SUMMER INTERNSHIP Embedded C

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TASK 12

Hands-on Activity-1

- ❑ Write a program to count no. of bits which are set in given binary pattern
- ❑ Write a program to set 5th and 12th bits in a 16-bit unsigned integer
- ❑ Write a program to clear 6th and 19th bits in a 32-bit unsigned integer
- ❑ Write a program to flip even positioned bits in a 16-bit unsigned integer
- ❑ An IP Address will be in the form of "a.b,c.d" format, where a,b,c,d will be in the range of 0-255. Given a,b,c,d values (or string format) pack them into 32-bit unsigned integer.
- ❑ Given an unsigned 32-bit integer holding packed IPv4 address, convert it into "a.b.c.d" format.
- ❑ Convert MAC address into 48-bit binary pattern
- ❑ Convert 48-bit binary pattern as MAC address
- ❑ Arduino examples using Bare metal code (Register level Bit Manipulations)
  - ➔ Blinky
  - ➔ LED controlling using PushButton

Q1)

```
#include <stdio.h>

int countSetBits(int n) {
```

```
    int count = 0;
    while (n) {
        count += n & 1;
        n >>= 1;
    }
    return count;
}
int main() {
    int num;
    printf("Enter an integer: ");
    scanf("%d", &num);
    int setBits = countSetBits(num);
    printf("Number of set bits in %d is %d\n", num, setBits);
    return 0;
}
```

Q2)

```
#include <stdio.h>
int main()
{
    unsigned short int value = 0;
    unsigned short int mask = (1 << 4) | (1 << 11);
    value |= mask;
    printf("The value after setting the 5th and 12th bits is: %u\n", value);
    return 0;
}
```

Q3)

```
#include <stdio.h>
unsigned int clearBits(unsigned int num) {
    unsigned int mask = ~((1 << 5) | (1 << 18));
```

```
    return num & mask;
}
int main() {
    unsigned int num;
    printf("Enter a 32-bit unsigned integer: ");
    scanf("%u", &num);
    unsigned int result = clearBits(num);
    printf("Result after clearing the 6th and 19th bits: %u\n", result);
    return 0;
}
```

Q4)

```
#include <stdio.h>
unsigned short flipEvenBits(unsigned short num) {
    unsigned short mask = 0x5555;
    return num ^ mask;
}

int main() {
    unsigned short num;
    printf("Enter a 16-bit unsigned integer: ");
    scanf("%hu", &num);
    unsigned short result = flipEvenBits(num);
    printf("Result after flipping the even-positioned bits: %hu\n", result);
    return 0;
}
```

Q5)

```
#include <stdio.h>
unsigned int packIP(unsigned char a, unsigned char b, unsigned char c, unsigned char d) {
    return (a << 24) | (b << 16) | (c << 8) | d;
```

```
}

int main() {
    unsigned char a = 192;
    unsigned char b = 168;
    unsigned char c = 1;
    unsigned char d = 100;
    unsigned int packedIP = packIP(a, b, c, d);
    printf("Packed IP address: 0x%X\n", packedIP);

    return 0;
}
```

Q6)

```
#include <stdio.h>
int main() {
    unsigned int packed_ip = 0xC0A80164;
    unsigned char a = (packed_ip >> 24) & 0xFF;
    unsigned char b = (packed_ip >> 16) & 0xFF;
    unsigned char c = (packed_ip >> 8) & 0xFF;
    unsigned char d = packed_ip & 0xFF;
    printf("The unpacked IP address is: %u.%u.%u.%u\n", a, b, c, d);
    return 0;
}
```

Q7)

```
#include <stdio.h>
#include <stdlib.h>
unsigned long long convertMACAddress(const char *mac) {
    unsigned int bytes[6];
```

```
    if (sscanf(mac, "%x:%x:%x:%x:%x:%x", &bytes[0], &bytes[1], &bytes[2], &bytes[3], &bytes[4],
&bytes[5]) != 6) {
        fprintf(stderr, "Invalid MAC address format.\n");
        exit(EXIT_FAILURE);
    }
    unsigned long long macBinary = 0;
    for (int i = 0; i < 6; ++i) {
        macBinary = (macBinary << 8) | (bytes[i] & 0xFF);
    }
    return macBinary;
}
int main() {
    char macString[18];
    printf("Enter MAC address in the format XX:XX:XX:XX:XX:XX: ");
    if (scanf("%17s", macString) != 1) {
        fprintf(stderr, "Failed to read MAC address.\n");
        return EXIT_FAILURE;
    }
    unsigned long long macBinary = convertMACAddress(macString);
    printf("MAC address in 48-bit binary pattern: %012llx\n", macBinary);
    return 0;
}
```

Q8)

```
#include <stdio.h>
#include <stdlib.h>
void binaryToMac(const char* binary) {
    unsigned int bytes[6] = {0};
    for (int i = 0; i < 48; ++i) {
        bytes[i / 8] = (bytes[i / 8] << 1) | (binary[i] - '0');
```

```
    }
    printf("MAC Address: %02X:%02X:%02X:%02X:%02X:%02X\n",
           bytes[0], bytes[1], bytes[2], bytes[3], bytes[4], bytes[5]);
}
int main() {
    const char* binary_pattern = "10101010101110111100110011011101111011111111111";
    binaryToMac(binary_pattern);
    return 0;
}
```

Task 14

1)bare metal blinky using arduino1

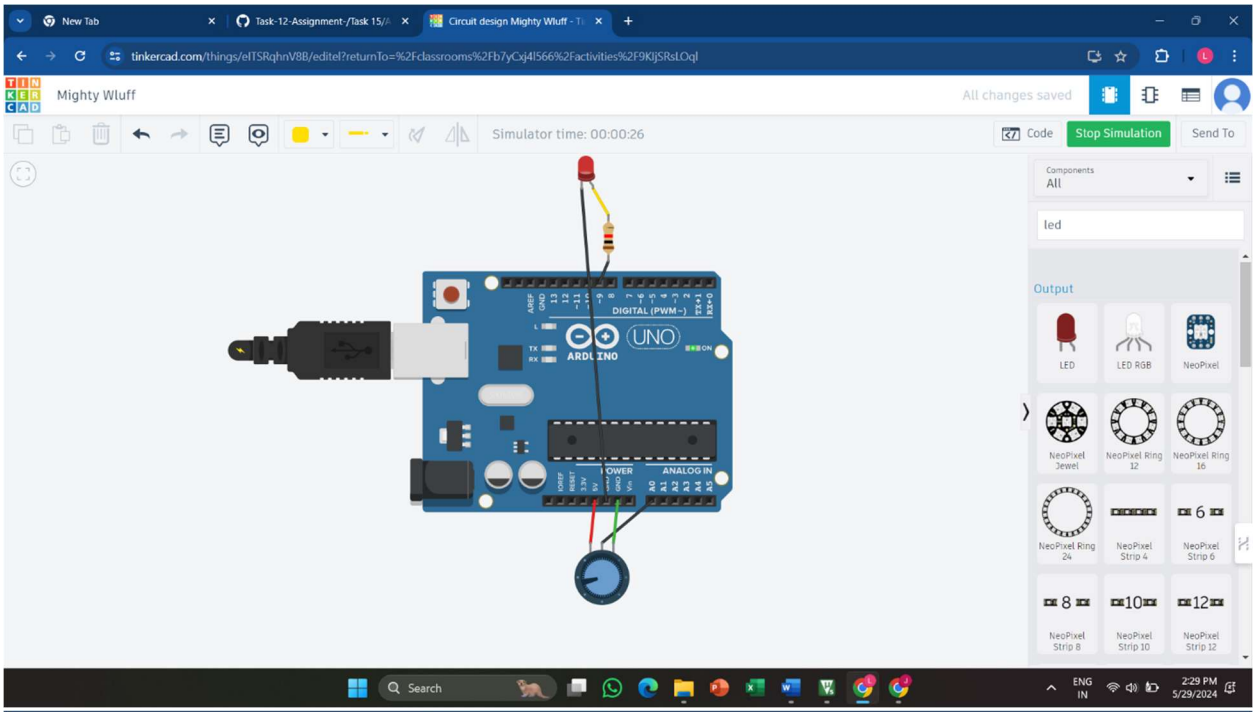
```
#define F_CPU 16000000UL
#include <avr/io.h>
#include <util/delay.h>
int main(void)
{
    // Set pin 7 (PD7) as an output
    DDRD |= (1 << PD7);
    while (1)
    {
        PORTD |= (1 << PD7);
        _delay_ms(1000);
        PORTD &= ~(1 << PD7);
        _delay_ms(1000);
    }
    return 0;
}
```

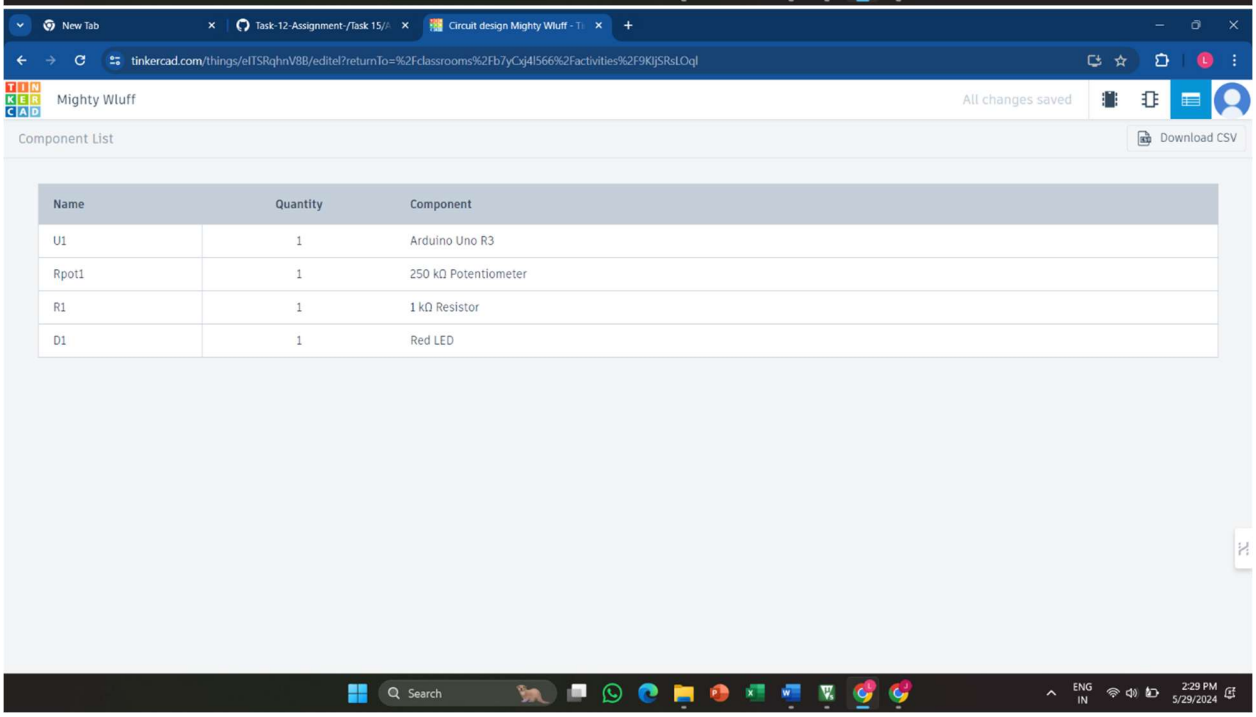
2)bare metal push button1

```
#define F_CPU 16000000UL
#include <avr/io.h>
#include <util/delay.h>
const uint8_t buttonPin = PD2;
const uint8_t ledPin = PB5;
uint8_t buttonState = 0;
void setup() {
   DDRD &= ~(1 << buttonPin);
   PORTD |= (1 << buttonPin);
   DDRB |= (1 << ledPin);
}
int main(void) {
   setup();
   while (1) {
      buttonState = PIND & (1 << buttonPin);
      if (buttonState) {
         PORTB |= (1 << ledPin);
      } else {
         PORTB &= ~(1 << ledPin);
      }
      _delay_ms(10);
   }
   return 0;
}
```

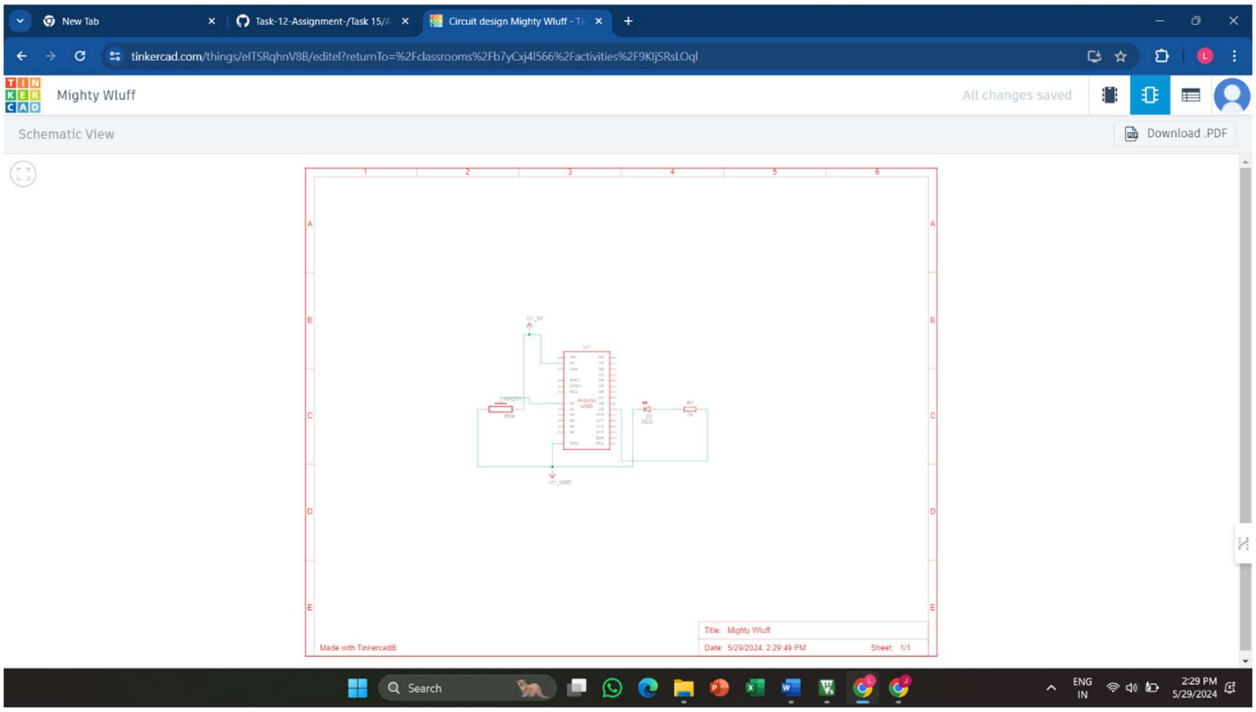
Task 15

Analog Read (Potentiometer)





Name	Quantity	Component
U1	1	Arduino Uno R3
Rpot1	1	250 kΩ Potentiometer
R1	1	1 kΩ Resistor
D1	1	Red LED




```
// Constants for pin assignments
const int potPin = A0;    // Pin where the potentiometer is connected
const int ledPin = 9;     // Pin where the LED is connected

// Variable to store the potentiometer value
int potValue = 0;

void setup() {
  // Initialize the LED pin as an output
  pinMode(ledPin, OUTPUT);
}

void loop() {
  // Read the value from the potentiometer
  potValue = analogRead(potPin);
```

```
  // Map the potentiometer value to the PWM range (0-255)
  int ledValue = map(potValue, 0, 1023, 0, 255);

  // Set the brightness of the LED
  analogWrite(ledPin, ledValue);

  // Small delay to smooth out the reading
  delay(10);
}
```

Analout Output(fading)

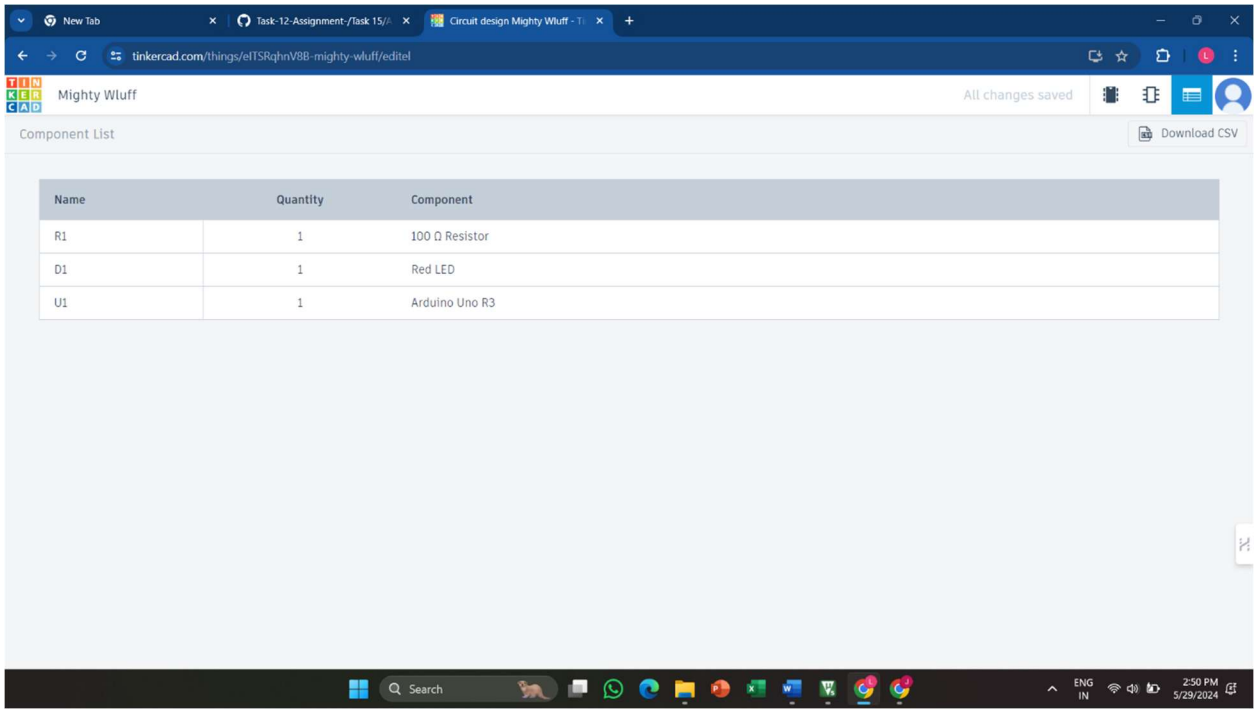
```
const int ledPin = 9;      // Pin where the LED is connected

void setup() {
  // Initialize the LED pin as an output
  pinMode(ledPin, OUTPUT);
}

void loop() {
  // Fade in from 0 to 100^6
  for (int brightness = 0; brightness <= 100^6; brightness++) {
    analogWrite(ledPin, brightness);  // Set the brightness
    delay(10);  // Wait for 10 milliseconds
  }

  // Fade out from 100^6 to 0
  for (int brightness = 100^6; brightness >= 0; brightness--) {
    analogWrite(ledPin, brightness);  // Set the brightness
    delay(10);  // Wait for 10 milliseconds
```

```
  }
}
```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Mighty Wluff
All changes saved
Component List
Download CSV
Name
Quantity
Component
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100 Ω Resistor
D1
1
Red LED
U1
1
Arduino Uno R3
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ENG
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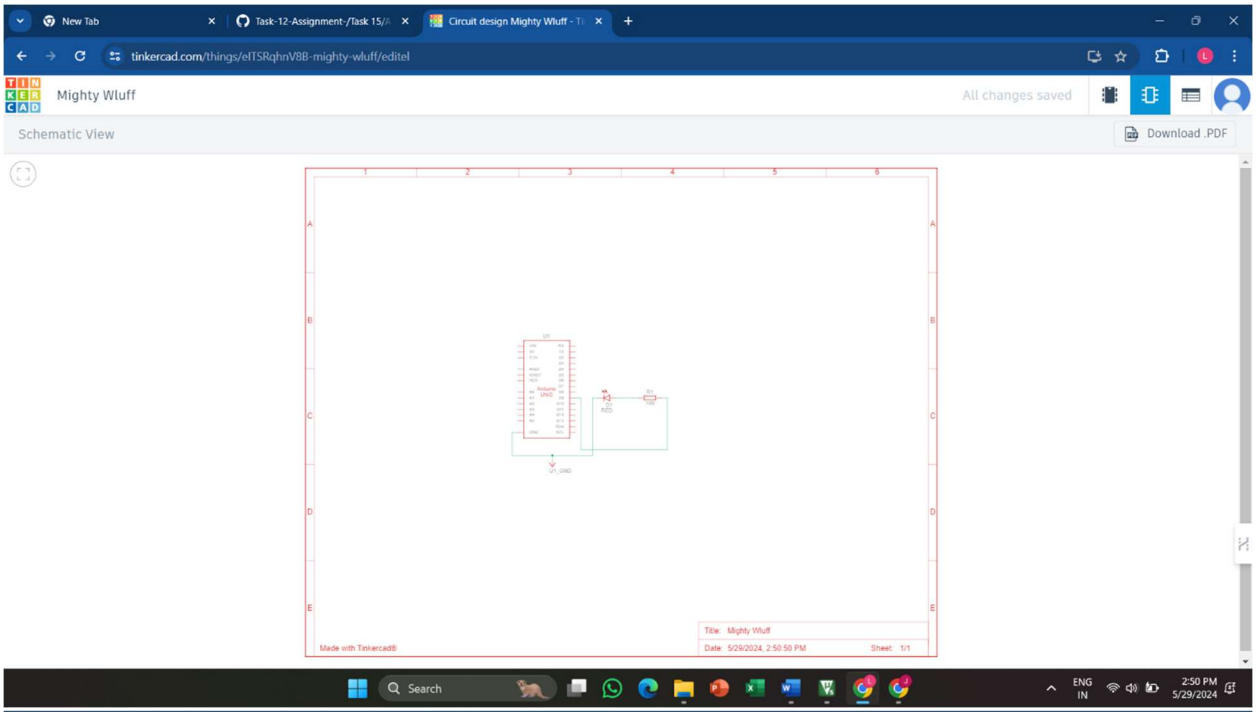
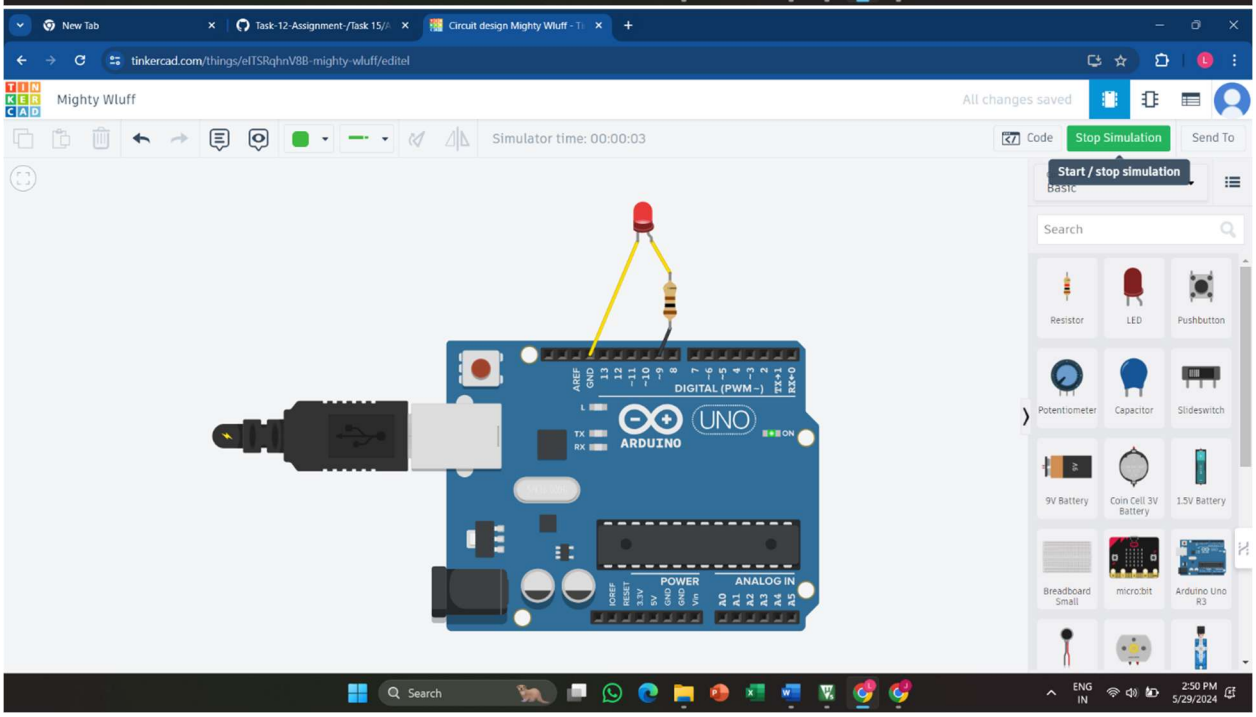




Digital Input using Interrupt

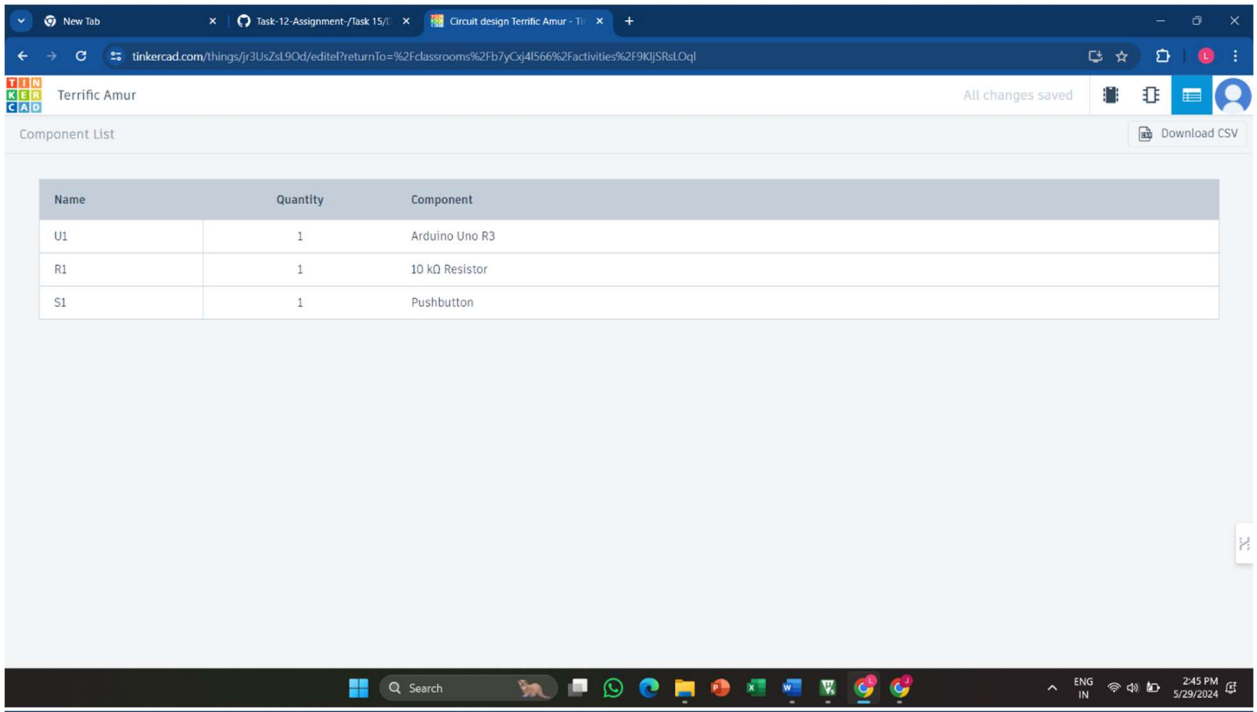
```
const int buttonPin = 2;    // Pin where the push button is connected

volatile bool buttonPressed = false; // Flag to indicate button press
```

```
void setup() {
  pinMode(buttonPin, INPUT);         // Set the button pin as input
  attachInterrupt(digitalPinToInterrupt(buttonPin), buttonPressISR, RISING); // Attach interrupt on rising edge
  Serial.begin(9600);                // Initialize serial communication
}

void loop() {
  if (buttonPressed) {
    Serial.println("Button Pressed!");  // Print message when button is pressed
    buttonPressed = false;             // Reset the flag
  }
}

void buttonPressISR() {
  buttonPressed = true; // Set the flag to indicate button press
}
```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All changes saved
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Download CSV
Name
Quantity
Component
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Arduino Uno R3
R1
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10 kΩ Resistor
S1
1
Pushbutton
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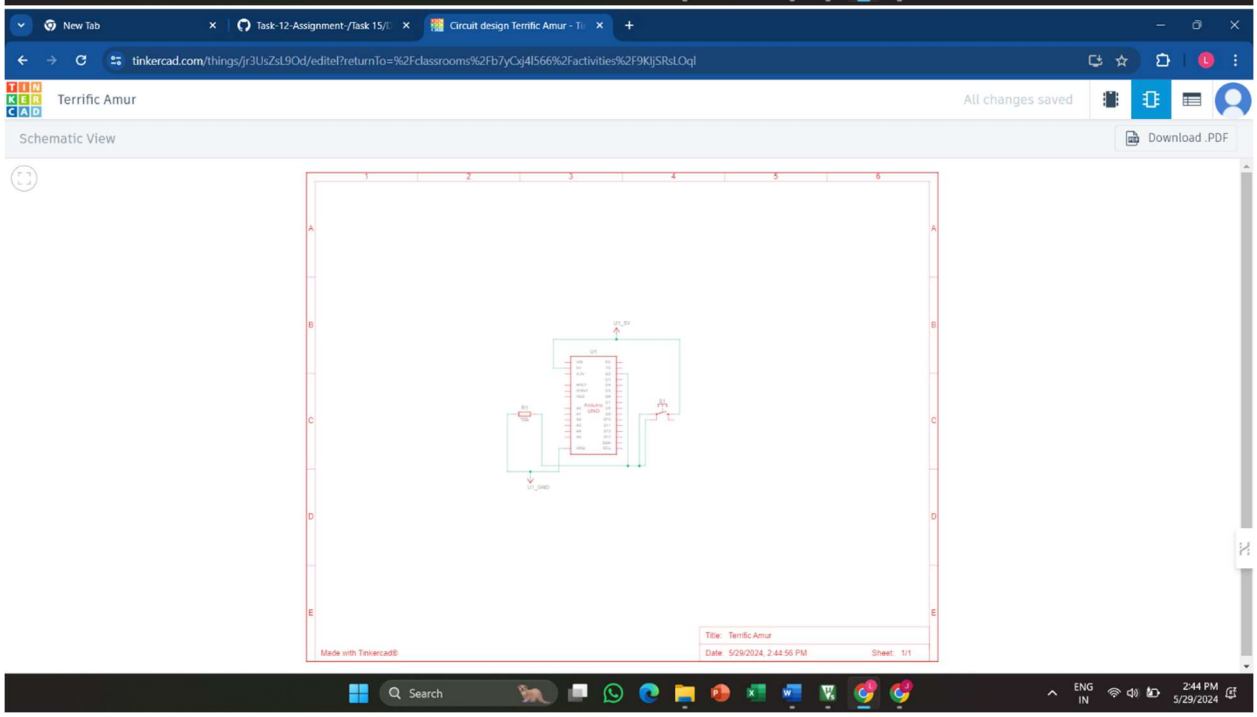
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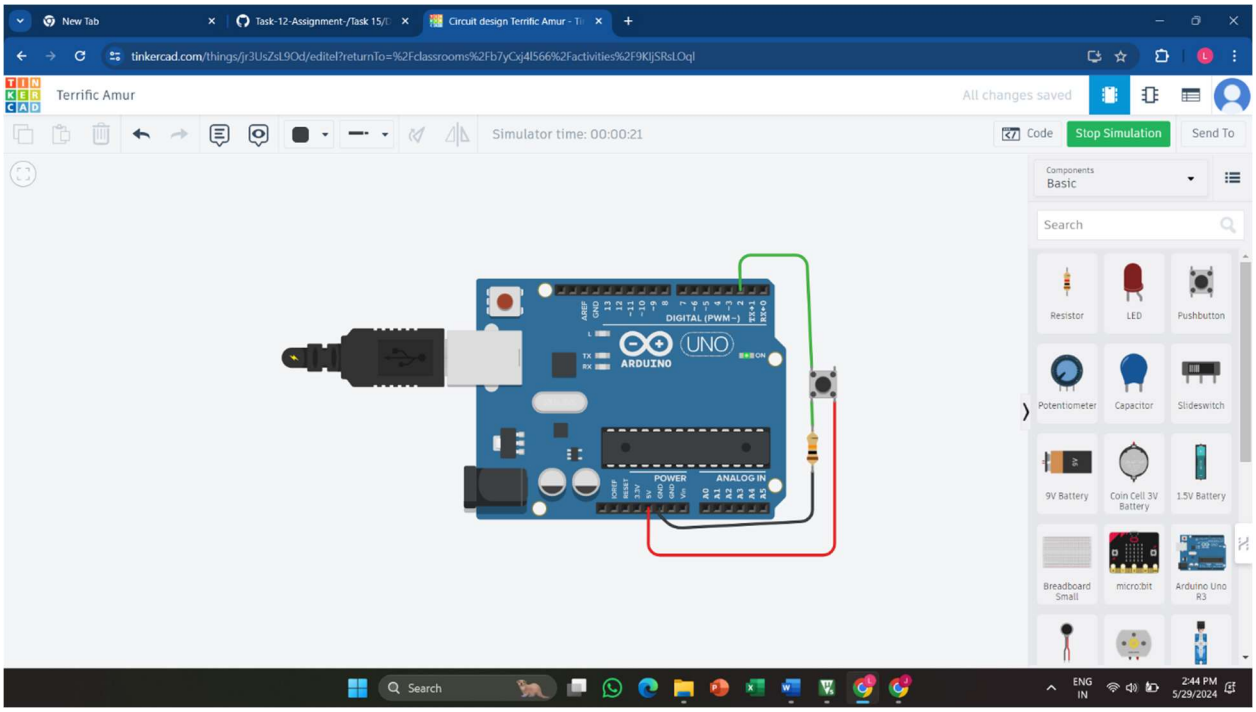
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Terrific Amur
All changes saved
Simulator time: 00:00:21
Code
Stop Simulation
Send To
Components
Basic
Search
Resistor
LED
Pushbutton
Potentiometer
Capacitor
Slideswitch
9V Battery
Coin Cell 3V Battery
1.5V Battery
Breadboard Small
micro:bit
Arduino Uno R3
DIGITAL (PWM~)
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