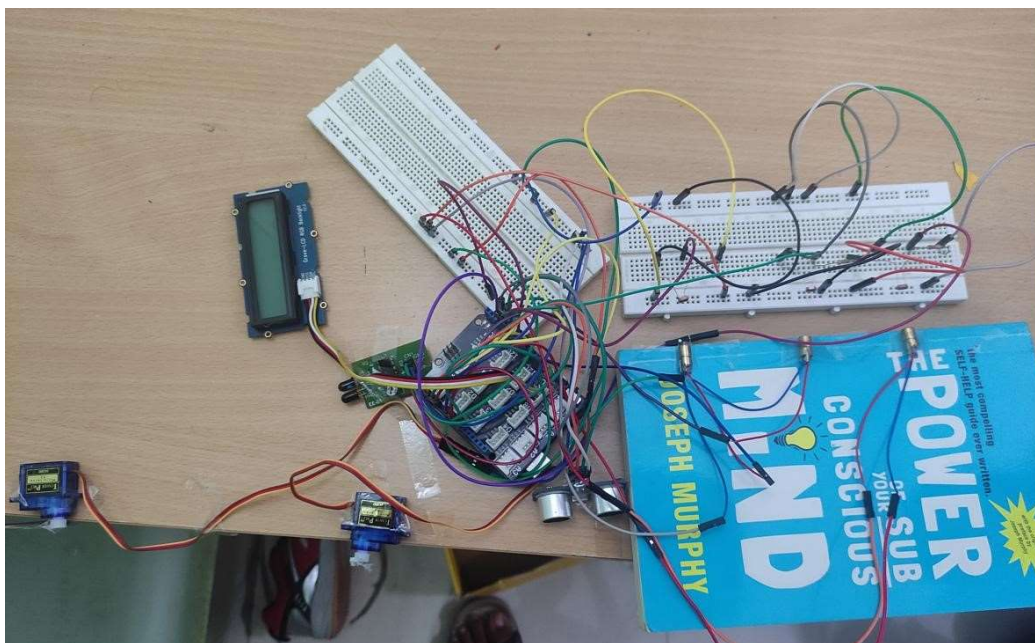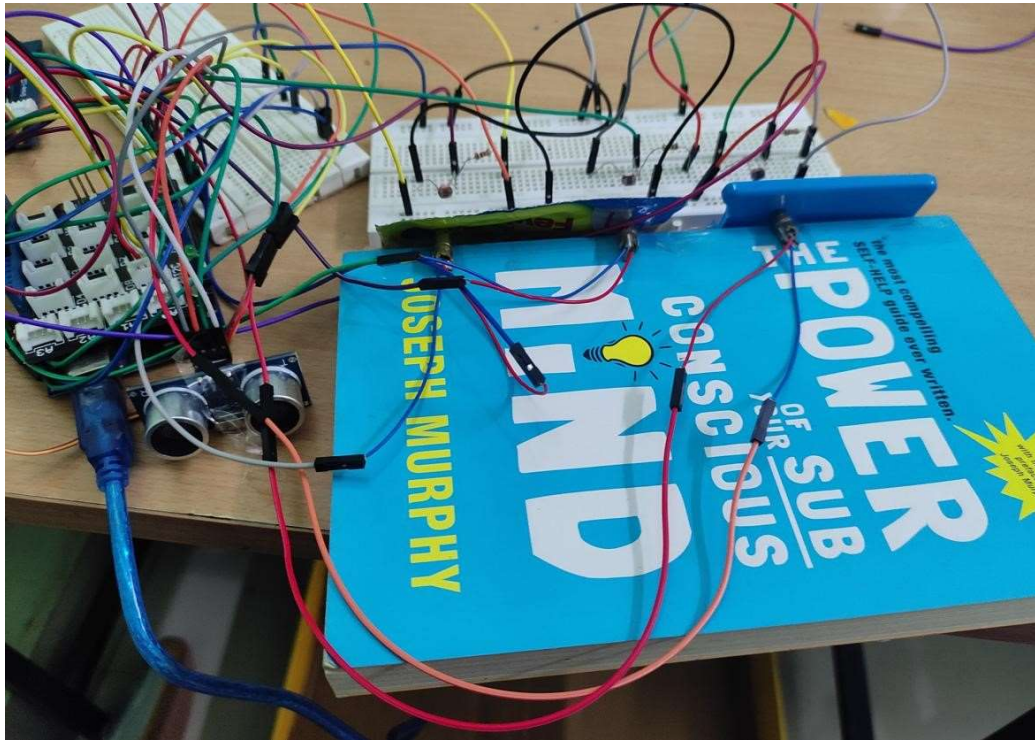*UV sensor with servo motor*:

For IR sensor with servo motor:

<u>*Full Circuit Images*</u>:

Connection Description:

1. LCD to I2C port of Grove shield and shield on top of Arduino

2. Laser diode's- 1st:RED- PIN 8 and BLUE to 0(GND)
                 2nd :RED- PIN 9 and BLUE to 0(GND)
                 3rd :RED- PIN 10 and BLUE to 0(GND)

3. UV sensor: GND to GND
             VCC to 5V
             ECHO to PIN 4
             TRIG to PIN 5

***4.* Servo motor's:** 1st : ORANGE to PIN 3
                  RED to 5V
                  BROWN to GND
                  2nd : ORANGE to PIN 11
                  RED to 5V
                  BROWN to GND

5. Photoresistor and Resistor:
        1st : Photo resistor's 1 side to VCC(5V) and other side to A0 and 10K
           ohm resistor's side to A0 and other to
           ground.
        2nd : Photo resistor's 1 side to VCC(5V) and other side to A0 and 10K
           ohm resistor's side to A0 and other to ground.
        3rd : Photo resistor's 1 side to VCC(5V) and other side to A0 and 10K
           ohm resistor's side to A0 and other to
           ground.

Working Flow:

Here I would be explaining step by step on what would happen at each step of the system:

Now, if a person comes near the gate controlled by UV sensor and operated by Servo motor and if the number of people already present in the building are less than 3 then the gate would open else it would not.

Now, suppose there is 1 person already inside the building then as soon as the 2nd person would come 2nd laser diode would get activated and count would also become 2.

Now suppose if the first person moves out of his position then on LCD screen Count would be displayed as 2 but Slots would be displaying only 2 meaning that 1st person is not in his correct position and seeing this information first person could come in his exact location.

Now, if suppose 1st person has to move out of the building then he/she would wave his/her hand at the IR sensor then the servo motor would open the door and decrease the count simultaneously triggering switching off the last laser diode which was active and forcing every other person to come 1 place forward.

Code Explanation:

```
#include <Servo.h>
#include <Wire.h>
#include "rgb_lcd.h"

rgb_lcd lcd;

const int colorR = 0;
const int colorG = 0;
const int colorB = 255;
#define echoPin 4
#define trigPin 5
Servo Myservo;
Servo myservo;
#define sensor 6
int pos;
long duration;
int distance;
int LDR[] = {A0, A1, A2};
int laser[] = {8, 9, 10};
```

- ➢ Including Wire libraries, Servo library to run servo motors, rgb_lcd library for running Grove Backlight LCD

- ➢ Defining ColorG, colorR and colorB variables to set color for background display for LCD which ranges from 0 to 255(0 being lowest and 255 being highest).

- ➢ Defining echopin as pin 4 and trigpin as pin 5 for HC-SR04 sensor.

- ➢ 2 instances of Servo motors: Myservo for entry one and myservo for exit one.

- ➢ IR sensor output pin to pin 6.

- ➢ Duration variable holds time taken to receive ultrasonic signals and distance holds final distance obtained by UV sensor.

- ➢ 3 LDR variables for assigning pins to photoresistor.

- ➢ 3 laser pins for assigning pins to Laser diode.

```
void setup()
{
  Myservo.attach(3);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  lcd.begin(16, 2);

  lcd.setRGB(colorR, colorG, colorB);

  lcd.print("Count: ");
  lcd.setCursor(8, 0);
  lcd.print('0');
  lcd.setCursor(0, 1);
  lcd.print("Slots: ");

  delay(1000);
  for (int i = 0; i < 3; i++)
  {
    pinMode(LDR[i], INPUT);
  }

  for (int i = 0; i < 3; i++)
  {
    pinMode(laser[i], OUTPUT);
  }

  pinMode(sensor, INPUT);
  myservo.attach(11);
  Myservo.write(0);
  myservo.write(0);
  delay(1000);
}
```

➤ Attaching Servo 1(Myservo) to pin 3 and 2nd servo(myservo) to pin 11

➤ Defining trigpin as OUTPUT and echopin as INPUT pin for UV sensor.

➤ Initializing 16x2 LCD display and setting it's colors.

➤ Printing count on first row and Slots occupied on 2nd row.

➤ Setting Photoresistor pins as INPUT pins.

➤ Setting Laser diode pins as output pins.

```arduino
void loop()
{

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

  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);

  distance = duration * 0.034 / 2;

  if (distance < 11 and count < 3)
  {
    count = count + 1;
    delay(100);
    Myservo.write(100);
    delay(1000);
    Myservo.write(0);
    lcd.setCursor(8, 0);
    lcd.print(count);
  }
  for (int j = 0; j < count; j++)
  {
    digitalWrite(laser[j], HIGH);
    int photores_val = analogRead(LDR[j]);
    if (photores_val < threshold)
    {
      lcd.setCursor(8 + 2 * j, 1);
      lcd.print(j + 1);
    }
    else
    {
      lcd.setCursor(8 + 2 * j, 1);
      lcd.print(' ');
    }
  }
  if (digitalRead(sensor) == HIGH)
  {
    if (count > 0)
    {
      myservo.write(100);
      delay(2000);
      myservo.write(0);
      count = count - 1;
      lcd.setCursor(8, 0);
      lcd.print(count);
      Serial.println(count);
      digitalWrite(laser[count], LOW);
      lcd.setCursor(8 + 2 * count, 1);
      lcd.print(' ');
    }
  }
  delay(100);
}
```

- Sending UV rays and receiving and calculating the duration of time elapsed in the process.

- Calculating distance by using the speed of sound in air as 340m/s and the time which was elapsed got divided into 2 parts, one for outgoing rays and one for incoming rays and hence distance would be (duration*(340))/2 meters and for cm we divide it by 100.

- If a person comes in the vicinity of UV sensor within range of 11 cm and number of people already inside is less than 3 then servo motor would rotate and open the gate and turn back down and count would be increased and shown in LCD.

- Now, if xth person(here count) comes xth laser diode(laser[j]) should get activated and if the photoresistor's value(photores_val) from Analog pin is high(corresponding to threshold set by us which in my case is 100) that means person is not standing in it's correct position and hence display blank space else display slot number too.

- Now, if person wants to leave he waves hand and sensor value becomes high then servo motor would get rotated enabling person to move out and decreasing count and simultaneously switching laser diode off.

So, with all this I conclude my project and hope such pandemic never occurs and requirement of my project never comes.

THANKYOU