MST Practical Activity Report
Submitted for

ENGINEERING DESIGN-II (UTA024)

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BE Second Year Batch:

2NC10

Submitted to-

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(Deemed to be University)

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ABSTRACT

This experiment delves into the fundamentals of Arduino microcontroller programming, focusing on basic LED manipulation, serial communication, and numerical conversions. The experiment begins with a simple LED blinking program, progressively advancing to more complex tasks such as designing forward and reverse patterns for multiple LEDs and implementing serial communication protocols.

Through a series of Arduino programs, participants learn to control LEDs' intensity using both digital and analog write functions, as well as exploring sequential patterns such as 35214, Additionally, the experiment covers converting decimal numbers to hexadecimal, binary, and octal representations, providing a comprehensive understanding of numerical systems within the Arduino environment.

Furthermore, participants engage in hands-on practice with the serial communication functions Like Serial.begin(),Serial.print(),Serial.println(),Serial.read(),andSerial.write(), enhancing their proficiency in Arduino programming.

Overall, this experiment serves as a foundational exploration into Arduino microcontroller programming, offering practical insights into LED manipulation, serial communication, and numerical conversions essential for further exploration in embedded systems development.

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 **MRS Ananya Kaim**.

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

1. OBJECTIVE: Introduction to Arduino Micro-Controller.

2. HARDWARE USED:

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

3. SOFTWARE USED Arduino

4. THEORY:

The Arduino Uno is a popular microcontroller board used in the field of electronics and embedded systems development. It is part of the Arduino platform, which is an open-source hardware and software ecosystem designed to make it easy for beginners and professionals alike to create interactive electronic projects.

Key features of the Arduino Uno include:

1. Microcontroller: The Arduino Uno is powered by the Atmega328P microcontroller from Atmel (now owned by Microchip Technology). This microcontroller has 32KB of flash memory for storing your program, 2KB of SRAM, and 1KB of EEPROM.
2. Digital I/O Pins: It has 14 digital input/output pins (of which 6 can be used as PWM outputs) that allow you to interface with various digital devices such as LEDs, switches, sensors, and more.
3. Analog Inputs: The Uno features 6 analog input pins, labeled A0 through A5, which can be used to read analog voltages from sensors and other analog devices.
4. Power Supply: The board can be powered via a USB connection, an external DC power supply (7-12V), or a battery. It includes a voltage regulator to provide a stable 5V supply to the microcontroller and other components.
5. Communication Interfaces: The Uno supports serial communication through its USB connection, making it easy to upload code and communicate with your computer. It also has a hardware UART for additional serial communication and an I2C interface.
6. Clock Speed: The microcontroller on the Uno runs at 16 MHz, which provides enough processing power for a wide range of projects.
7. Programming Environment: Arduino provides an integrated development environment (IDE)

that makes it straightforward to write, compile, and upload code to the Arduino Uno board. The programming language is based on C/C++ and includes a vast library of pre-written functions to simplify programming.

5. LOGIC/CIRCUIT DIAGRAM:

Figure 1

6. RESULT ANALYSIS

In this experiment, we get to know about basics of Arduino Uno Microcontroller and its various functions and components and also about Arduino programming connecting different components so as to use them as required.

Signature of faculty member

EXPERIMENT-2

1. **OBJECTIVE:** Write a program in Arduino to blink a LED.
    a. Single LED
    b. Multiple LEDs
2. **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	220m

3. **SOFTWARE USED:** Arduino Software

4. **THEORY:**

Resistor: A resistor is a passive two-terminal electronic component that restricts the flow of electrical current. It's one of the most fundamental and commonly used components in electronics. Resistors are used for various purposes in electronic circuits, such as limiting current, dividing voltage, setting biasing conditions, and providing specific resistance values in different parts of a circuit.

Figure 2

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).

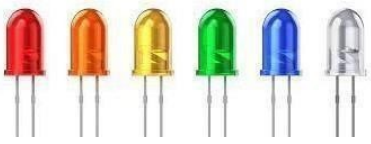


Figure 3

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

Figure 4

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

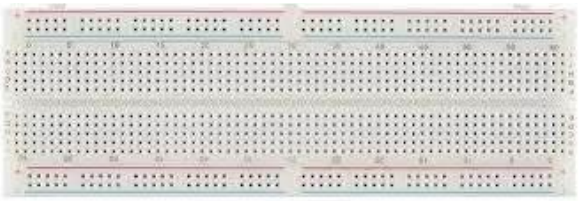


Figure 5

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

Figure 6

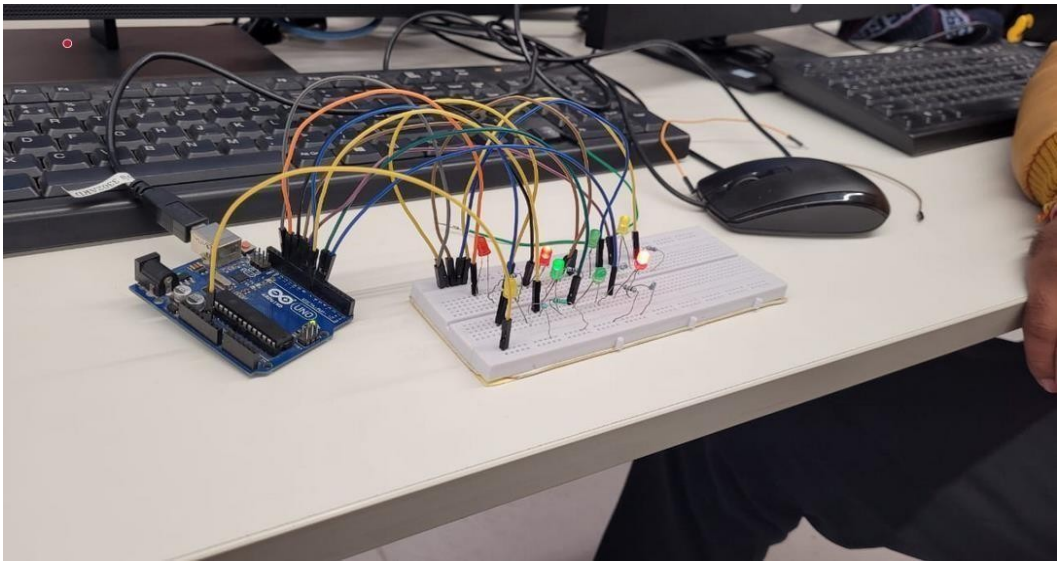
5. Code

```
void setup ()
{ pinMode (13,
OUTPUT);
} void loop
()
{ digitalWrite (13, HIGH); delay (2000); digitalWrite (13, LOW); delay (2000);
}
```

b. Multiple led

```
int ledPins [] = {2,3,4,5,6,7,8,9}; int
delayTime = 1000;
 void setup () {   for (int i =
0; i < 8; i++) {     pinMode
(ledPins [i],OUTPUT);
  }
}  void loop () { for (int i = 0;
i < 8; i++) {     digitalWrite
(ledPins [i], HIGH);delay
(delayTime);     digitalWrite
(ledPins [i], LOW);
  }
}
```

6. CIRCUIT DIAGRAM



RESULTS ANALYSIS:

In this experiment, we learnt how to blink single and multiple LEDs using Arduino Uno.

Signature of faculty member

EXPERIMENT 3

OBJECTIVE

Write a Arduino program to design and both forward and reverse pattern (1, 2, 3, 4, 5) sequence for different color LEDs using following function:

a. delay ()

b. for ()

HARDWARE USED:

Sr No.	Name of the Component	Value
1.	Arduino Uno Board	1
2.	Breadboard	1
3.	Jumper Wires	8
4.	LED	5
5.	Resistor	220 ohm

SOFTWARE USED: Arduino Software

THEORY

Resistor: A resistor is a passive two-terminal electronic component that restricts the flow of electrical current. It's one of the most fundamental and commonly used components in electronics. Resistors are used for various purposes in electronic circuits, such as limiting current, dividing voltage, setting biasing conditions, and providing specific resistance values in different parts of a circuit.

Figure 7

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).

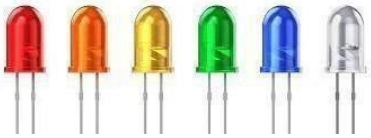


Figure 8

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

Figure 9

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

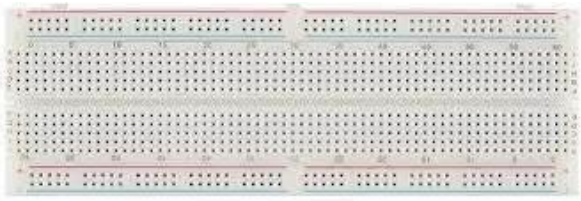


Figure 10

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

Figure 11

CODE :

USING FOR LOOP:

```
void setup()
{
pinMode(13,OUTPUT);
pinMode(12,OUTPUT);
pinMode(11,OUTPUT);
pinMode(10,OUTPUT);
pinMode(9,OUTPUT);
pinMode(8,OUTPUT);
pinMode(7,OUTPUT);
pinMode(6,OUTPUT);
}

//CIRCLE void loop() {
for(int i =13; i>=10;i--){
digitalWrite(i,HIGH);
delay(200);
  digitalWrite(i,LOW);
  }   for(int i =6;
i<=9;i++){
digitalWrite(i,HIGH);
delay(200);
  digitalWrite(i,LOW);
}
```

CIRCUIT DIAGRAM:

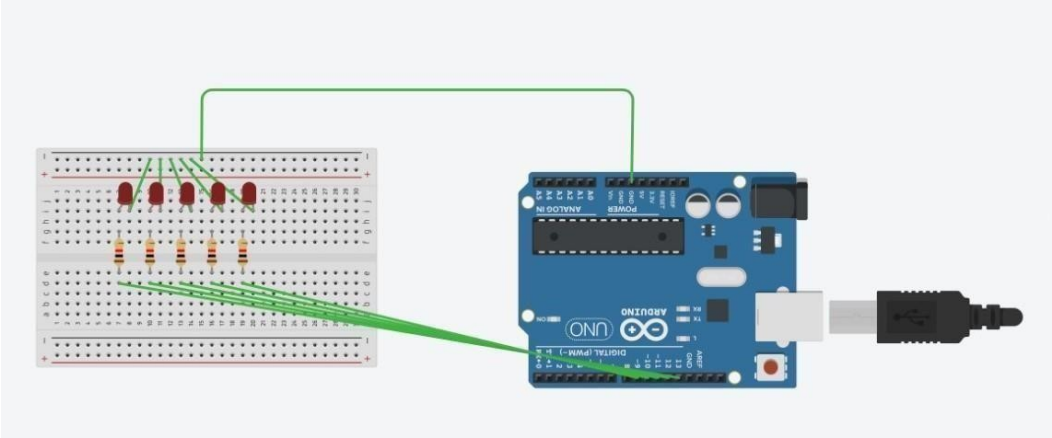


Figure 12

RESULT: In this experiment we learned how to blink 8 LEDs using for and delay functions.

EXPERIMENT 4

OBJECTIVE:

Serial Communications:

- Serial.begin(9600);
- Serial.print();
- Serial.println()
- Serial.read()
- Serial.write()

SOFTWARE USED: ARDUINO SOFTWARE

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.

Serial.begin(baudrate): This function initializes the serial port with a specified baud rate (speed of data transmission in bits per second). For example, Serial.begin(9600) sets the baud rate to 9600 bps. This function must be called in the setup() function before using any other Serial functions.

Serial.print(data): This function sends data to the serial port as human-readable ASCII text. For example, Serial.print("Hello") sends the string "Hello" to the serial port. The data can be of various types, such as char, byte, int, long, float, etc. The function also accepts an optional second parameter to specify the format of the data, such as DEC (decimal), HEX (hexadecimal), OCT (octal), BIN (binary), etc. For example, Serial.print(65, HEX) sends the hexadecimal value of 65, which is 41, to the serial port.

Serial.println(data): This function is similar to Serial.print(), but it also appends a newline character (\n) at the end of the data, which moves the cursor to the next line. For example, Serial.println("World") sends the string "World" followed by a newline character to the serial port.

Serial.read(): This function reads incoming data from the serial port and returns the first byte of data available. If no data is available, it returns -1. The data is read as a byte value (0 to 255) or a char value ('a' to 'z'). For example, if the serial port receives the character 'A', Serial.read() returns 65, which is the ASCII code of 'A'.

Serial.write(data): This function sends data to the serial port as raw bytes, without any conversion to ASCII

text. For example, Serial.write(65) sends the byte value of 65 to the serial port, which may or may not be displayed as 'A' depending on the receiving device. The data can be of various types, such as char, byte, int, long, etc. The function also accepts an array of bytes or a string as the data parameter. For example, Serial.write("Hello", 5) sends the string "Hello" as an array of 5 bytes to the serial port.

Figure 3

CODE :

```
void setup()

// put your setup code here, to run once:
 int
decinum;

Serial.begin(9600);

Serial.print("Enter the Number: ");

while(!Serial.available()){}
 decinum
Serial.parseInt();
Serial.print("Table of ");

Serial.print(decinum);

Serial.println(":");

for (int i=1; i <= 12; i++)

Serial.print(decinum);

Serial.print("*");
```

```
Serial.print(i);
Serial.print(");

Serial.println(decinum i);
  void
loop() {

// put your main code here, to run repeatedly:
}
```

RESULT: In this experiment we learned to print tables of numbers.

Signature of faculty member

EXPERIMENT-5

OBJECTIVE:

Serial Communication:

WAP to print following pattern using for loop.

Roll_No._____
****
Name:
****
Branch:
****

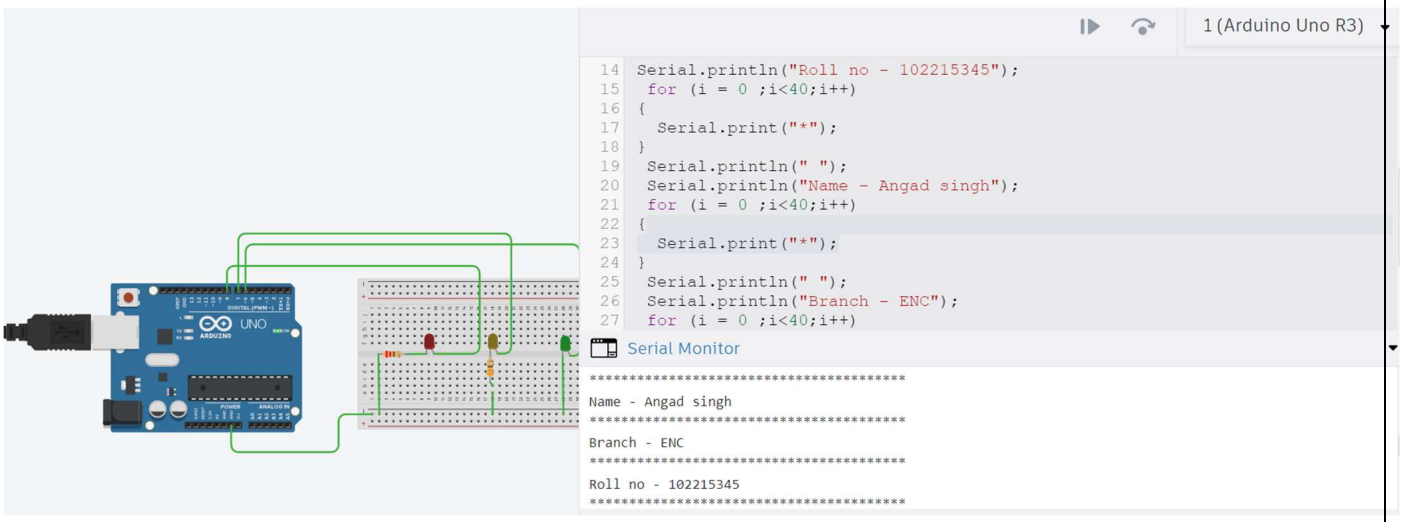
SOFTWARE USED: Arduino Software

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 theMicrochip ATmega328P microcontroller and developed by Arduino.cc.

Figure 14



CODE:

```
/*Roll_No._____
****************************************
Name:_____
****************************************
Branch:_____
****************************************
*/
void setup()
{
  Serial.begin(9600);
}
void loop()
{int i;
Serial.println("Roll no - 102215345");
 for (i = 0 ;i<40;i++)
{
  Serial.print("*");
}
 Serial.println(" ");
 Serial.println("Name - Angad singh");
 for (i = 0 ;i<40;i++)
{
  Serial.print("*");
}
 Serial.println(" ");
 Serial.println("Branch - ENC");
 for (i = 0 ;i<40;i++)
{
  Serial.print("*");
}
```

```
Serial.println(" ");
delay(10000)
```

RESULTS: In this experiment, we learnt how to print Name, Roll no, and Branch, using the SerialMonitor with Arduino Uno.

Signature of faculty member

EXPERIMENT-6

OBJECTIVE:

WAP for dimmer (Change in intensity of single and multiple LEDs) using

i. digitalWrite ()
ii. analogWrite()

SOFTWARE USED: Arduino Software

HARDWARE USED:

Sr No.	Name of the Component	Value
1.	Arduino Uno Board	1
2.	Breadboard	1
3.	Jumper Wires	8
4.	LED	5
5.	Resistor	220 ohm

THEORY:

Resistor: A resistor is a passive two-terminal electronic component that restricts the flow of electrical current. It's one of the most fundamental and commonly used components in electronics. Resistors are used for various purposes in electronic circuits, such as limiting current, dividing voltage, setting biasing conditions.

Figure 15

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).

Figure 16

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

Figure 17

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

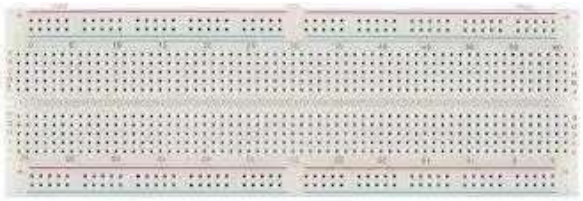


Figure 18

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

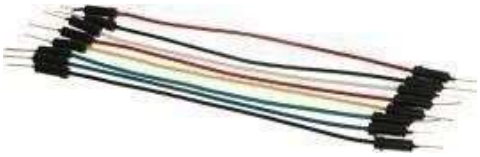


Figure 19

CODE:

a)

1.

```
void setup()
{
pinMode(3, OUTPUT);
}
void loop() {
for (int i = 10; i <= 1000; i=i+10)
{
digitalWrite(3, HIGH);
delay(50);
digitalWrite(3, LOW);
delay(50);
}
}
```

2.

```
int seq[]={3,5,6,9,10};
void setup() {
pinMode(3, OUTPUT);
pinMode(5, OUTPUT);
pinMode(6, OUTPUT);
pinMode(9, OUTPUT);
pinMode(10, OUTPUT);
}
void loop() {
for(int j=0;j<5;j++)
{
for (int i = 10; i <= 1000; i=i+10)
{
digitalWrite(seq[j], HIGH);
delay(50);
digitalWrite(seq[j], LOW);
delay(50);
}
}
}
```

b)

1.

```
void setup()
{
pinMode(3, OUTPUT);
}
void loop()
{
```

```
for(int i=50;i<255;i++)
{
analogWrite(3, i);
delay(50);
}
}
```

2.

```
void setup()
{
pinMode(3,   OUTPUT);
pinMode(5,   OUTPUT);
pinMode(6,   OUTPUT);
pinMode(9,   OUTPUT);
pinMode(10, OUTPUT);
}
void loop()
{
analogWrite(3,50);
delay(500);
analogWrite(5,100);
delay(500);
analogWrite(6,150);
delay(500);
analogWrite(9,200);
delay(500);
analogWrite(10,250);
delay(500);
}
```

TINKERCAD DIAGRAM:

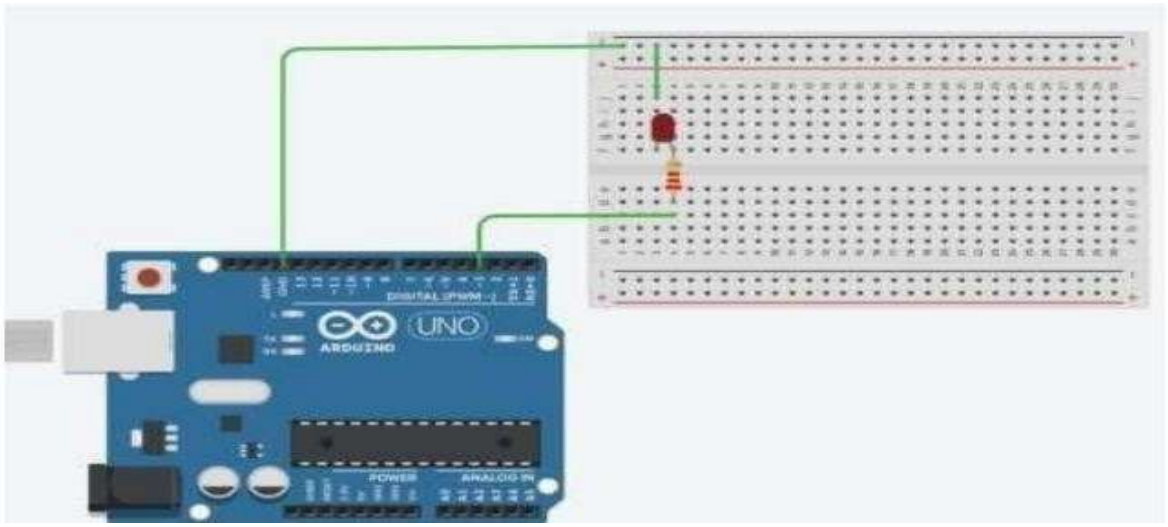


Figure 20

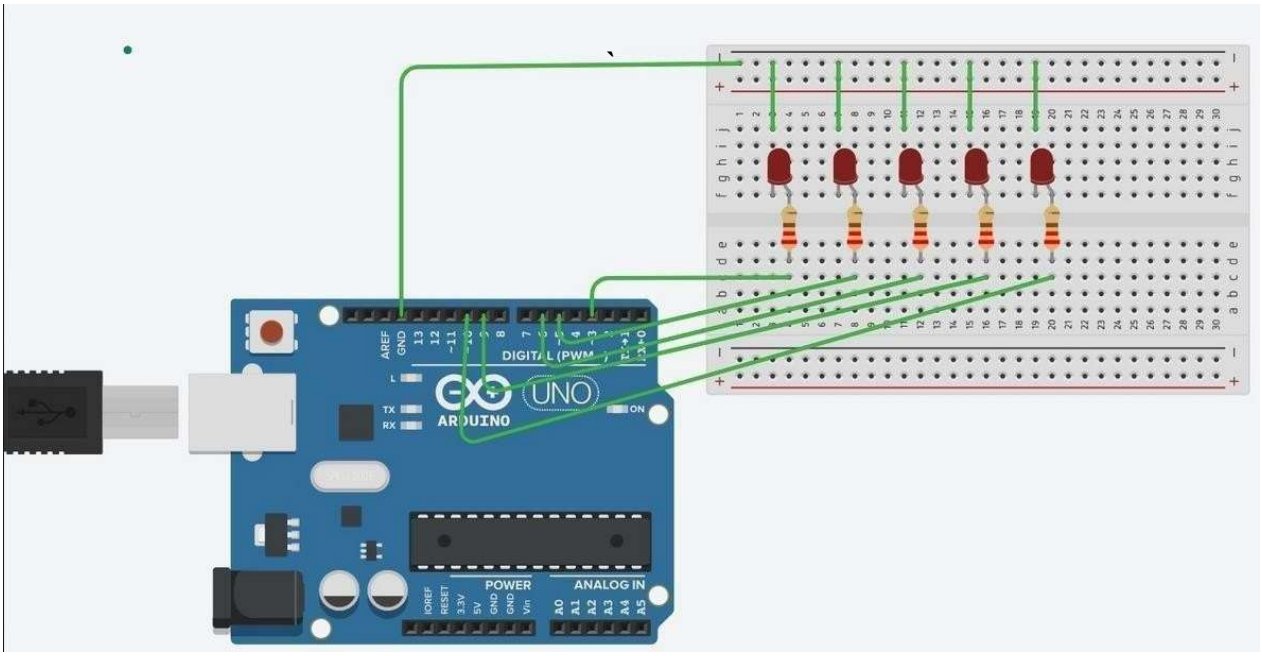


Figure 21

RESULTS: In this experiment, we learnt how to print Name, Roll no, and Branch, using the SerialMonitor with Arduino Uno.

Signature of faculty member

EXPERIMENT-7

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 nameindicates resist the flow of electricity and this function is key to the operation most circuits.

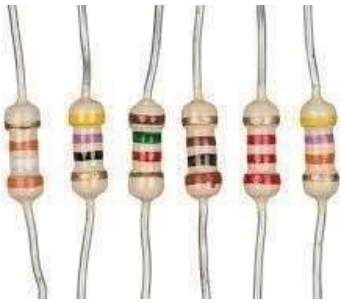


Figure 22

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 (Energypackets).

Figure 23

Arduino Uno Board: The Arduino Uno is an open-source microcontroller board based on the MicrochipATmega328P microcontroller and developed by Arduino.cc.

Figure 24

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

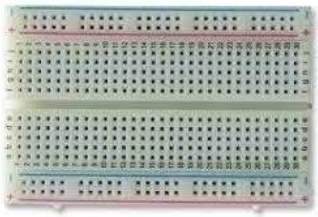


Figure 25

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

Figure 26

TINKERCAD DIAGRAM:

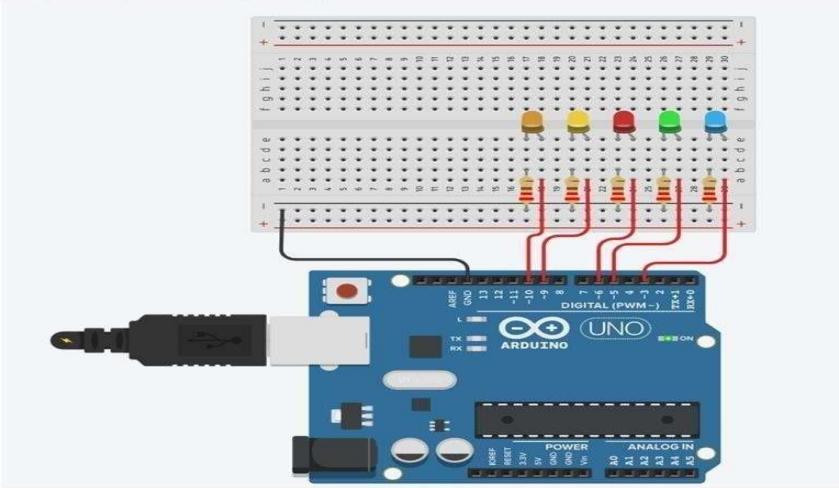


Figure 27

CODE:

```
define LED_COUNT 5
int sequence[]={6,10,5,3,9};

void setup() {

 for (int i = 0; i < LED_COUNT; i++)
   {pinMode(i, OUTPUT);
 }
}
void loop() {

 for(int j=0;j<5;j++){ for
(inti = 0; i < 255; i++) {
analogWrite(sequence[j],
  i);delay(5);
 }
 delay(1000);
 }

 for(int j=4;j<=0;j++){ for
 (int i = 255; i < 0; i--) {
 analogWrite(sequence[j],i
 );

   delay(5);
```

```
}
delay(1000);
}
}
```

RESULTS:

In this experiment, we learnt how to change the intensity of the given LEDs for the sequence 35214 in for bothforward and reverse order.

Signature of faculty member