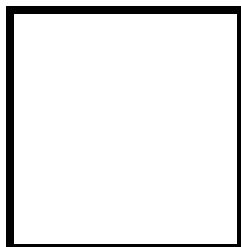




PAMANTASAN NG LUNGSOD NG MAYNILA
(University of the City of Manila)
Intramuros, Manila

Microprocessor Lab
Laboratory Activity No. 3

“Binary Representation of 8 LEDs”



Score

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10:00-1:00PM (Saturday) / CPE 0412.1-1

Date Submitted

14--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)

II. Method/s

- Perform a task problem given in the presentation.
- Write a code and perform an Arduino circuit diagram of a binary representation that display decimal value using eight (8) LEDs and a LCD-I2C (16x2) display.

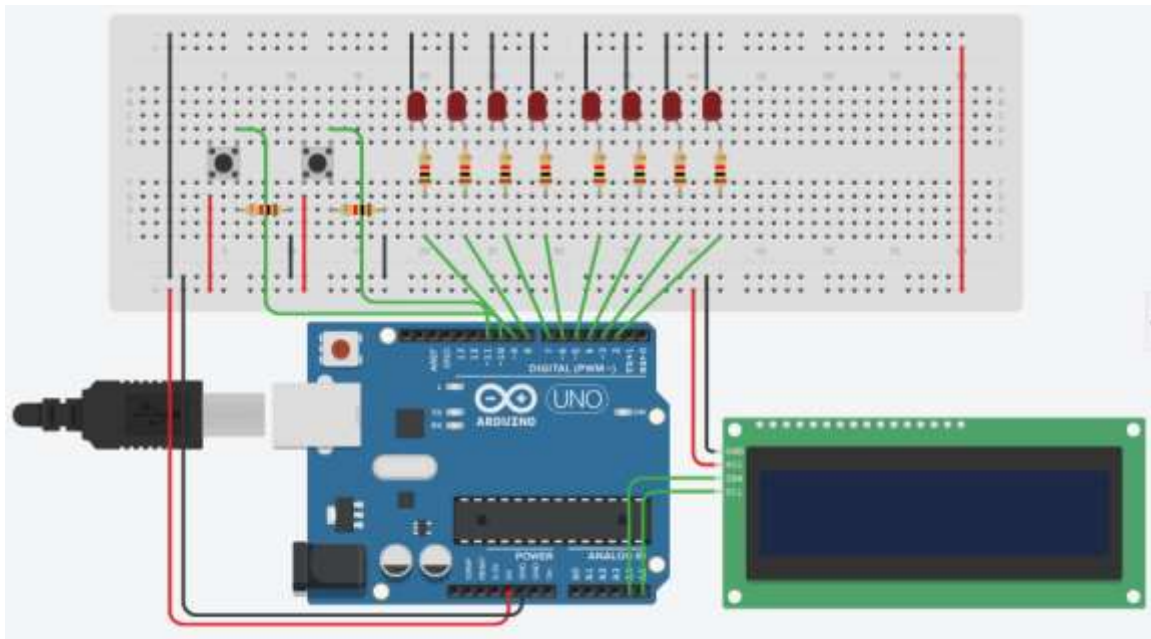


Figure 1: Binary Representation using LEDs through TinkerCad Simulation

Components Used

1. Eight (8) LEDs
2. Eight (8) 220 Ohms Resistor
3. Breadboard
4. Arduino Uno
5. Push Buttons (2)
6. I2C LCD 16x2

Source Code:

```
1  #include <Wire.h>
2  #include <LiquidCrystal_I2C.h>
3
4  LiquidCrystal_I2C lcd_1(0x3F, 16, 2);
5
6  int ledPins[] = {4, 5, 6, 7, 8, 9,10,11};
7  int arr[] = {0,0,0,0,0,0,0,0};
8  int ind = 7;
9  int but = 2;
10 int but1 = 3;
11
12 void setup() {
13     Serial.begin(9600);
14     pinMode(but, INPUT);
15     pinMode(but1, INPUT);
16     for (int i = 0; i < 8; i++) {
17         pinMode(ledPins[i], OUTPUT);
18     }
19     lcd_1.init();
20     lcd_1.backlight();
21     lcd_1.display();
22 }
23
24 void loop() {
25     int butState = digitalRead(but);
26     Serial.println(butState);
27     if(butState == 1){
28         //lcd_1.setCursor(0, 0);
29         //lcd_1.print("Dec. No: ");
30         for (int decimalNumber = 0; decimalNumber <= 256; decimalNumber++) {
31             displayBinary(decimalNumber);
32             delay(500);
33             int butState1 = digitalRead(but1);
34
35             if (butState1 == 1){
36                 off();
37                 lcd_1.clear();
38                 lcd_1.setCursor(0, 0);
39                 lcd_1.print("Program");
40                 lcd_1.setCursor(0, 1);
41                 lcd_1.print("Cancelling!");
42                 delay(2000);
43                 lcd_1.clear();
44                 break;
45             }
46             if (decimalNumber == 256){
47                 lcd_1.clear();
48                 lcd_1.setCursor(0, 0);
49                 lcd_1.print("Process Done!");
50                 lcd_1.setCursor(0, 1);
51                 lcd_1.print("Terminating!");
52                 off();
53                 delay(5000);
54                 lcd_1.clear();
55                 break;
56             }
57         }
58         delay(100);
59     }
60 }
```

```

61 void displayBinary(int decimalNumber) {
62     int ind = 7;
63     lcd_1.setCursor(0, 0);
64     lcd_1.print("Dec. No: ");
65     lcd_1.print(decimalNumber);
66     lcd_1.setCursor(0, 1);
67     lcd_1.print("Bin. No:");
68     for (int i = 0; i < 8; i++) {
69         int bitvalue = (decimalNumber >> i) & 1;
70         arr[ind] = bitvalue;
71         lcd_1.print(arr[i]);
72         digitalWrite(ledPins[i], bitvalue);
73         ind--;
74     }
75 }
76
77 void off(){
78     for (int j = 0; j < 8; j++){
79         digitalWrite(ledPins[j], LOW);
80     }
81 }

```

III. Results - *TinkerCad*

Exercise 1: Write a code that does a binary representation that display decimal value using eight (8) LEDs and a LCD-I2C (16x2) display.

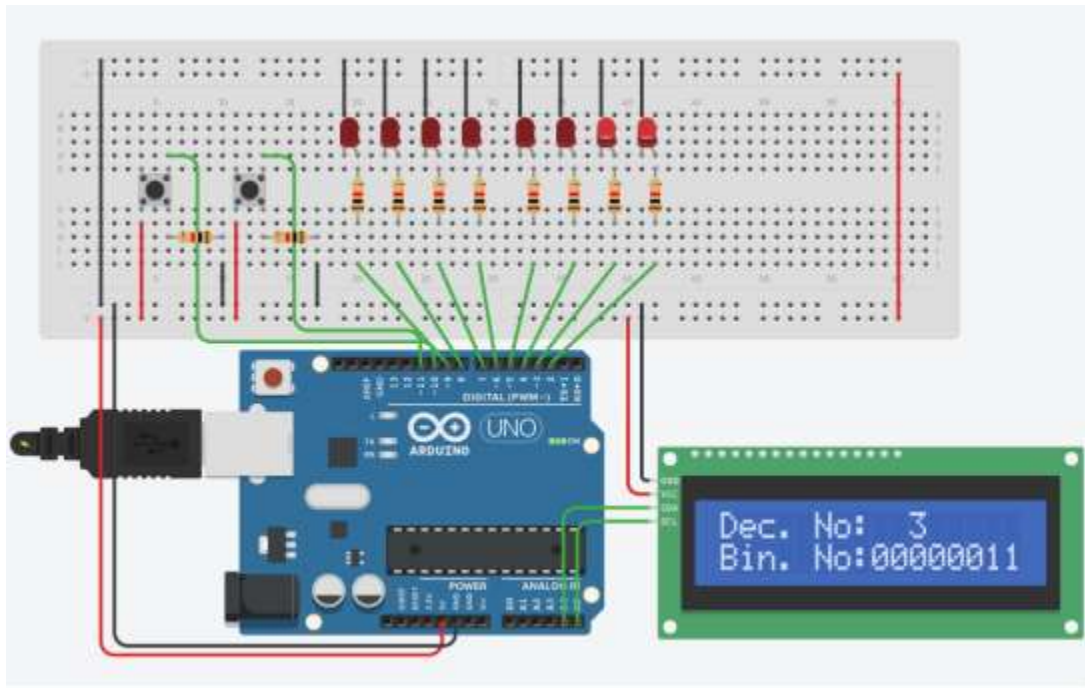


Figure 2: *Decimal 3*

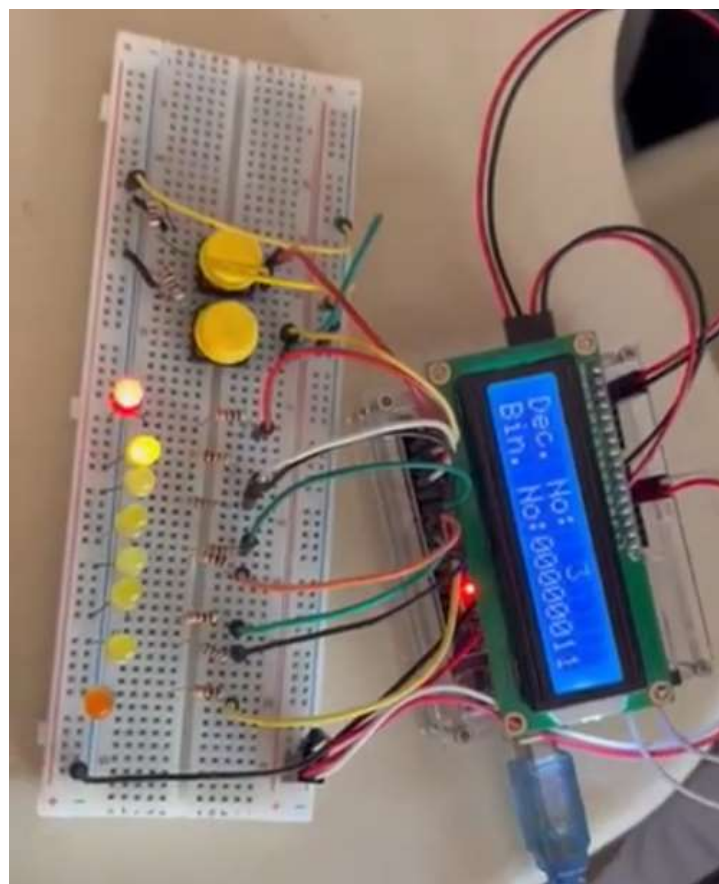


Figure 4: *Actual Demonstration (decimal 3)*

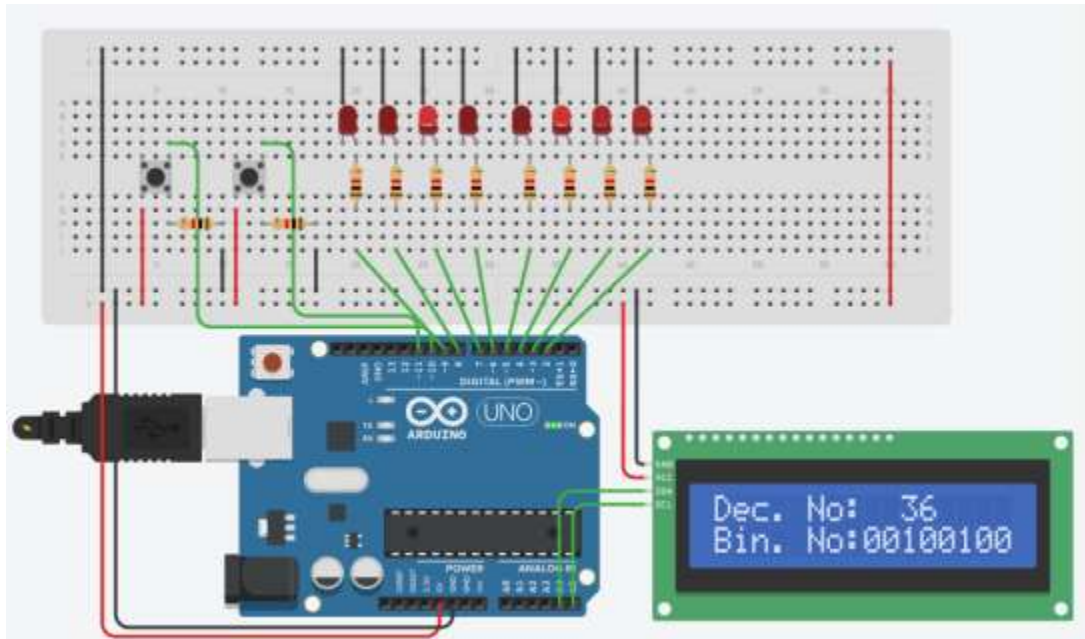


Figure 5: Decimal 36

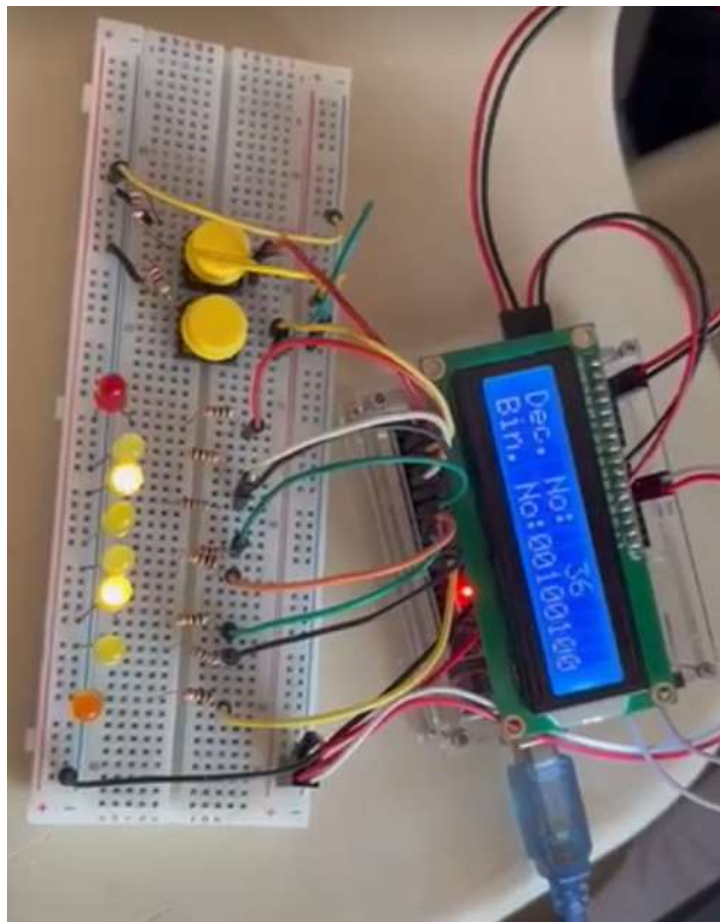


Figure 6: Actual Demonstration (decimal 36)

Link: [https://github.com/russbutdiff/412-Microprocessors/blob/fae0f3191ab372842a832324333f6db9f2145428/Documentation%20-%20Binary%20Representation%20\(Result\).mp4](https://github.com/russbutdiff/412-Microprocessors/blob/fae0f3191ab372842a832324333f6db9f2145428/Documentation%20-%20Binary%20Representation%20(Result).mp4)

IV. Conclusion

Developing this system proposed a lot of challenges for me as I didn't think of the function of the button only works by identifying its current state, and I2C LCD as it requires a library which gives me access to a different set of codes. Developing the process of the binary was hard too as I had to come up with a way where I can get the value of the current decimal number and light the led that corresponds to the value of the binary value.

Overall, it gave me a different way of thinking which I can use in the future in developing circuits like this. I learned a lot especially about the functionality of the component that I just used which is the LCD Screen, which made me think of the other applications where I can use that component. What I have learned in developing this activity will surely be implemented in the future activities.

References

- [1] D.J.D. Sayo. “University of the City of Manila Computer Engineering Department Honor Code,” PLM-CpE Departmental Policies, 2020.