PAMANTASAN NG LUNGSOD NG MAYNILA
(University of the City of Manila)
Intramuros, Manila

Microprocessor Lab

Laboratory Activity No. 3

Binary Representation of 8 LEDs in Tinkercad and Arduino Programming

Score

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S, 10:00 AM – 1:00 PM / CPE 0412.1-1

Date Submitted
07-10-2023

Submitted to:

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I. Objectives

This laboratory activity aims to implement the principles and techniques of hardware programming using Arduino through:

- To create Arduino circuit of Binary representation (decimal 0-256 using 8 LEDs)

Specifically, the laboratory activity's objectives are:

1. To understand various number systems.
2. To examine how decimal values can be converted into binary equivalents.
3. To explore how loops and conditional statements are used.
4. To utilize and observe the application of a potentiometer in an Arduino circuit.

II. Method/s

- Perform a task problem given in the presentation.
- Write a code and perform an Arduino circuit diagram that displays the binary representation of decimal values 0 to 256 using 8 LEDs with the use of a potentiometer.

III. Results

TinkerCad

Exercise 1: Write a code that does a binary representation of decimal values 0-256 using eight (8) LEDs.

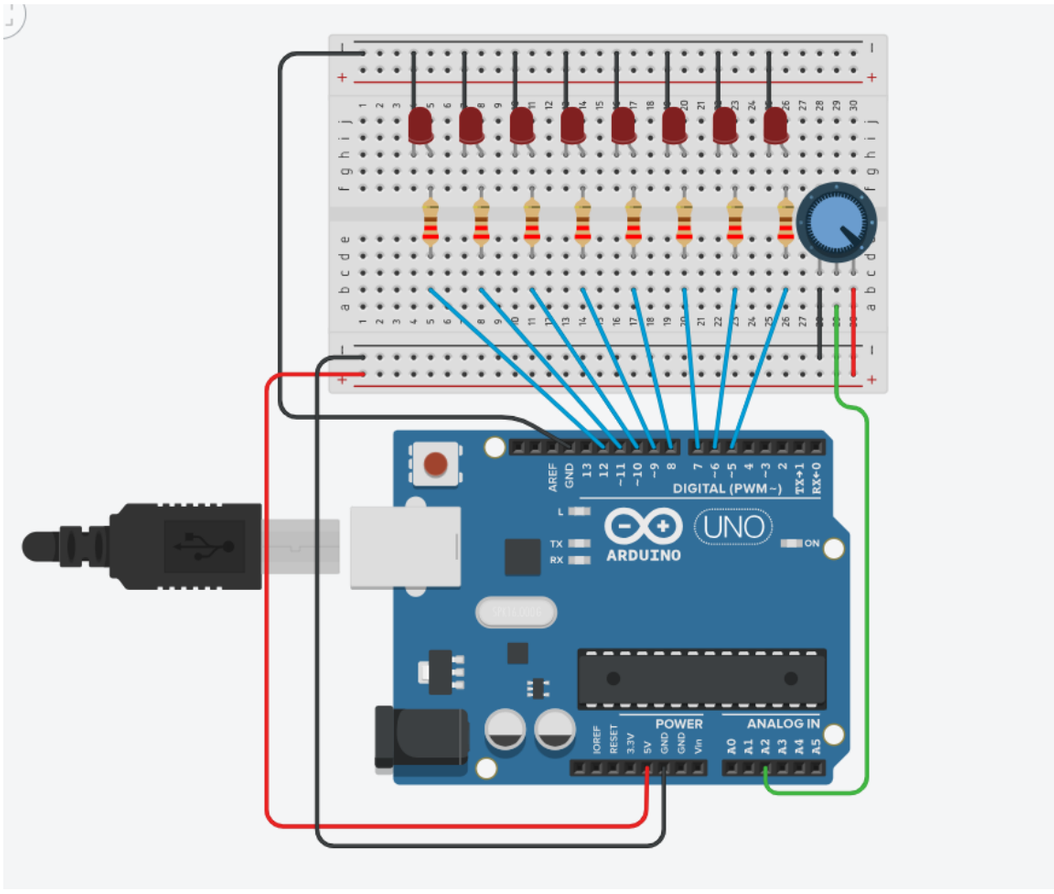

Figure No.1 Binary Representation Circuit Diagram

Actual Video:

Components Used

1. 8 LEDs
2. Resistor
3. Breadboard
4. 50k Ohm's potentiometer

CODE:

```
//C++ code
// Binary Representation of 8 LEDs in Tinkercad

int pin[] = {5, 6, 7, 8, 9, 10, 11, 12};
int potentiometer = A2;

void setup() {
  Serial.begin(9600);
  pinMode(potentiometer, INPUT);
  pinMode(5, OUTPUT);
  pinMode(6, OUTPUT);
  pinMode(7, OUTPUT);
  pinMode(8, OUTPUT);
  pinMode(9, OUTPUT);
  pinMode(10, OUTPUT);
  pinMode(11, OUTPUT);
  pinMode(12, OUTPUT);
}

void loop() {
  int num = 0;
  while (num <= 255) {
    BinaryLED(num);
    int delayval = analogRead(potentiometer);
    delay(delayval); // Delay with the value of the potentiometer
    num++;
  }
}

void BinaryLED(int decimal) {
  String binary = "";
  int decinum = decimal;

  for (int i = 0; i < 8; i++) {
    if (decinum % 2 == 1) {
      digitalWrite(pin[i], HIGH); // LED is ON if bit value is 1
      binary = "1" + binary;
    } else {
      digitalWrite(pin[i], LOW);  // LED is OFF if bit value is 0
      binary = "0" + binary;
    }
    decinum /=2;
  }
  int delays = analogRead(potentiometer);
  Serial.print("Potentiometer/Delay Value: ");
  Serial.println(delays);
  Serial.print("Decimal ");
  Serial.print(decimal); // Print decimal number
  Serial.print(" in binary: ");
  Serial.println(binary);  // Print binary equivalent of decimal number
}

```

Simulation:

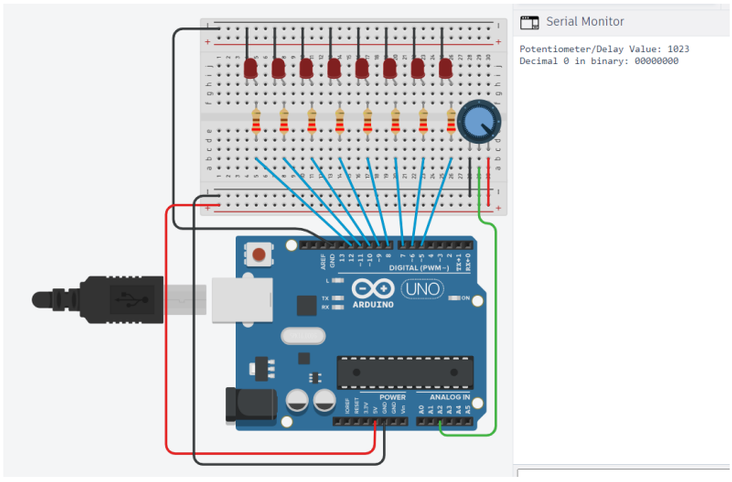

Figure No.3 Lighting of LED Decimal: 0 | Binary: 0000000 with delay value: 1023

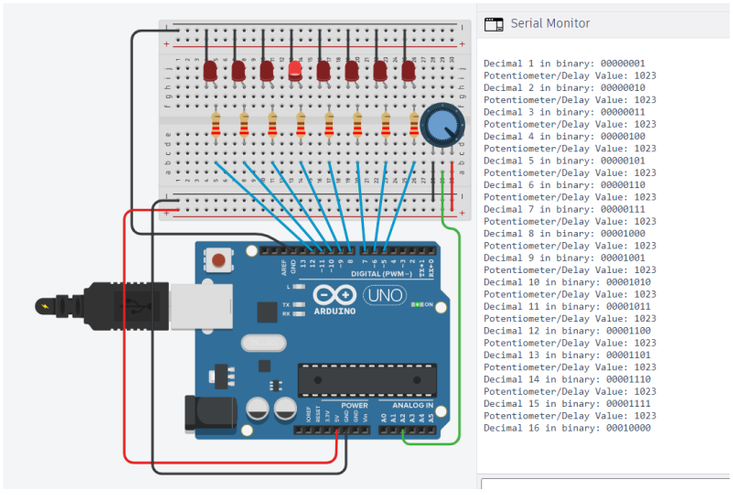

Figure No.3 Lighting of LED Decimal: 16 | Binary: 00010000 with delay value: 1023

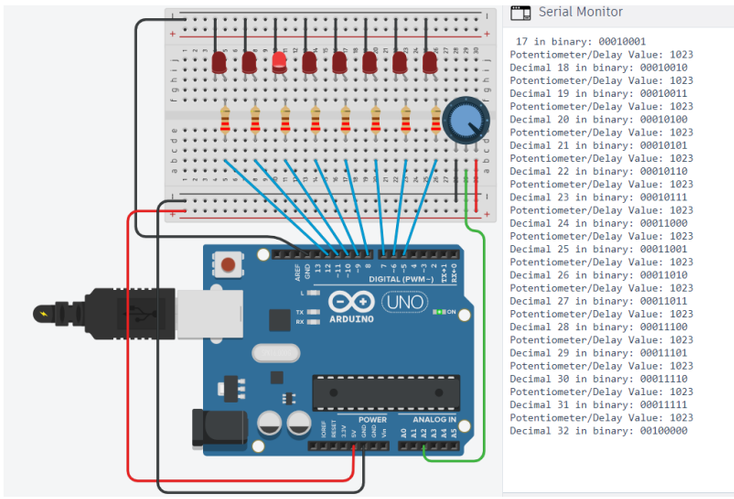

Figure No.4 Lighting of LED Decimal: 32 | Binary: 00100000 with delay value: 1023

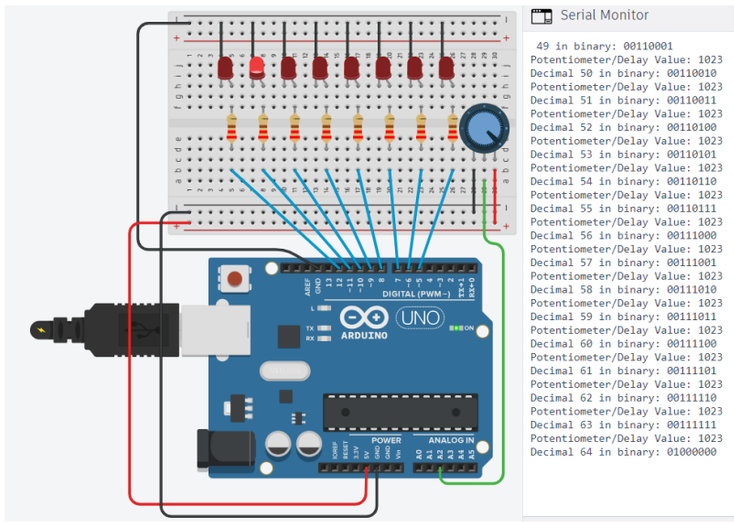

Figure No.5 Lighting of LED Decimal 64 | Binary: 01000000 with delay value: 1023

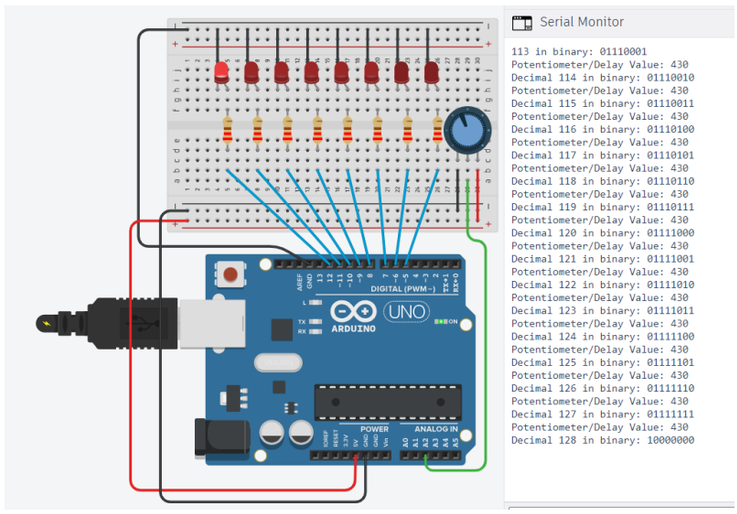

Figure No.6 Lighting of LED Decimal 128 | Binary: 10000000 with delay value: 430

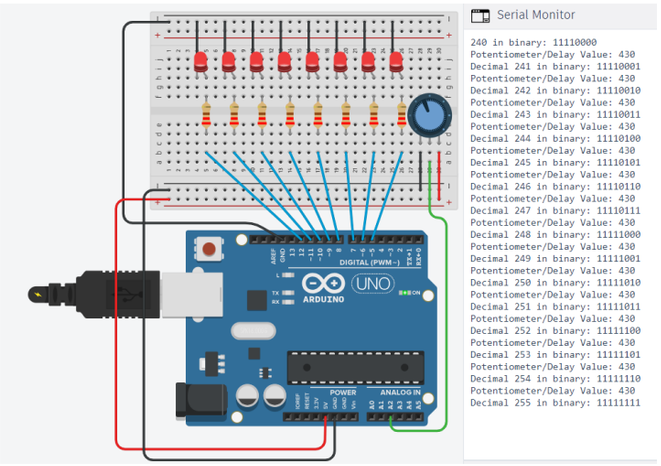

Figure No.7 Lighting of LED Decimal 255 | Binary: 11111111 with delay value: 430

Actual:

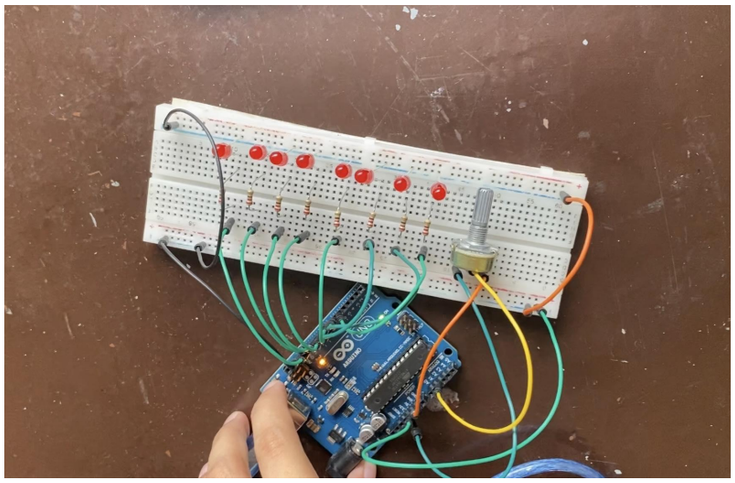

Figure No.8 Lighting of LED Decimal: 0 | Binary: 0000000 with delay value: 1023

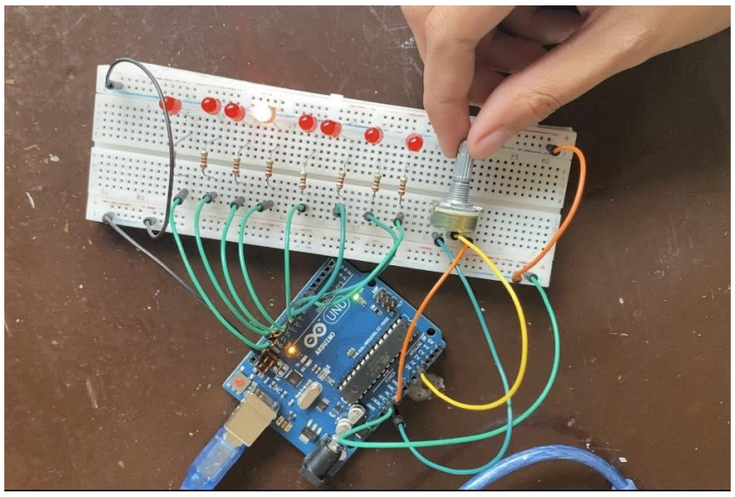

Figure No.9 Lighting of LED Decimal: 16 | Binary: 00010000 with delay value: 1023

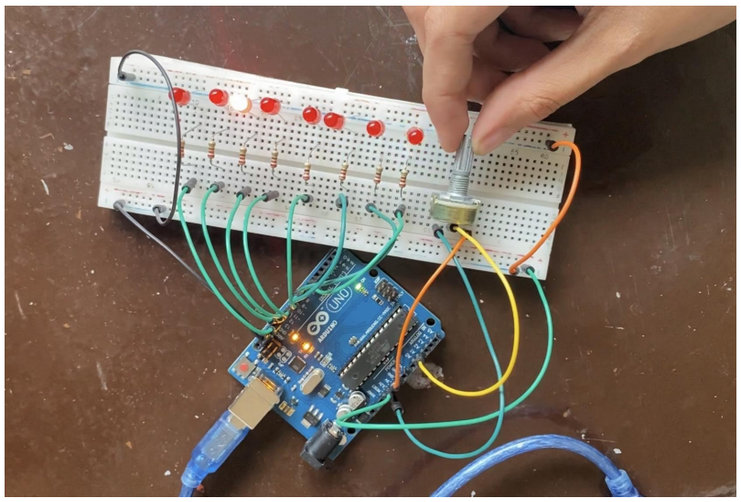

Figure No.10 Lighting of LED Decimal: 32 | Binary: 00100000 with delay value: 1023

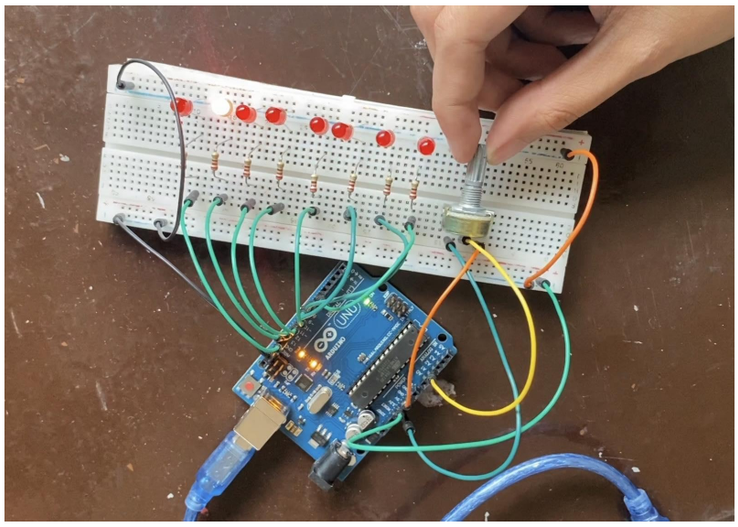

Figure No.11 Lighting of LED Decimal 64 | Binary: 01000000 with delay value: 1023

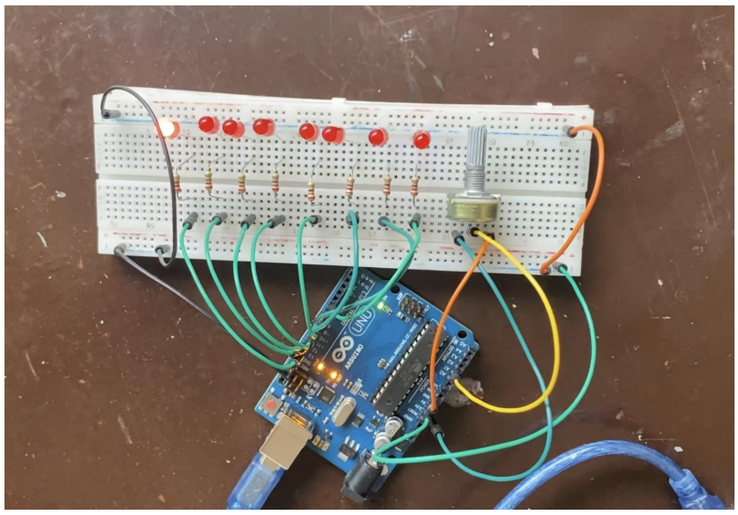

Figure No.12 Lighting of LED Decimal 128 | Binary: 10000000 with delay value: 430

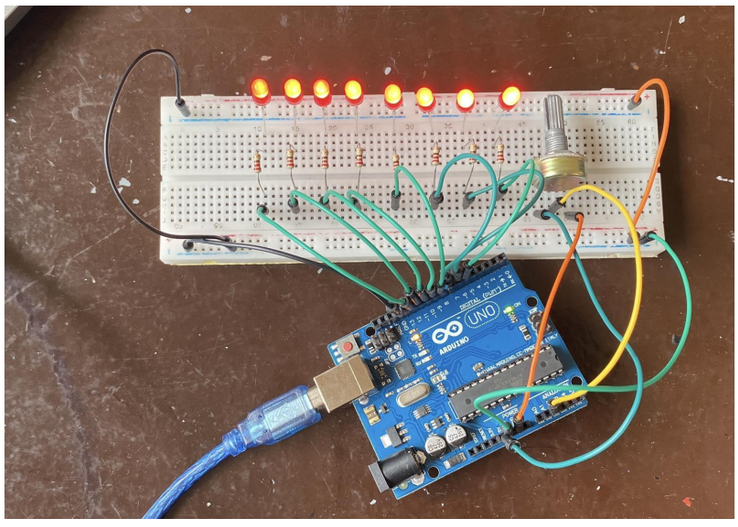

Figure No.13 Lighting of LED Decimal 255 | Binary: 11111111 with delay value: 430

Demo video link:

https://plmedu-my.sharepoint.com/:f:/g/personal/fnacastillo2020_plm_edu_ph/Et43TT0jAXBGpylbrNpAnxoBF4IrS1QNUjUuP0ZspnEc9g?e=XMuZo0

IV. Conclusion

In conclusion, this laboratory activity has been a valuable hands-on learning experience that deepened our comprehension of hardware programming with Arduino. It helped us grasp key concepts such as number systems, the conversion of decimal values into binary, and the use of Arduino to control electronic components.

By successfully displaying binary representations for decimal values from 0 to 256, we were able to demonstrate our understanding of the concepts covered in the activity. We are also able to utilize and observe the application of a potentiometer. The potentiometer served as a variable resistor, enabling us to control the delay time in our Arduino program. As we adjusted the potentiometer, the delay time changed accordingly. When the potentiometer's value was high, it resulted in a lower delay time, leading to a slower binary conversion displayed through the LEDs.

Overall, this laboratory activity also helped us to develop other important skills, such as critical thinking skills, creativity, and teamwork skills. We also gained valuable experience in using the Arduino IDE to write and compile code.

References

[1] V. Srinivasan, “Introduction to Binary,” Carnegie Mellon University. https://www.cmu.edu/gelfand/lgc-educational-media/digital-education-modules/dem-documents/new-the-world-of-the-internet-handouts.pdf

[2] New York University, “Lesson 12: Advanced Arduino Programming - I,” NYU Tandon School of Engineering, 2019. http://engineering.nyu.edu/mechatronics/ITEST/resources/pdf/itest-lesson12-arduino-advanced-pogramming_I.pdf