# EST Practical Activity Report

Submitted for

## ENGINEERING DESIGN-II (UTA024)

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Submitted to:

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**Computer Science and Engineering Department**

**Thapar Institute of Engineering & Technology, Patiala**

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# DECLARATION

We affirm that this project report reflects the endeavors conducted during our tenure in the Engineering-design II Computer Lab, overseen by Mr. Divjot Singh. The statements and conclusions presented are the result of our research efforts. We attest that the content of this report is original and executed under the overall guidance of our supervisor. Adhering to the University's directives, we have structured this report accordingly.

Furthermore, we confirm that this project is the culmination of our collective dedication and has not been previously submitted to any other academic institution for degree consideration.

# INDEX

# EXPERIMENT-1

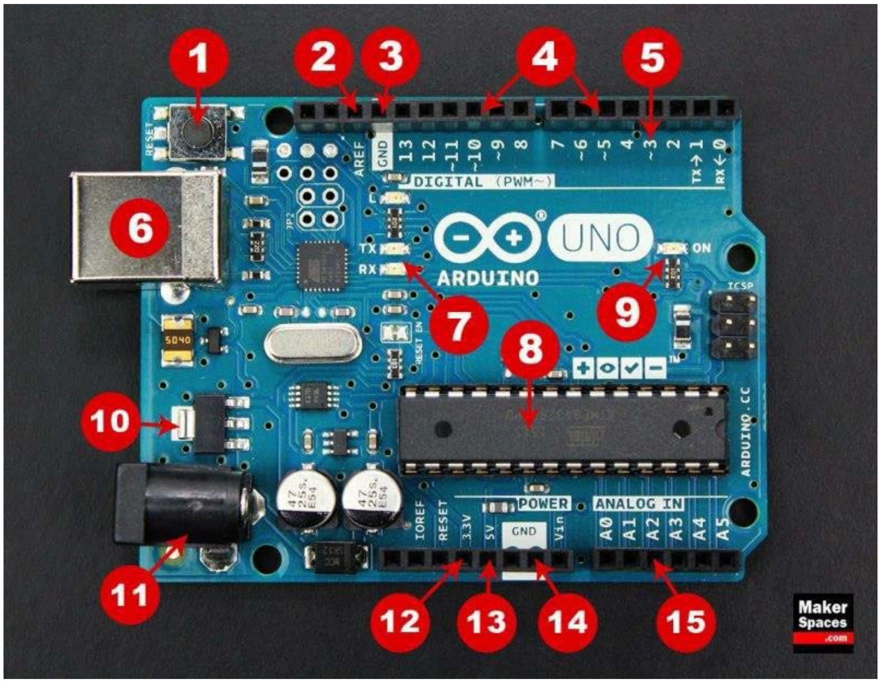
**OBJECTIVE:** Introduction to Arduino Micro-Controller.

**SOFTWARE USED:** Tinkercad Simulator

**HARDWARE USED:**

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

**LOGIC/CIRCUIT DIAGRAM:**



**THEORY:**

The Arduino Uno, introduced in 2010, stands as an open-source microcontroller board leveraging the Microchip ATmega328P microcontroller and developed by Arduino.cc. It boasts a collection of digital and analog input/output (I/O) pins suitable for interfacing with diverse expansion boards (shields) and circuits. Specifically, it features 14 digital I/O pins (six of which support PWM output), along with 6 analog I/O pins. Programming is facilitated through the Arduino IDE (Integrated Development Environment) using a type B USB cable. Powering options include either the USB cable or an external 9-volt battery, with support for voltages ranging from 7 to 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. **ATmega 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 basics of Arduino Uno Microcontroller and its various functions and components.

**Signature of faculty member**

# EXPERIMENT-2

**OBJECTIVE:** Write a program to blink a single LED using Arduino and breadboard.

**SOFTWARE USED:** Tinkercad Simulator.

## HARDWARE USED:

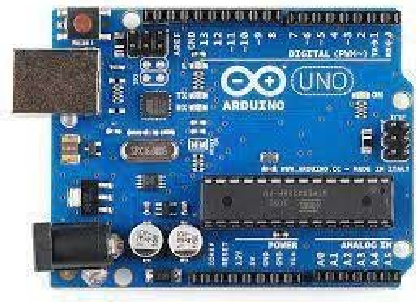
| Sr No. | Name of the Component | Value |
|---|---|---|
| 1. | Arduino Uno Board | 1 |
| 2. | Breadboard | 1 |
| 3. | Jumper Wires | 2 |
| 4. | LED | 1 |
| 5. | Resistor | 220 ohm |

## THEORY:

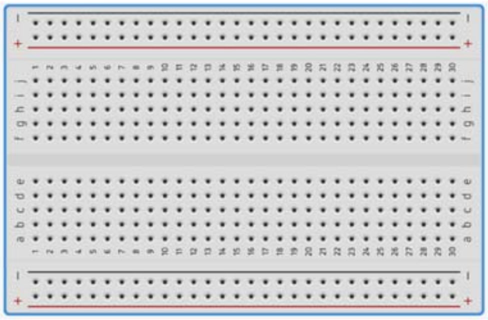
**Resistor:** Resistors are used in virtually all electronic circuits and many electrical ones. Resistors, as their name indicates resist the flow of electricity and this function is key to the operation most circuits.

**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).

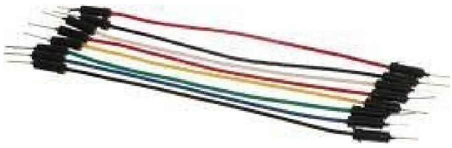
**Arduino Uno Board:** The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



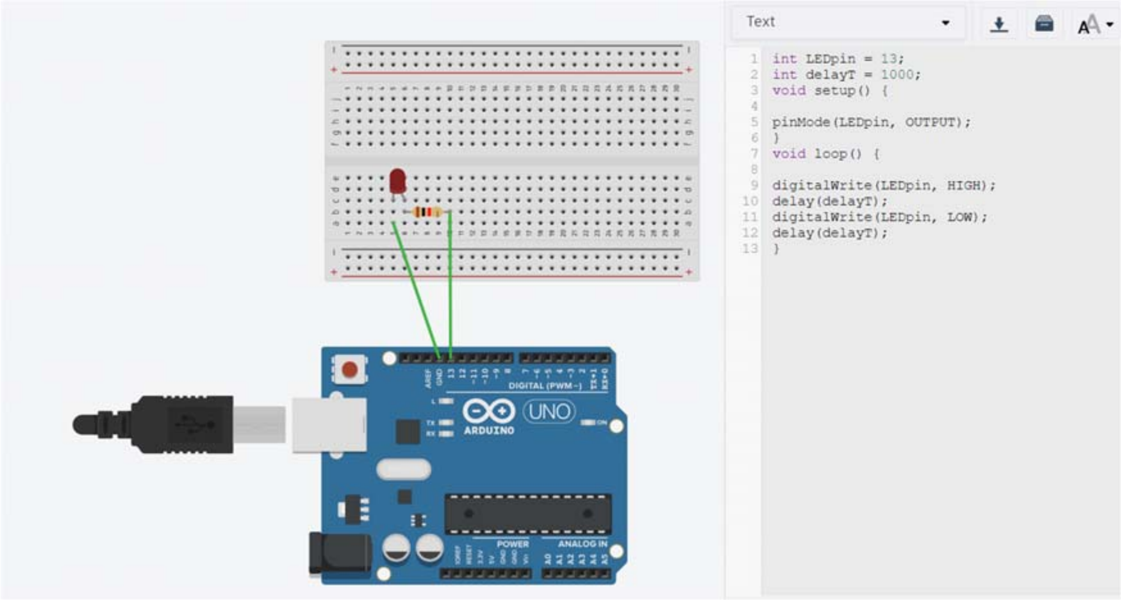
**Breadboard:** A breadboard is used to place components (resistor, capacitor, LED's etc.) that are wired together. It is used to make temporary circuits.



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



## TINKERCAD DIAGRAM:



```
int LEDpin = 13;
int delayT = 1000;
void setup() {

pinMode(LEDpin, OUTPUT);
}
void loop() {

digitalWrite(LEDpin, HIGH);
delay(delayT);
digitalWrite(LEDpin, LOW);
delay(delayT);
}
```

## CODE:

```
int LEDpin = 13;
int delayT = 1000;
void setup() {

pinMode(LEDpin, OUTPUT);
}
void loop() {

digitalWrite(LEDpin, HIGH);
delay(delayT);
digitalWrite(LEDpin, LOW);
delay(delayT);
}
```

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# EXPERIMENT-3

**OBJECTIVE:** Write a program to blink multiple LEDs using:

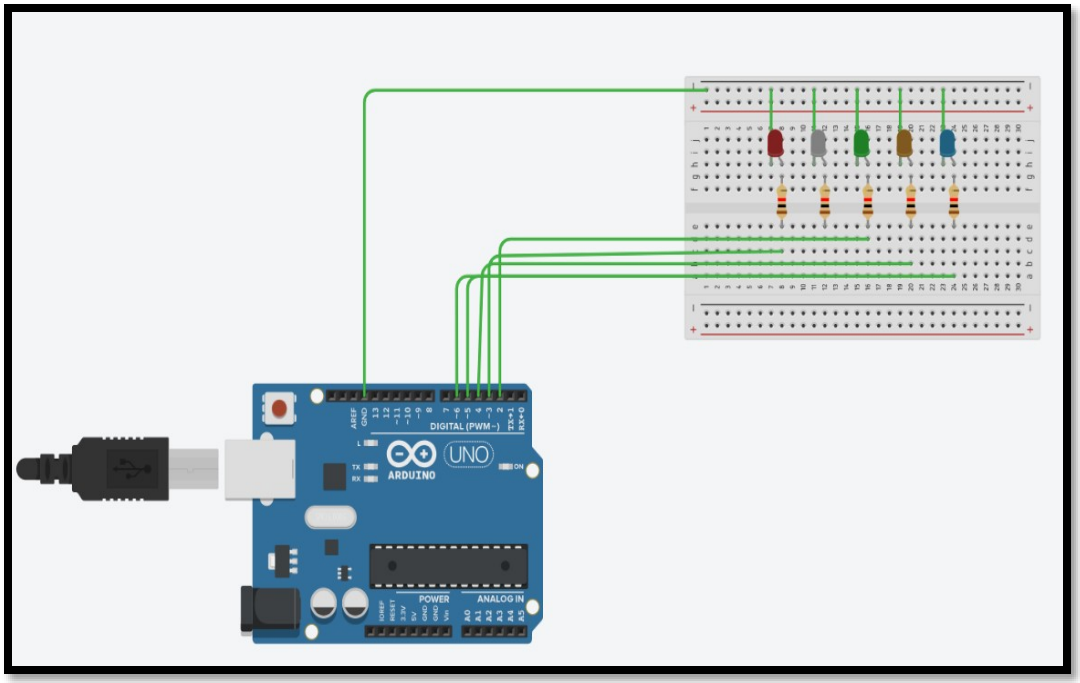
a. For
b. While
c. Array
d. Switch case
e. function

**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 |

## TINKERCAD DIAGRAM:



## CODE:

```
const int numLEDs = 5;
int ledPins[numLEDs] = { 2, 3, 4 ,5 ,6 };

void blinkLEDs(int duration) {
  for (int i = 0; i < numLEDs; i++) {
    digitalWrite(ledPins[i], HIGH);
  }
  delay(duration);
  for (int i = 0; i < numLEDs; i++) {
    digitalWrite(ledPins[i], LOW);
  }
  delay(duration);
}

void setup() {
  for (int i = 0; i < numLEDs; i++) {
    pinMode(ledPins[i], OUTPUT);
  }
}

void loop() {
  // Using 'For' loop
  for (int i = 0; i < 3; i++) {
    blinkLEDs(500);
  }

  // Using 'While' loop
  int count = 0;
  while (count < 3) {
    blinkLEDs(500);
    count++;
  }

  // Using array
  for (int i = 0; i < numLEDs; i++) {
    digitalWrite(ledPins[i], HIGH);
    delay(500); digitalWrite(ledPins[i],
    LOW);
  }
  // Using switch case
  int state = 0; switch
  (state) { case 0:
      blinkLEDs(500);
      break;
    case 1:
      // We can add additional cases for different patterns
      break;
    default:
    break;
  }

  // Using function
  blinkLEDs(500);
}
```

**Signature of faculty member**

# EXPERIMENT-4

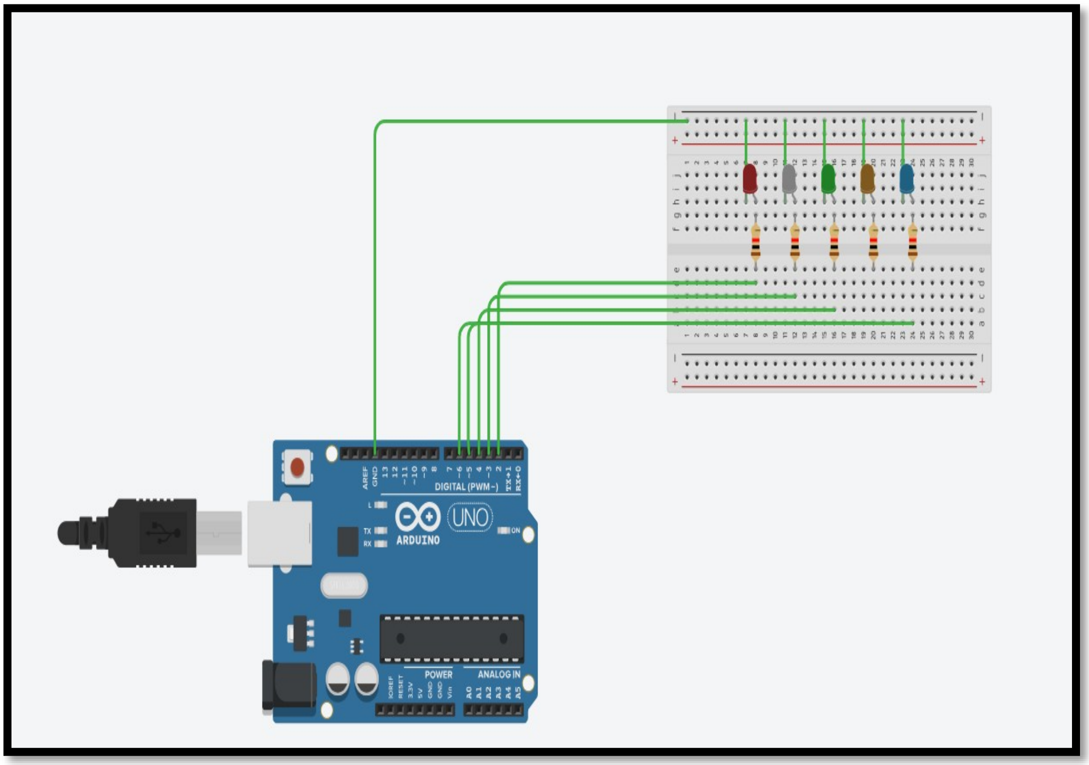
**OBJECTIVE:** Write a program to design an odd-even pattern and then perform the reverse operation.

**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 |

## TINKERCAD DIAGRAM:



**CODE:**

```
const int numLEDs = 5;
int ledPins[numLEDs] = {2, 3, 4, 5, 6};

void blinkPattern(int start, int end, int step, int duration) {
  for (int i = start; i <= end; i += step) {
  digitalWrite(ledPins[i], HIGH);
    delay(duration);
    digitalWrite(ledPins[i], LOW);
  }
}

void setup() {
  for (int i = 0; i < numLEDs; i++) {
    pinMode(ledPins[i], OUTPUT);
  }
}

void loop() {
  // Odd-Even Pattern
  blinkPattern(0, numLEDs - 1, 2, 500); // Odd LEDs
  blinkPattern(1, numLEDs - 1, 2, 500); // Even LEDs

  delay(500); // Pause before the reverse operation

  // Reverse Operation
  for (int i = numLEDs - 1; i >= 0; i--) {
    digitalWrite(ledPins[i], HIGH);
    delay(500);
    digitalWrite(ledPins[i], LOW);
  }

  delay(500); // Pause before restarting the pattern
}
```

**Signature of faculty member**

# EXPERIMENT-5

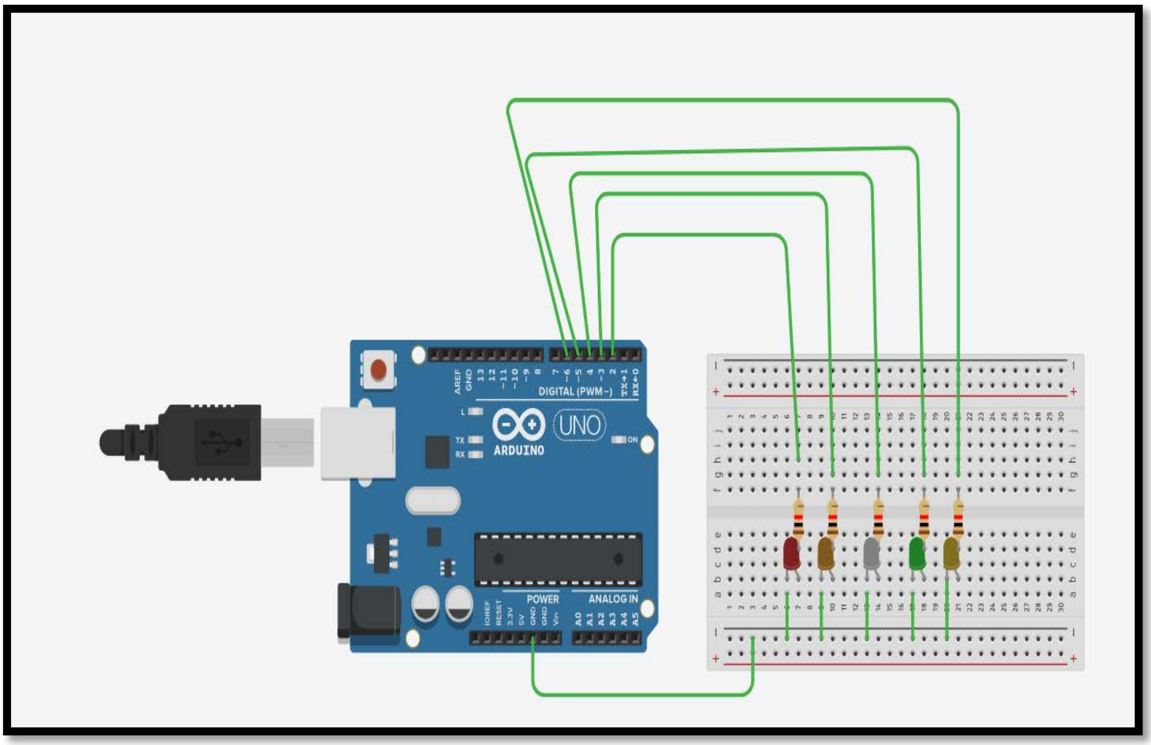
**OBJECTIVE:** Write a program to show binary inputs upto 2^5 on LEDs

**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 |

## TINKERCAD DIAGRAM:



## CODE:

```
const int numLEDs = 5;
const int ledPins[numLEDs] = {2, 3, 4, 5,6};

void setup() {

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

void displayBinary(int decimal) {
  for (int i = 0; i < numLEDs; i++) {
    int bit = (decimal >> i) & 1;
    digitalWrite(ledPins[i], bit);
  }
}

void loop() {

  for (int decimal = 0; decimal < 32; decimal++) {
    displayBinary(decimal);
    delay(5000);
  }
}
```

**Signature of faculty member**

# EXPERIMENT-6

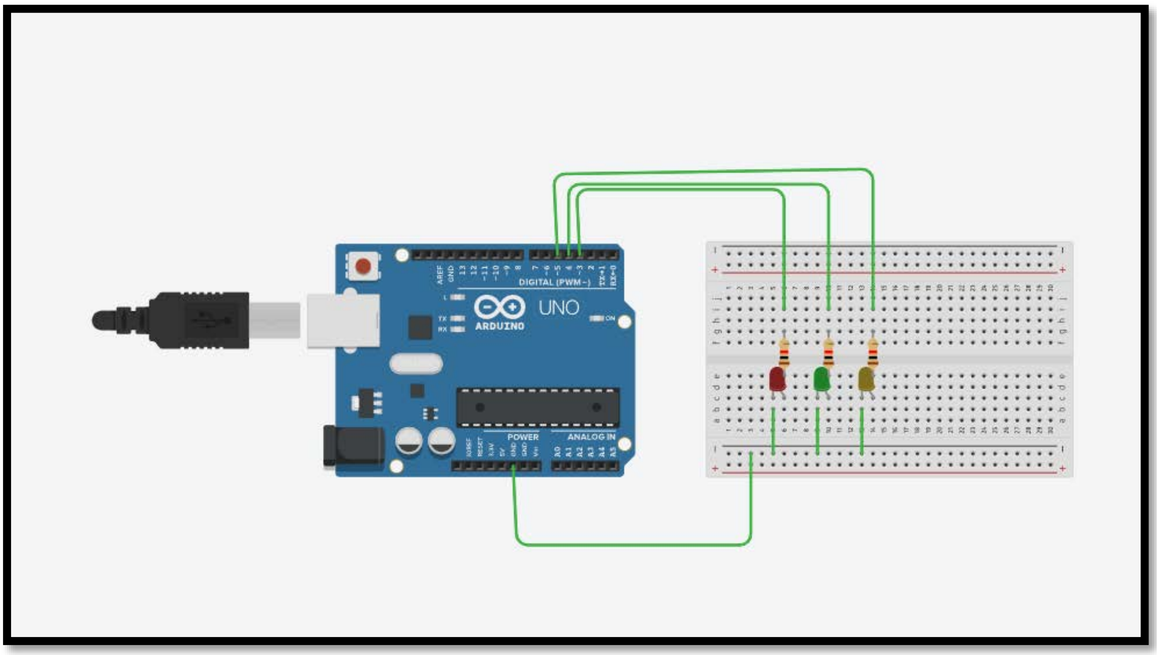
**OBJECTIVE:** WAP to blink multiple LEDs for exactly 3 times.

**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 |

## TINKERCAD DIAGRAM:



## CODE:

```
const int ledPins[] = {3, 4, 5};
int blinkCount = 0;

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

void loop() {
  if (blinkCount < 3) {
    for (int i = 0; i < 3; i++) {
      digitalWrite(ledPins[i], HIGH);
    }
    delay(500);
    for (int i = 0; i < 3; i++) {
      digitalWrite(ledPins[i], LOW);
    }
    delay(500);
    blinkCount++;
  } else {
    while (true) {}
  }
}
```

**Signature of faculty member**

# EXPERIMENT-7

**OBJECTIVE:** WAP to send the data using serial communication

a) print

b) read

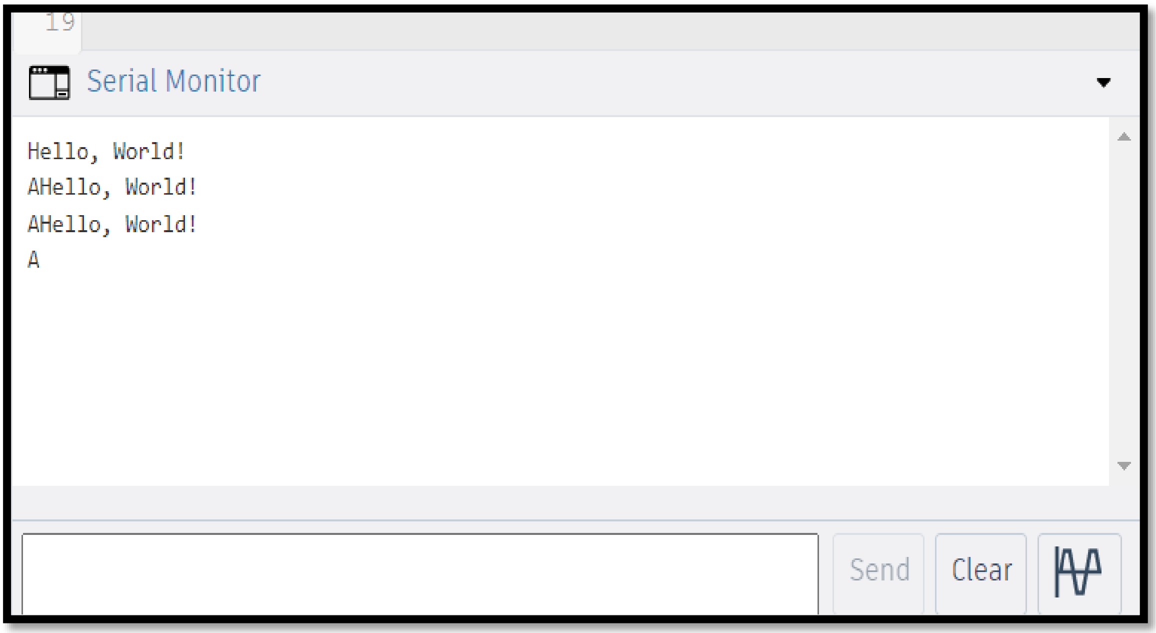
c) write

**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 |

**TINKERCAD OUTPUT:**



```
Hello, World!
AHello, World!
AHello, World!
A
```

## CODE:

```
void setup() {
  Serial.begin(9600);
}

void loop() {
  // a) Print data
  Serial.println("Hello, World!");
  // b) Read data
  if (Serial.available() > 0) {
    char receivedChar = Serial.read();
    Serial.print("Received: ");
    Serial.println(receivedChar);
  }

  // c) Write data
  Serial.write('A');
  delay(1000);
}
```

**Signature of faculty member**

# EXPERIMENT 8

**OBJECTIVE: Using Serial.readString() to print given String pattern.**

**HARDWARE USED**: Arduino UNO Board

**SOFTWARE USED**: Arduino IDE

**CODE:**

```
// C++ code
void setup()

{

  Serial.begin(9600);

}



void loop()

{

  if(Serial.available()>0)

  {

    for(int i=0;i<30;i++)

      Serial.print("*");

    String name = Serial.readString();

    Serial.println();

    Serial.print("Name: ");

    Serial.print(name);

    Serial.println();

  }

  //Serial.flush();

  if(Serial.available()>0)

  {
    for(int i=0;i<28;i++)
      Serial.print("*");
    String dept = Serial.readString();
    Serial.println();
    Serial.print("Department: ");
    Serial.print(dept);
    Serial.println();
  }
}
```

**RESULT ANALYSIS**:The data in the Serial function is read as a string in the above code.To display text and numbers from your sketch on a PC via a serial link, put the Serial.begin(9600) statement in setup(), and then use Serial.print() statements to print the text and values you want to see.

# EXPERIMENT 9

**OBJECTIVE: To perform dimmer effect for multiple LEDs:**

**(a)using for loop**

**(b) using Switch case**

**(c)using user input.**

**HARDWARE USED:** LEDs, Arduino UNO board, connecting wires, breadboard, USB connector, resistor.

**SOFTWARE USED:** Arduino IDE

**CODE:**

(a) USING FOR LOOP

```
void setup()

{

  Serial.begin(9600);

}

void loop() {


  int x;


 // if(Serial.available()>0){

    for(x=0;x<200;x++){

    analogWrite(3,x);

    delay(50);

    Serial.print(x);

    }
```

```
          for(x=200;x>0;x--){
         analogWrite(6,x);
         delay(50);
         Serial.print(x);
          }


     }
```

(b) USING SWITCH CASE

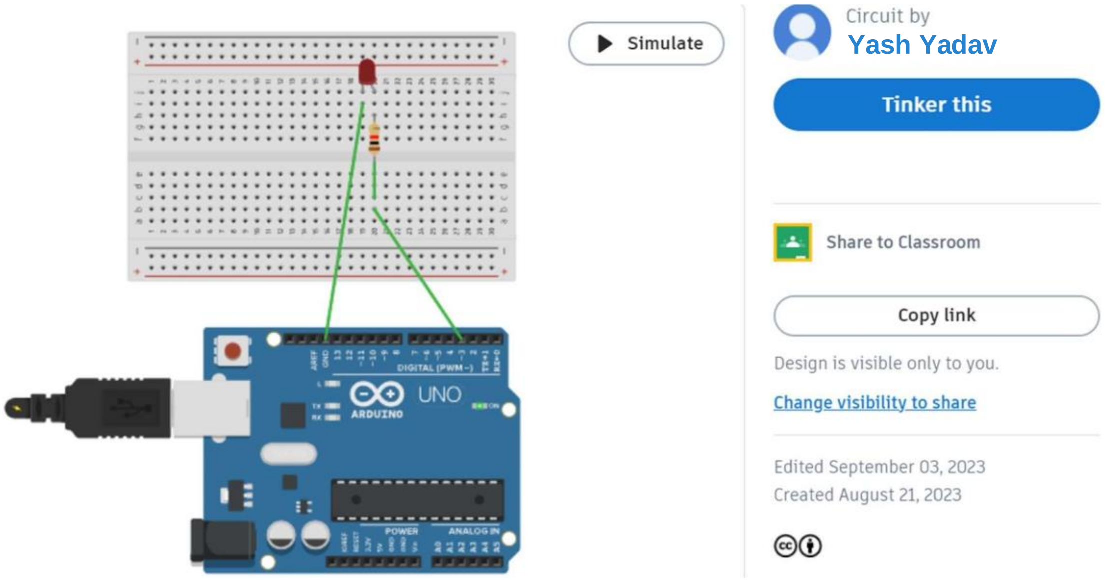
```
void setup() {

 Serial.begin(9600);
}
void loop() {

  int x,n;
  //x=Serial.parseInt();
   Serial.print("enter the intensity of light u want : ");
   n=Serial.read();
  switch(n){
            case 50:{
    x=50;
    analogWrite(3,x);
    Serial.print(x);
                        break;
               }
            case 100:{
    x=100;
    analogWrite(3,x);

    Serial.print(x);

                        break;

              }

            case 150:{

    x=150;

    analogWrite(3,x);

    Serial.print(x);

                        break;

            case 200:{

    x=200;

    analogWrite(3,x);

    Serial.print(x);

                        break;

              }

            case 250:{

    x=250;

    analogWrite(3,x);

    Serial.print(x);

                        break;

              }

default:

{

    x=0;

    analogWrite(3,x);

    Serial.print(x);

                        break;
```

```
  }
}
```

(C ): USING USER INPUT

```
/*void setup() {

 Serial.begin(9600);


}

void loop() {

  int x;
  if(Serial.available()>0){
  x=Serial.parseInt();
  analogWrite(3,x);
  Serial.print(x);
  }
```

**CIRCUIT:**



Circuit by
Yash Yadav

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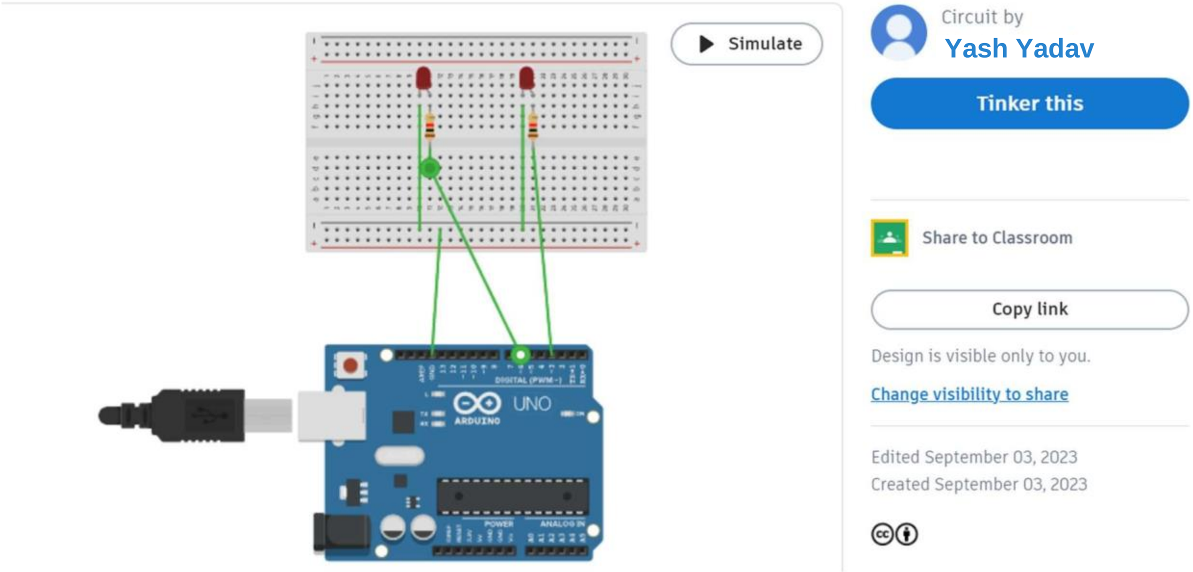
Edited September 03, 2023
Created August 21, 2023

FIG.9.1: DIMMER EFFECT FOR SINGLE LED



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Created September 03, 2023

FIG.9.2: DIMMER EFFECT FOR MULTIPLE LEDs

**RESULT ANALYSIS:**We have learnedto perform a dimmer effect for multiple LEDs in a circuit using the Serial function by user-defined input and using a loop. By doing we are able to change intensity of LEDs.

# EXPERIMENT 10

**OBJECTIVE:** To perform dimmer effect where LED1 should display values between 0-50

LED2=51-100

LED3=101-150

LED4=151-200

LED5=201-255

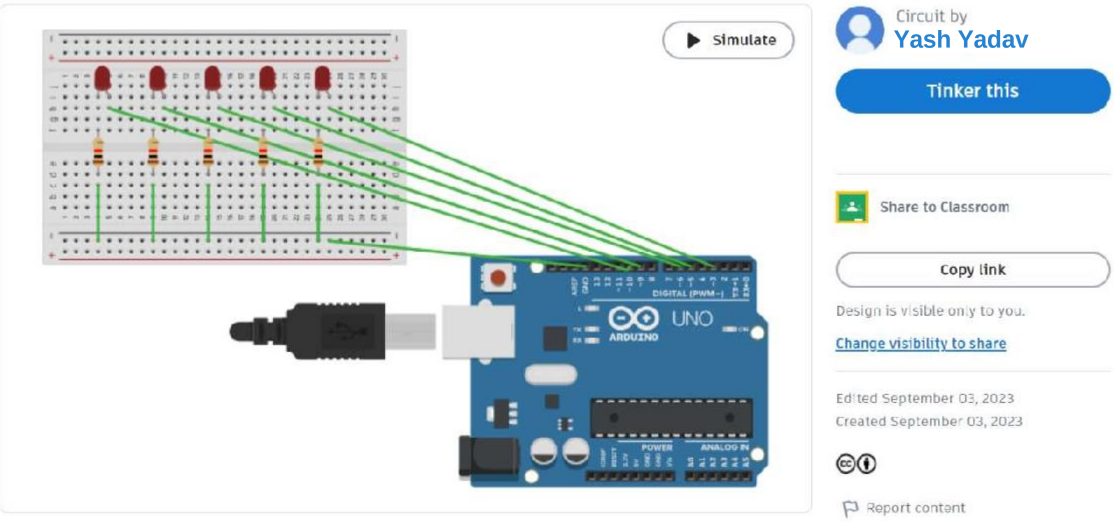
**HARDWARE USED:** LEDs, Arduino UNO board, connecting wires, breadboard, USB connector, resistor.

**SOFTWARE USED:** Arduino IDE

**CODE:**

```
const int LED1 = 3; // Pin for LED 1

const int LED2 = 5; // Pin for LED 2

const int LED3 = 6; // Pin for LED 3

const int LED4 = 9; // Pin for LED 4

const int LED5 = 10; // Pin for LED 5

void setup() {

  pinMode(LED1, OUTPUT);

  pinMode(LED2, OUTPUT);

  pinMode(LED3, OUTPUT);

  pinMode(LED4, OUTPUT);

  pinMode(LED5, OUTPUT);

}

void loop() {

  for (int brightness = 0; brightness <= 50; brightness++) {

    analogWrite(LED1, brightness);

    delay(10);}

for (int brightness = 51; brightness <= 100; brightness++) {
    analogWrite(LED2, brightness);
    delay(10);
  }
for (int brightness = 101; brightness <= 150; brightness++) {
    analogWrite(LED3, brightness);
    delay(10);
  }
for (int brightness = 151; brightness <= 200; brightness++) {
    analogWrite(LED4, brightness);
    delay(10);
  }
for (int brightness = 201; brightness <= 255; brightness++) {
    analogWrite(LED5, brightness);
    delay(10);
  }

 for (int brightness = 255; brightness >= 0; brightness--) {
    analogWrite(LED1, brightness);
    analogWrite(LED2, brightness);
    analogWrite(LED3, brightness);
    analogWrite(LED4, brightness);
    analogWrite(LED5, brightness);
    delay(10);
  }
}
```

## CIRCUIT DIAGRAM:



Circuit by
Yash Yadav

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Edited September 03, 2023
Created September 03, 2023

**RESULT ANALYSIS:** We have learned to perform a dimmer effect for multiple LEDs in a circuit using the Serial function by user-defined input and a loop. By doing so we are able to change the brightness of LEDs.

}

## EXPERIMENT 11

**OBJECTIVE:** To perform the following movements of Robo Car (Buggy) using function:

A) Forward

B) Reverse

C) Left

D) Right

E) Clockwise

F) Anti Clockwise

**HARDWARE USED:** USB connector, Robo Car (Buggy).

**SOFTWARE USED:** Arduino IDE

**CODE:**

**A) Forward**

```
void setup() {
  for(int i=0;i<9;i++){
pinMode(i,OUTPUT);
}
}



void forward(){
digitalWrite(5,HIGH);
digitalWrite(8,HIGH);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
delay(2000);
}
```

```
    void loop() {
      forward();
    }
```

**B) Reverse**

```
void setup() {
  for(int i=0;i<9;i++){
pinMode(i,OUTPUT);
}
}
void backward(){
digitalWrite(6,HIGH);
digitalWrite(7,HIGH);
digitalWrite(5,LOW);
digitalWrite(8,LOW);
delay(2000);
}
void loop() {
  backward();
}
```

**C) Left**

```
void setup() {
  for(int i=0;i<9;i++){
```

```
pinMode(i,OUTPUT);

}

}

void turntoleft(){

digitalWrite(5,HIGH);

digitalWrite(8,LOW);

digitalWrite(6,LOW);

digitalWrite(7,LOW);

delay(2000);

}

void loop() {

  turntoleft();

}
```

**D) Right**

```
void setup() {
  for(int i=0;i<9;i++){
pinMode(i,OUTPUT);
}
}


void turntoright(){
digitalWrite(5,LOW);
digitalWrite(8,HIGH);
digitalWrite(6,LOW);
digitalWrite(7,LOW);
delay(2000);
}

void loop() {
  turntoright();
}
```

**E) Clockwise**

```
void setup() {
  for(int i=0;i<9;i++){
pinMode(i,OUTPUT);
}
}
void clockwise(){
digitalWrite(5,LOW);
digitalWrite(8,HIGH);
digitalWrite(6,HIGH);
digitalWrite(7,LOW);
delay(2000);
}
void loop() {
  clockwise();
}
```

**F) Anti Clockwise**

```
void setup() {
  for(int i=0;i<9;i++){
pinMode(i,OUTPUT);
}
}
void anticlockwise(){
  digitalWrite(6,LOW);
digitalWrite(5,HIGH);

digitalWrite(7,HIGH);

digitalWrite(8,LOW);

delay(2000);

}

void loop() {
anticlockwise();

}
```

**RESULT ANALYSIS:** The movement of Robo car (Buggy) for different functions has been Verified for the following patterns.

A) Forward

B) Reverse

C) Left

D) Right

E) Clockwise

F) Anti Clockwise