CSLR61: EMBEDDED SYSTEMS LABs Report

106119100 - Rajneesh Pandey

Date : 31/01/2022

CSLR61 : EMBEDDED SYSTEMS
LAB-1

Roll no. : **106119100**

Name : **Rajneesh Pandey**

Section : **CSE-B**

1. Blink LEDs in alternate order – 1 and 3 together and 2 and 4 together.

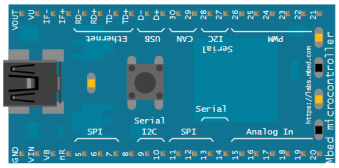
```c
/* 106119100 Rajneesh Pandey */
#include "mbed.h"

DigitalOut led1(LED1);
DigitalOut led2(LED2);
DigitalOut led3(LED3);
DigitalOut led4(LED4);

int main(){
    while (1){
        led1 = !led1;
        printf("Blink! LED1 is now %d\n", led1.read());
        led3 = !led3;
        printf("Blink! LED3 is now %d\n", led3.read());
        wait_ms(1000);
        led2 = !led2;
        printf("Blink! LED2 is now %d\n", led2.read());
        led4 = !led4;
        printf("Blink! LED4 is now %d\n", led4.read());
    }
}
```

arm MBED

Blinky | Load demo | Run

```
/* 106119100 Rajneesh Pandey*/

#include "mbed.h"

DigitalOut led1(LED1);
DigitalOut led2(LED2);
DigitalOut led3(LED3);
DigitalOut led4(LED4);

int main() {

    while (1) {

        led1 = !led1;
        printf("Blink! LED1 is now %d\n", led1.read());
        led3 = !led3;
        printf("Blink! LED3 is now %d\n", led3.read());

        wait_ms(1000);

        led2 = !led2;
        printf("Blink! LED2 is now %d\n", led2.read());
        led4 = !led4;
        printf("Blink! LED4 is now %d\n", led4.read());

    }
}
```

+ Add component



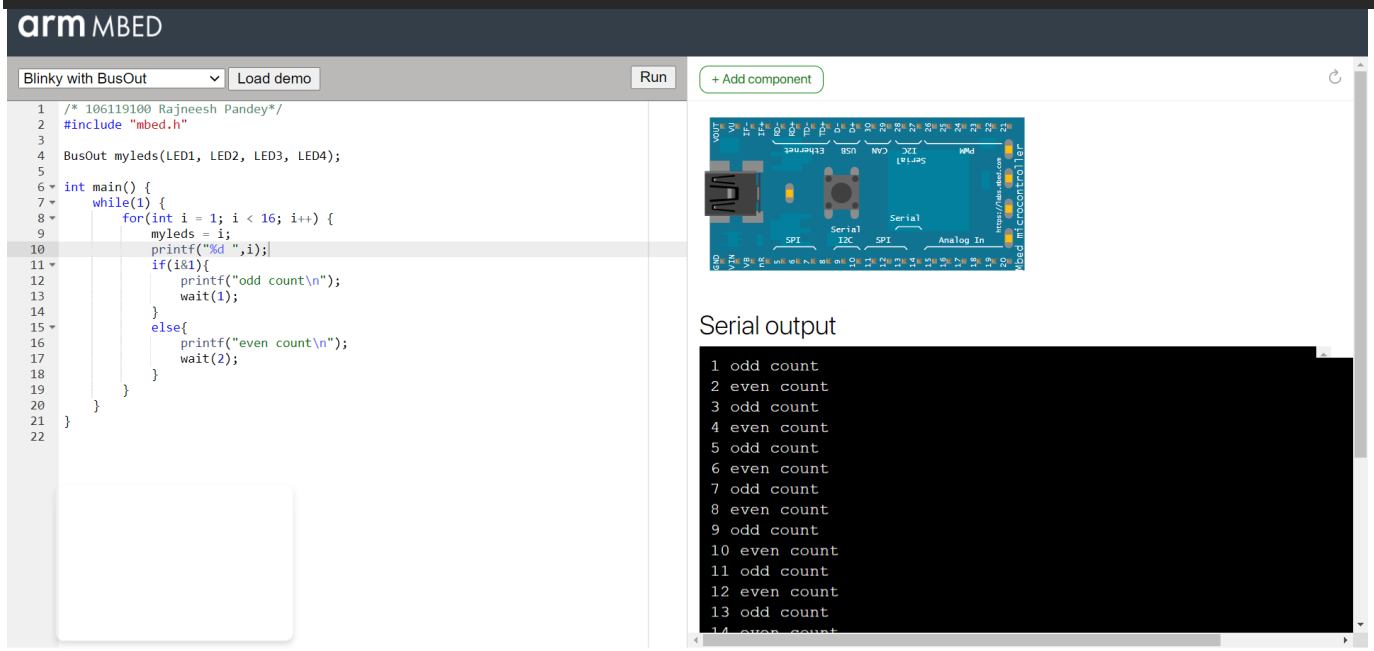
Serial output

```
Blink! LED4 is now 0
Blink! LED1 is now 1
Blink! LED3 is now 1
Blink! LED2 is now 1
Blink! LED4 is now 1
Blink! LED1 is now 0
Blink! LED3 is now 0
Blink! LED2 is now 0
Blink! LED4 is now 0
Blink! LED1 is now 1
Blink! LED3 is now 1
Blink! LED2 is now 1
Blink! LED4 is now 1
```

2. Blink LEDs – count from 1 to 15; if the board is counting odd value, wait for 1 sec, else wait for 2 sec.

```
/* 106119100 Rajneesh Pandey*/
#include "mbed.h"

BusOut myleds(LED1, LED2, LED3, LED4);

int main(){
    while (1){
            for (int i = 1; i < 16; i++){
                myleds = i;
                printf("%d ", i);
                if (i & 1){
                    printf("odd count\n");
                    wait(1);
                }
                else{
                    printf("even count\n");
                    wait(2);
                }
            }
        }
    }
```

24.



3. Blink LEDs – for all composite number below 15.

```
4./* 106119100 Rajneesh Pandey */
5.#include "mbed.h"
6.
7.BusOut myleds(LED1, LED2, LED3, LED4);
8.
9.bool isComposite(int n)
10.    {
11.        if (n == 1)
12.            return true;
13.        for (int i = 2; i < n; i++)
14.        {
15.            if (n % i == 0)
16.                return true;
17.        }
18.        return false;
19.    }
20.    int main()
21.    {
```

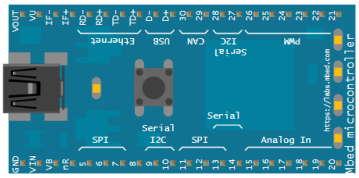
```
        while (1)
        {
            for (int i = 1; i < 16; i++)
            {
                if (isComposite(i))
                {
                    myleds = i;
                    printf("%d is Composite Number\n", i);
                    wait(1);
                }
            }
        }
    }
```

arm MBED

Blinky with BusOut | Load demo | Run

```
#include "mbed.h"

BusOut myleds(LED1, LED2, LED3, LED4);

bool isComposite(int n){
    if(n==1) return true;
    for(int i=2;i<n;i++){
        if(n%i==0) return true;
    }
    return false;
}
int main() {
    while(1) {
        for(int i = 1; i < 16; i++) {
            if(isComposite(i)){
                myleds = i;
                printf("%d is Composite Number\n",i);
                wait(1);
            }
        }
    }
}
```

+ Add component



Serial output

```
1 is Composite Number
4 is Composite Number
6 is Composite Number
8 is Composite Number
9 is Composite Number
10 is Composite Number
12 is Composite Number
14 is Composite Number
15 is Composite Number
1 is Composite Number
4 is Composite Number
6 is Composite Number
8 is Composite Number
```

4. Blink LEDs – to count even numbers

```
#include "mbed.h"

BusOut leds(LED1, LED2, LED3, LED4);

int main(){
        while (1){
           for(int i = 0; i < 16; i++){
                 if(i%2==0){
                    leds = i;
                    printf("count %d\n", leds.read());
                    wait(2);
                 }
          }
        }
    }

```

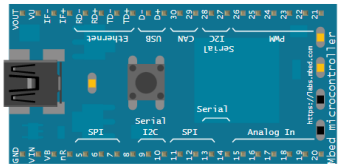
simulator.mbed.com/#user_1644232012069

arm MBED

Blinky | Load demo | Run

```
1  #include "mbed.h"
2
3  BusOut leds(LED1, LED2, LED3, LED4);
4
5  int main(){
6      while (1){
7          for(int i = 0; i < 16; i++){
8              if(i%2==0){
9                  leds = i;
10                 printf("count %d\n", leds.read());
11                 wait(2);
12             }
13         }
14     }
15 }
16
```

+ Add component



Serial output

```
count 0
count 2
count 4
count 6
count 8
count 10
count 12
count 14
count 0
count 2
```

Date : 07/02/2022

CSLR61 : EMBEDDED SYSTEMS
LAB-2

Roll no. : **106119100**

Name : **Rajneesh Pandey**

Section : **CSE-B**

1. Switch between hex counter and decade counter using switches. Display the current value of the counter with the help of 4 LEDs and the screen.
    - Libraries Used: InterruptIn, BusOut

```
#include "mbed.h"
BusOut leds(LED1, LED2, LED3, LED4);
InterruptIn swt(p5);

void hexCounter()
{
    while (1)
    {
        for (int i = 0; i < 16; i++)
        {
            leds = i;
            printf("Hex count : %d\n", i);
            wait(1);
        }
    }
}
void decCounter()
{
    while (1)
    {
        for (int i = 0; i < 10; i++)
        {
            leds = i;
            printf("Dec count : %d\n", i);
            wait(1);
        }
    }
}
int main()
{
    swt.rise(&hexCounter);
    swt.fall(&decCounter);
}
```

Output :

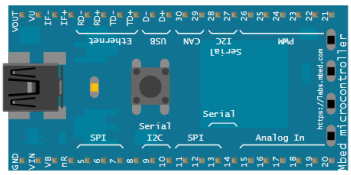
simulator.mbed.com/#user_1644227344419

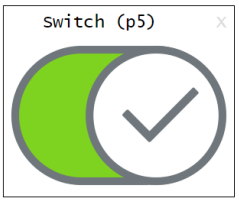
arm MBED

Blinky with BusOut | Load demo | Run

```
1  #include "mbed.h"
2
3  BusOut leds(LED1, LED2, LED3, LED4);
4  InterruptIn swt(p5);
5
6  void hexCounter(){
7      while(1){
8          for(int i = 0; i < 16; i++) {
9              leds = i;
10             printf("Hex count : %d\n",i);
11             wait(1);
12         }
13     }
14 }
15 void decCounter(){
16     while(1){
17         for(int i = 0; i < 10; i++) {
18             leds = i;
19             printf("Dec count : %d\n",i);
20             wait(1);
21         }
22     }
23 }
24 int main() {
25     swt.rise(&hexCounter);
26     swt.fall(&decCounter);
27 }
```

+ Add component





Serial output

```
Hex count : 1
Hex count : 2
Hex count : 3
Dec count : 0
Dec count : 1
Hex count : 0
Hex count : 1
Hex count : 2
Hex count : 3
```

2. Display the octal counter using the onboard LEDs using Ticker Object. After 10 second, reset all the values of the onboard LED using Timeout Object.

    •Libraries Used: TimeOut, Ticker

```
#include "mbed.h"

BusOut leds(LED1, LED2, LED3, LED4);
Ticker tck;
Timeout to;

int octCount = 0;

void octalCounter()
{
    leds = octCount;
    printf("counter  %d\n", leds.read());
    octCount = (octCount + 1) % 8;
}

void reset()
{
    printf("resetting...");
    octCount = 0;
    leds = 0;
    printf("Value after resetting  %d\n", leds.read());
}
```

```
int main()
{
    tck.attach(&octalCounter, 2);
    to.attach(&reset, 10);
}
```

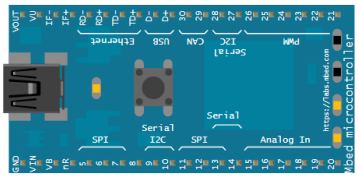
simulator.mbed.com/#user_1644228553682

arm MBED

Blinky | Load demo | Run

```
1  #include "mbed.h"
2
3  BusOut leds(LED1, LED2, LED3, LED4);
4  Ticker tck;
5  Timeout to;
6
7  int octCount = 0;
8
9  void octalCounter(){
10     leds = octCount;
11     printf("counter  %d\n", leds.read());
12     octCount = (octCount+1)%8;
13 }
14
15 void reset(){
16     printf("resetting...");
17     octCount = 0;
18     leds = 0;
19     printf("Value after resetting  %d\n", leds.read());
20 }
21
22 int main() {
23     tck.attach(&octalCounter,2);
24     to.attach(&reset,10);
25 }
26
```

+ Add component



Serial output

```
counter  0
counter  1
counter  2
counter  3
counter  4
resetting...Value after resetting  0
counter  0
counter  1
counter  2
counter  3
```

3. Display the odd counter using the onboard LEDs and screen; After 10 seconds, reset all the values of the onboard LED and display even counter using Timeout Object. Give switch option to manually toggle between two counters.

   Libraries Used: InterruptIn, Ticker, TimeOut, BusOut

```
#include "mbed.h"

BusOut leds(LED1, LED2, LED3, LED4);
Ticker tck;
Timeout to;
InterruptIn swt(p5);

int state = 1;
int odd = 1;

void Counter(){
    while(1){
        for(int i = 0; i < 16; i++){
        if (i % 2 == state){
            leds = i;
            if (state)
                printf("Odd Counter %d\n", leds.read());
            else{
                printf("Even Counter %d\n", leds.read());
            }
            wait(1);
        }
    }
   }
}
```

```
void Toggle(){
    state = !state;
    printf("Toggle using switch...\n");
    Counter();
}

void reset(){
    printf("resetting Odd Counter...\n");
    state = 0;
    leds = 0;
    tck.detach();
    printf("Starting Even Counter...\n");
    Counter();
}
void oddCounter(){
    leds = odd;
    odd = (odd+2)%16;
    printf("Odd Counter %d\n", leds.read());
}

int main()
{
    tck.attach(&oddCounter, 2.0);
    to.attach(&reset, 10);
    swt.rise(&Toggle);

}
```

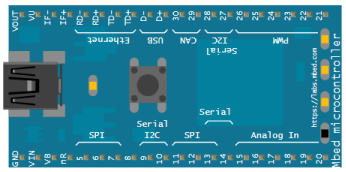
simulator.mbed.com/#user_1644231511600

arm MBED

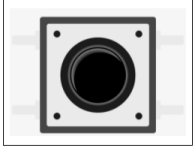
Blinky | Load demo | Run

```
#include "mbed.h"

BusOut leds(LED1, LED2, LED3, LED4);
Ticker tck;
Timeout to;
InterruptIn swt(p5);

int state = 1;
int odd = 1;

void Counter(){
    while(1){
        for(int i = 0; i < 16; i++){
        if (i % 2 == state){
            leds = i;
            if (state)
                printf("Odd Counter %d\n", leds.read());
            else{
                printf("Even Counter %d\n", leds.read());
            }
            wait(1);
        }
    }
   }
}

void Toggle(){
    state = !state;
    printf("Toggle using switch...\n");
    Counter();
}

void reset(){
    printf("resetting Odd Counter...\n");
    state = 0;
```

+ Add component



Push Button (p5)



Serial output

```
Odd Counter 9
resetting Odd Counter...
Starting Even Counter...
Even Counter 0
Even Counter 2
Even Counter 4
Even Counter 6
Even Counter 8
Even Counter 10
Even Counter 12
Even Counter 14
Even Counter 0
Toggle using switch...
Odd Counter 1
```

Date : 14/02/2022

CSLR61 : EMBEDDED SYSTEMS
LAB-3

Roll no. : **106119100**

Name : **Rajneesh Pandey**

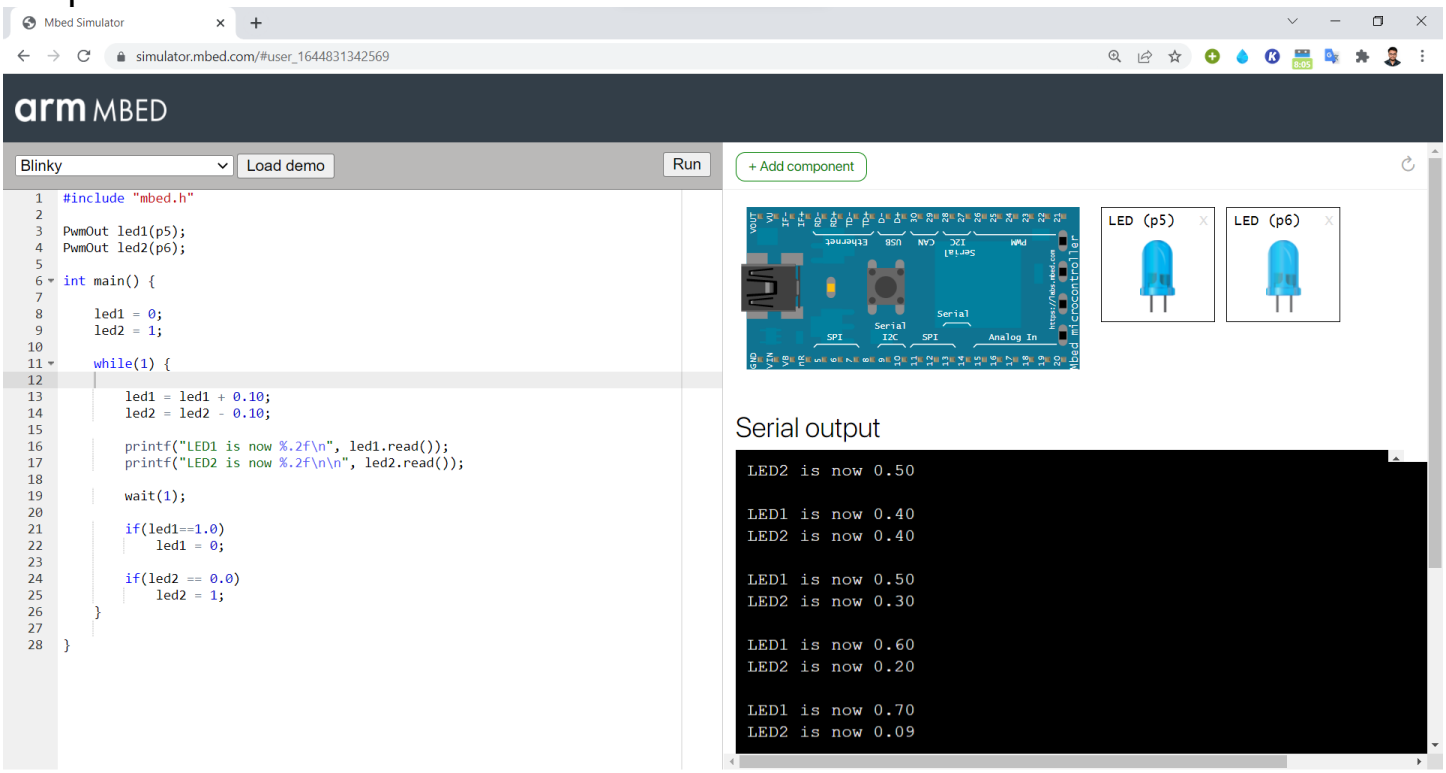
Section : **CSE-B**

1. Increase the intensity of one LED while decreasing the other LED's intensity at the same unit. Display the intensity value of the LEDs.
   •Libraries Used: pwmout

Code :

```
#include "mbed.h"

PwmOut led1(p5);
PwmOut led2(p6);

int main(){
    led1 = 0.0;
    led2 = 1.0;
    while (true)
    {

        led1 = led1+0.1;
        led2 = led2-0.1;
        printf("LED1 is now %.2f\n", led1.read());
        printf("LED2 is now %.2f\n", led2.read());
        wait(1);
        if (led1 == 1.0)
            led1 = 0.0;
        if (led2 == 0.0)
            led2 = 1.0;
    }
}
```

Output :

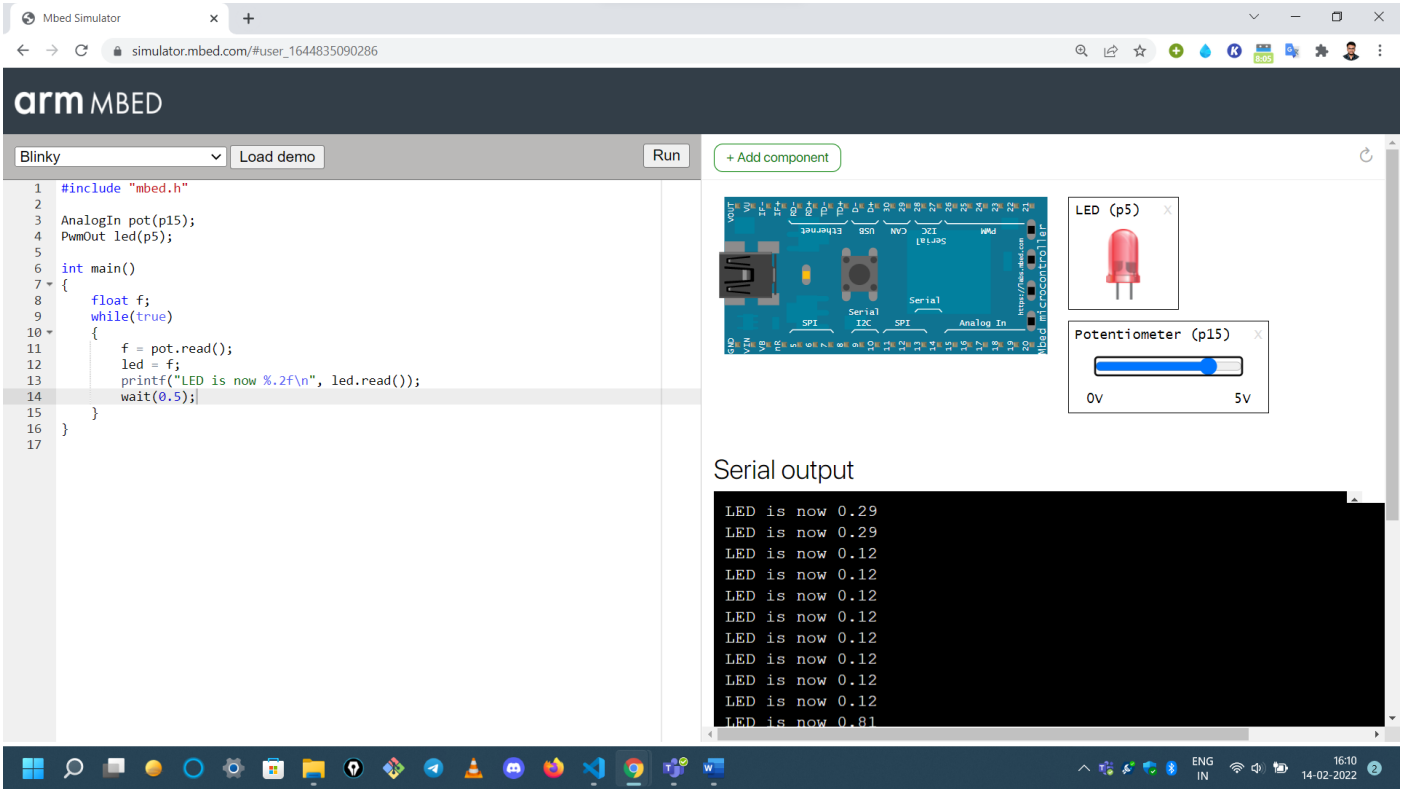



```
#include "mbed.h"

PwmOut led1(p5);
PwmOut led2(p6);

int main() {

    led1 = 0;
    led2 = 1;

    while(1) {

        led1 = led1 + 0.10;
        led2 = led2 - 0.10;

        printf("LED1 is now %.2f\n", led1.read());
        printf("LED2 is now %.2f\n\n", led2.read());

        wait(1);

        if(led1==1.0)
            led1 = 0;

        if(led2 == 0.0)
            led2 = 1;
    }

}
```

2. Interface potentiometer with mbed board and based on the value of potentiometer, adjust the intensity of an external LED.
    - Libraries To Be Used: pwmout, analogin

Code:

```
#include "mbed.h"

AnalogIn pot(p15);
PwmOut led(p5);

int main(){
    float f;
    while (true)
    {
        f = pot.read();
        led = f;
        printf("LED is now %.2f\n", led.read());
        wait(0.5);
    }
}
```



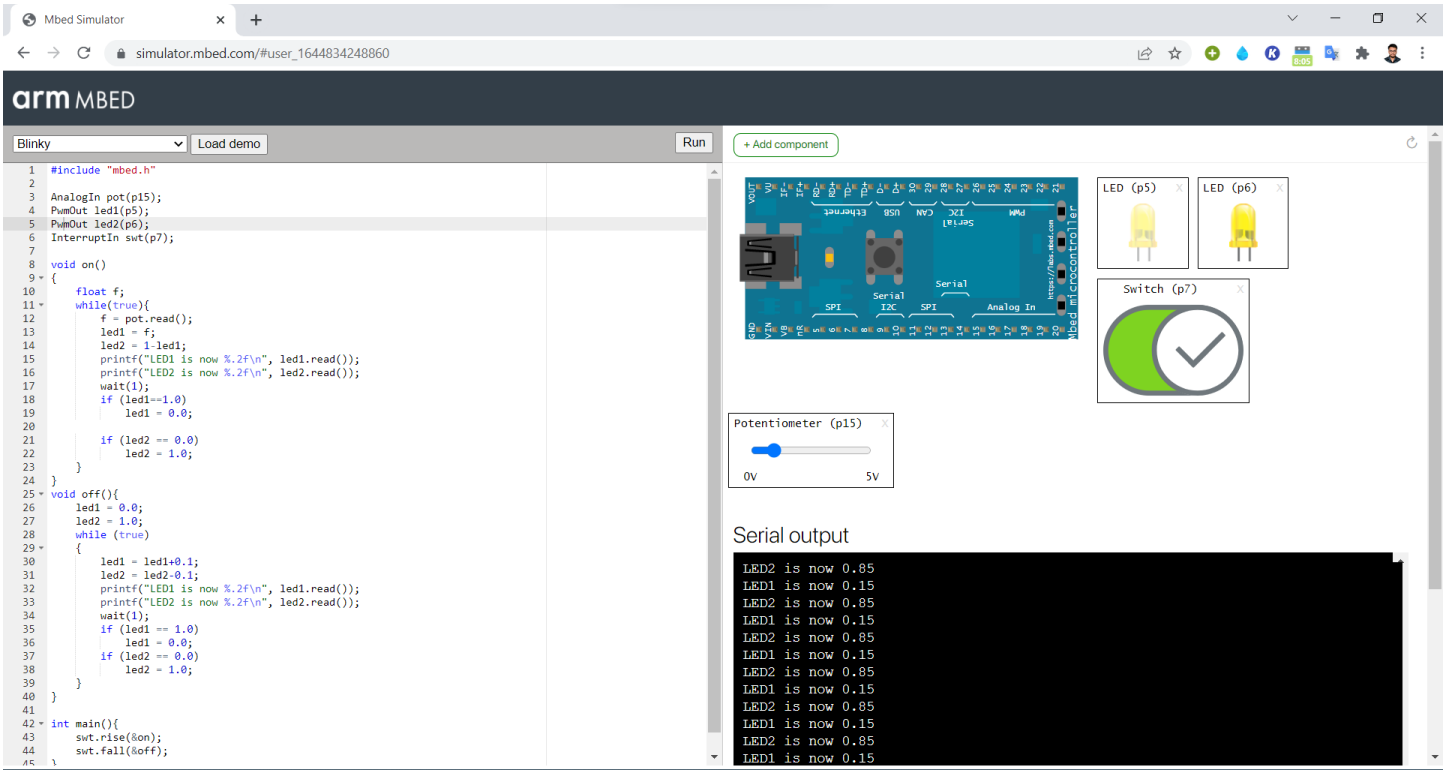
3. Interface switch, 2 LEDs, potentiometer with the mbed board. If the switch is on, control the intensity of the LEDs using potentiometer (one LED should be increasing and other should be decreasing at the rate given via potentiometer). If the switch is off, blink LEDs one at increasing rate and other at decreasing rate (same rate) and loop back.

Code:

```
#include "mbed.h"

AnalogIn pot(p15);
PumOut led1(p5);
PumOut led2(p6);

InterruptIn swt(p7);

void on()
{
    float f;
    while(true){
        f = pot.read();
        led1 = f;
        led2 = 1-led1;
        printf("LED1 is now %.2f\n", led1.read());
        printf("LED2 is now %.2f\n", led2.read());
        wait(1);
        if (led1==1.0)
            led1 = 0.0;

        if (led2 == 0.0)
            led2 = 1.0;
    }
}
void off(){
    led1 = 0.0;
    led2 = 1.0;
    while (true)
    {
```

```
        led1 = led1+0.1;
        led2 = led2-0.1;
        printf("LED1 is now %.2f\n", led1.read());
        printf("LED2 is now %.2f\n", led2.read());
        wait(1);
        if (led1 == 1.0)
            led1 = 0.0;
        if (led2 == 0.0)
            led2 = 1.0;
    }
}

int main(){
    swt.rise(&on);
    swt.fall(&off);
}
```

Output :



Date : 28/02/2022

CSLR61 : EMBEDDED SYSTEMS
LAB-4

Roll no. : **106119100**

Name : **Rajneesh Pandey**

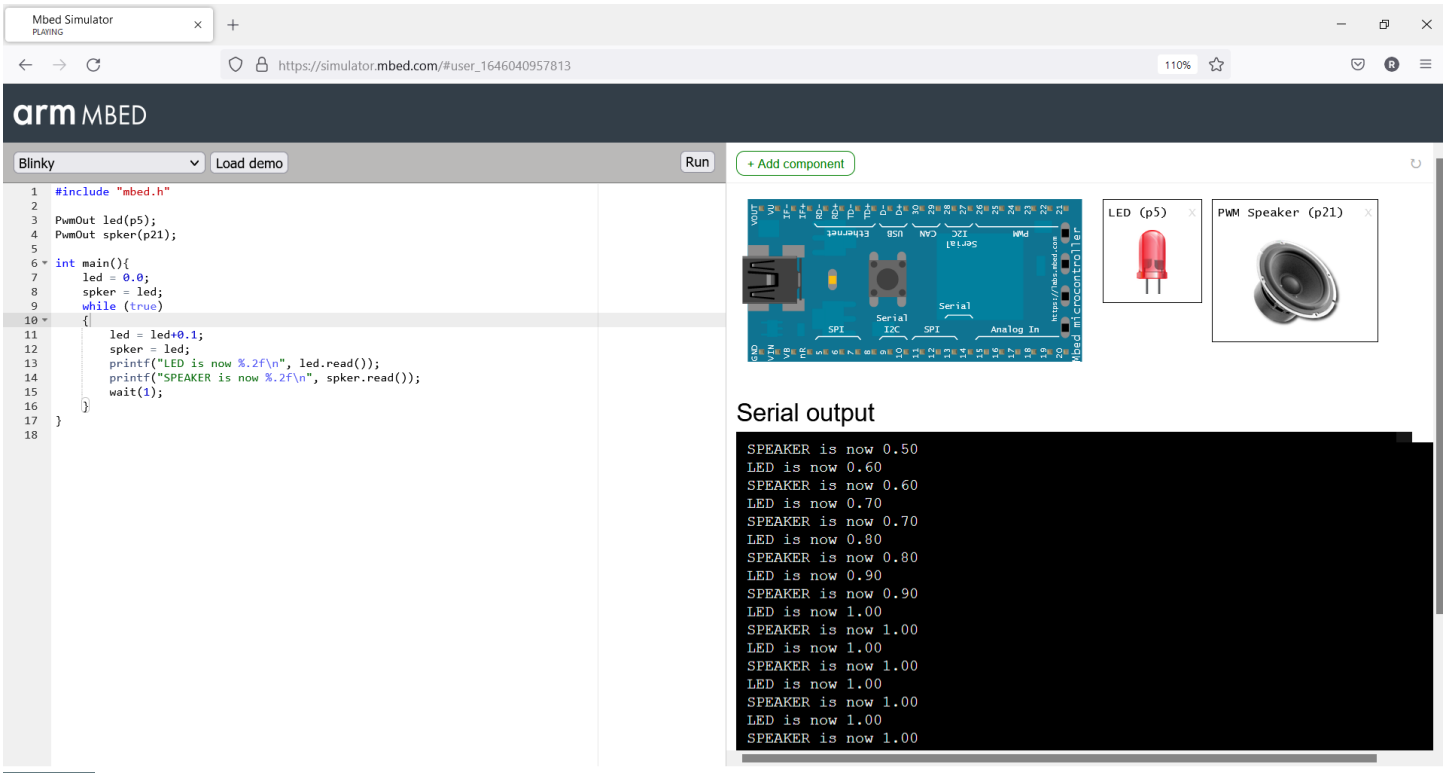
Section : **CSE-B**

1. Write a program to increase the intensity of external LED. At the same rate, increase the sound intensity of speaker.

Libraries to be Used: pwmout

```
#include "mbed.h"

PwmOut led(p5);
PwmOut spker(p6);

int main()
{
    led = 0.0;
    spker = led;
    while (true)
    {

        led = led + 0.1;
        spker = led;
        printf("LED is now %.2f\n", led.read());
        printf("SPEAKER is now %.2f\n", spker.read());
        wait(1);
    }
}
```

Output :



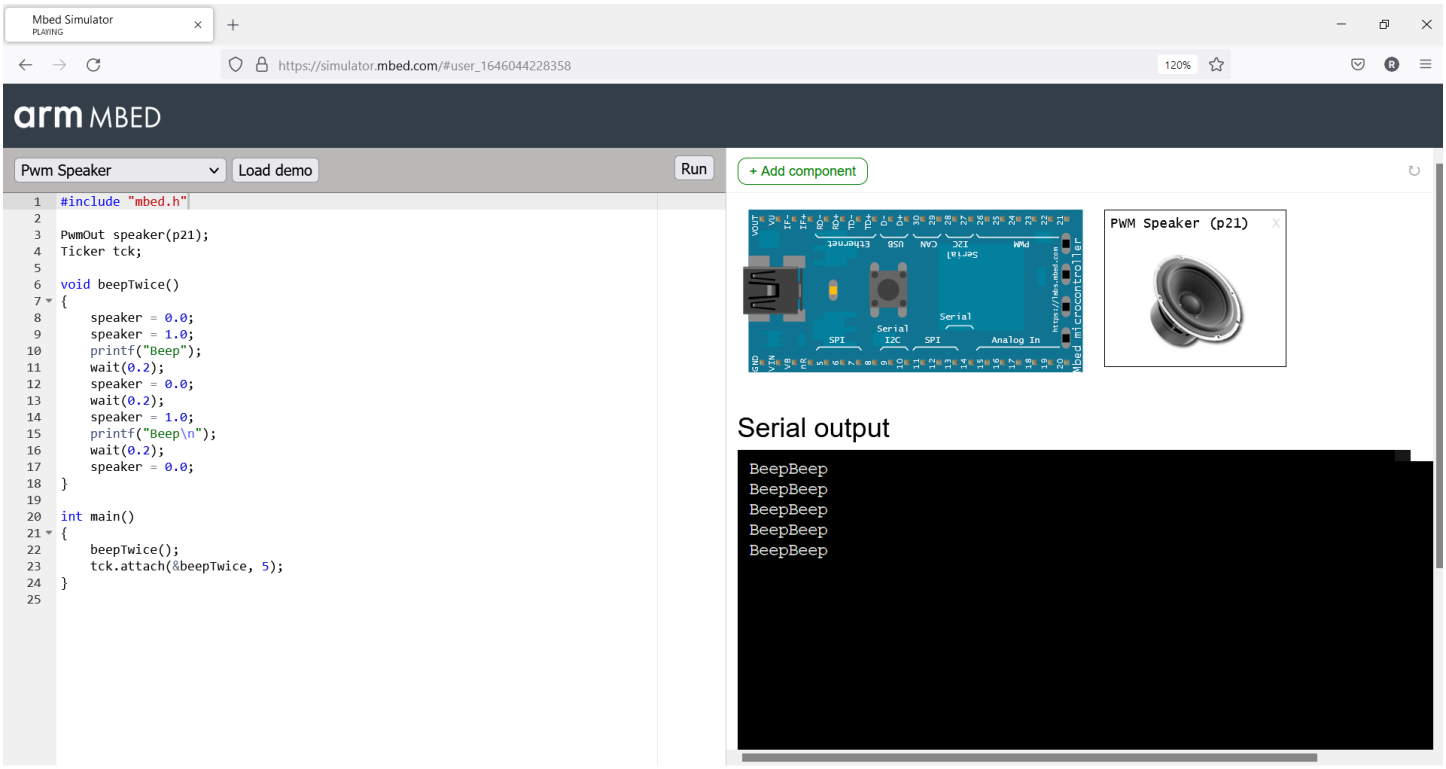

```
#include "mbed.h"

PwmOut led(p5);
PwmOut spker(p21);

int main(){
    led = 0.0;
    spker = led;
    while (true)
    {
        led = led+0.1;
        spker = led;
        printf("LED is now %.2f\n", led.read());
        printf("SPEAKER is now %.2f\n", spker.read());
        wait(1);
    }
}
```

2. Design an alarm system, which makes double beep sound for every 5s using a speaker.

Libraries To Be Used: pwmout, analogin

```
#include "mbed.h"

PwmOut speaker(p21);
Ticker tck;

void beepTwice()
{
    speaker = 0.0;
    speaker = 1.0;
    printf("Beep");
    wait(0.2);
    speaker = 0.0;
    wait(0.2);
    speaker = 1.0;
    printf("Beep\n");
    wait(0.2);
    speaker = 0.0;
}

int main()
{
    beepTwice();
    tck.attach(&beepTwice, 5);
}
```

Output :

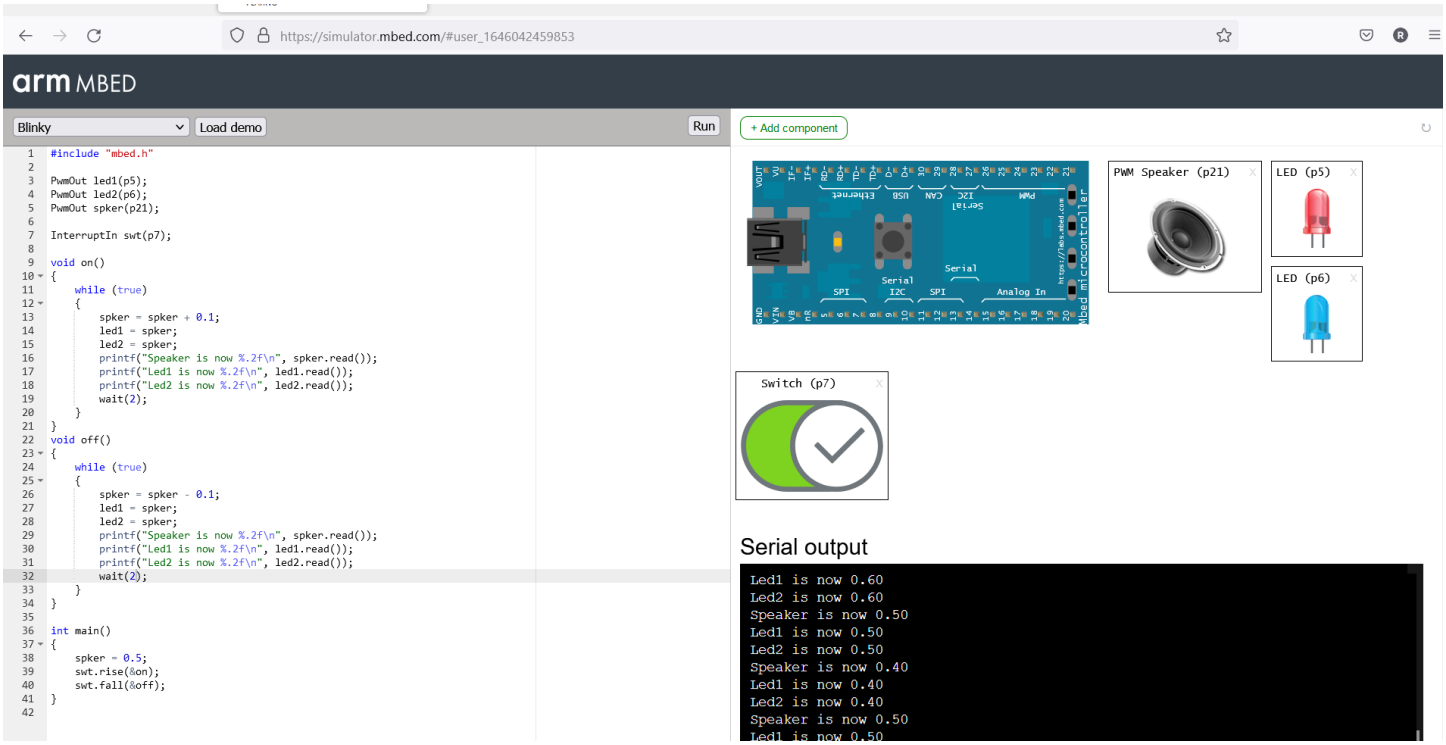



```
#include "mbed.h"

PwmOut speaker(p21);
Ticker tck;

void beepTwice()
{
    speaker = 0.0;
    speaker = 1.0;
    printf("Beep");
    wait(0.2);
    speaker = 0.0;
    wait(0.2);
    speaker = 1.0;
    printf("Beep\n");
    wait(0.2);
    speaker = 0.0;
}

int main()
{
    beepTwice();
    tck.attach(&beepTwice, 5);
}
```

3. Have a switch, 2 LEDs and a speaker interfaced with mbed board. Upon switching on, the intensity of the sound should be increasing and upon switching off, should make the intensity of the sound decreasing. Proportionally increase or decrease the intensity of two LEDs.

```
#include "mbed.h"

PwmOut led1(p5);
PwmOut led2(p6);
PwmOut spker(p21);

InterruptIn swt(p7);

void on()
{
    while (true)
    {
        spker = spker + 0.1;
        led1 = spker;
        led2 = spker;
        printf("Speaker is now %.2f\n", spker.read());
        printf("Led1 is now %.2f\n", led1.read());
        printf("Led2 is now %.2f\n", led2.read());
        wait(2);
    }
}
void off()
{
    while (true)
    {
        spker = spker - 0.1;
        led1 = spker;
        led2 = spker;
        printf("Speaker is now %.2f\n", spker.read());
        printf("Led1 is now %.2f\n", led1.read());
        printf("Led2 is now %.2f\n", led2.read());
        wait(2);
    }
```

```
}

int main()
{
    spker = 0.5;
    swt.rise(&on);
    swt.fall(&off);
}
```



Date : 07/03/2022

CSLR61 : EMBEDDED SYSTEMS
LAB-5

Roll no. : **106119100**

Name : **Rajneesh Pandey**

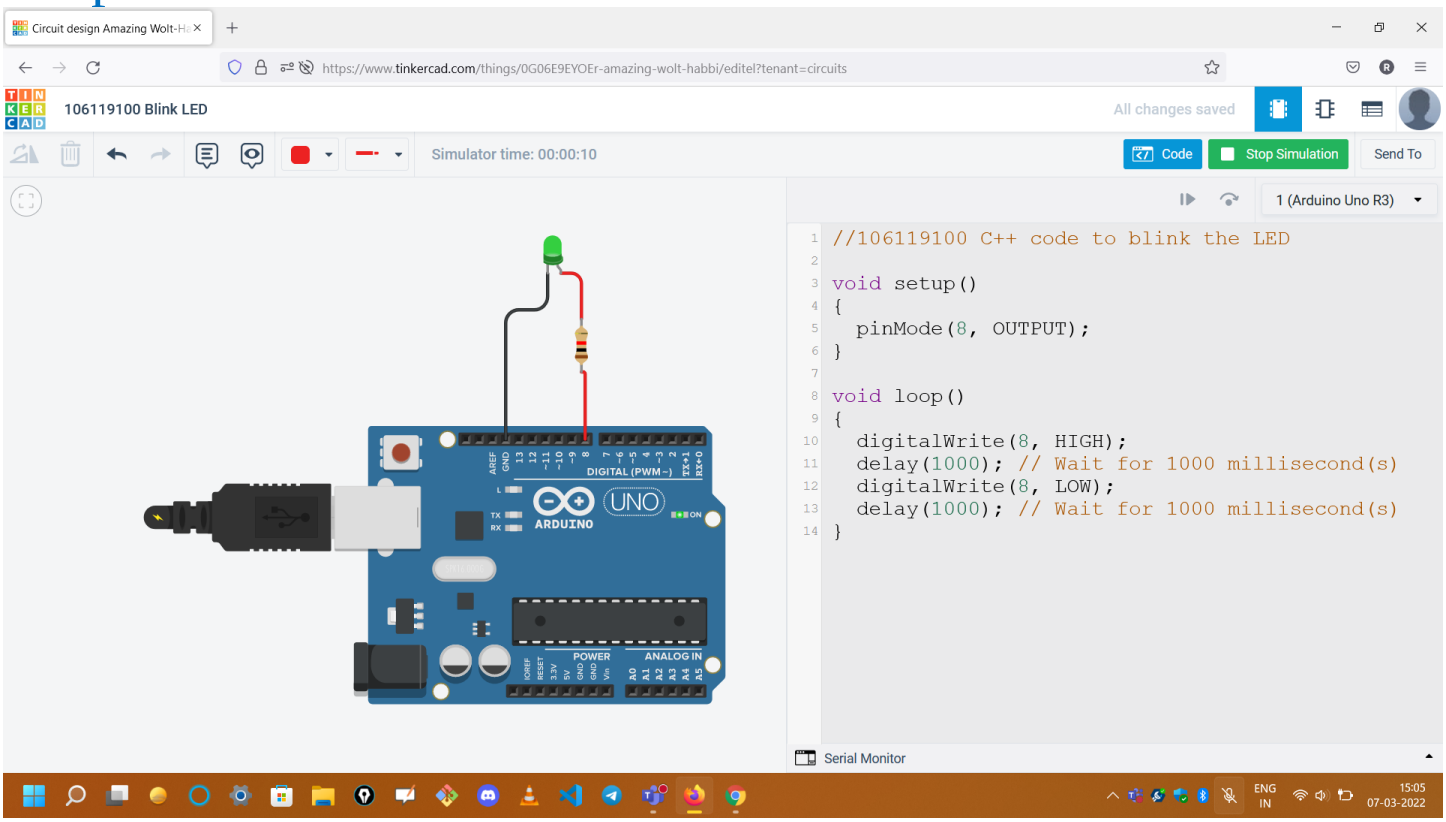
Section : **CSE-B**

1. Blink Led In Arduino UNO Simulator using Tinkercad

Code

```
// 106119100 C++ code to blink the LED

void setup(){
    pinMode(8, OUTPUT);
}

void loop(){
    digitalWrite(8, HIGH);
    delay(1000); // Wait for 1000 millisecond(s)
    digitalWrite(8, LOW);
    delay(1000); // Wait for 1000 millisecond(s)
}
```

Output

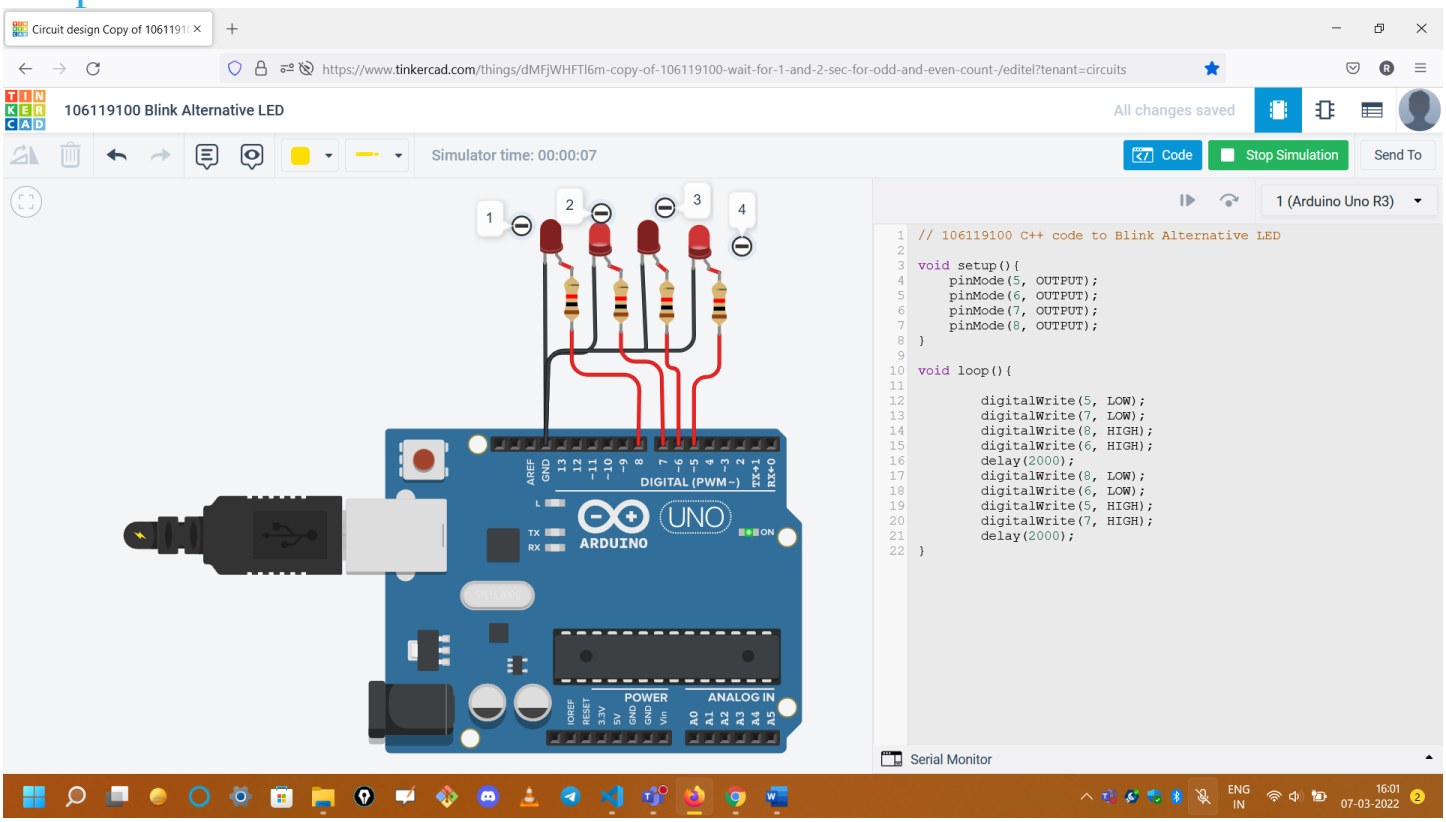


2. Blink LEDs in alternate order – 1 and 3 together and 2 and 4 together.

Code:

```
// 106119100 C++ code to Blink Alternative LED
void setup(){
    pinMode(5, OUTPUT);
    pinMode(6, OUTPUT);
    pinMode(7, OUTPUT);
    pinMode(8, OUTPUT);
}
void loop(){
    digitalWrite(5, LOW);
    digitalWrite(7, LOW);
    digitalWrite(8, HIGH);
    digitalWrite(6, HIGH);
    delay(2000);
    digitalWrite(8, LOW);
    digitalWrite(6, LOW);
    digitalWrite(5, HIGH);
    digitalWrite(7, HIGH);
    delay(2000);
}
```

Output:

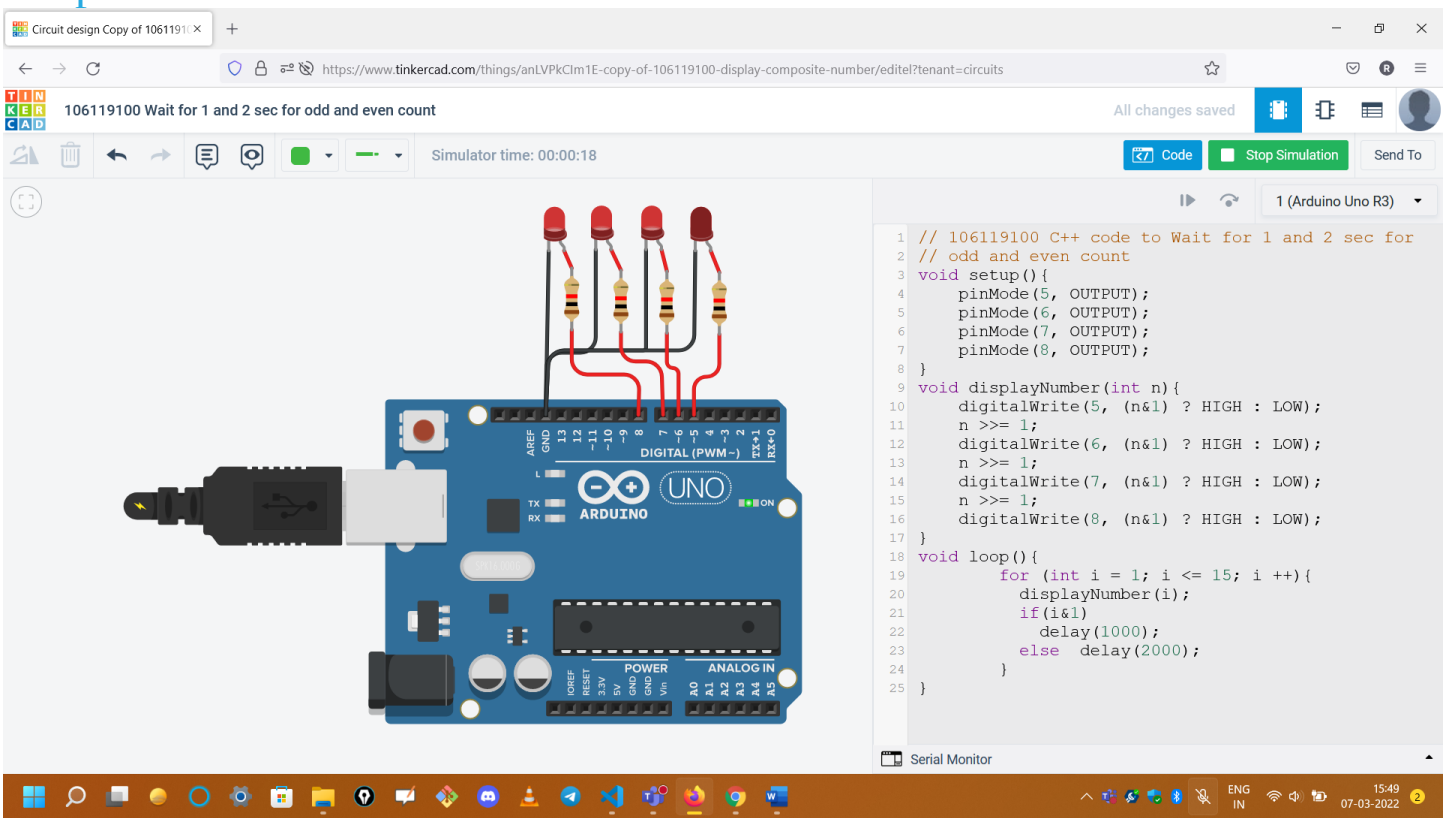

Circuit design Copy of 1061191
https://www.tinkercad.com/things/dMFjWHFTl6m-copy-of-106119100-wait-for-1-and-2-sec-for-odd-and-even-count-/editel?tenant=circuits
106119100 Blink Alternative LED
All changes saved
Simulator time: 00:00:07
Code
Stop Simulation
Send To
1 (Arduino Uno R3)
// 106119100 C++ code to Blink Alternative LED
void setup(){
pinMode(5, OUTPUT);
pinMode(6, OUTPUT);
pinMode(7, OUTPUT);
pinMode(8, OUTPUT);
}
void loop(){
digitalWrite(5, LOW);
digitalWrite(7, LOW);
digitalWrite(8, HIGH);
digitalWrite(6, HIGH);
delay(2000);
digitalWrite(8, LOW);
digitalWrite(6, LOW);
digitalWrite(5, HIGH);
digitalWrite(7, HIGH);
delay(2000);
}
Serial Monitor
ARDUINO
UNO
DIGITAL (PWM~)
POWER
ANALOG IN
ENG
IN
16:01
07-03-2022

3. Blink LEDs – count from 1 to 15; if the board is counting odd value, wait for 1 sec, else wait for 2 sec.

Code:

```
// 106119100 C++ code to Wait for 1 and 2 sec for
// odd and even count
void setup()
{
    pinMode(5, OUTPUT);
    pinMode(6, OUTPUT);
    pinMode(7, OUTPUT);
    pinMode(8, OUTPUT);
}
void displayNumber(int n)
{
    digitalWrite(5, (n & 1) ? HIGH : LOW);
    n >>= 1;
    digitalWrite(6, (n & 1) ? HIGH : LOW);
    n >>= 1;
    digitalWrite(7, (n & 1) ? HIGH : LOW);
    n >>= 1;
    digitalWrite(8, (n & 1) ? HIGH : LOW);
}
void loop()
{
    for (int i = 1; i <= 15; i++)
    {
        displayNumber(i);
        if (i & 1)
            delay(1000);
        else
            delay(2000);
    }
}
```

Output:



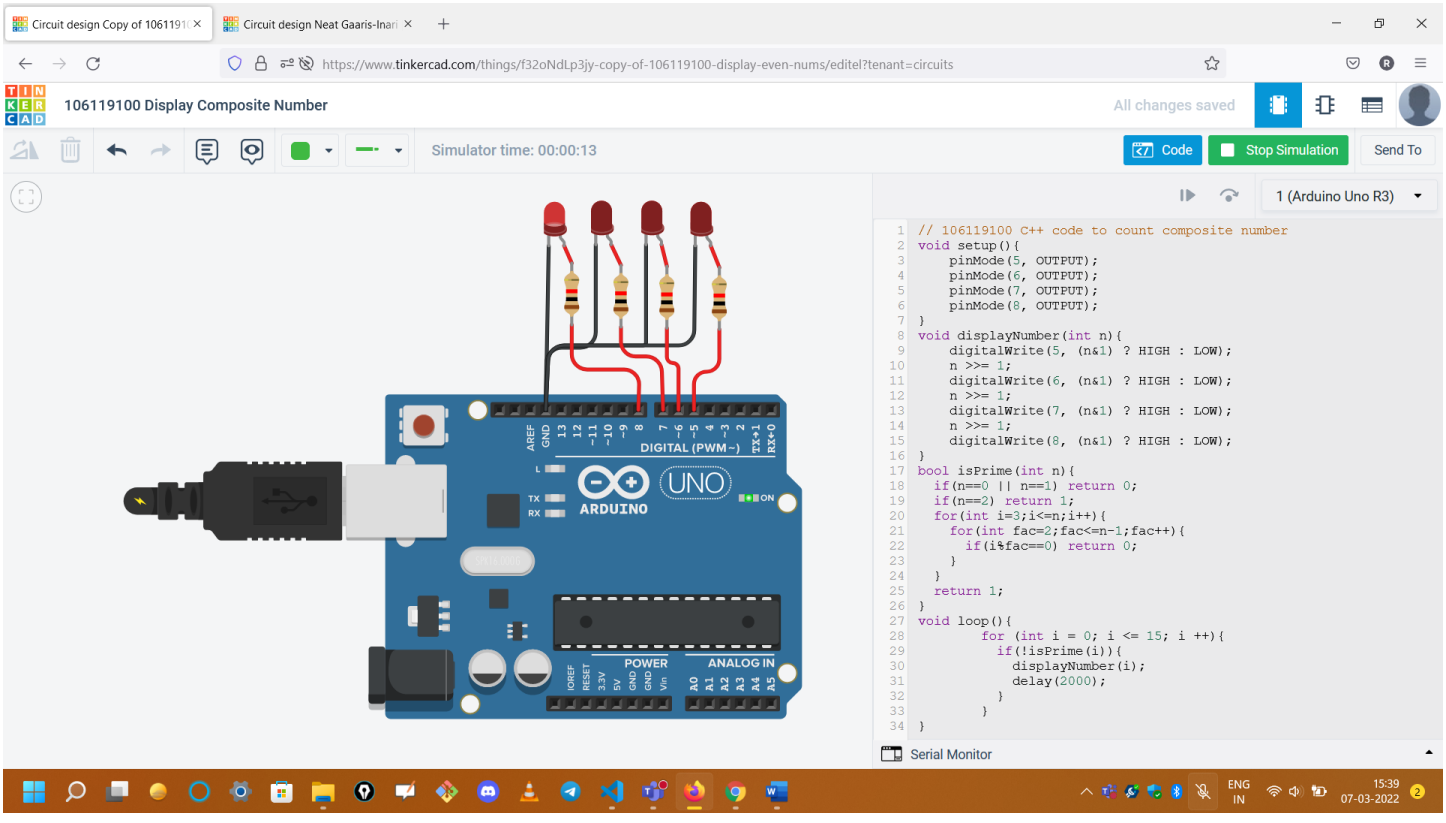
4. Blink LEDs – for all composite number below 15.

Code:

```
// 106119100 C++ code to count composite number
void setup()
{
    pinMode(5, OUTPUT);
    pinMode(6, OUTPUT);
    pinMode(7, OUTPUT);
    pinMode(8, OUTPUT);
}
void displayNumber(int n)
{
    digitalWrite(5, (n & 1) ? HIGH : LOW);
    n >>= 1;
    digitalWrite(6, (n & 1) ? HIGH : LOW);
    n >>= 1;
    digitalWrite(7, (n & 1) ? HIGH : LOW);
    n >>= 1;
    digitalWrite(8, (n & 1) ? HIGH : LOW);
}
bool isPrime(int n)
{
    if (n == 0 || n == 1)
        return 0;
    if (n == 2)
        return 1;
    for (int i = 3; i <= n; i++)
    {
        for (int fac = 2; fac <= n - 1; fac++)
        {
            if (i % fac == 0)
                return 0;
        }
    }
```

```
    return 1;
}
void loop()
{
    for (int i = 0; i <= 15; i++)
    {
        if (!isPrime(i))
        {
            displayNumber(i);
            delay(2000);
        }
    }
}
```

Output:

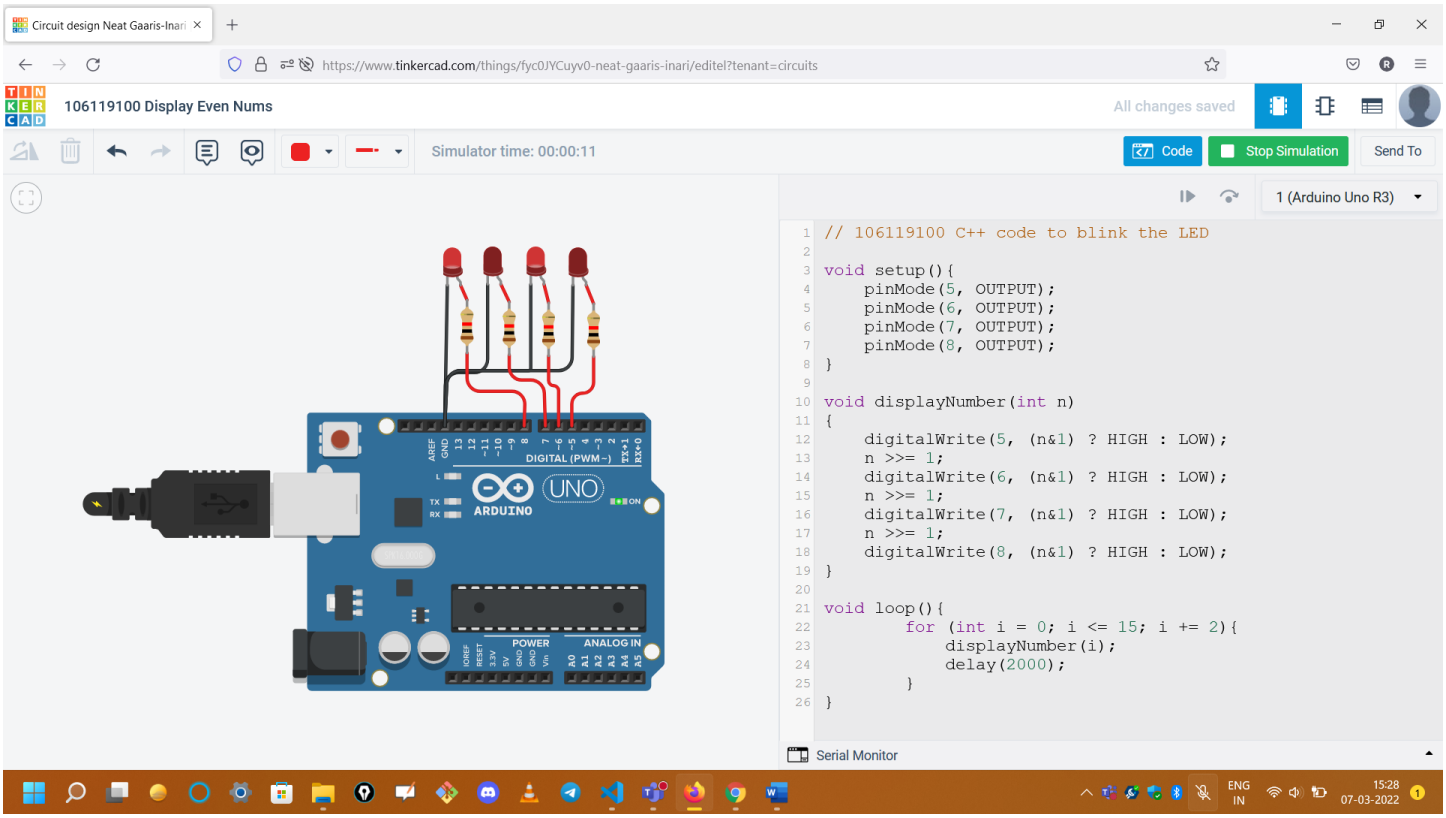


5. Blink LEDs – to count even numbers

Code:

```
// 106119100 C++ code to blink the LED

void setup()
{
    pinMode(5, OUTPUT);
    pinMode(6, OUTPUT);
    pinMode(7, OUTPUT);
    pinMode(8, OUTPUT);
}

void displayNumber(int n)
{
    digitalWrite(5, (n & 1) ? HIGH : LOW);
    n >>= 1;
    digitalWrite(6, (n & 1) ? HIGH : LOW);
    n >>= 1;
    digitalWrite(7, (n & 1) ? HIGH : LOW);
    n >>= 1;
    digitalWrite(8, (n & 1) ? HIGH : LOW);
}

void loop()
{
    for (int i = 0; i <= 15; i += 2)
    {
        displayNumber(i);
        delay(2000);
    }
}
```

Output:


Circuit design Neat Gaaris-Inari
https://www.tinkercad.com/things/fyc0JYCuyv0-neat-gaaris-inari/editel?tenant=circuits
106119100 Display Even Nums
All changes saved
Simulator time: 00:00:11
Code
Stop Simulation
Send To
1 (Arduino Uno R3)
// 106119100 C++ code to blink the LED
void setup(){
pinMode(5, OUTPUT);
pinMode(6, OUTPUT);
pinMode(7, OUTPUT);
pinMode(8, OUTPUT);
}
void displayNumber(int n)
{
digitalWrite(5, (n&1) ? HIGH : LOW);
n >>= 1;
digitalWrite(6, (n&1) ? HIGH : LOW);
n >>= 1;
digitalWrite(7, (n&1) ? HIGH : LOW);
n >>= 1;
digitalWrite(8, (n&1) ? HIGH : LOW);
}
void loop(){
for (int i = 0; i <= 15; i += 2){
displayNumber(i);
delay(2000);
}
}
Serial Monitor
DIGITAL (PWM~)
ARDUINO
UNO
POWER
ANALOG IN
ENG
IN
15:28
07-03-2022

Date : 28/03/2022

CSLR61 : EMBEDDED SYSTEMS
LAB-6

Roll no. : **106119100**

Name : **Rajneesh Pandey**

Section : **CSE-B**

1. Interface an ultrasonic sensor and display the distance measured in a screen and glow red, blue and green led if the distance is close, moderate and far respectively. Play different tones for different cases.

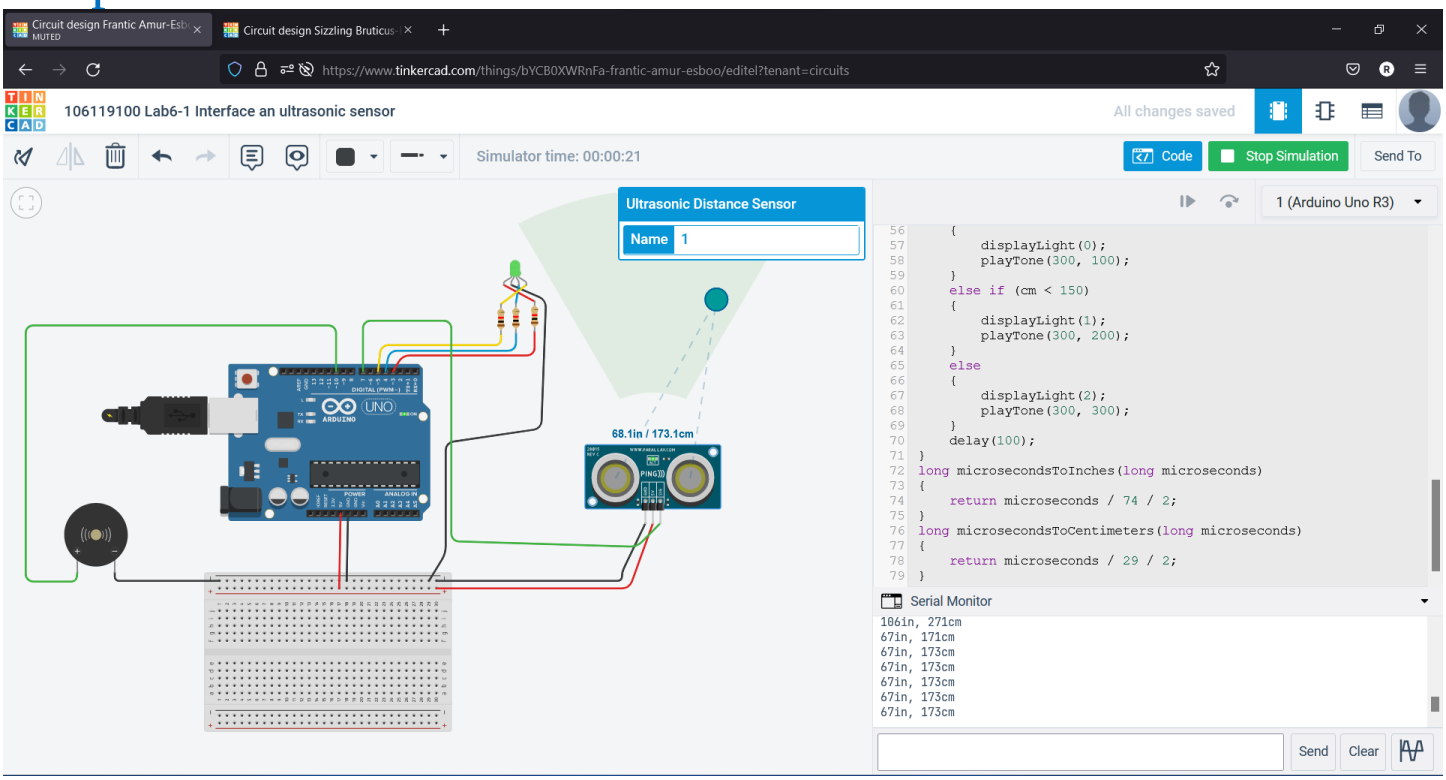
Code

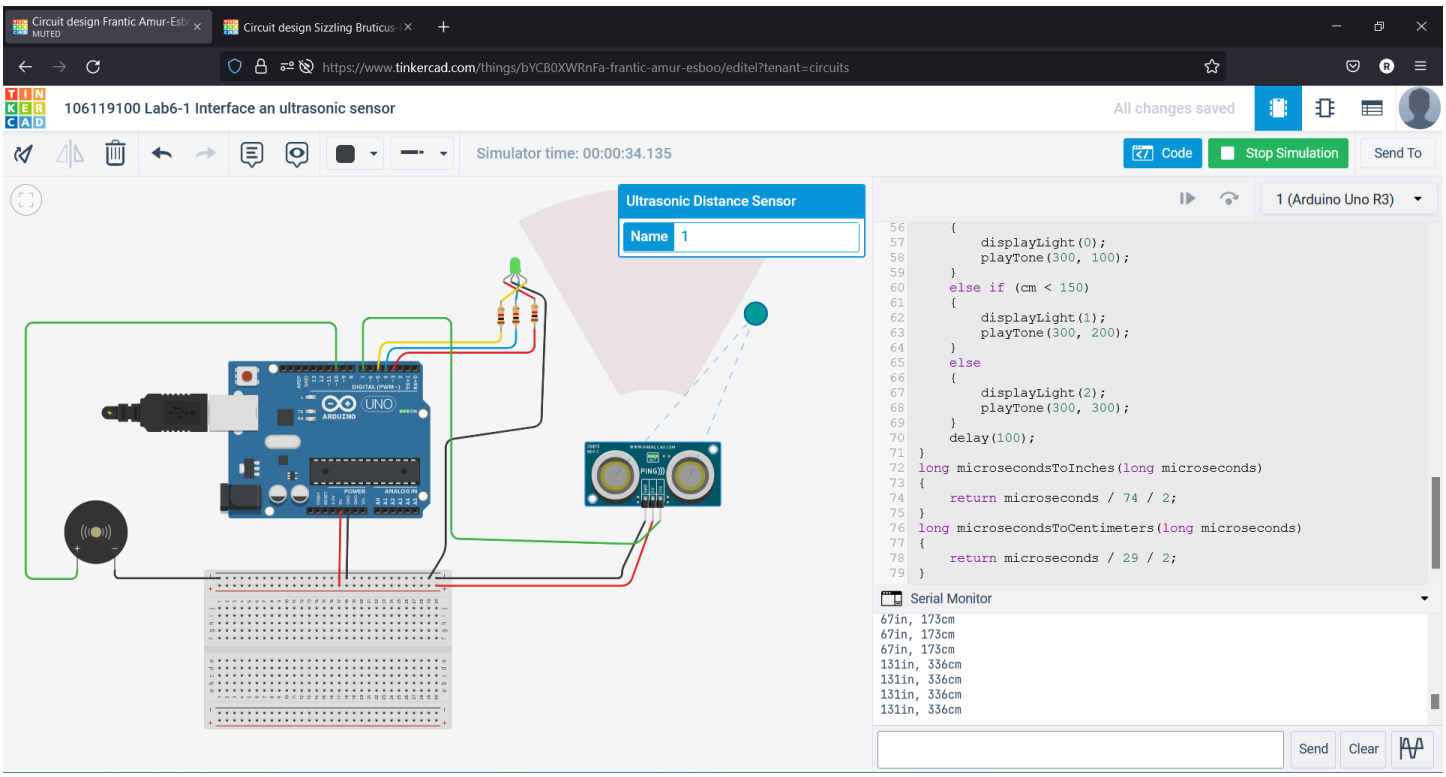
```
// 106119100 Lab6-1 Interface an ultrasonic sensor

#define F(x) x ? HIGH : LOW
const int red = 3;
const int blue = 4;
const int green = 5;
const int speaker = 10;
const int ping = 7;

void setup()
{
    // initialize serial communication:
    Serial.begin(9600);
    pinMode(red, OUTPUT);
    pinMode(blue, OUTPUT);
    pinMode(green, OUTPUT);
    pinMode(speaker, OUTPUT);
}
void displayLight(int code)
{
    digitalWrite(red, F(code == 0));
    digitalWrite(blue, F(code == 1));
    digitalWrite(green, F(code == 2));
}
void playTone(long duration, int freq)
{
    duration *= 1000;
    int period = (1.0 / freq) * 100000;
    long elapsed_time = 0;
```

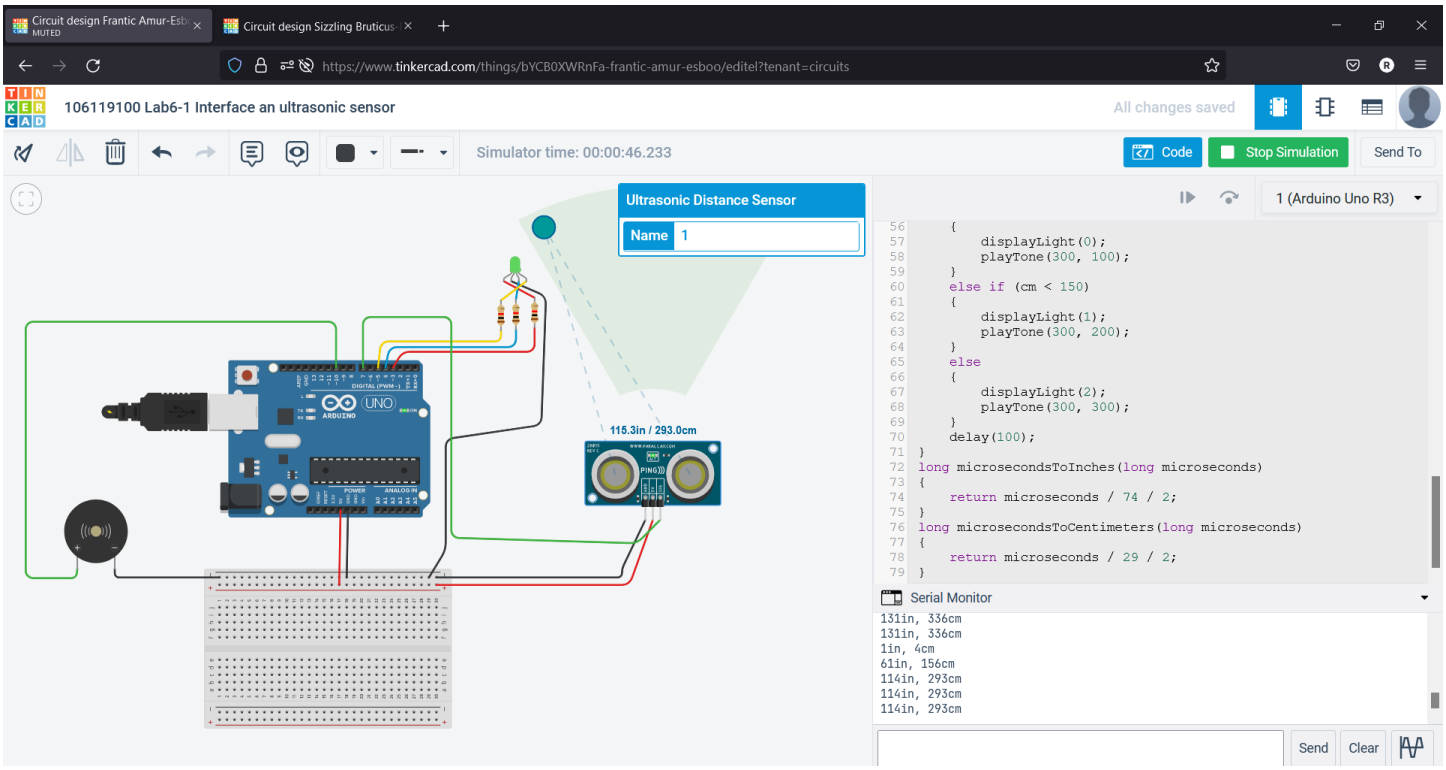
```
    while (elapsed_time < duration)
    {
        digitalWrite(speaker, HIGH);
        delayMicroseconds(period / 2);
        digitalWrite(speaker, LOW);
        delayMicroseconds(period / 2);
        elapsed_time += (period);
    }
}
void loop()
{
    long duration, inches, cm;
    pinMode(ping, OUTPUT);
    digitalWrite(ping, LOW);
    delayMicroseconds(2);
    digitalWrite(ping, HIGH);
    delayMicroseconds(5);
    digitalWrite(ping, LOW);
    pinMode(ping, INPUT);
    duration = pulseIn(ping, HIGH);
    inches = microsecondsToInches(duration);
    cm = microsecondsToCentimeters(duration);
    Serial.print(inches);
    Serial.print("in, ");
    Serial.print(cm);
    Serial.print("cm");
    Serial.println();
    if (cm < 50)
    {
        displayLight(0);
        playTone(300, 100);
    }
    else if (cm < 150)
    {
```

```
        displayLight(1);
        playTone(300, 200);
    }
    else
    {
        displayLight(2);
        playTone(300, 300);
    }
    delay(100);
}
long microsecondsToInches(long microseconds)
{
    return microseconds / 74 / 2;
}
long microsecondsToCentimeters(long microseconds)
{
    return microseconds / 29 / 2;
}
```

Output


Circuit design Frantic Amur-Esb
MUTED
Circuit design Sizzling Bruticus
https://www.tinkercad.com/things/bYCB0XWRnFa-frantic-amur-esboo/editel?tenant=circuits
106119100 Lab6-1 Interface an ultrasonic sensor
All changes saved
Simulator time: 00:00:21
Code
Stop Simulation
Send To
Ultrasonic Distance Sensor
Name 1
68.1in / 173.1cm
1 (Arduino Uno R3)
Serial Monitor
106in, 271cm
67in, 171cm
67in, 173cm
67in, 173cm
67in, 173cm
67in, 173cm
67in, 173cm
Send
Clear


Circuit design Frantic Amur-Esb
MUTED
Circuit design Sizzling Bruticus
https://www.tinkercad.com/things/bYCB0XWRnFa-frantic-amur-esboo/editel?tenant=circuits
106119100 Lab6-1 Interface an ultrasonic sensor
All changes saved
Simulator time: 00:00:34.135
Code
Stop Simulation
Send To
Ultrasonic Distance Sensor
Name 1
1 (Arduino Uno R3)
Serial Monitor
67in, 173cm
67in, 173cm
67in, 173cm
131in, 336cm
131in, 336cm
131in, 336cm
131in, 336cm
Send
Clear



2. Interface a PIR sensor with Arduino and blink a led if any movement is captured by the sensor and count the number of movements. Make a buzzer when movement detected

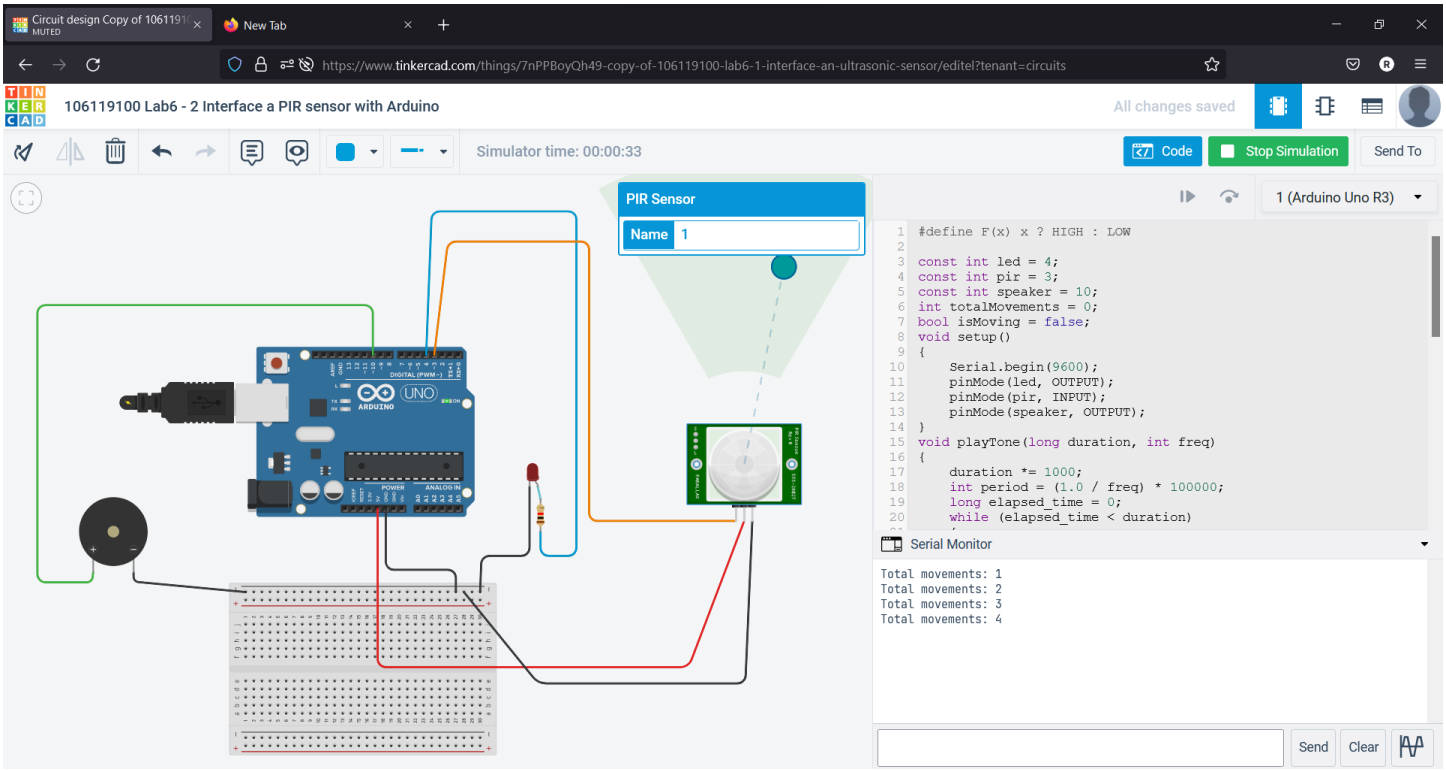
Code:

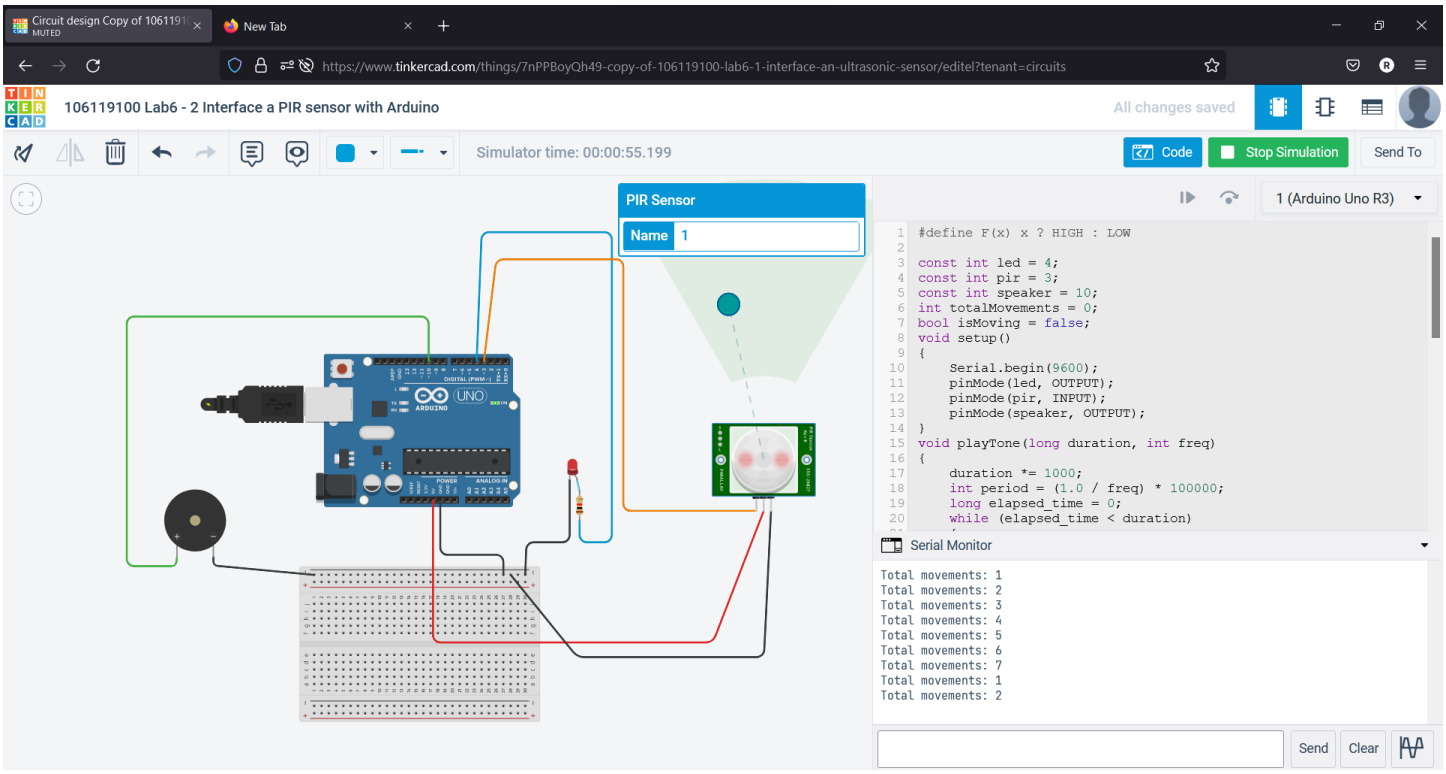
```
// 106119100 Interface a PIR sensor with Arduino
#define F(x) x ? HIGH : LOW
const int led = 4;
const int pir = 3;
const int speaker = 10;
int totalMovements = 0;
bool isMoving = false;
void setup()
{
    Serial.begin(9600);
    pinMode(led, OUTPUT);
    pinMode(pir, INPUT);
```

```
    pinMode(speaker, OUTPUT);
}
void playTone(long duration, int freq)
{
    duration *= 1000;
    int period = (1.0 / freq) * 100000;
    long elapsed_time = 0;
    while (elapsed_time < duration)
    {
        digitalWrite(speaker, HIGH);
        delayMicroseconds(period / 2);
        digitalWrite(speaker, LOW);
        delayMicroseconds(period / 2);
        elapsed_time += (period);
    }
}
void loop()
{
    int pirStat = digitalRead(pir);
    if (pirStat == HIGH)
    {
        if (!isMoving)
        {
            playTone(300, 300);
            totalMovements += 1;
            Serial.print("Total movements: ");
            Serial.print(totalMovements);
            Serial.print("\n");
            isMoving = true;
        }
        digitalWrite(led, HIGH);
    }
    else
    {
```

```
        isMoving = false;
        digitalWrite(led, LOW);
    }
}
```

Output:




Circuit design Copy of 106119100 Lab6 - 2 Interface a PIR sensor with Arduino
New Tab
https://www.tinkercad.com/things/7nPPBoyQh49-copy-of-106119100-lab6-1-interface-an-ultrasonic-sensor/editel?tenant=circuits
106119100 Lab6 - 2 Interface a PIR sensor with Arduino
All changes saved
Simulator time: 00:00:55.199
Code
Stop Simulation
Send To
PIR Sensor
Name 1
1 (Arduino Uno R3)
#define F(x) x ? HIGH : LOW
const int led = 4;
const int pir = 3;
const int speaker = 10;
int totalMovements = 0;
bool isMoving = false;
void setup()
{
Serial.begin(9600);
pinMode(led, OUTPUT);
pinMode(pir, INPUT);
pinMode(speaker, OUTPUT);
}
void playTone(long duration, int freq)
{
duration *= 1000;
int period = (1.0 / freq) * 100000;
long elapsed_time = 0;
while (elapsed_time < duration)
Serial Monitor
Total movements: 1
Total movements: 2
Total movements: 3
Total movements: 4
Total movements: 5
Total movements: 6
Total movements: 7
Total movements: 1
Total movements: 2
Send
Clear