MST Practical Activity Report

Submitted for
ENGINEERING DESIGN-II (UTA024)

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BE Second Year

Group – 2NC8

Submitted to:

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THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Computer Science and Engineering Department, TIET, Patiala

January – May 2024

DECLARATION

- We declare that this project report is based on our own work carried out during the course of ourstudy in our Engineering-Design II Computer Lab under the supervision of Dr Niyaz Ahmad Wani.

- 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 underthe 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 submittedto any other university for the award of any degree.

INDEX

EXPERIMENT-1

OBJECTIVE: Introduction to Arduino Micro-Controller.

SOFTWARE USED: Tinkercad Simulator

HARDWARE USED:

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

LOGIC/CIRCUIT DIAGRAM

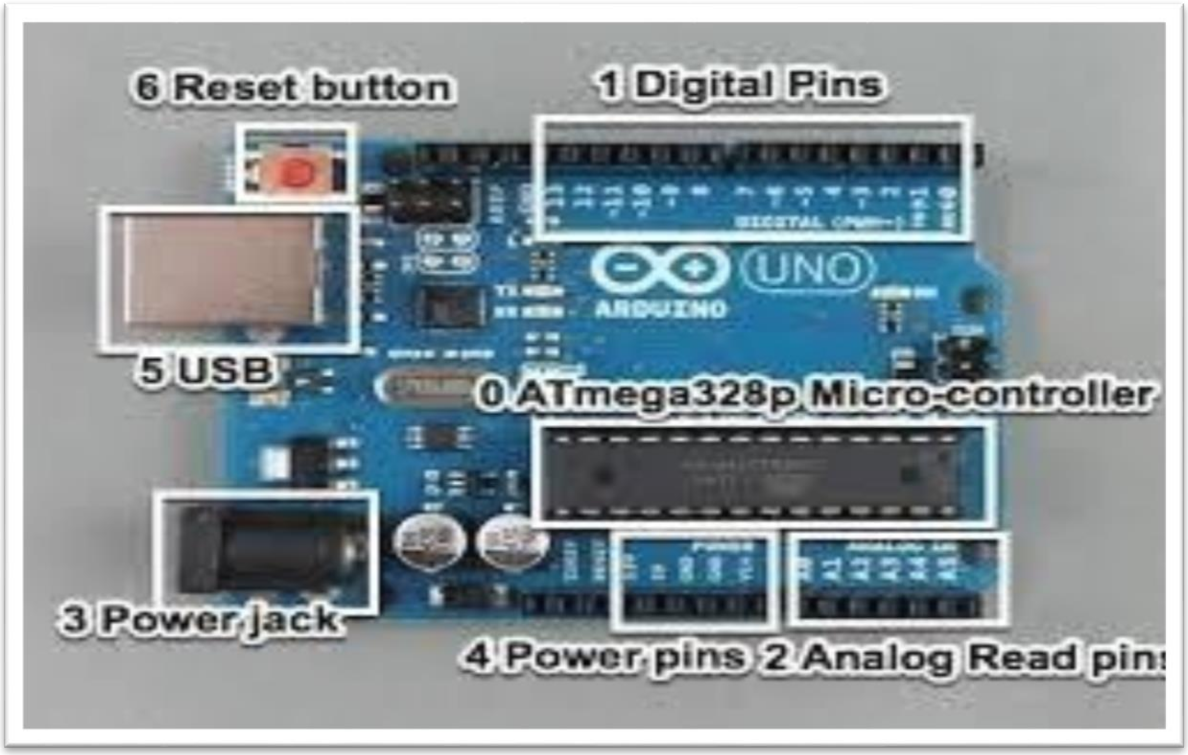

Fig 1.1 Arduino UNO Board Schematic

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.

i. **Power USB:** Arduino board can be provided power from PC/laptop using power cable

ii. **Power Jack:** Arduino can be powered directly from the AC power supply.

iii. **Reset Button:** It is used to reset the Arduino board i.e., start programming from beginning.

iv. **Pins:** Used to connect different components to the Arduino board, voltage and groundconnections.

v. **Analog Pins:** Used to read analog signals from analog sensors and converts it into digitalsignal.

vi. **Digital Pins**: These pins can be configured to work a input or output pins to read logics(0 and 1).

vii. **Power Pins:** Pins that provide power (operating voltage) and ground connections.

viii. **ATmega328P Microcontroller:** It is a high performance yet low power consumption 8-bitAVR microcontroller. It can be commonly found in Arduino boards such as Arduino Uno.It is also known as the brain of Arduino.

RESULT ANALYSIS

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

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	Quantity
1.	Arduino Uno Board	1
2.	Breadboard	1
3.	Jumper Wires	2
4.	LED	1
5.	Resistor	1

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.

Fig 2.1 Resistors

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).

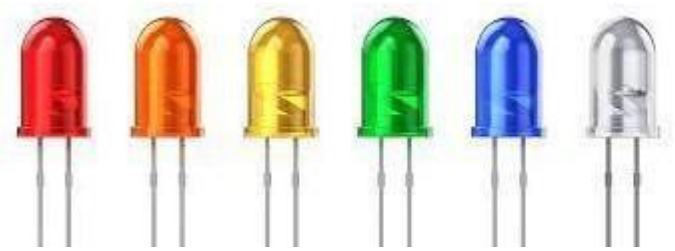

Fig 2.2 LED

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

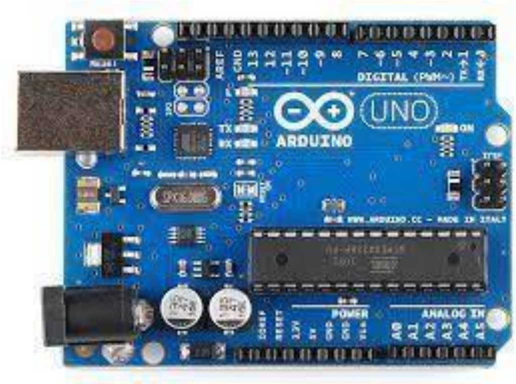

Fig 2.3 Arduino UNO Board

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

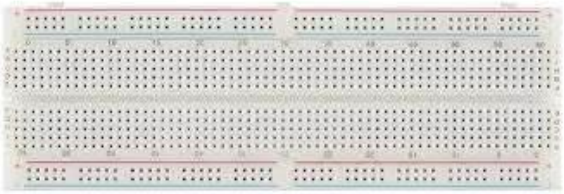

Fig 2.4 Breadboard

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

Fig 2.5 Jumper wires

TINKERCAD DIAGRAM:

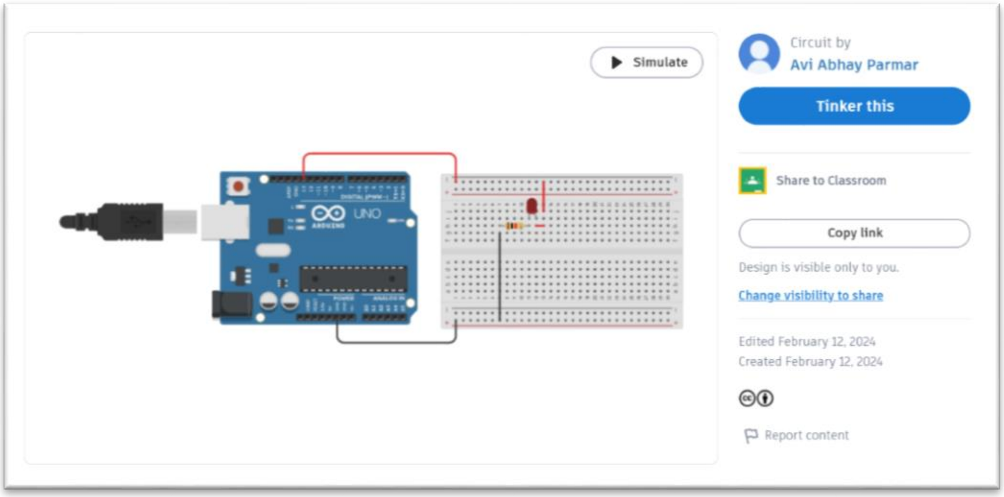

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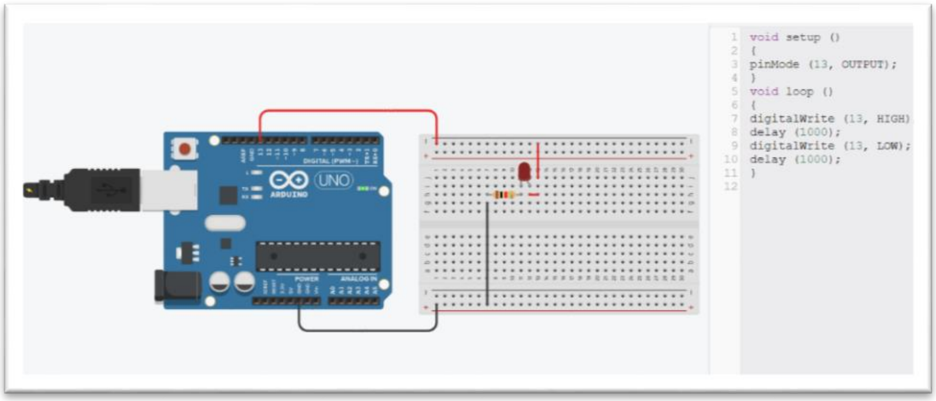
Fig 2.6 Single LED Blinking (Tinkercad Schematic)



```
void setup ()
{
pinMode (13, OUTPUT);
}
void loop ()
{
digitalWrite (13, HIGH)
delay (1000);
digitalWrite (13, LOW);
delay (1000);
}
```

Fig 2.7 Single LED Blinking (Tinkercad Schematic)

CODE –

```
void setup()
{
  pinMode(13, OUTPUT);
}

void loop()
{
  digitalWrite(13, HIGH);
  delay(1000);
  digitalWrite(13, LOW);
  delay(1000);
}
```

RESULT:

In this experiment, we learnt how to blink a single LED using Arduino UNO Board and Arduino IDE.

OUTPUT :

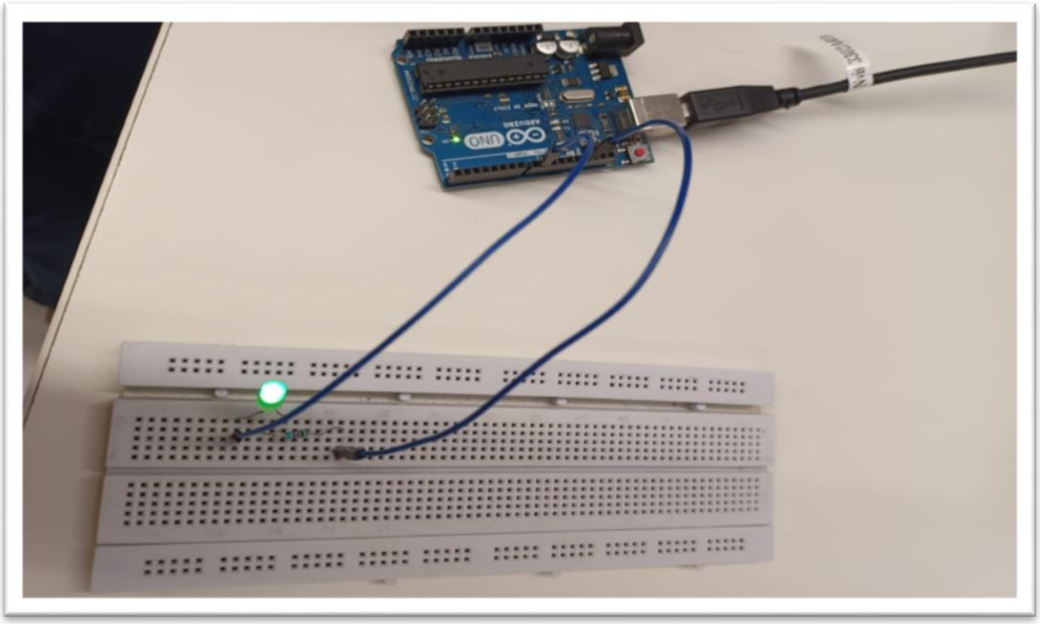


Fig 2.8 Implementation of single LED blinking circuit in real life

EXPERIMENT 3

OBJECTIVE: Write a program to blink multiple LEDs using Arduino UNO and Breadboard.

SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

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

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.

Fig 3.1 Resistors

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).

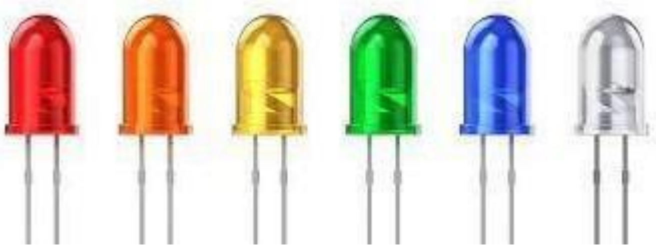


Fig 3.2 LEDs

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

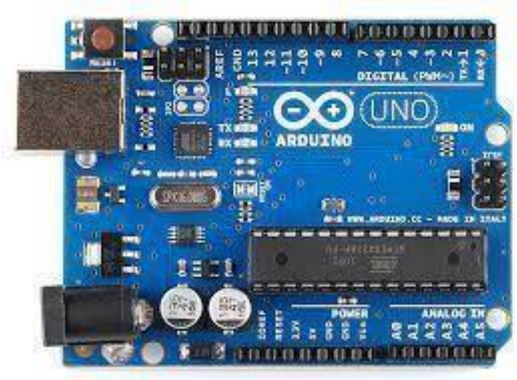


Fig 3.3 Arduino UNO Board

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

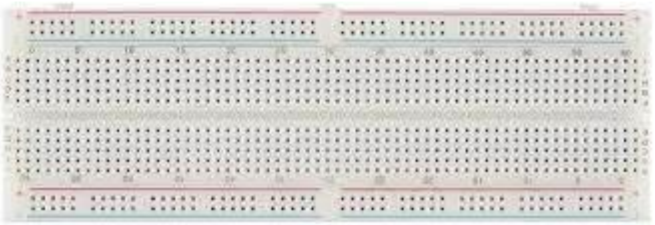


Fig 3.4 Breadboard

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

Fig 3.5 Jumper Wires

TINKERCAD DIAGRAM:

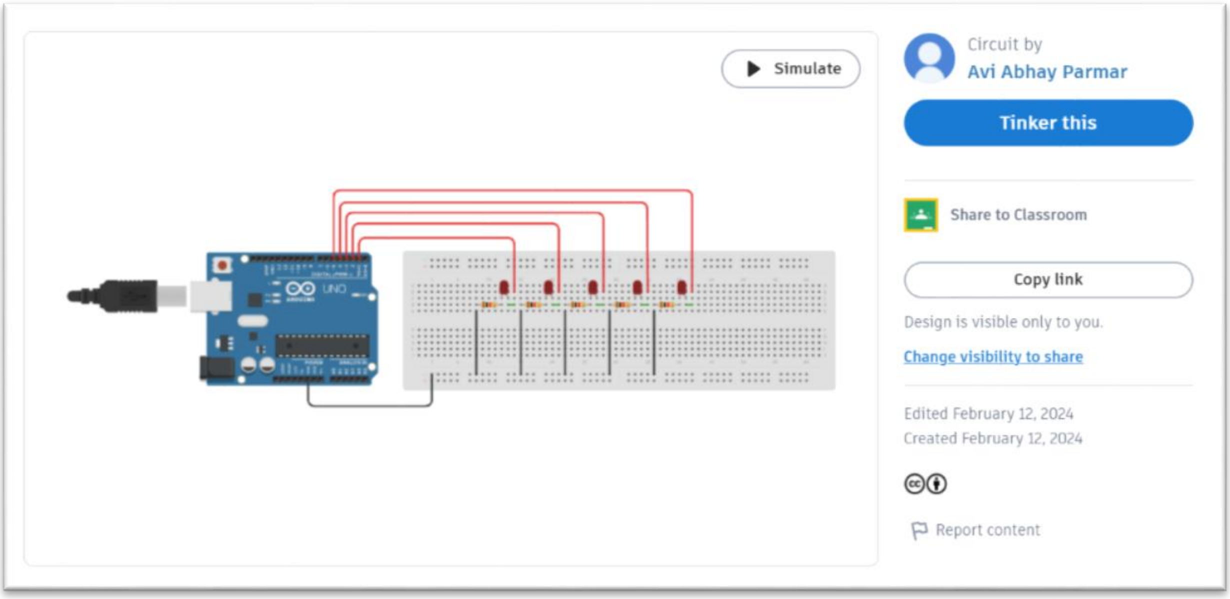


Fig 3.6 Blinking Multiple LEDs (Tinkercad Schematic)

CODE –

```
void setup()
{
  pinMode(1, OUTPUT);
  pinMode(2, OUTPUT);
  pinMode(3, OUTPUT);
  pinMode(4, OUTPUT);

}

void loop()
{
  digitalWrite(1, HIGH);
  delay(1000);
  digitalWrite(1, LOW);
  delay(1000);
  digitalWrite(2, HIGH);
  delay(1000);
  digitalWrite(2, LOW);
  delay(1000);

  digitalWrite(3, HIGH);
  delay(1000);
  digitalWrite(3, LOW);
  delay(1000);

  digitalWrite(3, HIGH);
  delay(1000);
  digitalWrite(3, LOW);
  delay(1000);

}
```

RESULT:

In this experiment, we learnt how to blink multiple LEDs using an Arduino UNO Board and Arduino IDE.

OUTPUT :

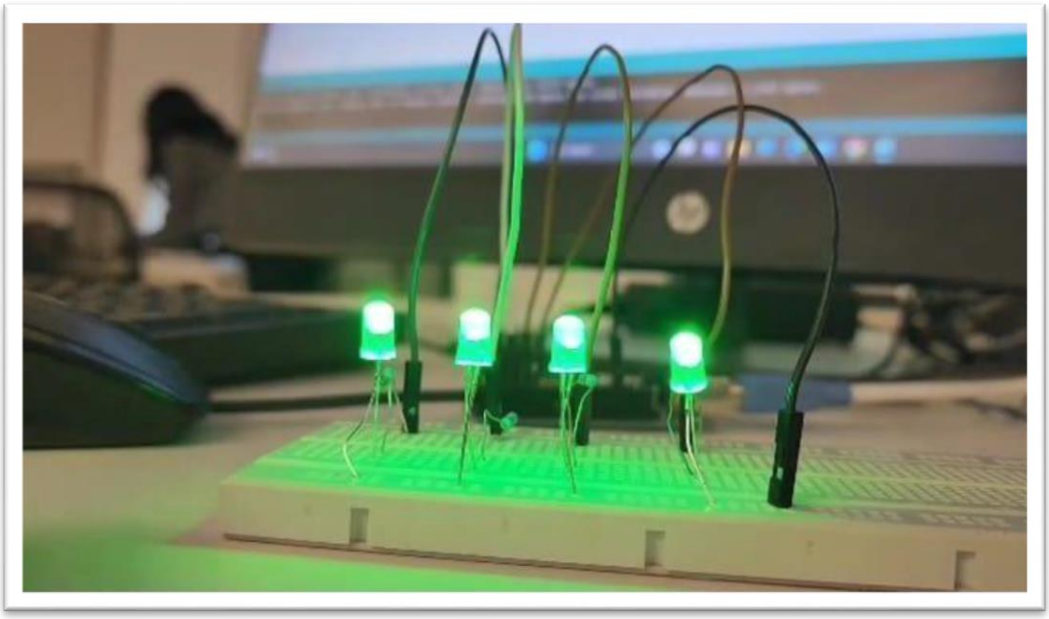


Fig 3.7 Implementation of blinking of multiple LEDs using Arduino UNO Board and Breadboard

EXPERIMENT 4

OBJECTIVE: Write a program to design a pattern of sequence of multiple LEDs using for loop in Arduino.

SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

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

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.

Fig 4.1 Resistor

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).

Fig 4.2 LEDs

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

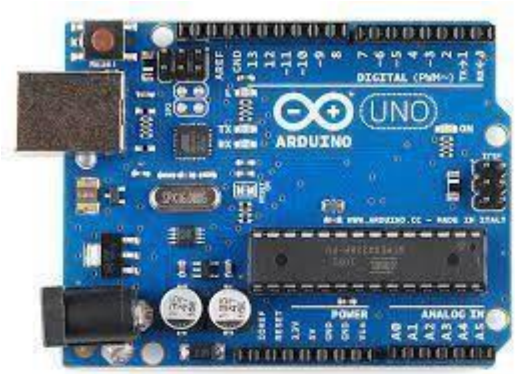


Fig 4.3 Arduino UNO Board

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

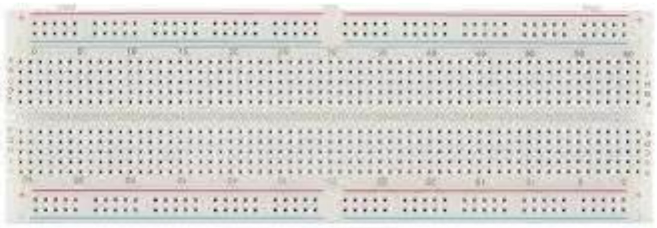
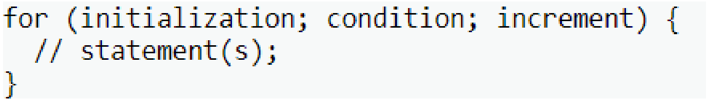


Fig 4.4 Breadboard

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

Fig 4.5 Jumper Wires

FOR Loop Implementation: The for statement is used to repeat a block of statements enclosed in curly braces. An increment counter is usually used to increment and terminate the loop. The for statement is useful for any repetitive operation, and is often used in combination with arrays to operate on collections of data/pins.



```
for (initialization; condition; increment) {
  // statement(s);
}
```

Fig 4.6 Syntax of FOR Loop in Arduino IDE

TINKERCAD DIAGRAM:

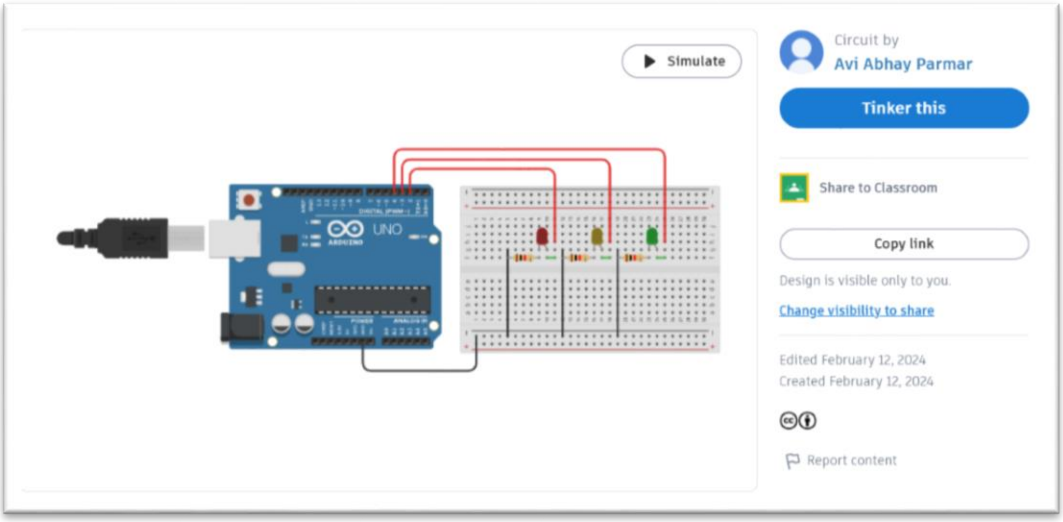


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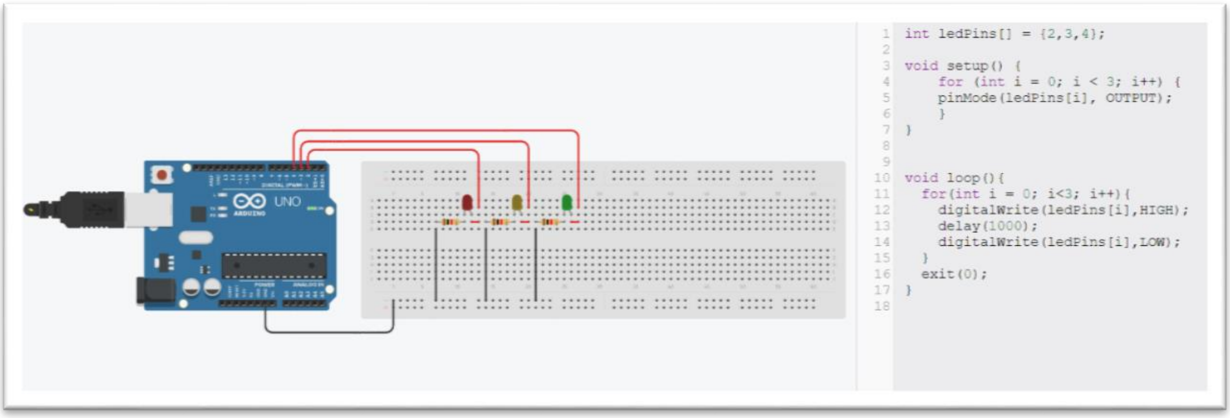
Fig 4.7 Designing a traffic light signal using for loop (Tinkercad Schematic)



```
int ledPins[] = {2,3,4};

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


void loop(){
  for(int i = 0; i<3; i++){
    digitalWrite(ledPins[i],HIGH);
    delay(1000);
    digitalWrite(ledPins[i],LOW);
  }
  exit(0);
}
```

Fig 4.8 Designing a traffic light signal using for loop with code (Tinkercad Schematic)

CODE –

```
int ledPins[]={2,3,4};
void setup()
{
        for (int i=0;i<3;i++)
        {
                pinMode(ledPins[i], OUTPUT);
        }
}

void loop()
{
        for (int i=0;i<3;i++)
        {
                digitalWrite (ledPins[i], HIGH);
                delay(1000);
                digitalWrite (ledPins[i], LOW);
        }
        exit (0);

}
```

RESULT:

In this experiment, we learnt how to blink a pattern of LEDs (Traffic Light Signal) using an Arduino UNO Board and Breadboard. We have implemented this pattern using "for" loop in Arduino IDE.

OUTPUT :

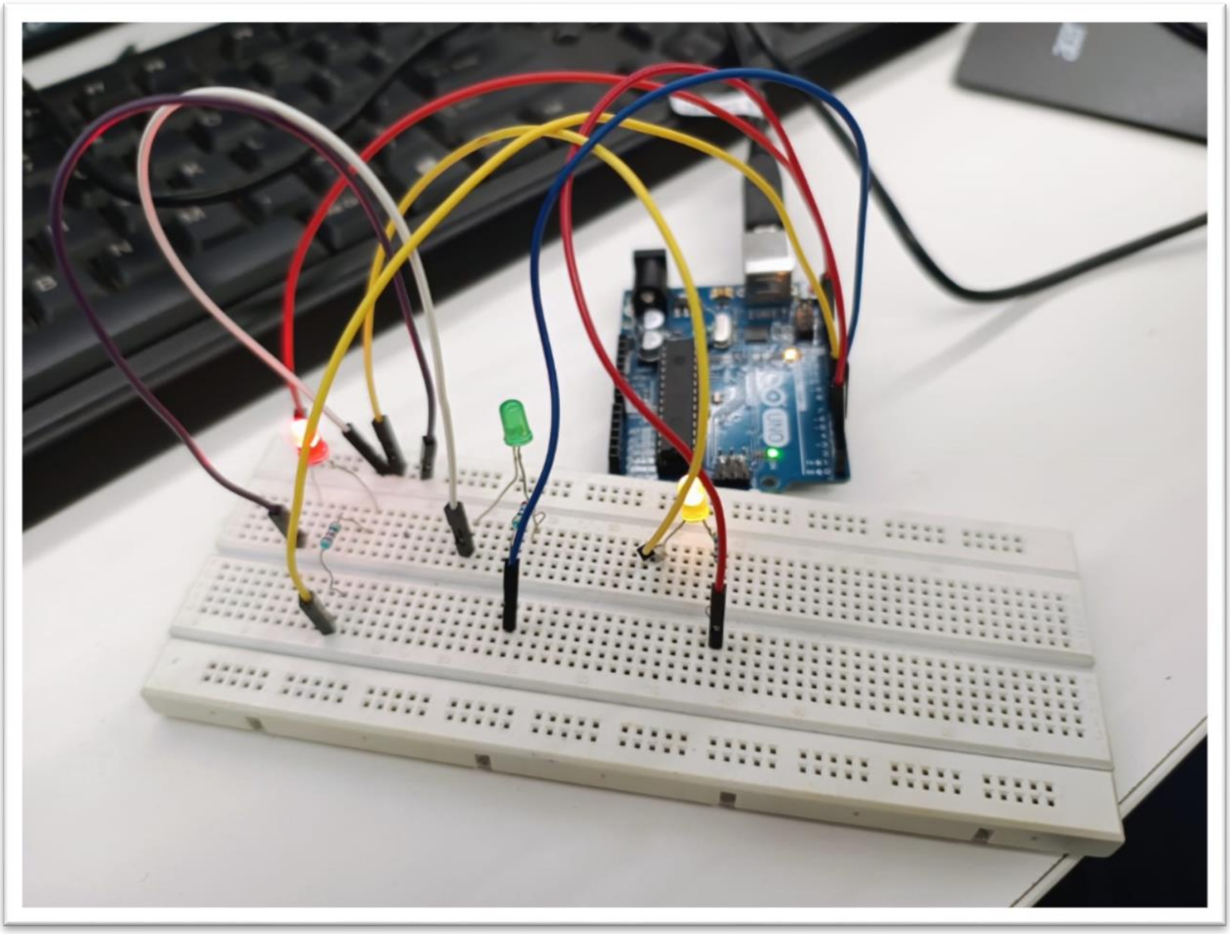


Fig 4.9 Implementation of traffic signal pattern using “for” loop in Arduino UNO Board and Arduino IDE.

EXPERIMENT 5

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

SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

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

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.

Fig 5.1 Resistors

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).

Fig 5.2 LEDs

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

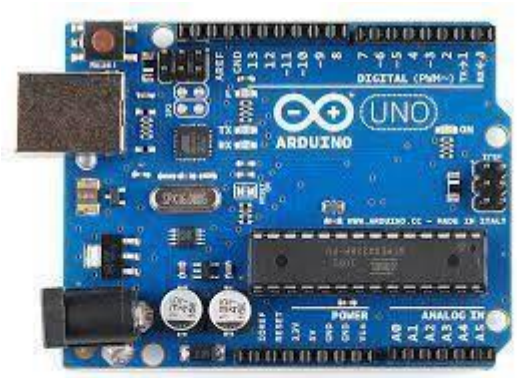


Fig 5.3 Arduino UNO Board

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

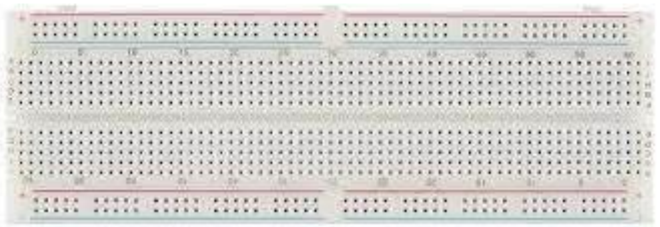
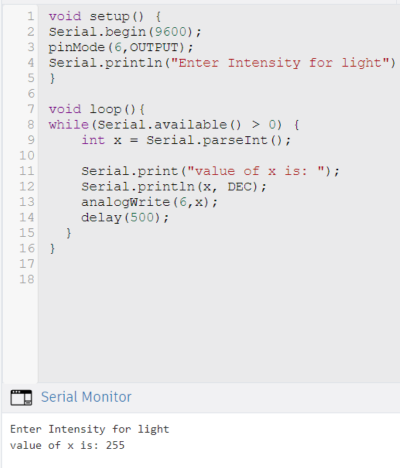


Fig 5.4 Breadboard

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

Fig 5.5 Jumper Wires

Brightness of LED: To change the brightness of LED, one need to connect LED to one of the six available PWM pins. The code need to be modified to use analogWrite() function. This function accepts a value that represents brightness, rather than values HIGH or LOW. The brightness can be set anywhere between the range of 0 to 255.



```
void setup() {
Serial.begin(9600);
pinMode(6,OUTPUT);
Serial.println("Enter Intensity for light")
}

void loop(){
while(Serial.available() > 0) {
    int x = Serial.parseInt();

    Serial.print("value of x is: ");
    Serial.println(x, DEC);
    analogWrite(6,x);
    delay(500);
  }
}
```

```
Enter Intensity for light
value of x is: 255
```

Fig 5.6 Snippet of code to change the brightness of an LED

TINKERCAD DIAGRAM:

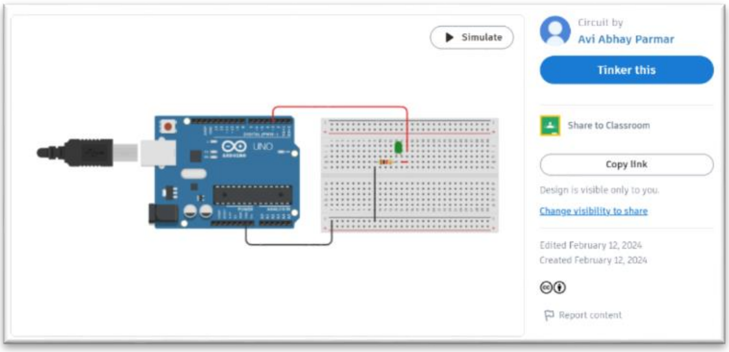


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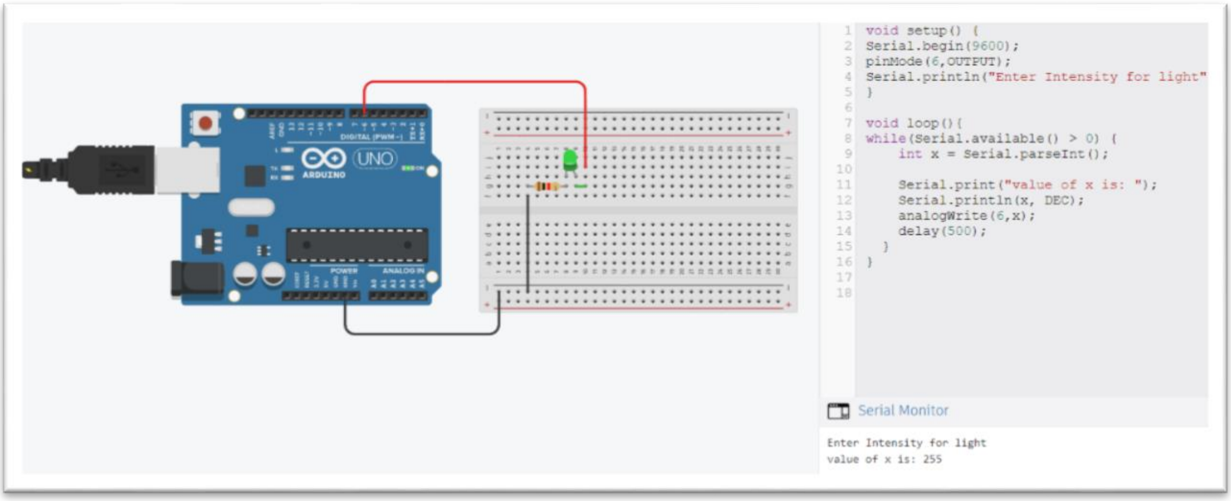
Fig 5.7 Controlling brightness of LED (Tinkercad Schematic)



```
void setup() {
Serial.begin(9600);
pinMode(6,OUTPUT);
Serial.println("Enter Intensity for light"
}

void loop(){
while(Serial.available() > 0) {
    int x = Serial.parseInt();

    Serial.print("value of x is: ");
    Serial.println(x, DEC);
    analogWrite(6,x);
    delay(500);
  }
}
```

```
Enter Intensity for light
value of x is: 255
```

Fig 5.8 Controlling brightness of LED (Tinkercad Schematic)

CODE –

```
void setup()
{
        Serial.begin(9600);
        pinMode(6, OUTPUT);
        Seial.println(“Enter Intensity for light”);
}

void loop()
{
        while(Serial.available()>0)
        {
                int x = Serial.parseInt();
                Serial.println(x, DEC);
                analogWrite(6, x);
                delay(500);
        }
}
```

RESULT:

In this experiment, we learnt how to adjust the brightness of LED using serial communication between Arduino IDE and Arduino UNO Board.

OUTPUT :

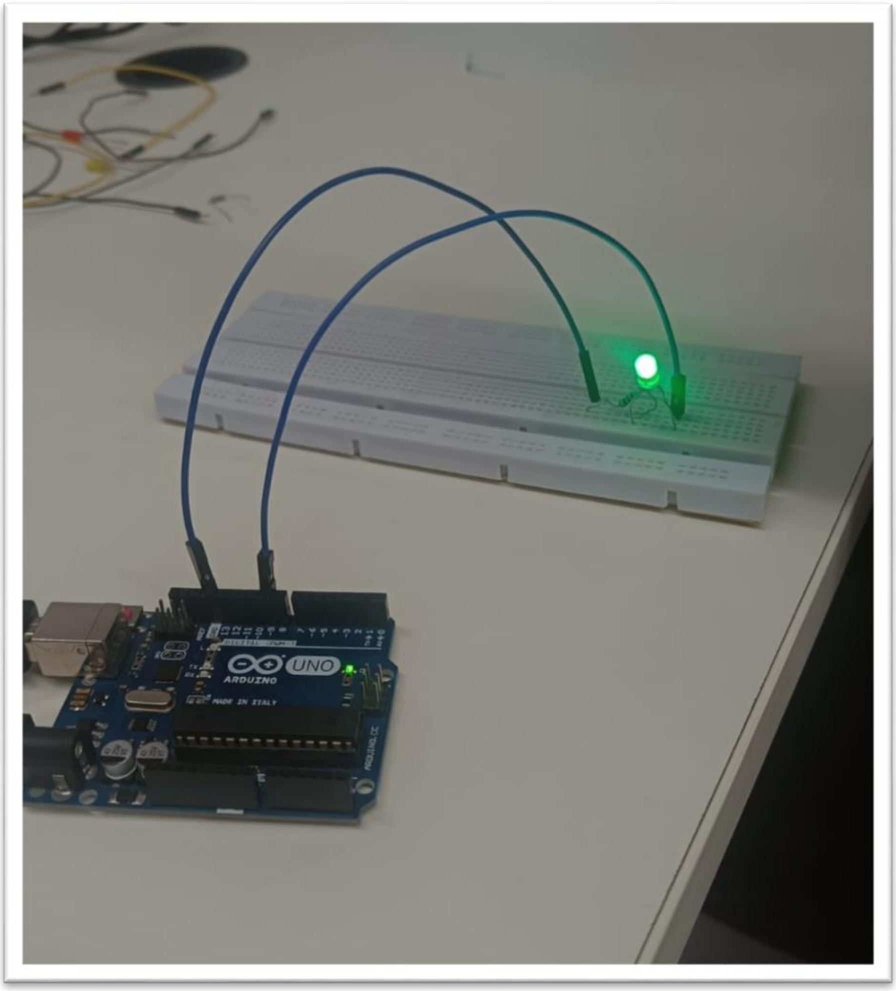


Fig 5.9 Controlling brightness of an LED using Serial Communication.

EXPERIMENT 6

OBJECTIVE: Write a program to print following pattern using for loop.

```
************************************************
****

RollNo.
****************************
Name:

**********************************
Branch:

****************************
```

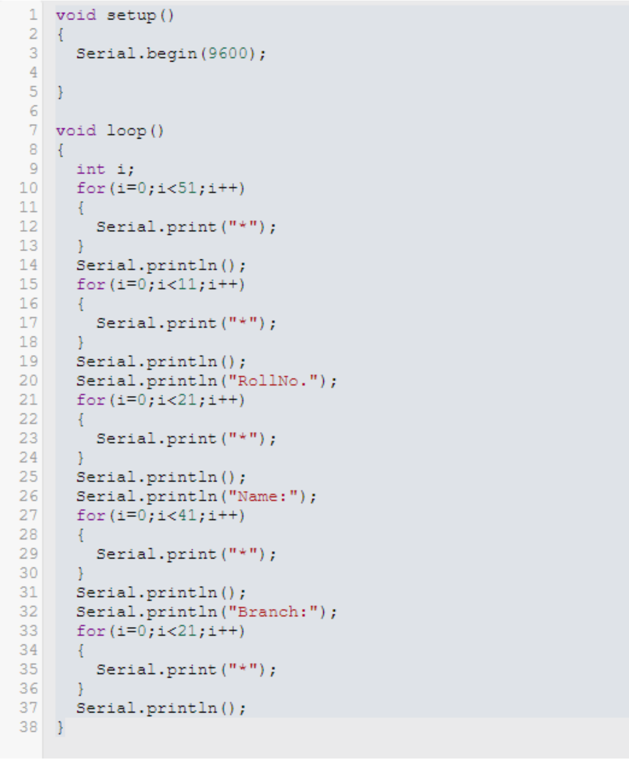
SOFTWARE USED: Tinkercad Simulator.

THEORY:

Serial Communication:

This type of communication is used for communicating between the Arduino board and a computer or other devices. All Arduino boards have at least one serial port (also known as a UART or USART), and some have several. One can use the Arduino environment's built-in serial monitor to communicate with an Arduino board. Click the serial monitor button in the toolbar and select the same baud rate used in the call to begin(). Serial communication on pins TX/RX uses TTL logic levels (5V or 3.3V depending on the board). Serial communication in Arduino is widely used for debugging, logging, controlling external devices, and interfacing with other hardware components. It's a versatile tool for building interactive projects and prototypes.

TINKERCAD DIAGRAM:



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

}

void loop()
{
  int i;
  for(i=0;i<51;i++)
  {
    Serial.print("*");
  }
  Serial.println();
  for(i=0;i<11;i++)
  {
    Serial.print("*");
  }
  Serial.println();
  Serial.println("RollNo.");
  for(i=0;i<21;i++)
  {
    Serial.print("*");
  }
  Serial.println();
  Serial.println("Name:");
  for(i=0;i<41;i++)
  {
    Serial.print("*");
  }
  Serial.println();
  Serial.println("Branch:");
  for(i=0;i<21;i++)
  {
    Serial.print("*");
  }
  Serial.println();
}
```

Fig 6.1 Code snippet of the pattern

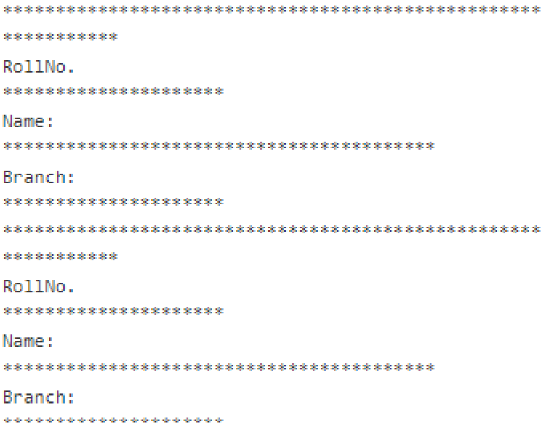
CODE –

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

}

void loop()
{
         int i;
        for(i=0;i<51;i++)
        {
                Serial.print("*");
         }
        Serial.println();
        for(i=0;i<11;i++)
        {
                Serial.print("*");
        }
        Serial.println();
        Serial.println("RollNo.");
        for(i=0;i<21;i++)
        {
                Serial.print("*");
        }
        Serial.println();
        Serial.println("Name:");
        for(i=0;i<41;i++)
        {
                Serial.print("*");
        }
        Serial.println();
        Serial.println("Branch:");
        for(i=0;i<21;i++)
        {
                Serial.print("*");
        }
        Serial.println();
}
```

RESULT:

In this experiment, we wrote a program to print a particular patter through serial communication.

OUTPUT :



```
***************************************************
***********
RollNo.
*********************
Name:
*****************************************
Branch:
*********************
***************************************************
***********
RollNo.
*********************
Name:
*****************************************
Branch:
*********************
```

Fig 6.2 Output of the code printing the desired pattern.

EXPERIMENT 7

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

SOFTWARE USED: Tinkercad Simulator.

HARDWARE USED:

Sr No.	Name of the Component	Quantity
1.	Arduino Uno Board	1
2.	Breadboard	1
3.	Jumper Wires	-
4.	LED	5
5.	Resistor	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 most circuits.

Fig 7.1 Resistors

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).

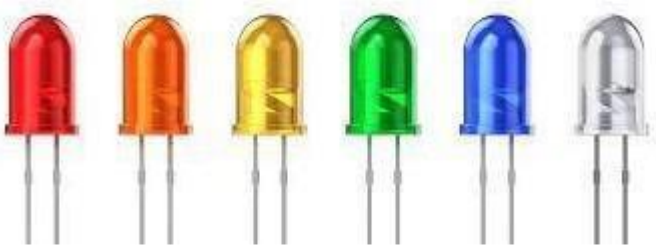


Fig 7.2 LEDs

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

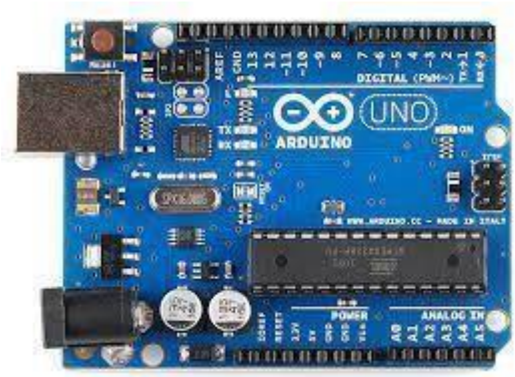


Fig 7.3 Arduino UNO Board

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

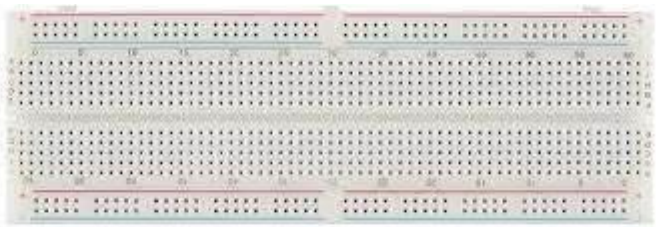
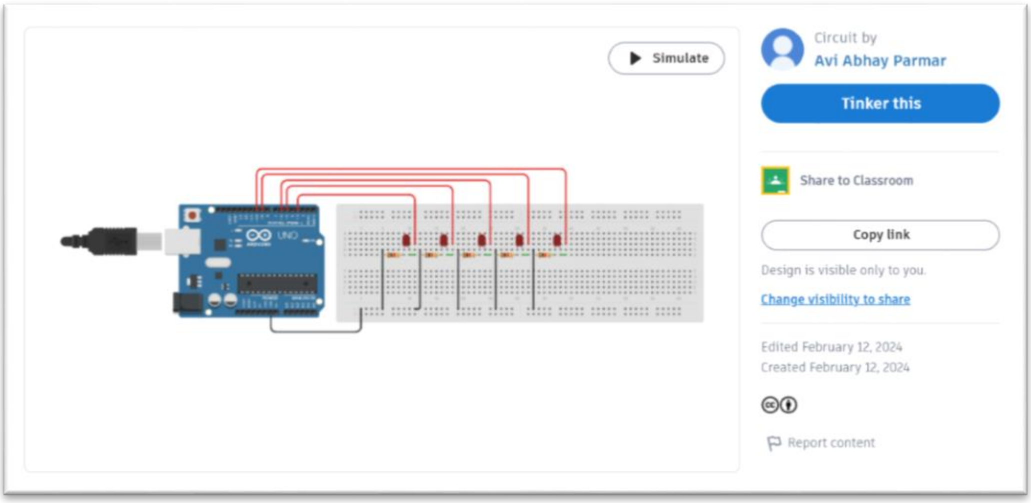


Fig 7.4 Breadboard

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

Fig 7.5 Jumper Wires

TINKERCAD DIAGRAM:

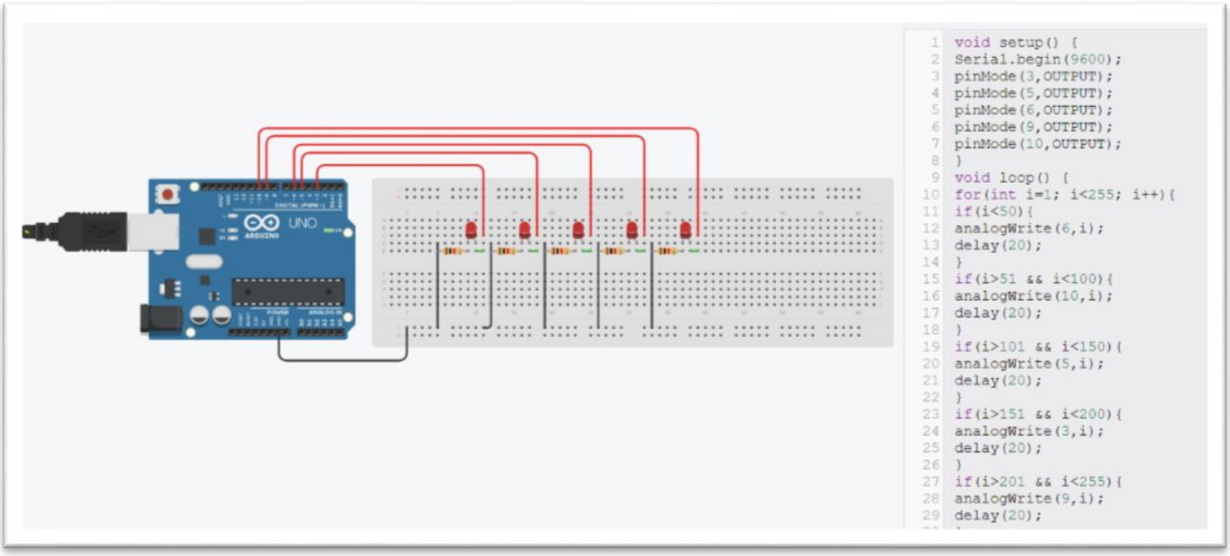


Circuit by
Avi Abhay Parmar

Design is visible only to you.

Edited February 12, 2024
Created February 12, 2024

Fig 7.6 Changing the intensity of LEDs in definite manner (Tinkercad Schematic)



```
void setup() {
Serial.begin(9600);
pinMode(3,OUTPUT);
pinMode(5,OUTPUT);
pinMode(6,OUTPUT);
pinMode(9,OUTPUT);
pinMode(10,OUTPUT);
}
void loop() {
for(int i=1; i<255; i++){
if(i<50){
analogWrite(6,i);
delay(20);
}
if(i>51 && i<100){
analogWrite(10,i);
delay(20);
}
if(i>101 && i<150){
analogWrite(5,i);
delay(20);
}
if(i>151 && i<200){
analogWrite(3,i);
delay(20);
}
if(i>201 && i<255){
analogWrite(9,i);
delay(20);
```

Fig 7.7 Changing the intensity of LEDs in definite manner (Tinkercad Schematic)

CODE –

```
void setup()
{
        Serial.begin(9600);
        pinMode(3, OUTPUT);
        pinMode(5, OUTPUT);
        pinMode(6, OUTPUT);
        pinMode(9, OUTPUT);
        pinMode(10, OUTPUT);

}

void loop()
{
        for (int i=1;i<255;i++);
        {
                if(i<50)
                {
                        analogWrite(6, i);
                        delay(2000);
                }
                if(i>51 && i<100)
                {
                        analogWrite(10, i);
                        delay(2000);
                }
                if(i>101 && i<150)
                {
                        analogWrite(5, i);
                        delay(2000);
                }
                if(i>151 && i<200)
                {
                        analogWrite(3, i);
                        delay(2000);
                }
                if(i>201 && i<255)
                {
                        analogWrite(9, i);
                        delay(2000);
                }
                if(i<50)
                {
                        analogWrite(9, i);
                        delay(2000);
                }
                if(i>51 && i<100)
                {
                        analogWrite(3, i);
                        delay(2000);
                }
                if(i>101 && i<150)
                {
                        analogWrite(5, i);
                        delay(2000);
                }
                if(i>151 && i<200)
                {
                        analogWrite(10, i);
                        delay(2000);
                }
                if(i>201 && i<255)
                {
                        analogWrite(6, i);
                        delay(2000);
                }
        }
}
```

RESULT:

In this experiment, we learnt how to change the intensity of LEDs in a particular manner in forward and reverse order.

OUTPUT :

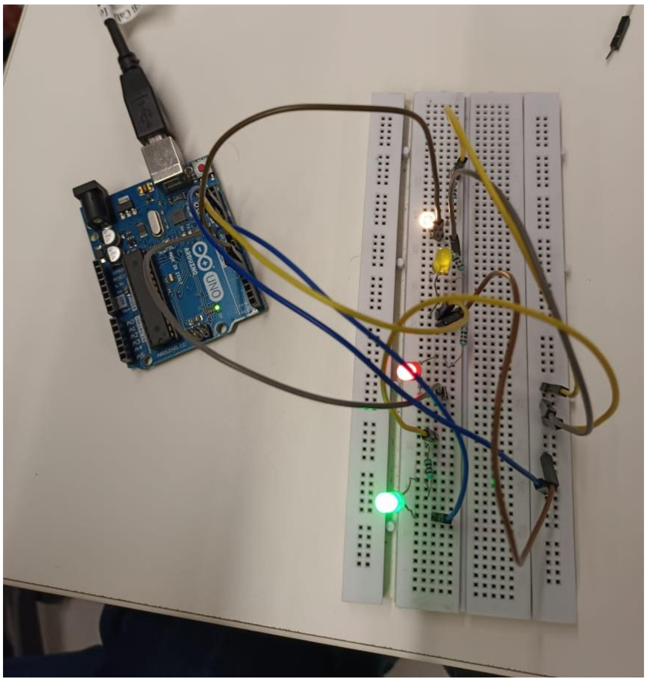


Fig 7.8 Implementation of the above circuit.