Embedded System Workshops

LED Dice
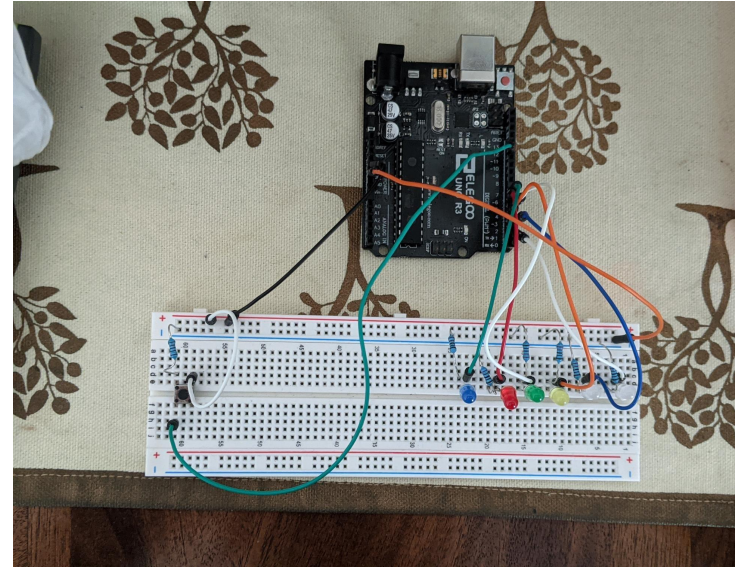Ronit Munshi
CCA Girls Who Code

Project Overview

➔ Purpose

◆ The purpose of this project is to show an arduino and LEDs together can replicate rolling a dice.

➔ Grab your kit, and let's get started!

What are we making?

➔ Description

◆ The project, being a copy of EvDS's project on Arduino Project Hub, is suppose to be used like a dice, as when you press the button, a random number from 1 to 6 will be generated, with the number of LEDs lit corresponding to that number.
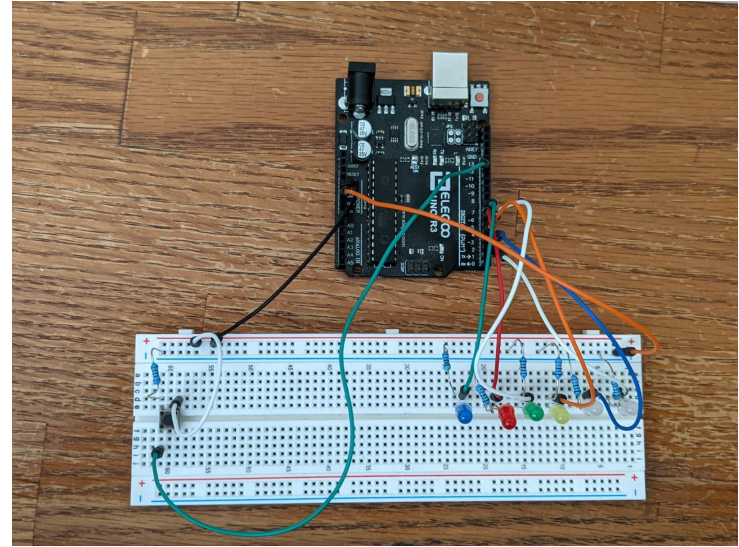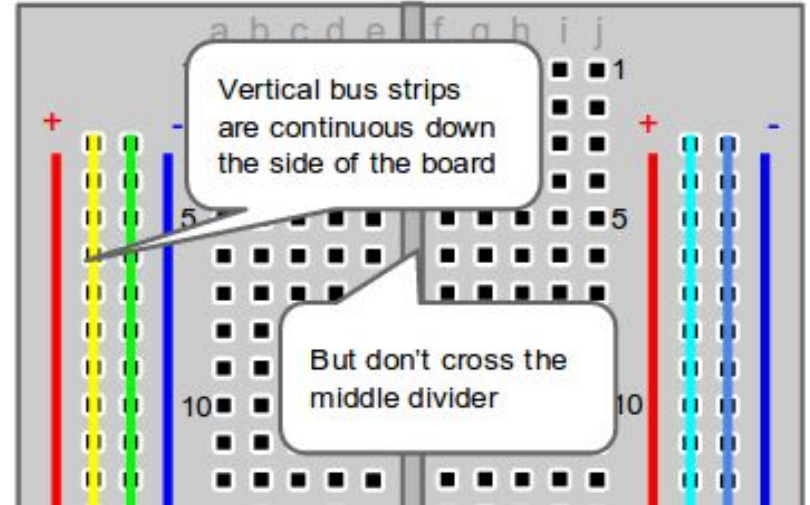
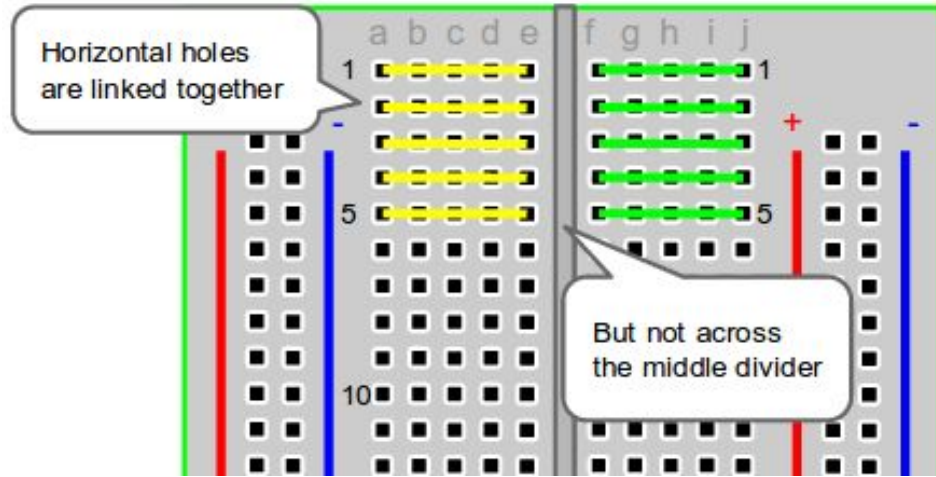# Parts List

➔ Arduino UNO R3 Controller Board

➔ USB Cable

➔ Breadboard

➔ LEDs (6)

➔ Jumper Wires

➔ 1k Ohm Resistor

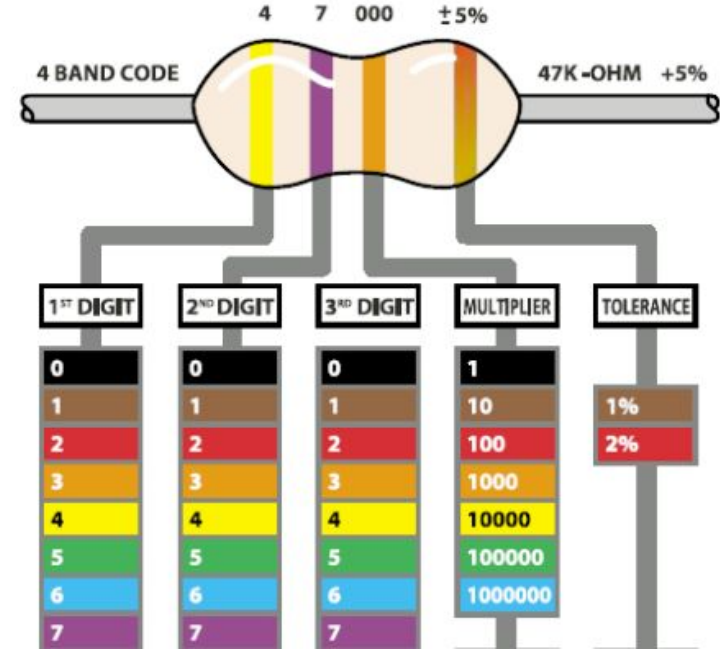➔ 221 Ohm Resistors (6)

➔ Button

Theory

Review: Breadboards Explained

Tip: It is good practice to have your power input connected to the red/positive rail and your ground pin connected to the blue/negative rail.
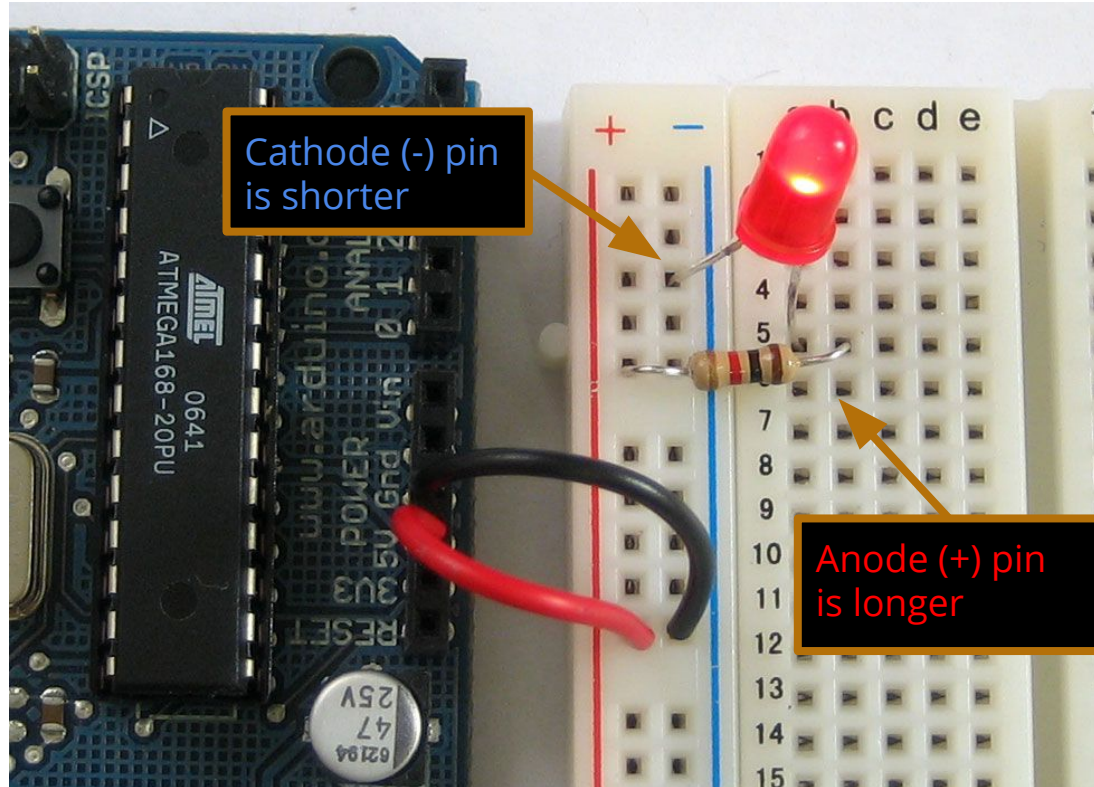
Review: Resistors

- Resistors slow the electric current, and control where and how fast the current flows
- Resistance value is measured in ohms Ω, which is represented by colored stripes on the body of the resistor
- Each stripe has a different value depending on the color and location as shown in the reference chart
- A potentiometer is a variable resistor

4 BAND CODE

4   7   000   ±5%

47K–OHM +5%

1ST DIGIT	2ND DIGIT	3RD DIGIT	MULTIPLIER	TOLERANCE
0	0	0	1	
1	1	1	10	1%
2	2	2	100	2%
3	3	3	1000	
4	4	4	10000	
5	5	5	100000	
6	6	6	1000000	
7	7	7		

Project

(Part slides taken from project requirements presentation)

LEDs

Cathode (-) pin is shorter

Anode (+) pin is longer

NOTE: Make sure the power input is connected to the Anode, and the ground pin is connected to the Cathode. Make sure you also have a resistor between either the power input and Anode, or the Cathode and ground pin. Failing to do either of these things can damage the LED or the Arduino.

What are Switches?

A switch is a device that you can use to open or close a circuit at will. A closed circuit allows current to flow through it. An open circuit has a gap in the circuit, preventing current from flowing through it.
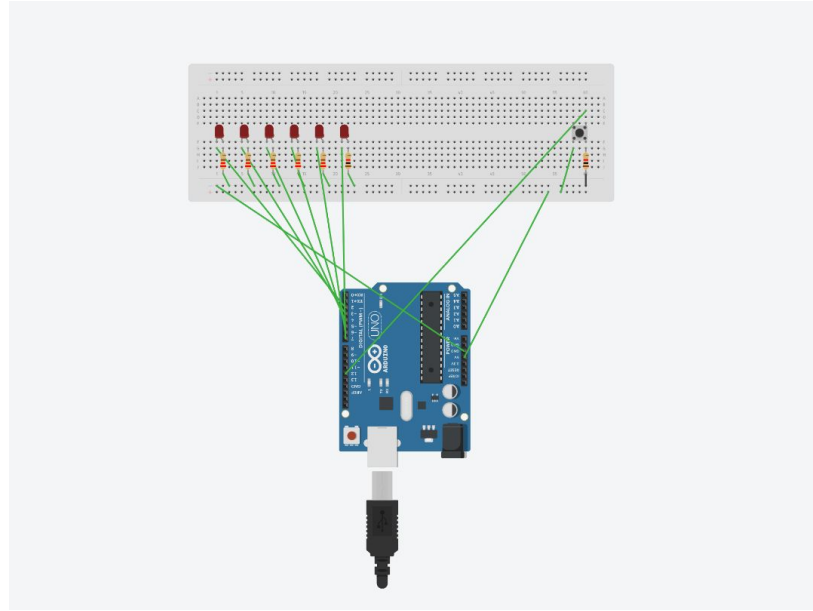
Why is this relevant?

A button is a type of switch that closes the circuit when pressed down and opens it when released.

A button

Schematic

For the 6 LEDs, swap the positions of the Anodes and Cathodes so the anode is on the left most side and the cathode is in the right most side. (Tinkercad doesn't allow you to place the LEDs on the breadboard like that)

Project Code by EvDs

```
// 6 consecutive digital pins for the LEDs
int first = 2;
int second = 3;
int third = 4;
int fourth = 5;
int fifth = 6;
int sixth = 7;

// pin for the button switch
int button = 12;
// value to check state of button switch
int pressed = 0;

void setup() {
  // set all LED pins to OUTPUT
  for (int i=first; i<=sixth; i++) {
    pinMode(i, OUTPUT);
  }
  // set buttin pin to INPUT
  pinMode(button, INPUT);

  // initialize random seed by noise from analog pin 0 (should be unconnected)
  randomSeed(analogRead(0));

  // if we're debugging, connect to serial
  #ifdef DEBUG
    Serial.begin(9600);
  #endif

}
```

Set each integer to correspond to a different digital pin.

Sets the LEDs to input and button to output.

To test your code, click the checkmark then the arrow!

Project Code by EvDs

```
void buildUpTension() {
  // light LEDs from left to right and back to build up tension
  // while waiting for the dice to be thrown
  // left to right
  for (int i=first; i<=sixth; i++) {
    if (i!=first) {
      digitalWrite(i-1, LOW);
    }
    digitalWrite(i, HIGH);
    delay(100);
  }
  // right to left
  for (int i=sixth; i>=first; i--) {
    if (i!=sixth) {
      digitalWrite(i+1, LOW);
    }
    digitalWrite(i, HIGH);
    delay(100);
  }
}

void showNumber(int number) {
  digitalWrite(first, HIGH);
  if (number >= 2) {
    digitalWrite(second, HIGH);
  }
  if (number >= 3) {
    digitalWrite(third, HIGH);
  }
  if (number >= 4) {
    digitalWrite(fourth, HIGH);
  }
  if (number >= 5) {
    digitalWrite(fifth, HIGH);
  }
  if (number == 6) {
    digitalWrite(sixth, HIGH);
  }
}
```

Builds up tension by lighting the LEDs from left to right, and right to left, until the button is released.

A number is generated, and If the generated number is greater than or equal to 1,2,3,4,5, or 6, those respective lights will light up.

To test your code, click the checkmark then the arrow!

✓ →

Project Code by EvDs

```
int throwDice() {
  // get a random number in the range [1,6]
  int randNumber = random(1,7);

  #ifdef DEBUG
    Serial.println(randNumber);
  #endif

  return randNumber;
}


void setAllLEDs(int value) {
  for (int i=first; i<=sixth; i++) {
    digitalWrite(i, value);
  }
}


void loop() {
  // if button is pressed - throw the dice
  pressed = digitalRead(button);

  if (pressed == HIGH) {
    // remove previous number
    setAllLEDs(LOW);

    buildUpTension();
    int thrownNumber = throwDice();
    showNumber(thrownNumber);
  }


}
```

The script generates a number between 1 and 6, like a dice would do.

When the button is pressed, the the total number of LEDs lit will be turned off, and the the LEDs will build up tension again,and when the button is released, it will show the total number of LEDs lit.

To test your code, click the checkmark then the arrow!

✓ →

Thank you!

Link to original project on Arduino Project Hub:
https://create.arduino.cc/projecthub/EvdS/led-dice-885cf1?ref=platform&ref_id=424_popular_part_beginner_&offset=67