22ECL31 - DIGITAL ELECTRONICS LABORATORY

Mini Project - Digital Dice using Microcontroller and Digital Gates

Members:

Vidyaa Shre G – 23ECR235

Vibishra C – 23ECR234

Thejashwini R – 23ECR224

Date of Submission

Digital Dice using Microcontroller and Digital Gates

Abstract:

This project focuses on simulating a digital dice roll experience using Arduino and binary-coded decimal (BCD) adders, combining digital logic, binary transmission, and LED display control. The project generates two pseudo-random numbers from 1 to 6, representing two dice. These numbers are transmitted in binary form to a BCD adder, which computes their sum. The output is then displayed using a series of LEDs, with an additional LED lighting up when a carry bit is generated by the addition process. Digitizing the traditional dice roll in this way not only modernizes a classic tool but also highlights the versatility and efficiency of digital logic circuits in real-world applications.

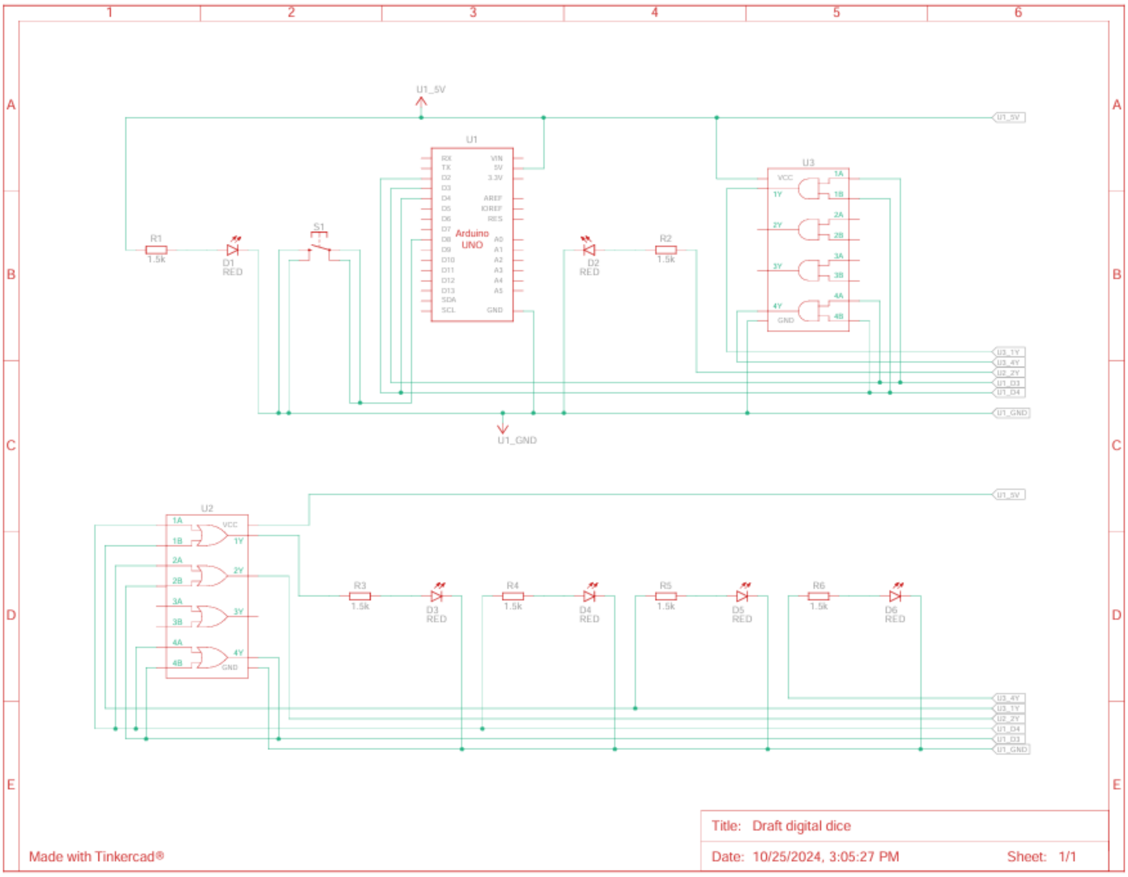
The digitization of dice allows for improved reliability and reproducibility of outcomes, eliminating mechanical inconsistencies. By representing dice numbers in binary format, this project leverages the compactness of digital data, reducing the number of pins and connections required while minimizing hardware complexity. The BCD adder provides an efficient solution for adding binary values, a process fundamental in digital electronics, and facilitates the understanding of binary arithmetic. Moreover, using LEDs for the result output provides a clear, practical visualization of digital data processing, reinforcing concepts of binary-to-decimal conversion.

This project demonstrates the benefits of binary data manipulation, as well as the applications of logic gates and adders in achieving complex operations like multi-bit addition. The approach is scalable, meaning that more dice or additional operations could be incorporated with minimal adjustments to the circuit. It also offers insight into digital displays, carry operations, and error-free computation, which are essential in digital circuit design and embedded systems. The project serves as an engaging example of digital technology's ability to simulate physical actions and represents a step towards understanding more complex digital systems and automation tasks.

Components Required:

S.No	Components and description	Quantity
1.	Arduino Microcontroller	1
3.	IC 74HC08	2
4.	IC 74LS32	1
5.	Connecting wires	As required
6.	Led	6
7.	Bread board	1

Circuit Diagram:

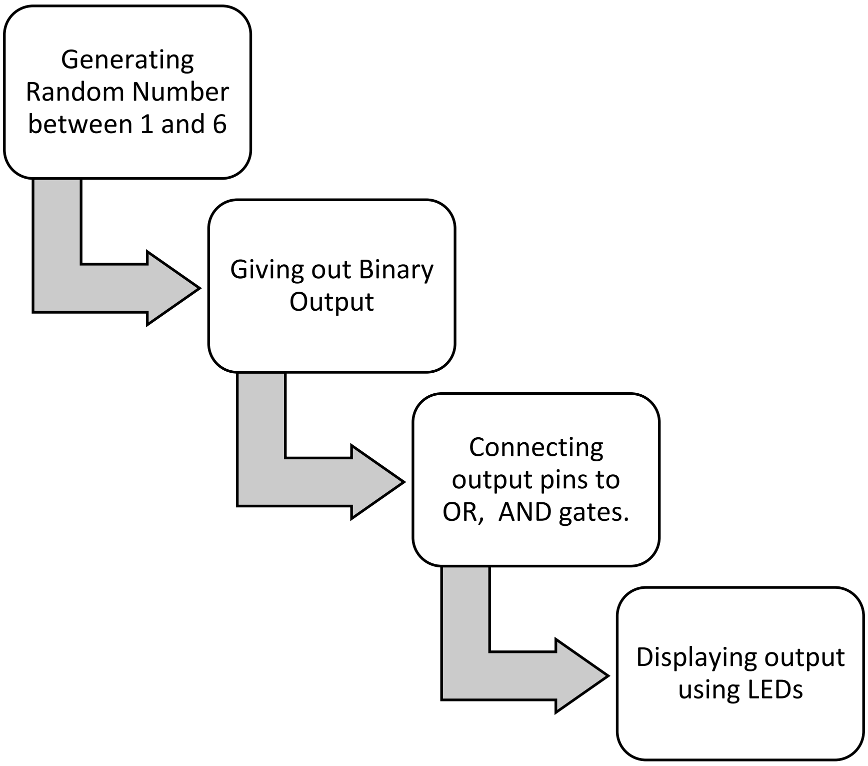


Arduino Micro-controller Code:

```
// Define output pins for binary representation of num1 (Dice 1) and num2 (Dice 2)
int num1Pins[3] = {2, 3, 4};  // Pins for num1 (Dice 1) output
//int num2Pins[3] = {5, 6, 7};  // Pins for num2 (Dice 2) output
// Define input pin for the button
int buttonPin = 8;  // Pin for the button

void setup() {
 // Initialize output pins as OUTPUT for both num1 and num2
 for (int i = 0; i < 3; i++) {
  pinMode(num1Pins[i], OUTPUT);
  //pinMode(num2Pins[i], OUTPUT);
 }
```

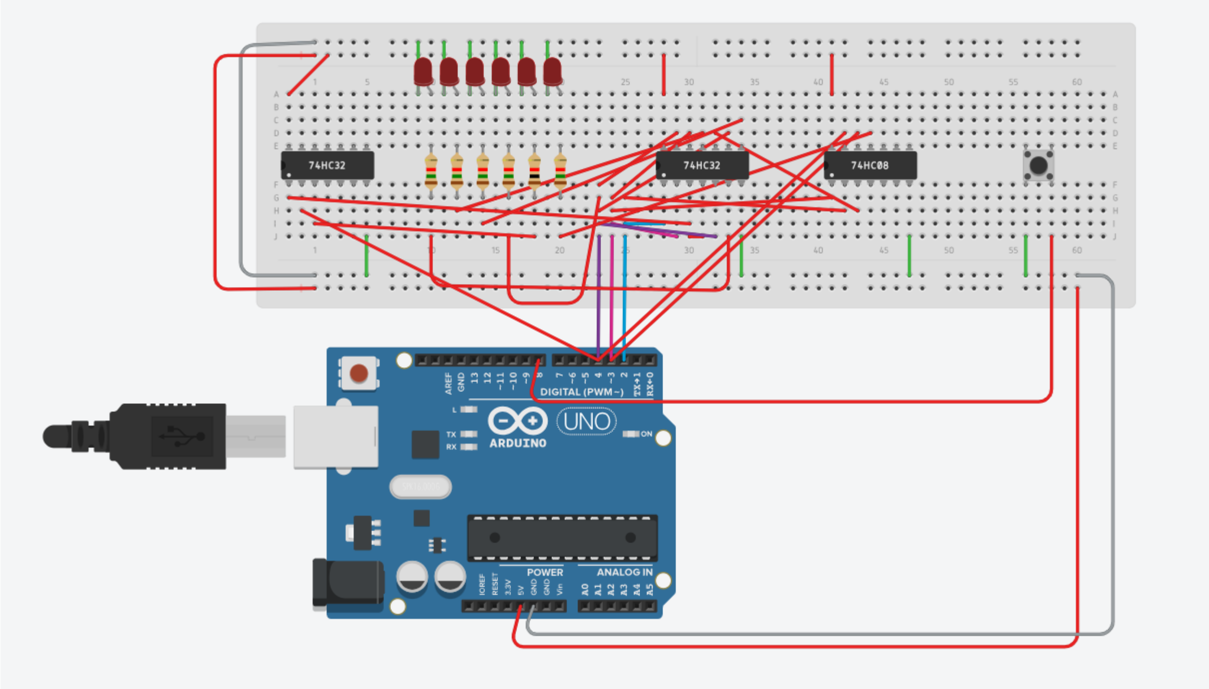
```
  // Initialize button pin as INPUT with internal pull-up resistor
  pinMode(buttonPin, INPUT_PULLUP);

  // Initialize serial communication to display the numbers on the Serial Monitor
  Serial.begin(9600);

  // Seed random function for more randomness
  randomSeed(analogRead(0));
}

void loop() {
  // Wait for the button to be pressed
  if (digitalRead(buttonPin) == LOW) {  // Button pressed (active LOW)
    delay(50);  // Debounce delay

    if (digitalRead(buttonPin) == LOW) {  // Confirm button press
      // Generate two random numbers between 1 and 6
      int num1 = random(1, 7);  // Random number for Dice 1
      //int num2 = random(1, 7);  // Random number for Dice 2

      // Output the binary values of num1 and num2 on the assigned pins
      outputBinary(num1, num1Pins);
      //outputBinary(num2, num2Pins);

      // Display the generated numbers in the Serial Monitor
      Serial.print("Button pressed, Dice : ");
      Serial.println(num1);

      // Wait for the button to be released
      while (digitalRead(buttonPin) == LOW) {
        delay(10);  // Small delay to avoid bouncing issues
      }
    }
  }
}

// Function to output a 3-bit binary number to the specified pins
void outputBinary(int number, int pins[]) {
  for (int i = 0; i < 3; i++) {
    digitalWrite(pins[i], bitRead(number, i));  // Output each bit to the corresponding pin
  }
}
```

Block Diagram:

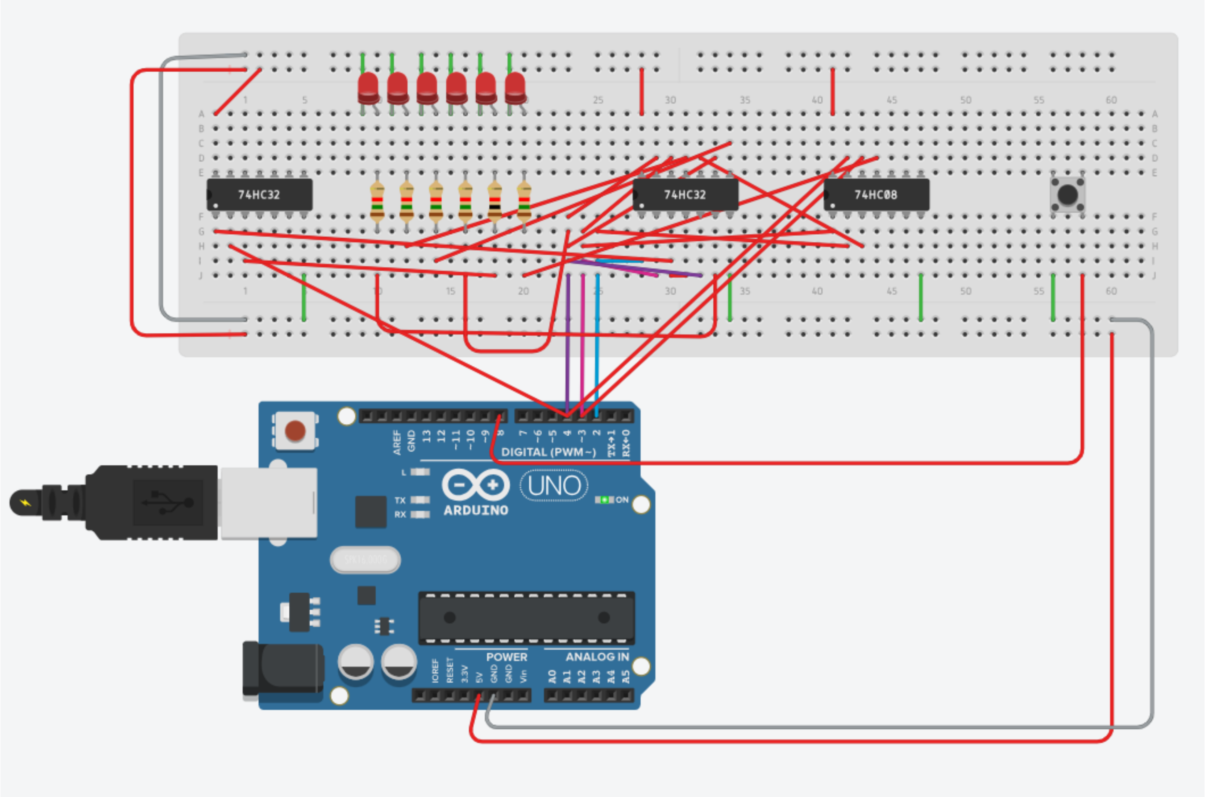

Generating Random Number between 1 and 6
Giving out Binary Output
Connecting output pins to OR, AND gates.
Displaying output using LEDs

Simulation:

Initial state:

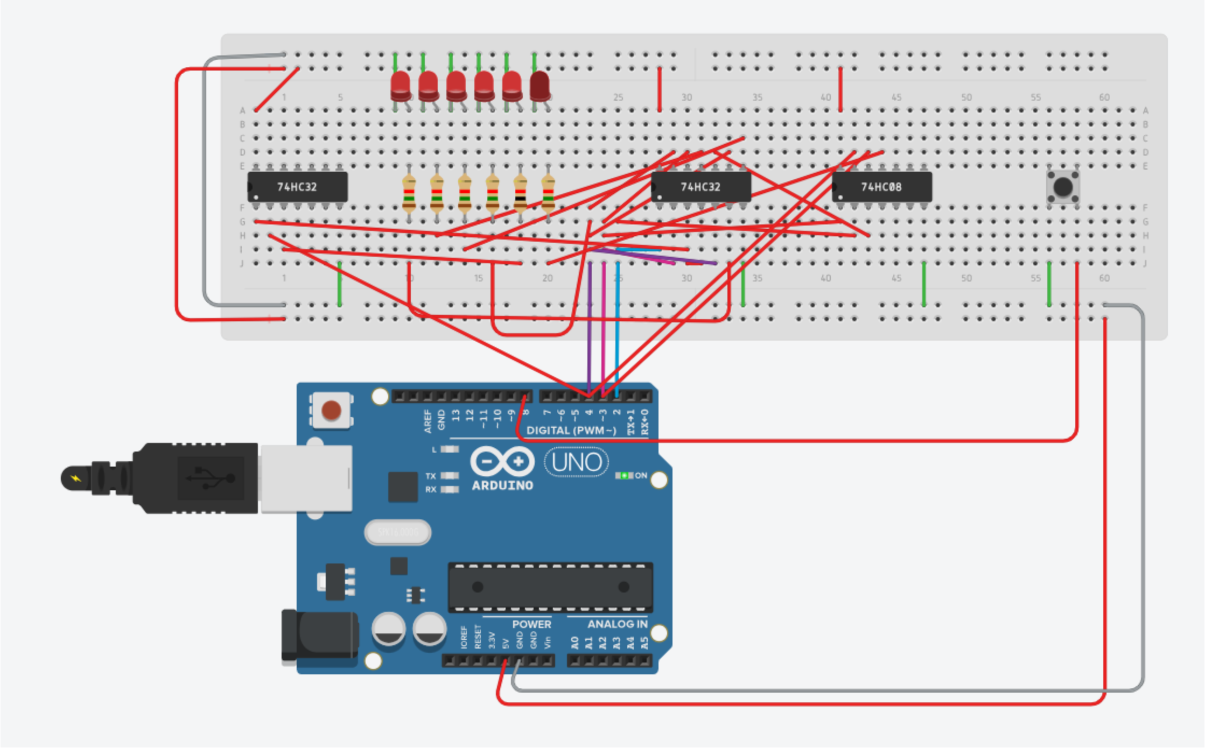


When button is pressed,



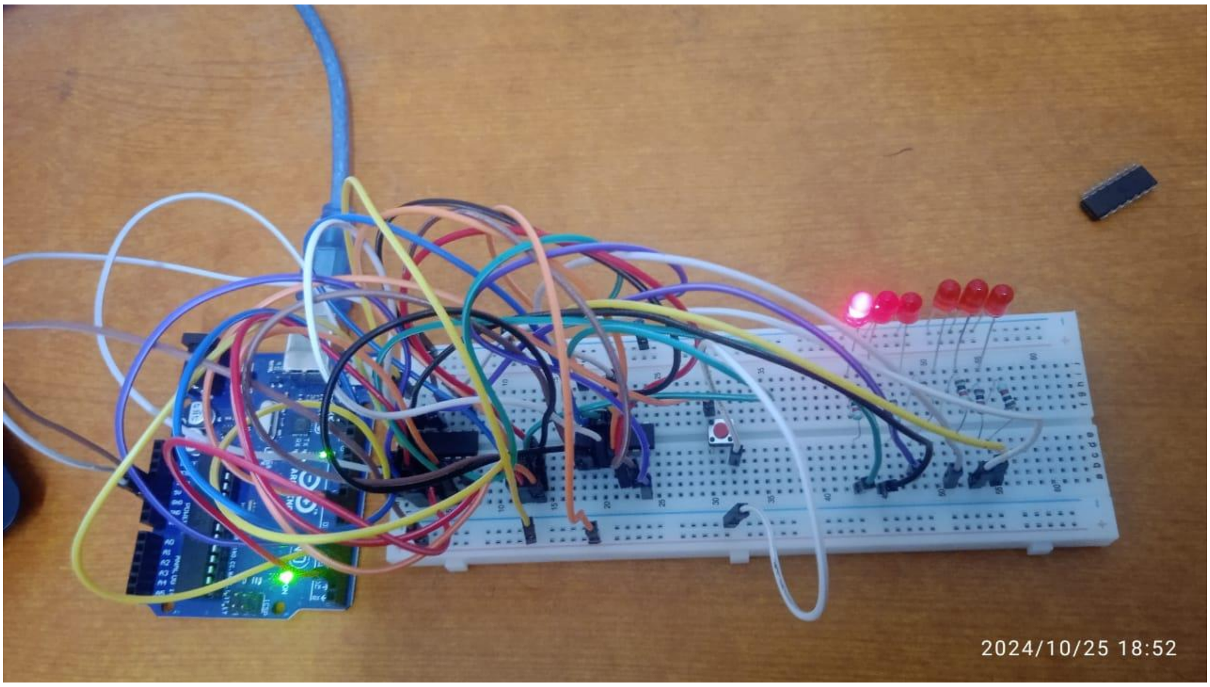
Random Number generated : 6

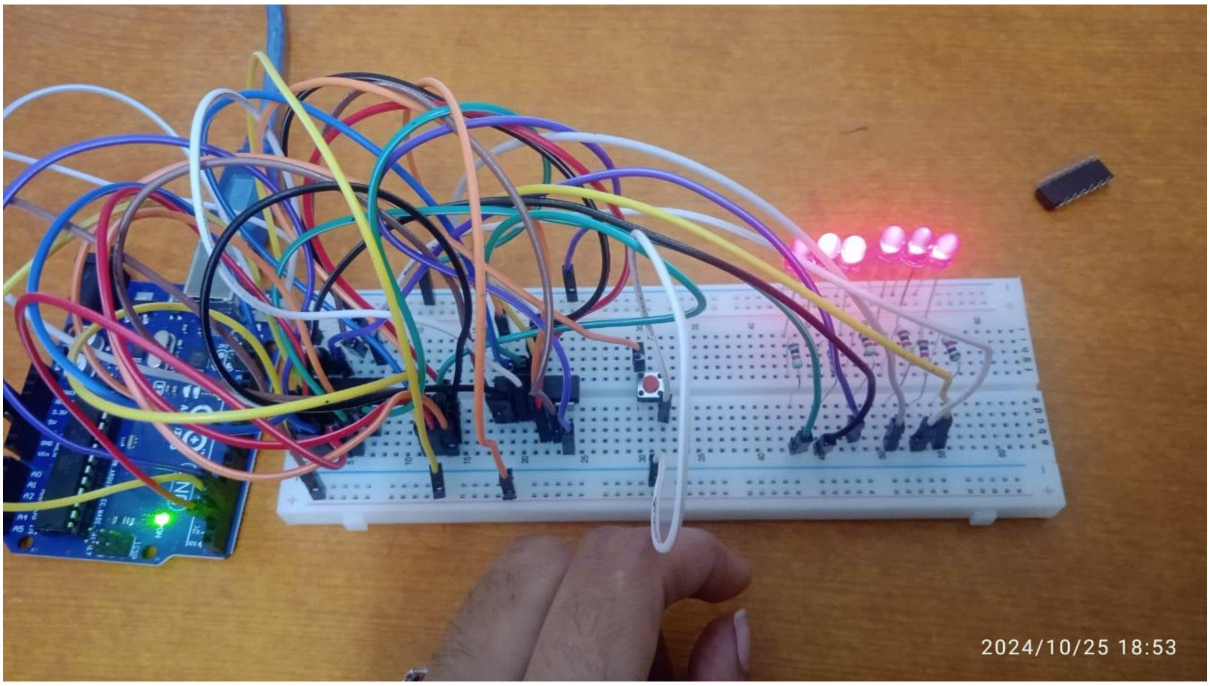
When button pressed again,



Number generated : 5

Implementation:





Link:

https://drive.google.com/file/d/1kz3EO8vfJWmOfegspbgiIglAU_209dTz/view?usp=drive_link

Result:

This project successfully demonstrates the use of digital logic and binary arithmetic in simulating a dice roll, with clear output using LEDs and efficient binary addition via a BCD adder. By digitizing a simple, random process, the project emphasizes the reliability and versatility of digital systems in practical applications. Future enhancements could include additional displays or advanced randomization techniques, broadening the educational scope of digital electronics