BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

Department of Electrical and Electronic Engineering

Course No.: EEE 318
Course Title: Control Systems I Laboratory

Project Title:
UV sanitization robot

Group Members:

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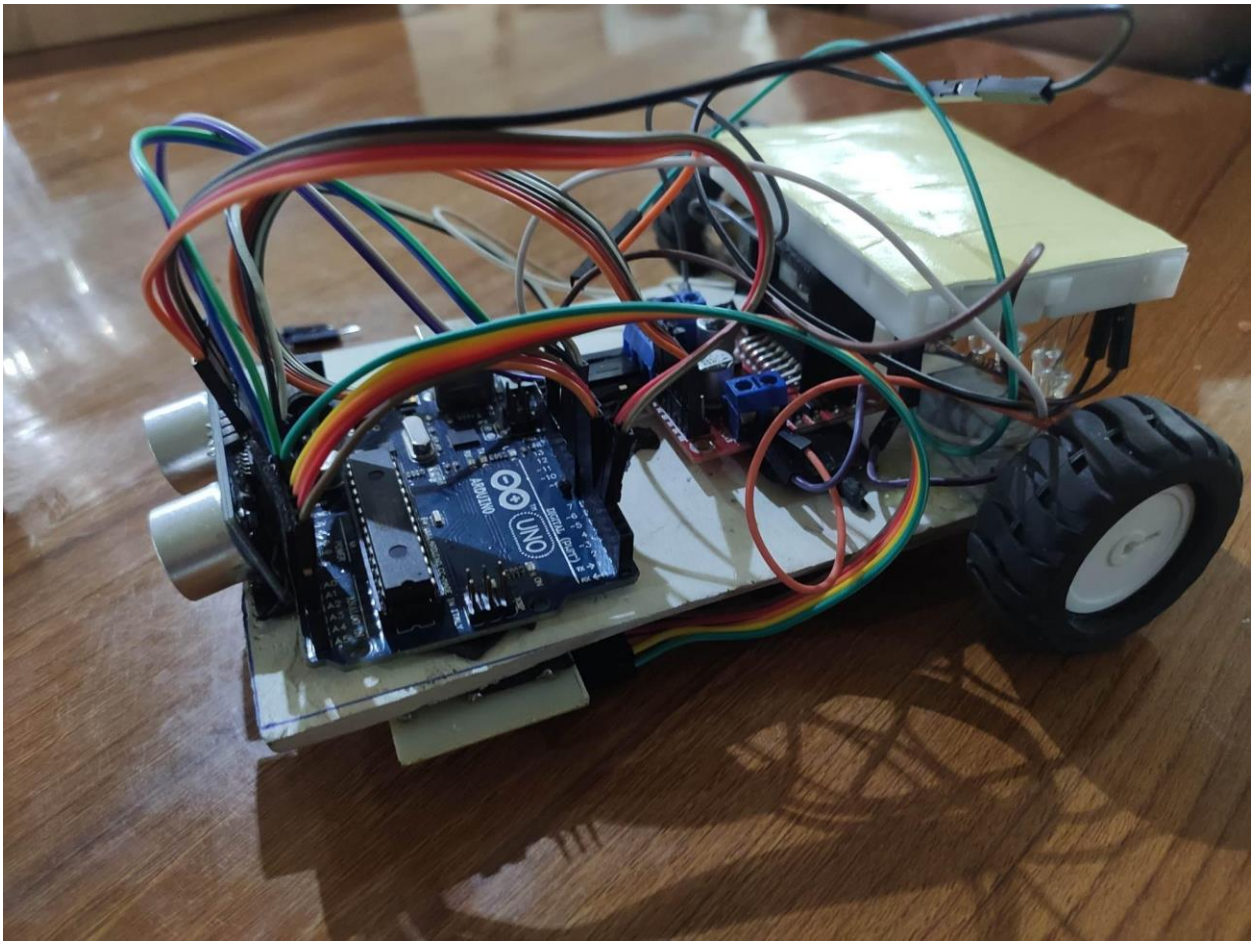
Introduction:

Sanitizing hospital rooms with human effort is not an easy task. It increases the chances of contracting infection, leading to further spread of harmful microorganisms.
We propose to make a device which will follow a line and sanitize alongside the hospital floor with UV ray thus to curb the spread of pathogens and to minimize human labour. It will reduce health hazard and save time. The robot will also be able to avoid obtascles.
The Smart Hospital Sanitization Robot will use the power of UV rays to kill germs and bacteria. The robot can run autonomously by avoiding obstacles using the ultrasonic sonar sensor. All this enables us to sanitize the hospital room as per our requirements. By killing the germs, the UV light restricts their multiplication by destroying their reproductive system.

Necessary Components :

1. Arduino
2. Robot Chassis
3. Ultrasonic Sensor
4. UV LED
5. DC Motor
6. Motor Driver
7. Wheels
8. Lipo Battery
9. IR sensor etc

Hardware Setup and Description:



1. Arduino:

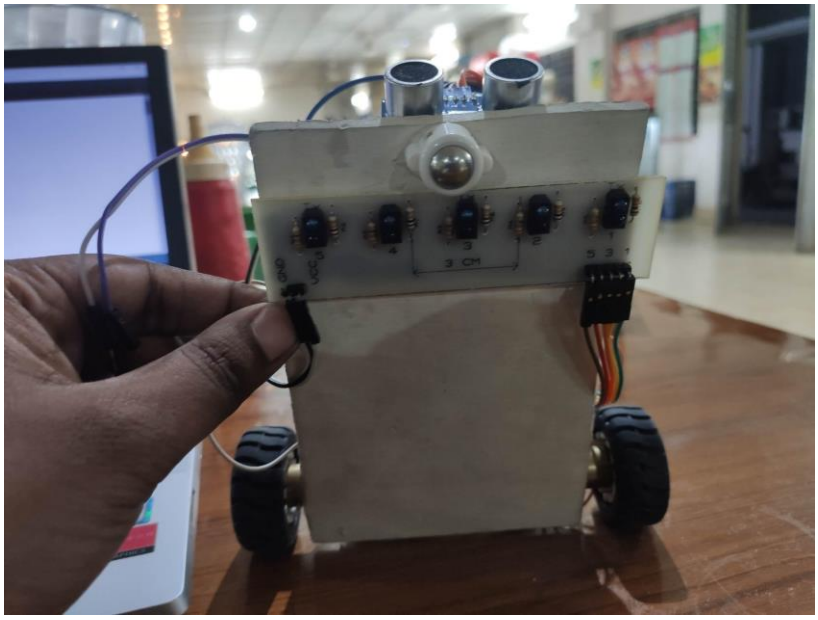
Arduino uno is the microcontroller of this project which runs the robot according to the programming by taking readings from IR sensors and Sonar sensors

2. Robot chassis:

We have assembled all our components on this chassis.

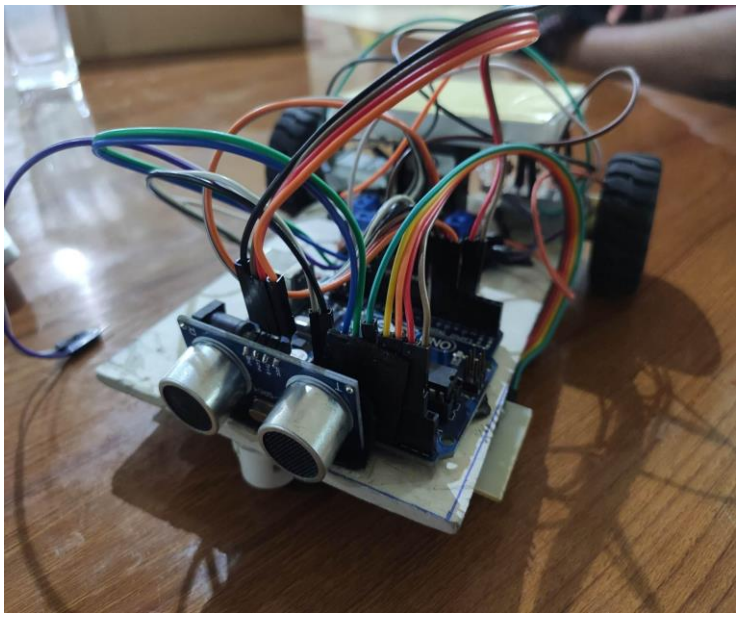
3. IR Sensor:

This sensor is used to implement the Line follower part. This sensor will continuously provide reading of white & black portions which is later used to keep the robot on the white line



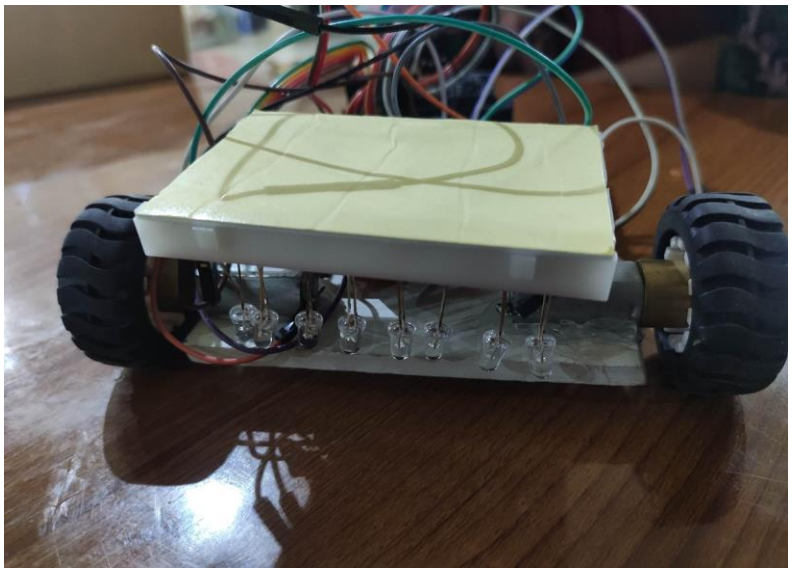
4. Ultrasonic Sensor:

This sensor is used to implement the obstacle avoiding part. The Ultrasonic sensor will continuously provide distance data. In our code we have implemented such an algorithm so that when the reading of Ultrasonic sensor is less than 10 cm, our robot will bypass it.



5. **UV LED:**

   Around 10-12 UV LEDs are attached to the tail of robot , so that it can sanitize the way along which the robot moves.

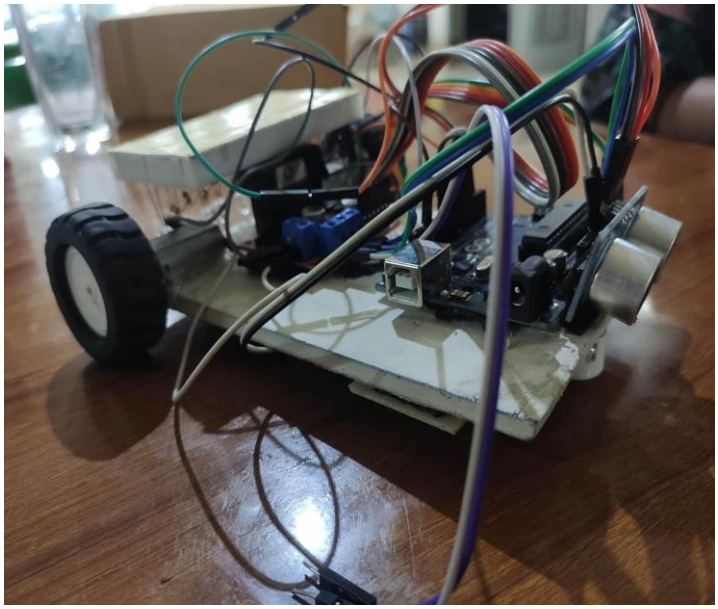


6. **Lipo Battery:**

   This is used as the the only power source. It is a rechargeable battery. We will need to charge it at a regular interval.

7. **Motor driver, DC motor, wheel:**

   Motor driver wil control the speed, angle of rotation of DC motor which in turn will control the wheels.



Software Setup:

```
#include <NewPing.h>

#define MotorBp 7
#define MotorBn 6
#define MotorB 5

#define MotorAp 8
#define MotorAn 9
#define MotorA 10

int th[5]={745,745,735,835,835};
int led[5]={2,3,4,5,6};

int i, sen[5],s[5], lastSensor,lastError;

int base_L=100;
int base_R=100;
int kp=15;
int kd=8;
int error,sum,p,d,corr;

int dis;
#define MAX_DISTANCE 200
#define TRIGGER_PIN  4
#define ECHO_PIN     3
NewPing sonar(TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE);


void setup()
{
  mot_init();
//  other_init();
  delay(1000);
```

```
}

void loop()
{

  dis = sonar.ping_cm();
  if (dis <= 10 && dis != 0)
  {
    delay(30);
    rightturn();
    delay(100);
    wheel_drive(100,100);
    delay(500);
    leftturn();
    delay(300);
    wheel_drive(100,100);
    delay(1200);
    leftturn();
    delay(200);
    wheel_drive(100,100);
    delay(800);
    rightturn();
    delay(150);
  }

  line_follow();
}

void other_init()
{
  for(i=0;i<5;i++)
    pinMode(led[i],OUTPUT);
  Serial.begin(9600);
}
```

```
void rightturn()
{
  wheel_drive(100,-100);
  delay(350);
}

void leftturn()
{
  wheel_drive(-100,100);
  delay(350);
}


void mot_init()
{
  pinMode(MotorBp,OUTPUT);
  pinMode(MotorBn,OUTPUT);
  pinMode(MotorAp,OUTPUT);
  pinMode(MotorAn,OUTPUT);
  pinMode(MotorB,OUTPUT);
  pinMode(MotorA,OUTPUT);
}

void line_follow()
{
  readSensor();
  if(error==420)
  {
    if(lastSensor==1) wheel_drive(-100,100);
    else if(lastSensor==2) wheel_drive(100,-100);
  }
  else
  {
    p=kp*error;
    d=kd*(error-lastError);
```

```
    corr=p+d;
//   Serial.println(corr);
    wheel_drive(base_L+corr,base_R-corr);
    if((error-lastError)!=0) delay(5);
    lastError=error;
  }
}

void readSensor()
{
  for(i=0;i<5;i++)
  {
    sen[i]=analogRead(i);
    if(sen[i]<th[i])
    {
      s[i]=0;
      //digitalWrite(led[i],LOW);
    }
    else {
      s[i]=1;
      //digtalWrite(led[i],HIGH);
    }
  }

  sum=s[0]+s[1]+s[2]+s[3]+s[4];
  if(sum!=0)
    error=(s[0]*10 + s[1]*20 + s[2]*30 + s[3]*40 + s[4]*50) /sum -30;

  else
     error=420;

  if(s[0]==1) lastSensor=1;
  else if(s[4]==1) lastSensor=2;
//  Serial.println(error);
}
```

```
void wheel_drive(int lms, int rms)
{
  if (lms > 254) lms = 254;
  else if (lms < -254) lms = -254;
  if (rms > 254) rms = 254;
  else if (rms < -254) rms = -254;

  if (lms == 0)
  {
    digitalWrite(MotorBp,HIGH);
    digitalWrite(MotorBn,HIGH);
  }
  else if (lms > 0)
  {
    digitalWrite(MotorBp,HIGH);
    digitalWrite(MotorBn,LOW);
  }
  else if (lms < 0)
  {
    digitalWrite(MotorBp,LOW);
    digitalWrite(MotorBn,HIGH);
  }

  if (rms == 0)
  {
    digitalWrite(MotorAp,HIGH);
    digitalWrite(MotorAn,HIGH);
  }
  else if (rms > 0)
  {
    digitalWrite(MotorAp,HIGH);
    digitalWrite(MotorAn,LOW);
  }
  else if (rms < 0)
```

```
  {
    digitalWrite(MotorAp,LOW);
    digitalWrite(MotorAn,HIGH);
  }

  analogWrite(MotorA,abs(rms));
  analogWrite(MotorB,abs(lms));
}
```

Working procedure:

1. Our robot will start moving when power source is attached to it.
2. We have designed a track for the LFR part. We have designed the track in such way so that it ensures almost all area of the room is covered. The robot will follow the white lines and proceed.Along its line if it faces any obstacle it will bypass it & then will quickly return to its track.
3. As UV LEDs are attached to its tail it will always keep sanitizing the floor throughout.

Cost Analysis:

Component	Price
wheel	160
Ball caster	60
DC motor	600
Motor Driver	200
IR Sensor	900
Sonar sensor	120
wire	160
12V Lipo Battery	1200
Battery Charger	500
Mini breadboard	80
resistors	20
Arduino uno	1200
UV led	200
Chassis	300
LFR Track	1500
Total	7200

Contributions:

Member 1 prepared the chassis and implemented the wheel drive with corresponding codes. Member 2 worked with the sonar sensor and wrote the corresponding codes. Member 3 worked with both the sonar and IR sensors and corresponding codes. Member 4 worked with IR sensor and wrote the corresponding codes.

Conclusion:

Although sometimes there are a bit deviation from the ideal condition, we have successfully implemented out sanitizing robot. If this project is commercially produced, it will be a great milestone to the sanitizing system of hospital and other institutions. It will reduce human efforts and ensure 24/7 sanitizing in necessary sectors.