

EST PRACTICAL ACTIVITY REPORT

Submitted for

ENGINEERING DESIGN-II(UTA024)

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BE SECOND YEAR BATCH - 2-EM3

Submitted to:

Mr. Rajesh Kumar Chaudhary



**Computer Science and Engineering Department
Thapar Institute of Engineering & Technology,
Patiala**

July-Dec 2023

DECLARATION

We declare that this project report is based on our own work carried out during the course of our study in our Engineering-design II Computer Lab under the supervision of Mr. Rajesh Kumar Chaudhary.

We assert that the statements made and conclusions drawn are an outcome of our own research work.

We further certify that the work contained in this report is original and has been done by us under the general supervision of our supervisor.

We have followed the guidelines provided by the University in writing this report.

We also declare that this project is the outcome of our own effort, that it has not been submitted to any other university for the award of any degree.

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EXPERIMENT-1

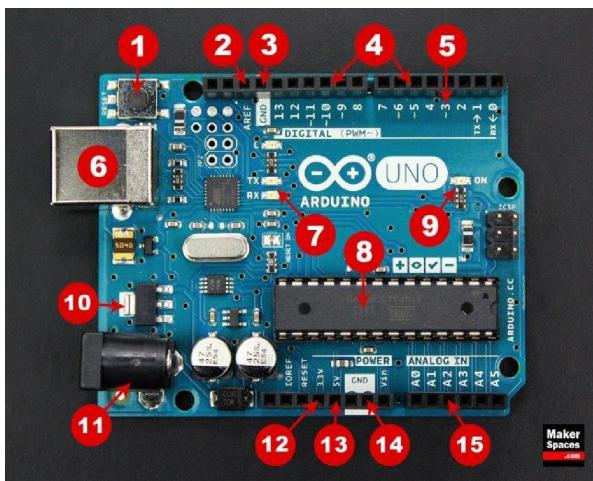
OBJECTIVE: Introduction to Arduino Microcontroller.

SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

| Sr. No | Name of Components | Value |
|--------|-----------------------------|-------|
| 1 | Arduino Uno Microcontroller | 1 |

LOGIC/CIRCUIT DIAGRAM:



THEORY:

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc and initially released in 2010.

The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

1. **Reset Button** – This will restart any code that is loaded to the Arduino board.
2. **AREF** – Stands for “Analog Reference” and is used to set an external reference voltage.
3. **Ground Pin** – There are a few ground pins on the Arduino and they all work the same.
4. **Digital Input/Output** – Pins 0-13 can be used for digital input or output.
5. **PWM** – The pins marked with the (~) symbol can simulate analog output.
6. **USB Connection** – Used for powering up your Arduino and uploading sketches.
7. **TX/RX** – Transmit and receive data indication LEDs.

8. **AT mega Microcontroller** – This is the brains and is where the programs are stored
9. **Power LED Indicator** – This LED lights up anytime the board is plugged in a power source.
10. **Voltage Regulator** – This controls the amount of voltage going into the Arduino board.
11. **DC Power Barrel Jack** – This is used for powering your Arduino with a power supply.
12. **3.3V Pin** – This pin supplies 3.3 volts of power to your projects.
13. **5V Pin** – This pin supplies 5 volts of power to your projects.
14. **Ground Pins** – There are a few ground pins on the Arduino and they all work the same.
15. **Analog Pins** – These pins can read the signal from an analog sensor and convert it to digital.

DISCUSSIONS

In this experiment, we get to know about the basics of Arduino Uno Microcontroller and its various functions and components.

Signature of faculty member

EXPERIMENT-2

OBJECTIVE: To make a circuit of blinking an LED using Arduino Uno and breadboard.

SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

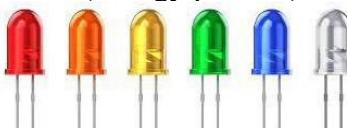
| Sr No. | Name of the Component | Value |
|--------|-----------------------|---------|
| 1. | Arduino Uno Board | 1 |
| 2. | Breadboard | 1 |
| 3. | Jumper Wires | 2 |
| 4. | LED | 1 |
| 5. | Resistor | 220 ohm |

THEORY:

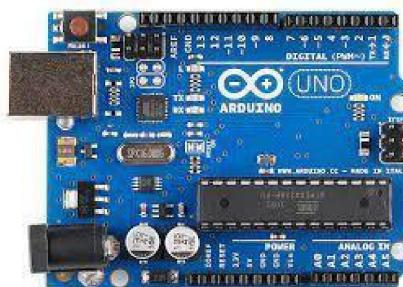
Resistor: Resistors are used in virtually all electronic circuits and many electrical ones. Resistors, as their name indicates, resist the flow of electricity and this function is key to the operation of most circuits.



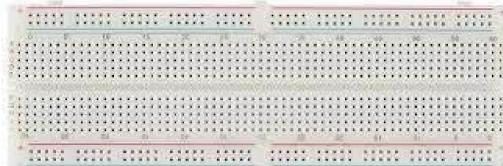
LED: A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons (Energy packets).



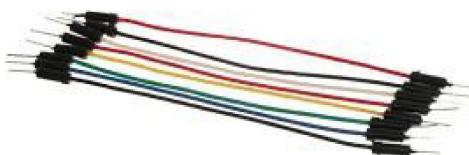
Arduino Uno Board: The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



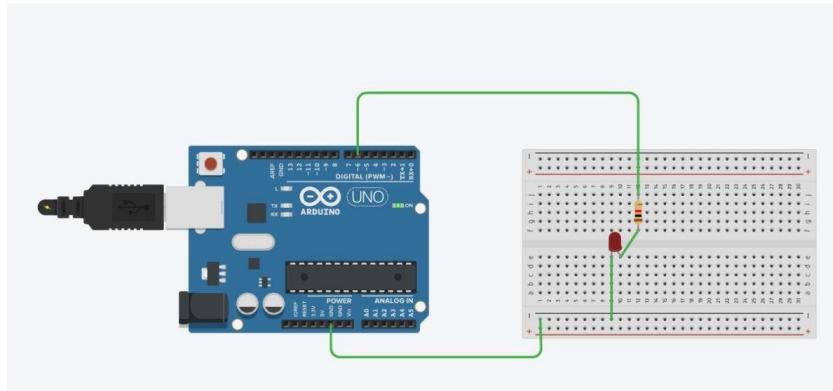
Breadboard: A breadboard is used to place components (resistor, capacitor, LED's etc.) that are wired together. It is used to make temporary circuits.



Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



TINKERCAD DIAGRAM:



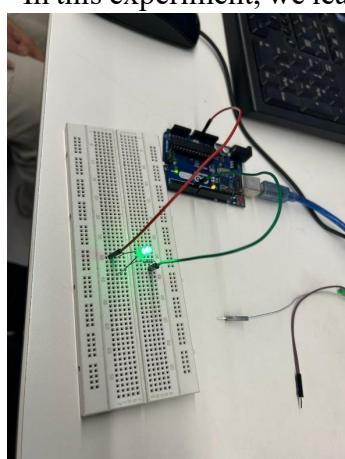
CODE:

```
void setup ()  
{  
pinMode (6, OUTPUT);  
}  
void loop ()  
{  
digitalWrite (6, HIGH);  
delay (1000);  
digitalWrite (6, LOW);  
delay (1000);  
}
```

```
1 // C++ code  
2 //  
3 void setup()  
4 {  
5   pinMode(6, OUTPUT);  
6 }  
7 void loop()  
8 {  
9   digitalWrite(6, HIGH);  
10  delay(1000); // Wait for 1000 millisecond(s)  
11  digitalWrite(6, LOW);  
12  delay(1000); // Wait for 1000 millisecond(s)  
13 }  
14 }
```

RESULTS/ DISCUSSIONS:

In this experiment, we learnt how to blink an LED using Arduino Uno.



Signature of faculty member

EXPERIMENT-3

OBJECTIVES: To blink multiple LEDs using Arduino Uno and breadboard.

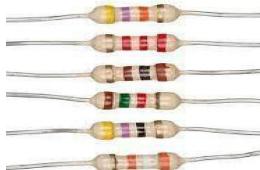
SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

| Sr No. | Name of the Component | Value |
|--------|-----------------------|---------|
| 1. | Arduino Uno Board | 1 |
| 2. | Breadboard | 1 |
| 3. | Jumper Wires | 2 |
| 4. | LED | 5 |
| 5. | Resistor | 220 ohm |

THEORY:

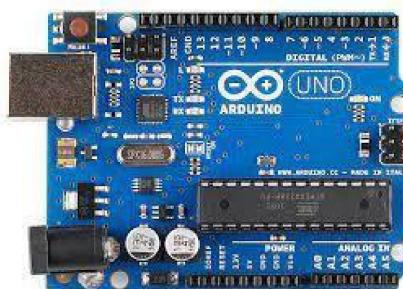
Resistor: Resistors are used in virtually all electronic circuits and many electrical ones. Resistors, as their name indicates, resist the flow of electricity and this function is key to the operation of most circuits.



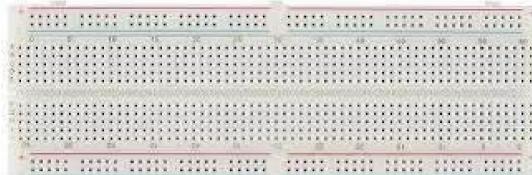
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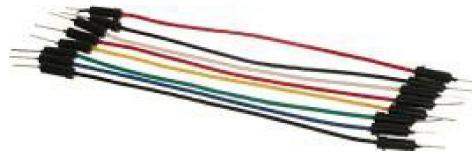
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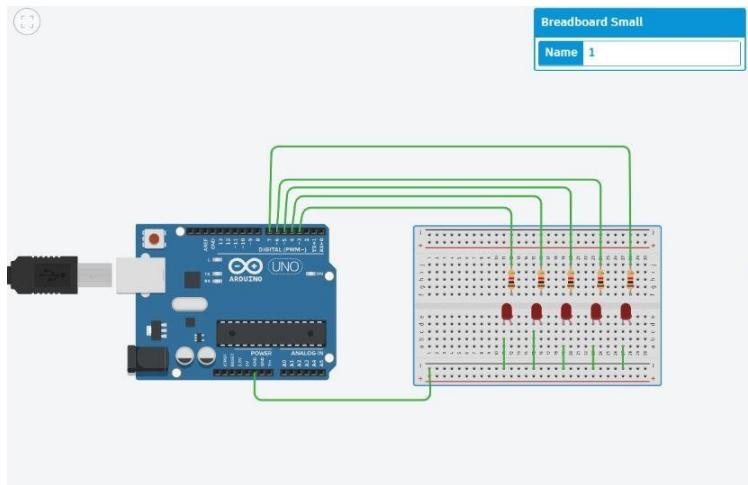
Breadboard: A breadboard is used to place components (resistor, capacitor, LED's etc.) that are wired together. It is used to make temporary circuits.



Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



TINKERCAD DIAGRAM:



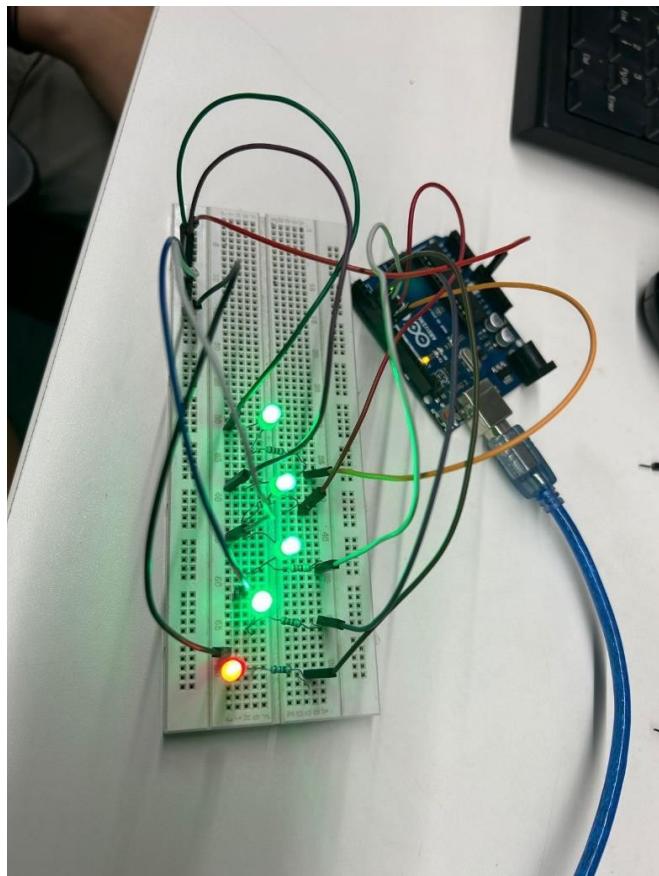
CODE:

```
// C++ code
void setup()
{
pinMode(7, OUTPUT);
pinMode(6, OUTPUT);
pinMode(5, OUTPUT);
pinMode(4, OUTPUT);
pinMode(3, OUTPUT);
}
void loop ()
{
for (int i=3; i<=7; i++)
{
digitalWrite(i, HIGH);
delay(1000);
}
for (int i=7; i>=3;i--)
{
digitalWrite(i, LOW);
delay(1000);
}
}
```

```
ED_Assignment_1.ino
3 void setup()
4 {
5   pinMode(7, OUTPUT);
6   pinMode(6, OUTPUT);
7   pinMode(5, OUTPUT);
8   pinMode(4, OUTPUT);
9   pinMode(3, OUTPUT);
10 }
11
12 void loop()
13 {
14   digitalWrite(7, HIGH);
15   delay(1000); // Wait for 1000 millisecond(s)
16   digitalWrite(7, LOW);
17   delay(1000); // Wait for 1000 millisecond(s)
18   digitalWrite(6, HIGH);
19   delay(1000); // Wait for 1000 millisecond(s)
20   digitalWrite(6, LOW);
21   delay(1000); // Wait for 1000 millisecond(s)
22   digitalWrite(5, HIGH);
23   delay(1000); // Wait for 1000 millisecond(s)
24   digitalWrite(5, LOW);
25   delay(1000); // Wait for 1000 millisecond(s)
26   digitalWrite(4, HIGH);
27   delay(1000); // Wait for 1000 millisecond(s)
28   digitalWrite(4, LOW);
29   delay(1000); // Wait for 1000 millisecond(s)
30   digitalWrite(3, HIGH);
31   delay(1000); // Wait for 1000 millisecond(s)
32   digitalWrite(3, LOW);
33   delay(1000); // Wait for 1000 millisecond(s)
34 }
35 }
```

RESULTS/ DISCUSSIONS:

In this Exp We Learn to use more than one Led in Order.



Signature of faculty member

EXPERIMENT-4

OBJECTIVE: Write a program to design a pattern of sequence of multiple LED's using loop in Arduino.

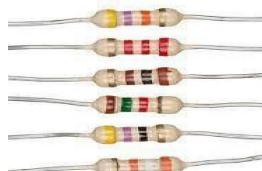
SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

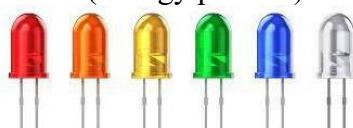
| Sr No. | Name of the Component | Value |
|--------|-----------------------|---------|
| 1. | Arduino Uno Board | 1 |
| 2. | Breadboard | 1 |
| 3. | Jumper Wires | 4 |
| 4. | LED | 5 |
| 5. | Resistor | 220 ohm |

THEORY:

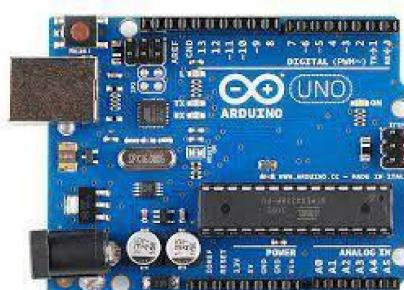
Resistor: Resistors are used in virtually all electronic circuits and many electrical ones. Resistors, as their name indicates, resist the flow of electricity and this function is key to the operation of most circuits.



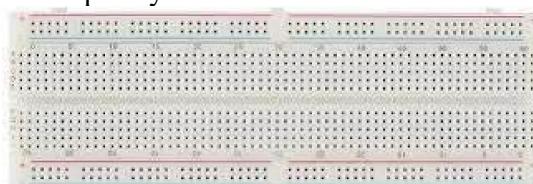
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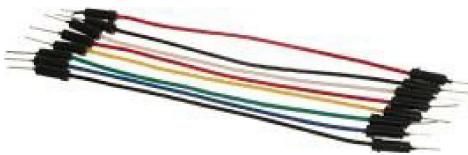
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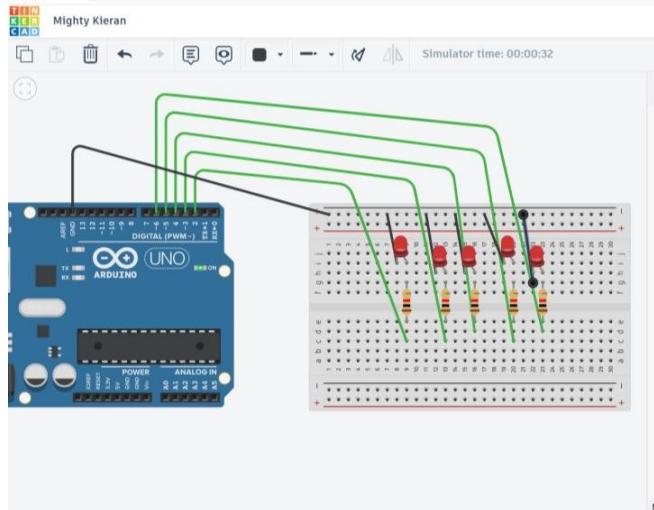
Breadboard: A breadboard is used to place components (resistor, capacitor, LED's etc.) that are wired together. It is used to make temporary circuits.



Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



TINKERCAD DIAGRAM:

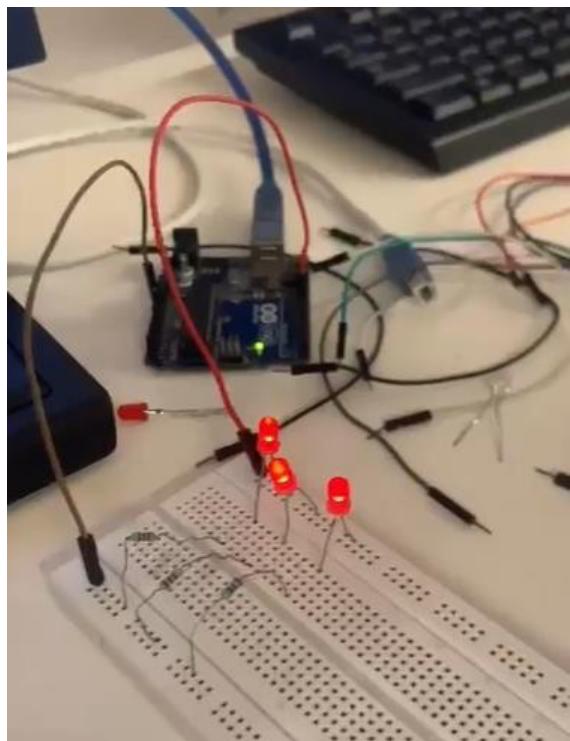


CODE:

```
void setup()
{
    pinMode(2, OUTPUT);
    pinMode(3, OUTPUT);
    pinMode(4, OUTPUT);
    pinMode(5, OUTPUT);
    pinMode(6, OUTPUT);
}
void loop()
{
    for(int i=2;i<=6;i++)
    {
        digitalWrite(i, HIGH);
        delay(500);
    }
    for(int i=6;i>=2;i--)
    {
        digitalWrite(i, LOW);
        delay(500);
    }
}
```

RESULTS/ DISCUSSIONS:

In this we learn to glow led in pattern using loops.



Signature of faculty member

EXPERIMENT-5

OBJECTIVE: Write a program to demonstrate sending data from the computer to Arduino Board and control the brightness of LED.

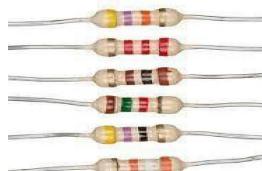
SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

| Sr No. | Name of the Component | Value |
|--------|-----------------------|---------|
| 1. | Arduino Uno Board | 1 |
| 2. | Breadboard | 1 |
| 3. | Jumper Wires | 2 |
| 4. | LED | 1 |
| 5. | Resistor | 220 ohm |

THEORY:

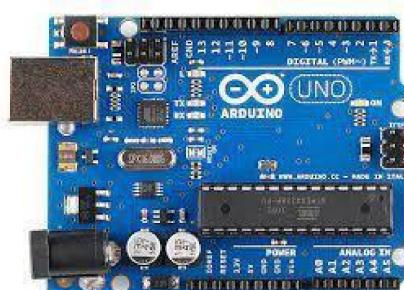
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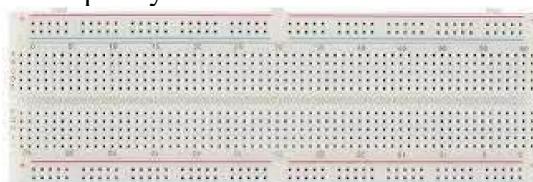
LED: A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons (Energy packets).



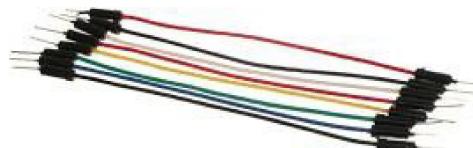
Arduino Uno Board: The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



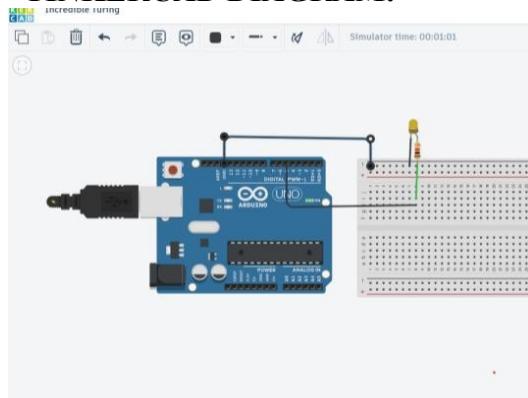
Breadboard: A breadboard is used to place components (resistor, capacitor, LED's etc.) that are wired together. It is used to make temporary circuits.



Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



TINKERCAD DIAGRAM:



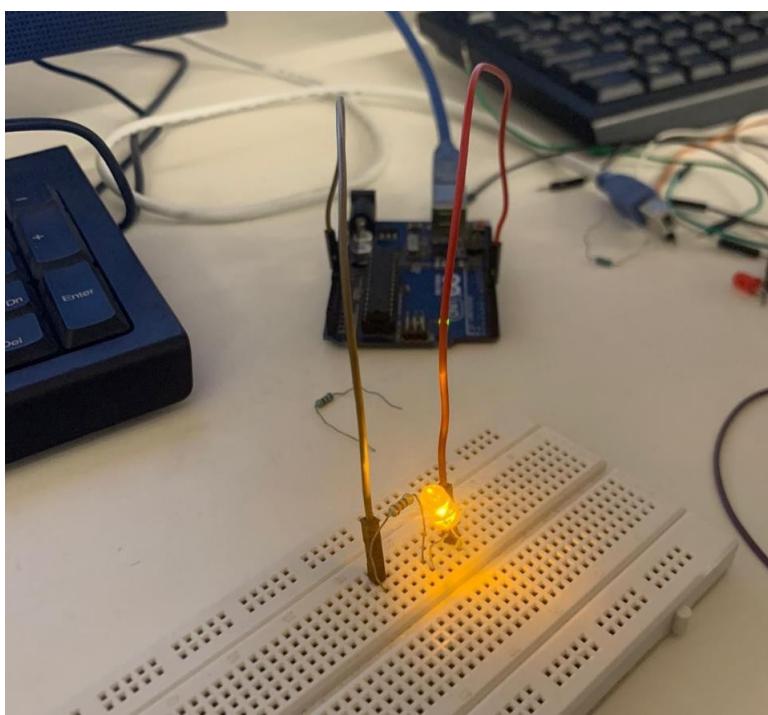
CODE:

```
// C++ code
//
void setup()
{
    pinMode(5, OUTPUT);
    Serial.begin(9600);
}

void loop()
{
    Serial.println("Enter Value of Brightness or intensity");
    int a=Serial.parseInt();
    analogWrite(5,a);
    delay(1000);
    analogWrite(5,0);
    delay(1000);
}
```

RESULTS/ DISCUSSIONS:

In this Exp we learn use of Analog pins and control brightness of led and input is taken from the user.



Signature of faculty member

EXPERIMENT-6

OBJECTIVE: Serial Communication:

WAP to print following pattern using for loop.

Roll No. _____

Name: _____

Branch: _____

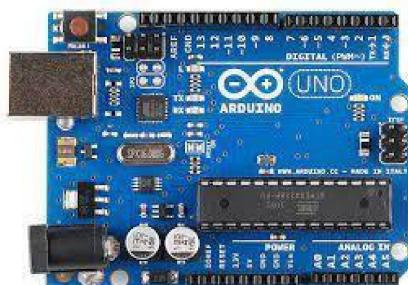
SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

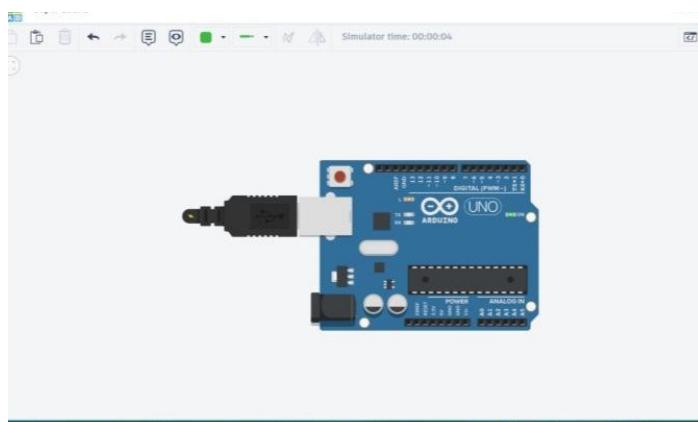
| Sr No. | Name of the Component | Value |
|--------|-----------------------|-------|
| 1. | Arduino Uno Board | 1 |

THEORY:

Arduino Uno Board: The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



TINKERCAD DIAGRAM:

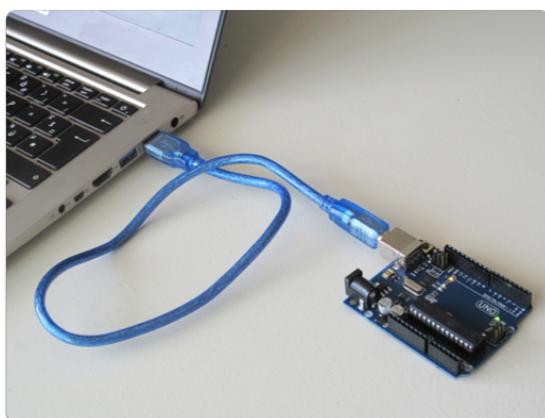


CODE:

```
int a;
void setup()
{
    Serial.begin(9600);
    pinMode(6,OUTPUT);
    for(int i=0; i<=25; i++)
    {
        Serial.print("*");
    }
    Serial.println("");
    Serial.println("Enter Roll no.: ");
    for(int i=0; i<=25; i++)
    {
        Serial.print("*");
    }
    Serial.println("");
    Serial.println("Enter Name: ");
    for(int i=0; i<=25; i++)
    {
        Serial.print("*");
    }
    Serial.println("");
    Serial.println("Enter Branch: ");
    for(int i=0; i<=25; i++)
    {
        Serial.print("*");
    }
}
```

RESULTS/ DISCUSSIONS:

In this Exp we learn about Serial Communication and Serial Monitor.



Signature of faculty member

EXPERIMENT-7

OBJECTIVE: WAP to show the dimmer effect where LED 1 should display values between 0-50.

LED 2 = 51- 100

LED 3 = 101- 150

LED 4 = 151- 200

LED 5 = 201-255

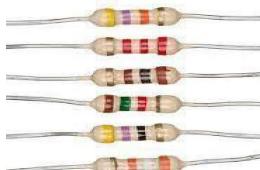
SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

| Sr No. | Name of the Component | Value/Quantity |
|--------|-----------------------|----------------|
| 1. | Arduino Uno Board | 1 |
| 2. | Breadboard | 1 |
| 3. | Jumper Wires | 10 |
| 4. | LED | 5 |
| 5. | Resistor | 220 ohm/5 |

THEORY:

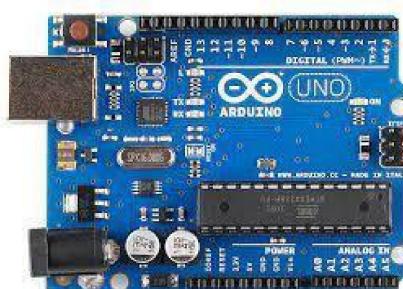
Resistor: Resistors are used in virtually all electronic circuits and many electrical ones. Resistors, as their name indicates, resist the flow of electricity and this function is key to the operation of most circuits.



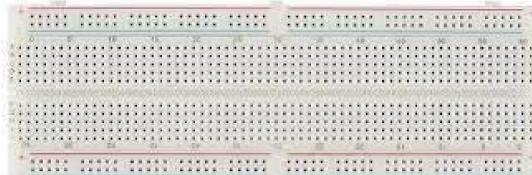
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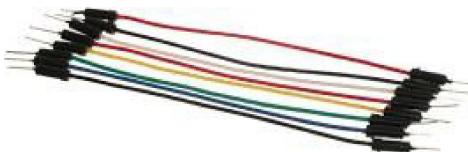
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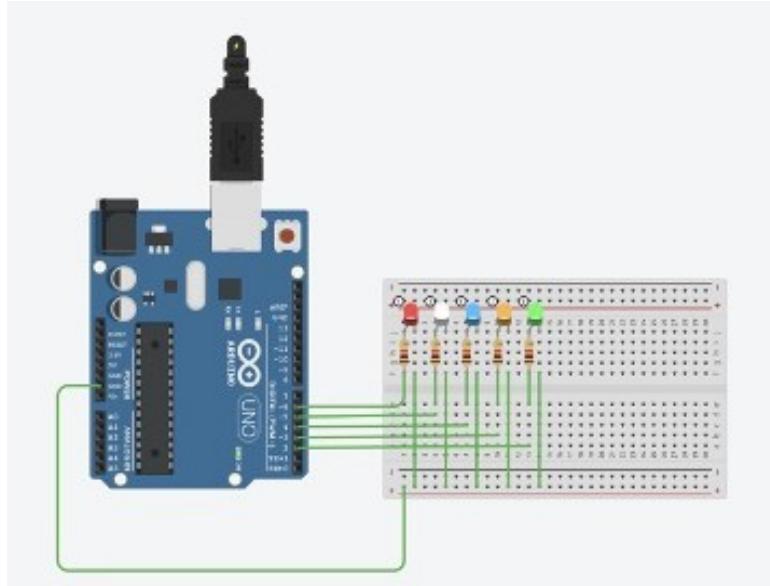
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Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



TINKERCAD DIAGRAM:

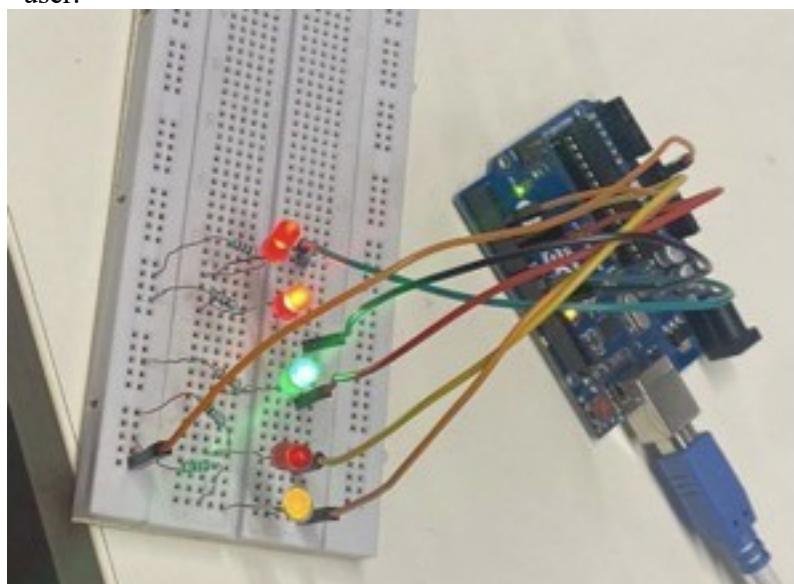


CODE:

```
const int ledPins() = {2,3,4,5,6};  
void setup() {  
  for (int i = 0; i < 5; i++) {  
    pinMode(ledPins[i], OUTPUT);  
  }  
  Serial.begin(9600);  
}  
void loop() {  
  int brightness = 0; // Initial brightness is set to 0 for distinction  
  if (Serial.available() > 0) {  
    brightness = Serial.parseInt();  
    brightness = constrain(brightness, 0, 255);  
    Serial.print("Brightness set to: ");  
    Serial.println(brightness);  
  }  
  for (int i = 0; i < 5; i++) {  
    int IB = i * 50 + 1;  
    int uB = (i + 1) * 50;  
    if (brightness >= IB && brightness <= uB) {  
      analogWrite(ledPins[i], brightness - IB);  
    } else {  
      analogWrite(ledPins[i], 0);  
    }  
  }  
}
```

RESULTS/ DISCUSSIONS:

In this Exp we learn use of Analog pins and control brightness of led and input is taken from the user.



Signature of faculty member

EXPERIMENT-8

OBJECTIVE: Write a program to change the intensity of the given LEDs for the sequence 35214 in for both forward and reverse order.

SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

| Sr No. | Name of the Component | Value |
|--------|-----------------------|---------|
| 1. | Arduino Uno Board | 1 |
| 2. | Breadboard | 1 |
| 3. | Jumper Wires | 6 |
| 4. | LED | 5 |
| 5. | Resistor | 220 ohm |

THEORY:

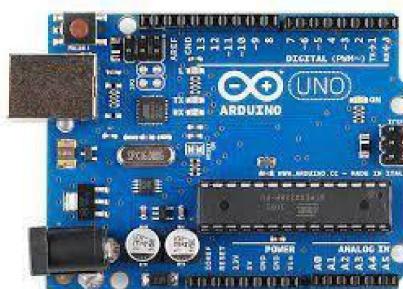
Resistor: Resistors are used in virtually all electronic circuits and many electrical ones. Resistors, as their name indicates, resist the flow of electricity and this function is key to the operation of most circuits.



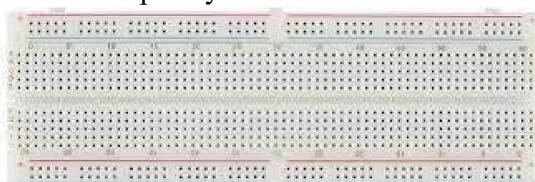
LED: A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons (Energy packets).



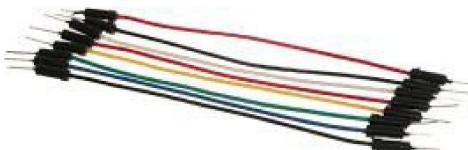
Arduino Uno Board: The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



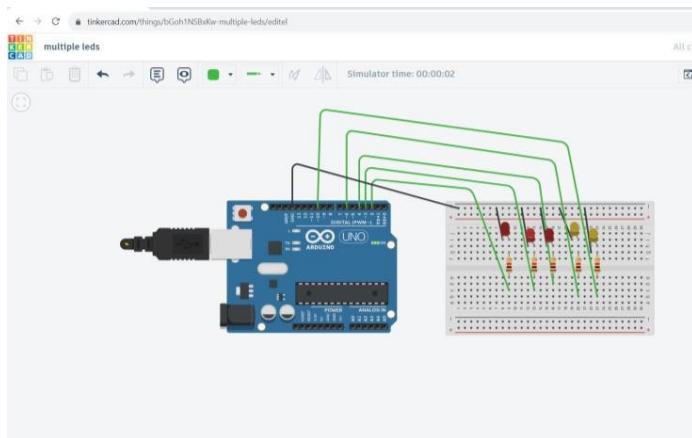
Breadboard: A breadboard is used to place components (resistor, capacitor, LED's etc.) that are wired together. It is used to make temporary circuits.



Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



TINKERCAD DIAGRAM:



CODE:

```
void setup()
{
    Serial.begin(9600);
    pinMode(2, OUTPUT);
    pinMode(3, OUTPUT);
    pinMode(4, OUTPUT);
    pinMode(6, OUTPUT);
    pinMode(10, OUTPUT);

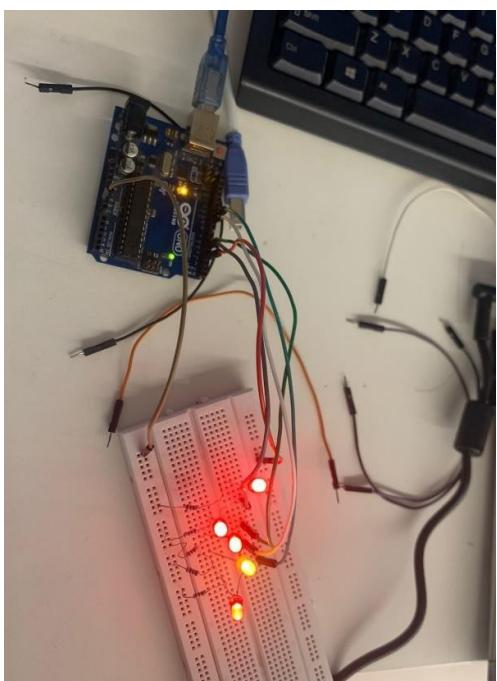
}

void loop()
{
    for(int i=10;i<=20;i++)
    {
        analogWrite(4,i);
        delay(500);
        analogWrite(10,i);
        delay(500);
        analogWrite(3,i);
        delay(500);
        analogWrite(2,i);
    }
}
```

```
delay(500);
analogWrite(6,i);
delay(500);
}
analogWrite(6,0);
delay(500);
analogWrite(2,0);
delay(500);
analogWrite(3,0);
delay(500);
analogWrite(10,0);
delay(500);
analogWrite(4,0);
delay(500);
}
```

RESULTS/ DISCUSSIONS:

In this Exp we learn how to change intensity of Leds in a given order (35214 asked in question).



Signature of faculty member

EXPERIMENT-9

OBJECTIVE: Write a program to demonstrate control of DC Motor using forward, backward, left, right turn motion and clock- wise/anti clock- wise rotation.

HARDWARE USED:

| Sr No. | Name of the Component | Value |
|--------|-----------------------|-------|
| 1. | Buggy Car | 1 |

THEORY:

DC Motor: A DC motor is an electrical motor that uses direct current (DC) to produce mechanical force. The most common types rely on magnetic forces produced by currents in the coils. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.



Arduino Uno Board: The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



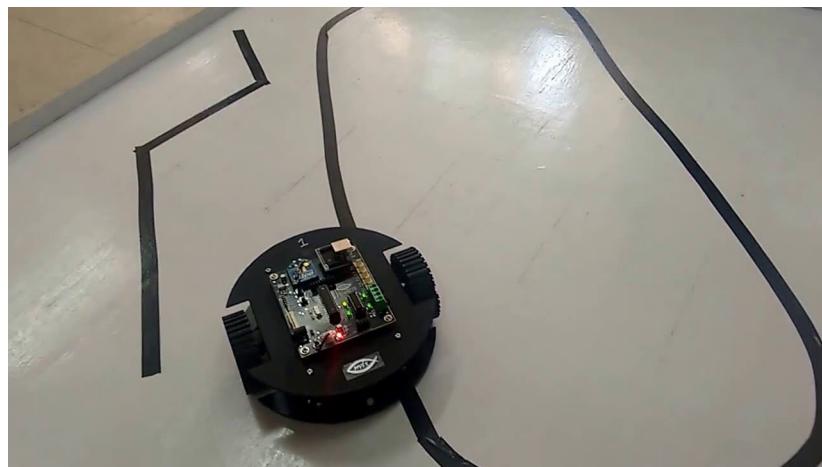
CODE:

```
void setup()
{
pinMode(5,OUTPUT);
pinMode(6,OUTPUT);
pinMode(7,OUTPUT);
pinMode(8,OUTPUT);
}
void forward()
{
digitalWrite(5,HIGH);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
digitalWrite(8,HIGH);
}
```

```
void backward()
{
digitalWrite(5,LOW);
digitalWrite(6,HIGH);
digitalWrite(7,HIGH);
digitalWrite(8,LOW);
}
void left()
{
digitalWrite(5,HIGH);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
digitalWrite(8,LOW);
}
void right()
{
digitalWrite(5,LOW);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
digitalWrite(8,HIGH);
}
void clockwise()
{
digitalWrite(5,HIGH);
digitalWrite(6,LOW);
digitalWrite(7,HIGH);
digitalWrite(8,LOW);
}
void anticlockwise()
{
digitalWrite(5,LOW);
digitalWrite(6,HIGH);
digitalWrite(7,LOW);
digitalWrite(8,HIGH);
}
void loop()
{
forward();
delay(5000);
backward();
delay(5000);
right();
left();
clockwise();
anticlockwise();
}
```

RESULTS/ DISCUSSIONS:

In this Exp we learn about Dc motors (placed in Buggy) and we also learn how to do basic movements in Buggy by changing in our Code.



Signature of faculty member

EXPERIMENT-10

OBJECTIVE: Write a program to read values of IR Sensor using analog and digital read and convert buggy into normal line follower robocar.

HARDWARE USED:

| Sr No. | Name of the Component | Value |
|--------|-----------------------|-------|
| 1. | Buggy Car | 1 |
| 2. | IR Sensors | 2 |
| 3. | Jumper Wires | 6 |

THEORY:

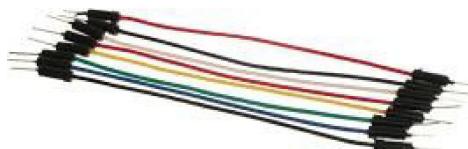
DC Motor: A DC motor is an electrical motor that uses direct current (DC) to produce mechanical force. The most common types rely on magnetic forces produced by currents in the coils. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.



Arduino Uno Board: The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



IR Sensors: IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations

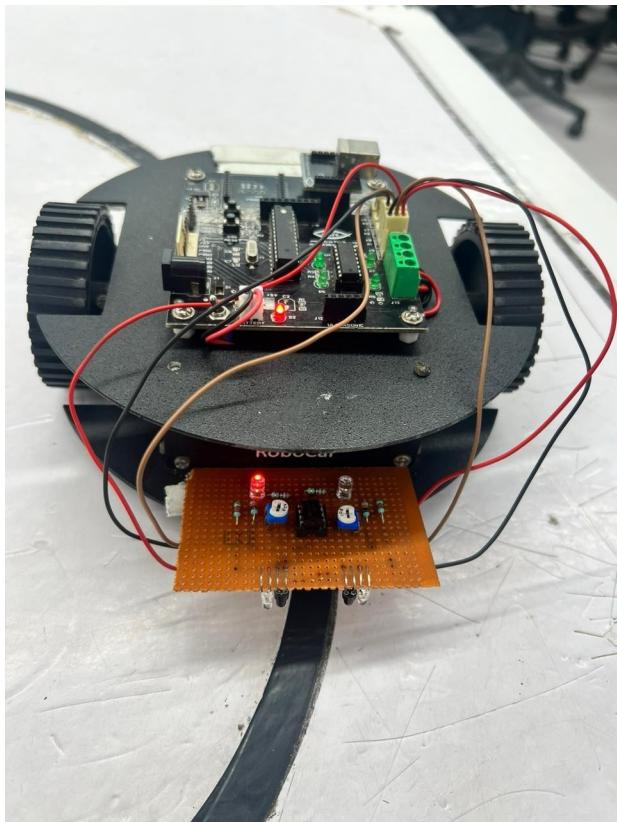


CODE:

```
void setup()
{
pinMode(A0,INPUT);
pinMode(A1,INPUT);
pinMode(5,OUTPUT);
pinMode(6,OUTPUT);
pinMode(7,OUTPUT);
pinMode(8,OUTPUT);
}
void forward()
{
digitalWrite(5,HIGH);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
digitalWrite(8,HIGH);
}
void right()
{
digitalWrite(5,LOW);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
digitalWrite(8,HIGH);
}
void left()
{
digitalWrite(5,HIGH);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
digitalWrite(8,LOW);
}
void loop()
{
int l,r;
l=digitalRead(A0);
r=digitalRead(A1);
if(l==1&&r==1)
forward();
if(l==0&&r==1)
left();
if(r==0&&l==1)
right();
if(l==0&&r==0)
forward();
}
```

RESULTS/ DISCUSSIONS:

In this Exp we learn about IR sensor, We learn how to align our Buggy in the path using IR sensor. We also learn that IR is the main sensor which help our Buggy to move in a correct path, So to having a good command in IR sensor will help us a lot.



Signature of faculty member

EXPERIMENT-11

OBJECTIVE: To demonstrate the use of ultrasonic sensor by integrating line follower robocar with obstacle avoidance capability.

HARDWARE USED:

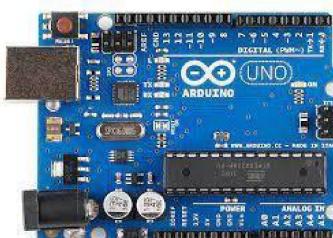
| Sr No. | Name of the Component | Value |
|--------|-----------------------|-------|
| 1. | Buggy Car | 1 |
| 2. | Ultrasonic Sensor | 1 |
| 3. | IR Sensor | 2 |
| 4. | Jumper Wires | 6 |

THEORY:

DC Motor: A DC motor is an electrical motor that uses direct current (DC) to produce mechanical force. The most common types rely on magnetic forces produced by currents in the coils. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.



Arduino Uno Board: The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



Ultrasonic Sensor: An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.



IR Sensors: IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations



CODE:

```
const int trigPin=13;
const int echoPin=12;
long duration;
int distance;
int buggypin5=5;
int buggypin6=6;
int buggypin7=7;
int buggypin8=8;
void forward()
{
    digitalWrite(5,HIGH);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,HIGH);
}
void Stop()
{
    digitalWrite(5,LOW);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,LOW);
}
void right()
{
    digitalWrite(5,LOW);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,HIGH);
}
void left()
{
    digitalWrite(5,HIGH);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,LOW);
}
```

```

void setup()
{
    pinMode(trigPin, OUTPUT);
    pinMode(echoPin, INPUT);
    pinMode(5, OUTPUT);
    pinMode(6, OUTPUT);
    pinMode(7, OUTPUT);
    pinMode(8, OUTPUT);
}
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<=20)
    {
        Stop();
        delay(2000);
    }
    else
        forward();
}

```

RESULTS/ DISCUSSIONS:

In this Exp we learn about Ultrasonic sensor, We learn how to detect obstacle using Ultrasonic Sensor.



Signature of faculty member

EXPERIMENT-12

OBJECTIVE: Write a program to read the pulse width of gantry transmitter and trigger stop buggy function by detecting individual gantry.

HARDWARE USED:

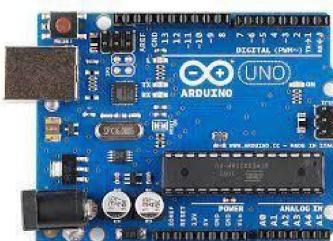
| Sr No. | Name of the Component | Value |
|--------|-----------------------|-------|
| 1. | Buggy Car | 1 |
| 2. | Transmitter Circuit | 1 |
| 3. | IR Sensor | 2 |
| 4. | Jumper Wires | 6 |
| 5. | Zigbee Module | 1 |

THEORY:

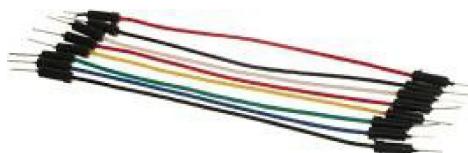
DC Motor: A DC motor is an electrical motor that uses direct current (DC) to produce mechanical force. The most common types rely on magnetic forces produced by currents in the coils. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.



Arduino Uno Board: The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



IR Sensors: IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiation.



CODE:

```
int buggypin5=5;
int buggypin6=6;
int buggypin7=7;
int buggypin8=8;
int ir1 = A0;
int ir2 = A1;
int pin=4;
int count = 0,l,r;
unsigned long value=0 ;
void setup() {
Serial.begin(9600);
pinMode(ir1, INPUT);
pinMode(ir2, INPUT);
pinMode(pin, INPUT);
pinMode(5,OUTPUT);
pinMode(6,OUTPUT);
pinMode(7,OUTPUT);
pinMode(8,OUTPUT);
}
void forward()
{
digitalWrite(5,HIGH);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
digitalWrite(8,HIGH);
delay(10);
}
void left()
{
digitalWrite(5,HIGH);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
digitalWrite(8,LOW);
//delay(10);
}
void right()
{
digitalWrite(5,LOW);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
digitalWrite(8,HIGH);
delay(10);
}
void stopp()
{
digitalWrite(5,LOW);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
digitalWrite(8,LOW);
}
```

```

long st=millis(),endt;
int flag =0;
void loop()
{
    if(Serial.read() == 'V' || flag == 1 )
    {
        if(digitalRead(pin) > 0)
        {
            value=pulseIn(pin,HIGH);
            Serial.print("Value =");
            Serial.println(value);
            if(value >1500 && value <2000)
                Serial.println("Gantry 1 Crossed");
            stopp();
            delay(1000);

            if(value >2500 && value <3000)
                Serial.println("Gantry 2 Crossed");
            stopp();
            delay(1000);

            if(value >500 && value <1000)
            {
                Serial.println("Gantry 3 Crossed");
                stopp();
                delay(1000);
            }
        }
        flag = 1;
    }

    l=digitalRead(ir1);
    r=digitalRead(ir2);

    if(l==1 && r ==1)
        forward();
    if(l==0 && r==1)
        left();
    if(l==1 && r==0)
        right();
    if(l==0 && r==0)
    {
        // forward();
        endt= millis();
        if(endt - st > 500)
        {
            count++;

            Serial.print("Count =");
            Serial.println(count);

            // Serial.print("Time = ");
            // Serial.println(endt - st);
    }
}

```

```

//analogWrite(13, 150);
//delay(10);
//analogWrite(13, 0);

    st=millis();
}

if(count == 1)
    forward();
    Serial.print("forward :");
    Serial.println(count);
if(count == 2)
{
    left();
    delay(500);
    Serial.print("left :");
    Serial.println( count);
}
if(count == 3)
    forward();
    Serial.print(count);
if(count == 4)
{
    forward();
    Serial.print(count);
    Serial.println("forward");
}
if(count == 5)
{
    left();
    delay(1000);
    Serial.print(count);
    Serial.println("left");
}

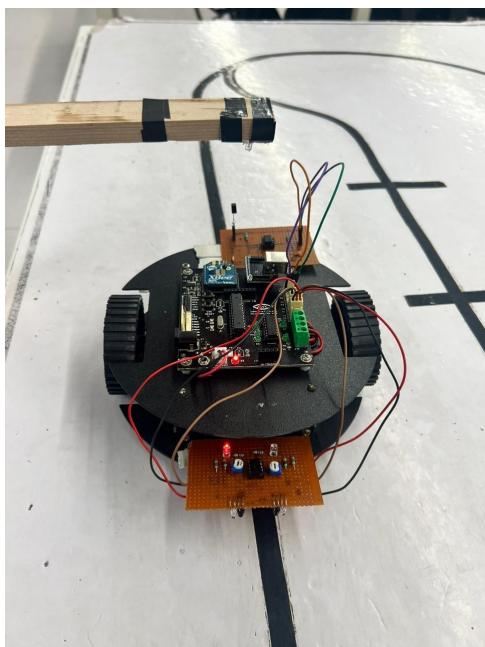
if(count == 6)
{
    forward();
    Serial.print(count);
    Serial.println("forward");
}

if(count > 6)
{
    stopp();
    Serial.print("Stop");
    flag=0;
}
}
}

```

RESULTS/ DISCUSSIONS:

In this Exp we learn about Transmitter Sensor, We also learned about Zigbee Module as well.



Signature of faculty member

EXPERIMENT-13

OBJECTIVE: To demonstrate Zigbee module communication between two PCs using X-CTU.

SOFTWARE USED: X-CTU.

HARDWARE USED:

| Sr No. | Name of the Component | Value |
|--------|-----------------------|-------|
| 1. | Buggy Car | 1 |
| 2. | IR Sensor | 2 |
| 3. | Jumper Wires | 6 |
| 4. | Zigbee Module | 1 |

THEORY:

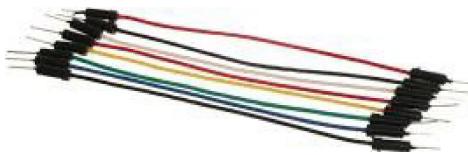
DC Motor: A DC motor is an electrical motor that uses direct current (DC) to produce mechanical force. The most common types rely on magnetic forces produced by currents in the coils. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.



Arduino Uno Board: The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



IR Sensors: IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion.

Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations



Zigbee Module: Zigbee is a standards-based wireless technology developed to enable low-cost, low-power wireless machine-to-machine (M2M) and internet of things (IoT) networks. Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate applications that require long battery life and secure networking. (Zigbee networks are secured by 128 bit symmetric encryption keys.)



CODE:

```
const int trigPin=13;
const int echoPin=12;
long duration;
int distance;
int buggypin5=5;
int buggypin6=6;
int buggypin7=7;
int buggypin8=8;
int ir1 = A0;
int ir2 = A1;
int pin=4;
int count = 0,l,r;
unsigned long value=0 ;
void setup() {
    // put your setup code here, to run once:
    Serial.begin(9600);
    pinMode(trigPin,OUTPUT);
    pinMode(echoPin,INPUT);
    pinMode(ir1, INPUT);
    pinMode(ir2, INPUT);
    pinMode(pin, INPUT);
    pinMode(5,OUTPUT);
    pinMode(6,OUTPUT);
    pinMode(7,OUTPUT);
    pinMode(8,OUTPUT);
```

```

}

void forward()
{
    digitalWrite(5,HIGH);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,HIGH);
    delay(10);
}
void left()
{
    digitalWrite(5,HIGH);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,LOW);
    //delay(10);
}
void right()
{
    digitalWrite(5,LOW);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,HIGH);
    delay(10);
}
void stopp()
{
    digitalWrite(5,LOW);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,LOW);
}
long st=millis(),endt;
int flag =0;
void loop()
{
    if(Serial.read() == 'z' || flag == 1 )
    {
        digitalWrite(trigPin,LOW);
        delayMicroseconds(2);
        digitalWrite(trigPin,HIGH);
        delayMicroseconds(10);
        digitalWrite(trigPin,LOW);
        duration=pulseIn(echoPin,HIGH);
        distance=duration*0.034/2;
        if
        (distance<=20)
        {
            stopp();
            delay(2000);
        }
        else
    }
}

```

```

{
    forward();
}

if(digitalRead(pin) > 0)
{
    value=pulseIn(pin,HIGH);
    Serial.print("Value =");
    Serial.println(value);
    if(value >1500 && value <2000)
        Serial.println("Gantry 1 Crossed");
    stopp();
    delay(1000);

    if(value >2500 && value <3000)
        Serial.println("Gantry 2 Crossed");
    stopp();
    delay(1000);

    if(value >500 && value <1000)
    {
        Serial.println("Gantry 3 Crossed");
        stopp();
        delay(1000);
    }
}

flag = 1;

l=digitalRead(ir1);
r=digitalRead(ir2);

if(l==1 && r ==1)
    forward();

if(l==0 && r==1)
    left();

if(l==1 && r==0)
    right();

if(l==0 && r==0)
{
    // forward();
    endt= millis();

    if(endt - st > 500)
    {
        count++;
    }
}

```

```

    Serial.print("Count = ");
    Serial.println(count);

    // Serial.print("Time = ");
    // Serial.println(endt - st);

    //analogWrite(13, 150);
    //delay(10);
    //analogWrite(13, 0);

    st=millis();
}

if(count == 1)
    forward();
    Serial.print("forward :");
    Serial.println(count);
if(count == 2)
{
    left();
    delay(500);
    Serial.print("left :");
    Serial.println( count);
}
if(count == 3)
    forward();
    Serial.print(count);
if(count == 4)
{
    forward();
    Serial.print(count);
    Serial.println("forward");

}
if(count == 5)
{
    left();
    delay(1000);
    Serial.print(count);
    Serial.println("left");

}
if(count == 6)
{
    forward();
    Serial.print(count);
    Serial.println("forward");

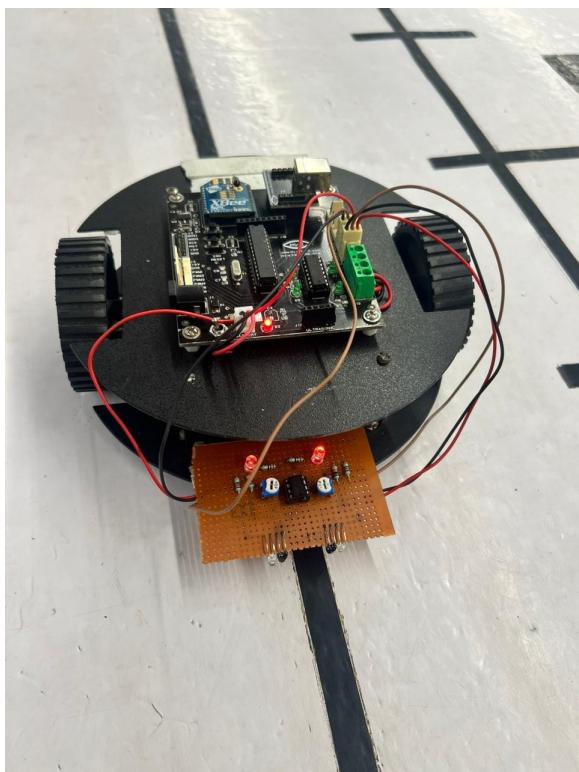
}

```

```
if(count > 6)
{
    stop();
    Serial.print("Stop");
    flag=0;
}
}
}
}
```

RESULTS/ DISCUSSIONS:

In this Exp we learn how we can wirelessly control our Buggy using Zigbee Module, We can give a specific command after pressing which our Buggy will start working.



Signature of faculty member

EXPERIMENT-14

OBJECTIVE: Bronze Challenge: Single buggy around track twice in clockwise direction, under full supervisory control. Buggy can detect an obstacle, Parks safely. Prints state of the track and buggy at each gantry stop.

SOFTWARE USED: X-CTU.

HARDWARE USED:

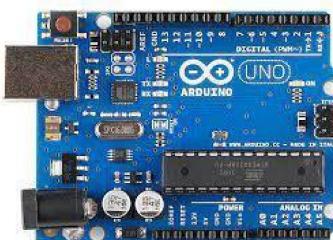
| Sr No. | Name of the Component | Value |
|--------|-----------------------|-------|
| 1. | Buggy Car | 1 |
| 2. | IR Sensor | 2 |
| 3. | Jumper Wires | 6 |
| 4. | Zigbee Module | 1 |
| 5. | Ultrasonic Sensor | 1 |
| 6. | Transmitter Circuit | 1 |

THEORY:

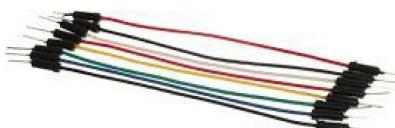
DC Motor: A DC motor is an electrical motor that uses direct current (DC) to produce mechanical force. The most common types rely on magnetic forces produced by currents in the coils. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.



Arduino Uno Board: The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



Jumper Wires: A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards.



IR Sensors: IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations



Ultrasonic Sensor: An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.



Zigbee Module: Zigbee is a standards-based wireless technology developed to enable low-cost, low-power wireless machine-to-machine (M2M) and internet of things (IoT) networks. Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate applications that require long battery life and secure networking. (Zigbee networks are secured by 128 bit symmetric encryption keys.)



CODE:

```
const int trigPin=13;
const int echoPin=12;
long duration;
int distance;
int buggypin5=5;
int buggypin6=6;
int buggypin7=7;
int buggypin8=8;
int ir1 = A0;
int ir2 = A1;
int pin=4;
int count = 0,r;
```

```

unsigned long value=0 ;
void setup() {
    // put your setup code here, to run once:
    Serial.begin(9600);
    pinMode(trigPin,OUTPUT);
    pinMode(echoPin,INPUT);
    pinMode(ir1, INPUT);
    pinMode(ir2, INPUT);
    pinMode(pin, INPUT);
    pinMode(5,OUTPUT);
    pinMode(6,OUTPUT);
    pinMode(7,OUTPUT);
    pinMode(8,OUTPUT);
}
void forward() {
    digitalWrite(5,HIGH);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,HIGH);
    delay(10);
}
void left() {
    digitalWrite(5,HIGH);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,LOW);
    //delay(10);
}
void right() {
    digitalWrite(5,LOW);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,HIGH);
    delay(10);
}
void stopp() {
    digitalWrite(5,LOW);
    digitalWrite(6,LOW);
    digitalWrite(7,LOW);
    digitalWrite(8,LOW);
}

long st=millis(),endt;
int flag =0;

void loop() {
    if(Serial.read() == 'z' || flag == 1 )
    {
        digitalWrite(trigPin,LOW);
        delayMicroseconds(2);

```

```

digitalWrite(trigPin,HIGH);
delayMicroseconds(10);
digitalWrite(trigPin,LOW);
duration=pulseIn(echoPin,HIGH);
distance=duration*0.034/2;

if
(distance<=20)
{
stopp();
delay(2000);
}
else
{
forward();
}

if(digitalRead(pin) > 0)
{
    value=pulseIn(pin,HIGH);
    Serial.print("Value =");
    Serial.println(value);
    if(value >1500 && value <2000)
        Serial.println("Gantry 1 Crossed");
    stopp();
    delay(1000);

    if(value >2500 && value <3000)
        Serial.println("Gantry 2 Crossed");
    stopp();
    delay(1000);

    if(value >500 && value <1000)
    {
        Serial.println("Gantry 3 Crossed");
        stopp();
        delay(1000);
    }
}

flag = 1;

l=digitalRead(ir1);
r=digitalRead(ir2);

if(l==1 && r==1)
    forward();

if(l==0 && r==1)

```

```

left();

if(l==1 && r==0)
right();

if(l==0 && r==0)
{
    // forward();
    endt= millis();

    if(endt - st > 500)
    {
        count++;

        Serial.print("Count = ");
        Serial.println(count);

        // Serial.print("Time = ");
        // Serial.println(endt - st);

        //analogWrite(13, 150);
        //delay(10);
        //analogWrite(13, 0);

        st=millis();
    }

    if(count == 1)
        forward();
        Serial.print("forward :");
        Serial.println(count);
    if(count == 2)
    {
        left();
        delay(500);
        Serial.print("left :");
        Serial.println( count);
    }
    if(count == 3)
        forward();
        Serial.print(count);
    if(count == 4)
    {
        forward();
        Serial.print(count);
        Serial.println("forward");

    }
    if(count == 5)
    {
}

```

```

    left();
    delay(1000);
    Serial.print(count);
    Serial.println("left");

}

if(count == 6)
{
    forward();
    Serial.print(count);
    Serial.println("forward");

}

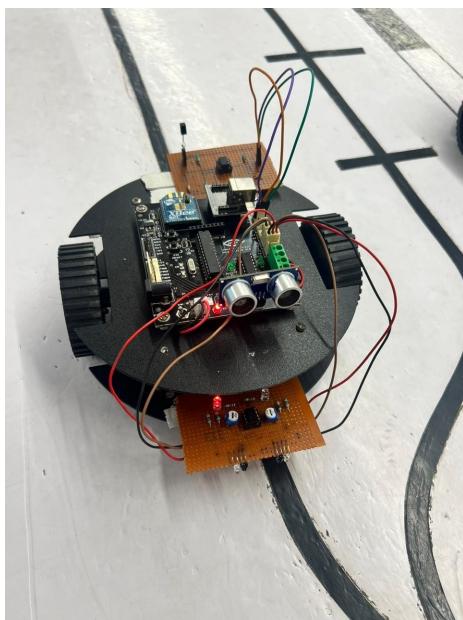
if(count > 6)
{
    stopp();
    Serial.print("Stop");
    flag=0;
}

}
}
}

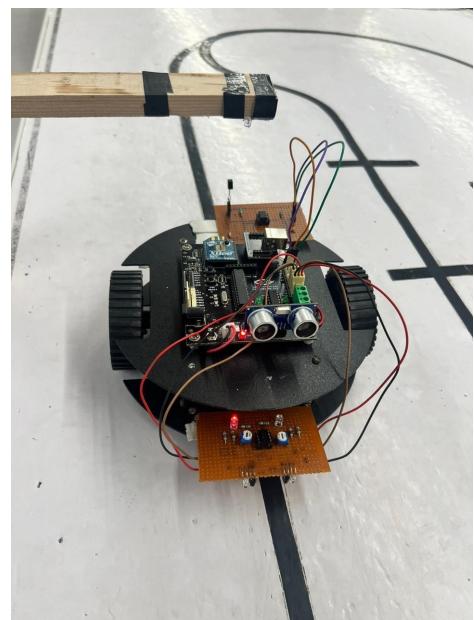
```

RESULTS/ DISCUSSIONS:

In this we have perform Bronze Challenge in which our Buggy will start from the middle, Move 2 times on the outer track, Stop on the Gantry and then again comes back to inner track and safely park to the parking.



Output 1



Output 2

Signature of faculty member