

**Name: Laiba Fatima**

**Reg# 23-ntu-cs-1257**

## Code:

```
/*
```

```
Project Title: Dual LED Toggle using External Interrupts with Timer Debouncing
```

```
Name: Laiba Fatima
```

```
Registration No: [23-ntu-cs-1257]
```

```
Course: Embedded Systems (ESP32 - Wokwi Project)
```

```
*/
```

```
#include <Arduino.h>
```

```
#define LED1_PIN 2
```

```
#define LED2_PIN 5
```

```
#define BUTTON1_PIN 4
```

```
#define BUTTON2_PIN 18
```

```
#define DEBOUNCE_MS 50  
#define DEBOUNCE_US (DEBOUNCE_MS * 1000UL)
```

```
hw_timer_t *debounceTimer1 = NULL;
```

```
hw_timer_t *debounceTimer2 = NULL;
```

```
volatile bool debounceActive1 = false;
```

```
volatile bool debounceActive2 = false;
```

```
void ARDUINO_ISR_ATTR onDebounceTimer1() {  
    if (digitalRead(BUTTON1_PIN) == LOW) {  
        digitalWrite(LED1_PIN, !digitalRead(LED1_PIN));  
    }  
    debounceActive1 = false;  
}
```

```
void ARDUINO_ISR_ATTR onDebounceTimer2() {  
    if (digitalRead(BUTTON2_PIN) == LOW) {  
        digitalWrite(LED2_PIN, !digitalRead(LED2_PIN));  
    }  
    debounceActive2 = false;  
}
```

```
void ARDUINO_ISR_ATTR onButton1Press() {  
    if (!debounceActive1) {  
        debounceActive1 = true;
```

```
    timerAlarm(debounceTimer1, DEBOUNCE_US, false, 0);  
}  
}
```

```
void ARDUINO_ISR_ATTR onButton2Press() {  
    if (!debounceActive2) {  
        debounceActive2 = true;  
        timerAlarm(debounceTimer2, DEBOUNCE_US, false, 0);  
    }  
}
```

```
void setup() {  
    Serial.begin(115200);
```

```
    pinMode(LED1_PIN, OUTPUT);  
    pinMode(LED2_PIN, OUTPUT);  
    digitalWrite(LED1_PIN, LOW);  
    digitalWrite(LED2_PIN, LOW);
```

```
    pinMode(BUTTON1_PIN, INPUT_PULLUP);  
    pinMode(BUTTON2_PIN, INPUT_PULLUP);
```

```
    attachInterrupt(BUTTON1_PIN, onButton1Press, FALLING);  
    attachInterrupt(BUTTON2_PIN, onButton2Press, FALLING);
```

```
debounceTimer1 = timerBegin(1000000);
```

```
debounceTimer2 = timerBegin(1000000);
```

```
timerAttachInterrupt(debounceTimer1, &onDebounceTimer1);
```

```
timerAttachInterrupt(debounceTimer2, &onDebounceTimer2);
```

```
Serial.println("System Ready - Press Buttons to Toggle LEDs");
```

```
}
```

```
void loop() {
```

```
}
```

Wokwi - Online ESP32, STM32

wokwi.com/projects/444347267945778177

WOKWI SAVE SHARE 23-ntu-cs-1257(IOT Hometask3) Docs

sketch.ino diagram.json Library Manager

Simulation 01:50.192 96%

```
1 /*
2  Project Title: Dual LED Toggle using External Interrupts with Timer Debouncing
3  Name: Laiba Fatima
4  Registration No: [23-ntu-cs-1257]
5  Course: Embedded Systems (ESP32 - Wokwi Project)
6  */
7
8  #include <Arduino.h>
9
10 #define LED1_PIN 2
11 #define LED2_PIN 5
12 #define BUTTON1_PIN 4
13 #define BUTTON2_PIN 18
14 #define DEBOUNCE_MS 50
15 #define DEBOUNCE_US (DEBOUNCE_MS * 1000UL)
16
17
18 hw_timer_t *debounceTimer1 = NULL;
19 hw_timer_t *debounceTimer2 = NULL;
20
21
22 volatile bool debounceActive1 = false;
23 volatile bool debounceActive2 = false;
24
25
26
27 void ARDUINO_ISR_ATTR onDebounceTimer1() {
28   if (digitalRead(BUTTON1_PIN) == LOW) {
29     digitalWrite(LED1_PIN, !digitalRead(LED1_PIN));
30   }
31   debounceActive1 = false;
```

(POWERON\_RESET),boot:0x13 (SPI\_FAST\_FLASH\_BOOT)

7:59 PM 10/9/2025

Wokwi - Online ESP32, STM32

wokwi.com/projects/444347267945778177

WOKWI SAVE SHARE 23-ntu-cs-1257(IOT Hometask3) Docs

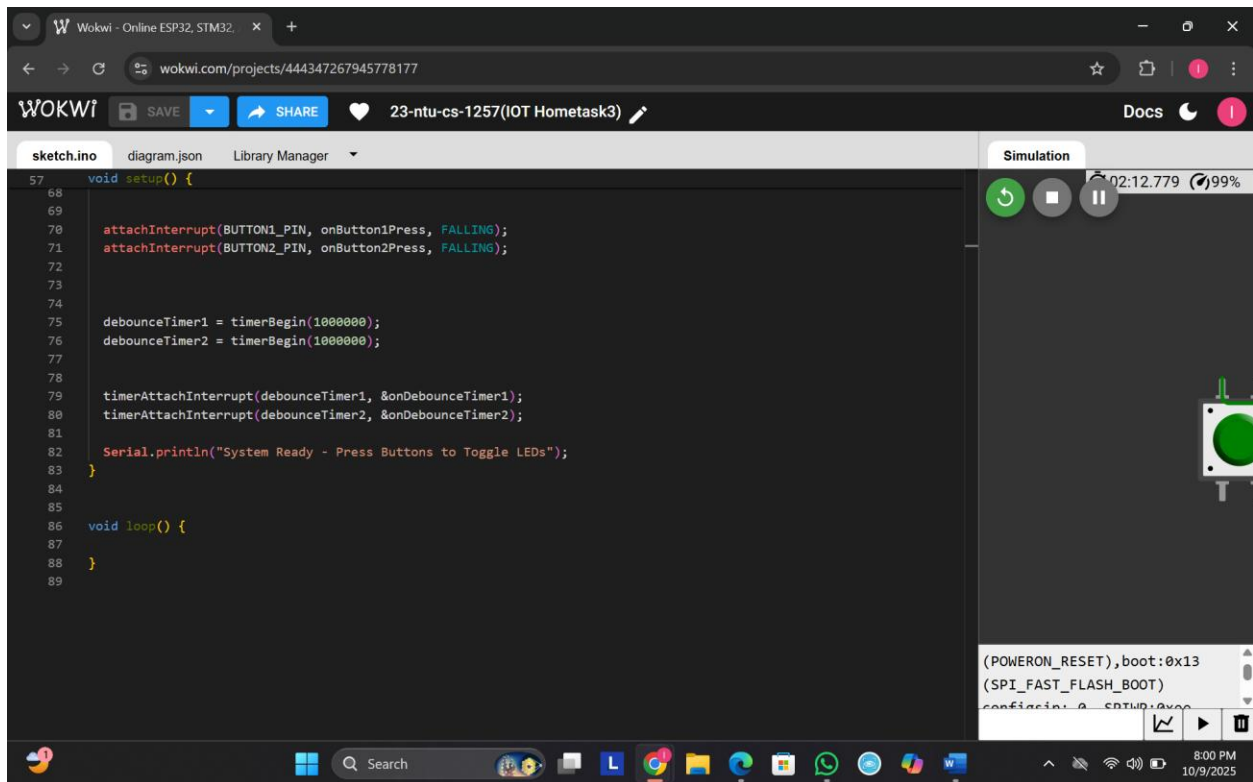
sketch.ino diagram.json Library Manager

Simulation 02:05.085 95%

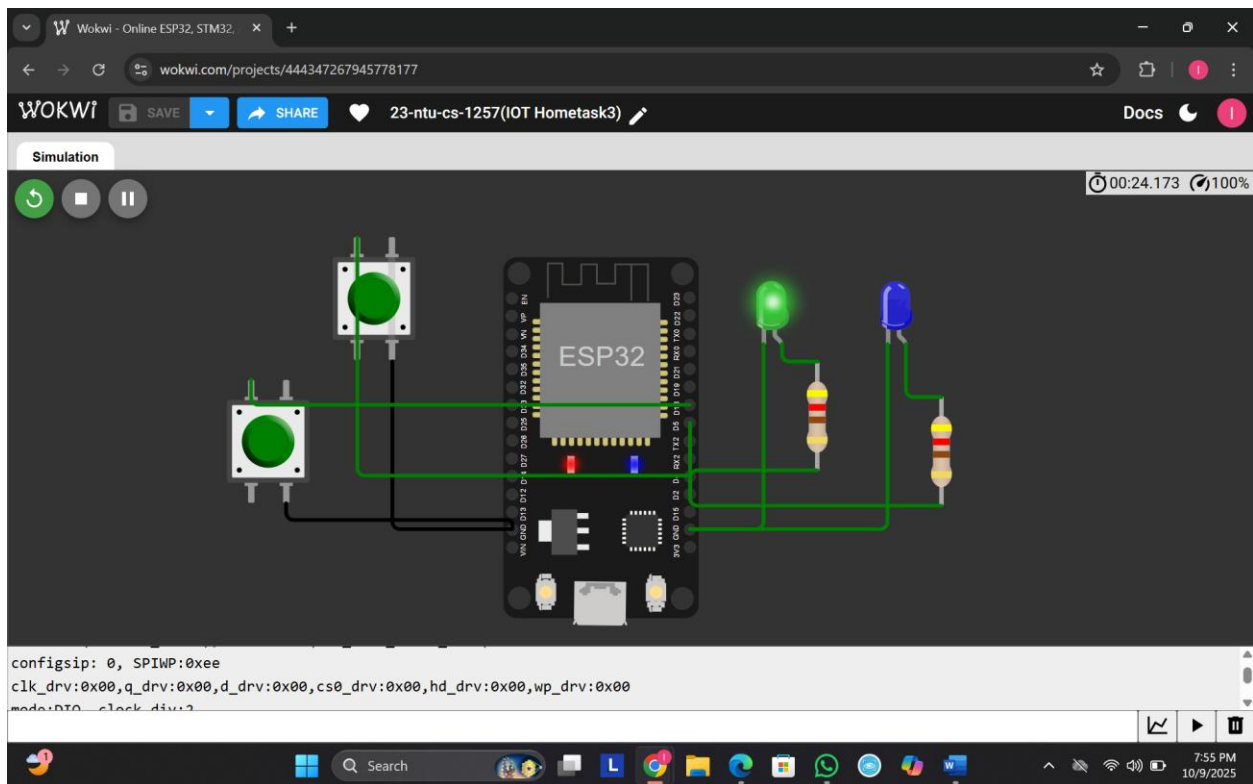
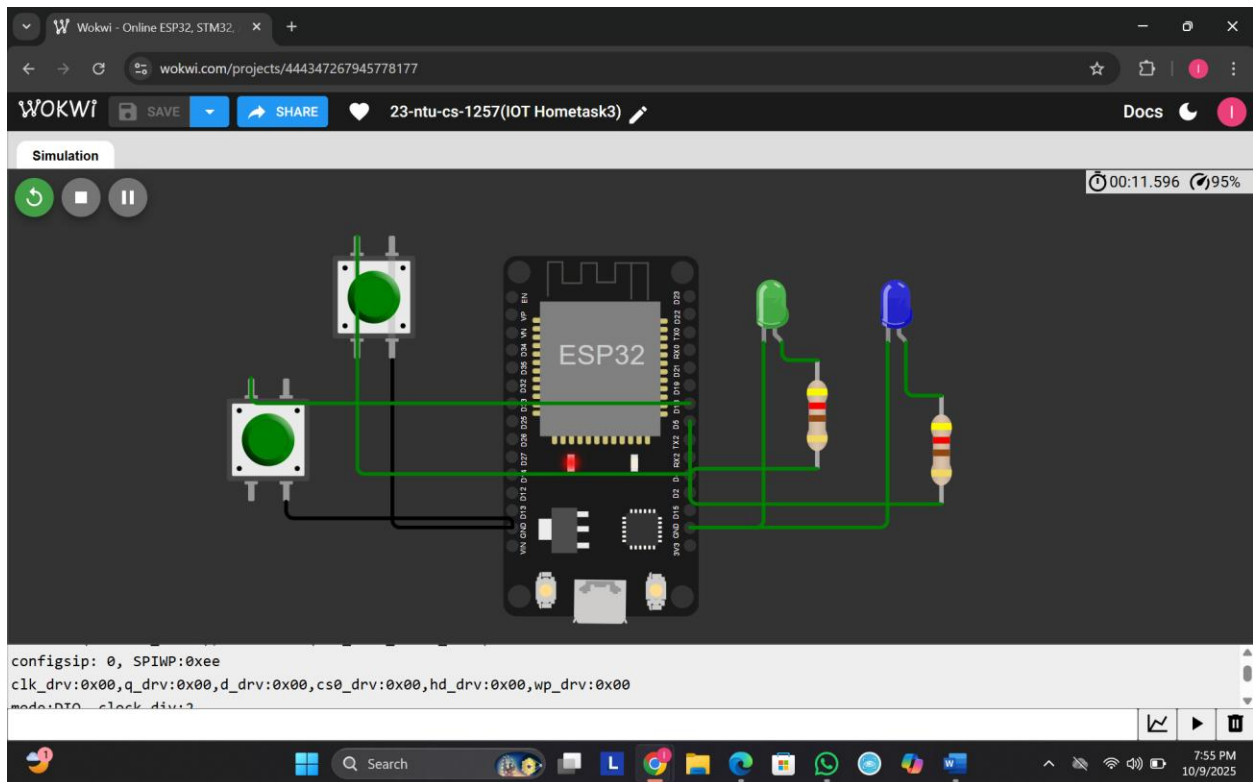
```
35 void ARDUINO_ISR_ATTR onDebounceTimer2() {
36
37 }
38
39
40
41
42
43 void ARDUINO_ISR_ATTR onButton1Press() {
44   if (!debounceActive1) {
45     debounceActive1 = true;
46     timerAlarm(debounceTimer1, DEBOUNCE_US, false, 0);
47   }
48 }
49
50 void ARDUINO_ISR_ATTR onButton2Press() {
51   if (!debounceActive2) {
52     debounceActive2 = true;
53     timerAlarm(debounceTimer2, DEBOUNCE_US, false, 0);
54   }
55 }
56
57 void setup() {
58   Serial.begin(115200);
59
60   pinMode(LED1_PIN, OUTPUT);
61   pinMode(LED2_PIN, OUTPUT);
62   digitalWrite(LED1_PIN, LOW);
63   digitalWrite(LED2_PIN, LOW);
64
65
66   pinMode(BUTTON1_PIN, INPUT_PULLUP);
67   pinMode(BUTTON2_PIN, INPUT_PULLUP);
68
69 }
```

(POWERON\_RESET),boot:0x13 (SPI\_FAST\_FLASH\_BOOT)

7:59 PM 10/9/2025



**Working:**



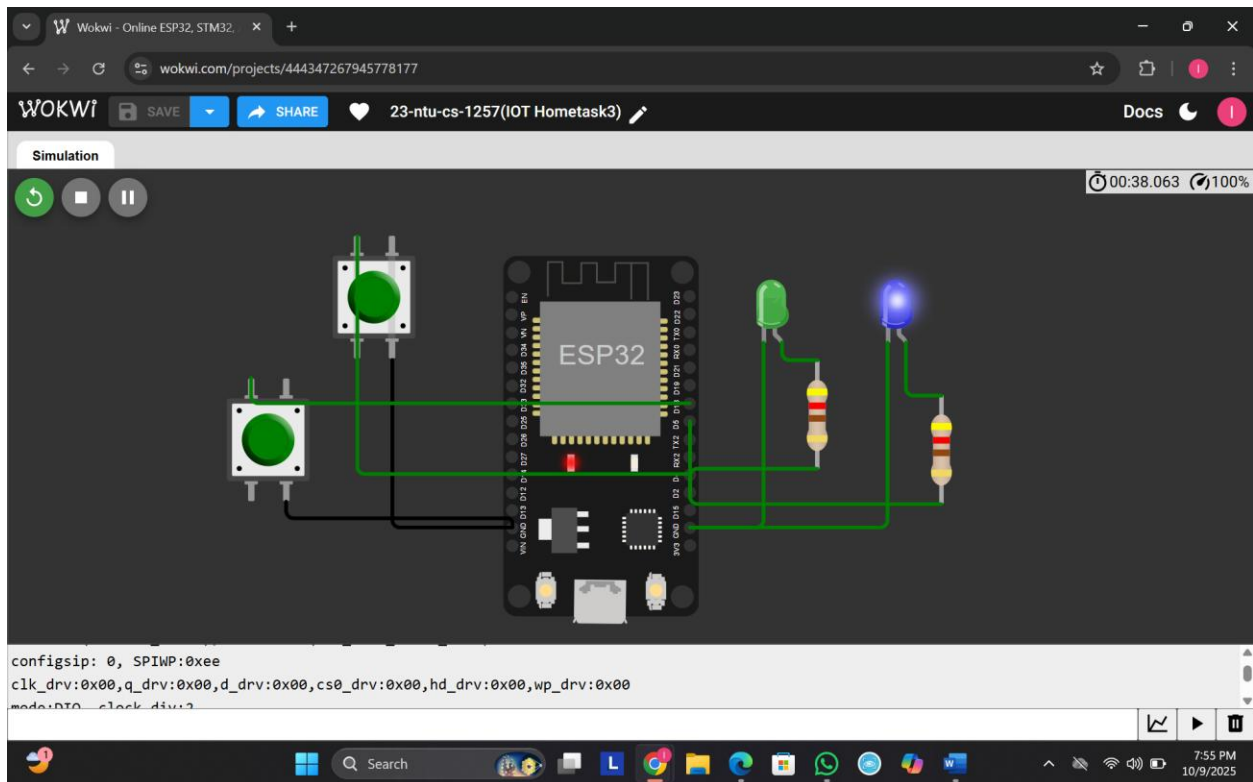
Wokwi - Online ESP32, STM32

wokwi.com/projects/444347267945778177

WOKWI SAVE SHARE 23-ntu-cs-1257(IOT Hometask3) Docs

Simulation

00:38.063 100%



configsip: 0, SPIWP:0xee  
clk\_drv:0x00,q\_drv:0x00,d\_drv:0x00,cs0\_drv:0x00,hd\_drv:0x00,wp\_drv:0x00  
mode=DIO\_clock\_div=2

7:55 PM 10/9/2025

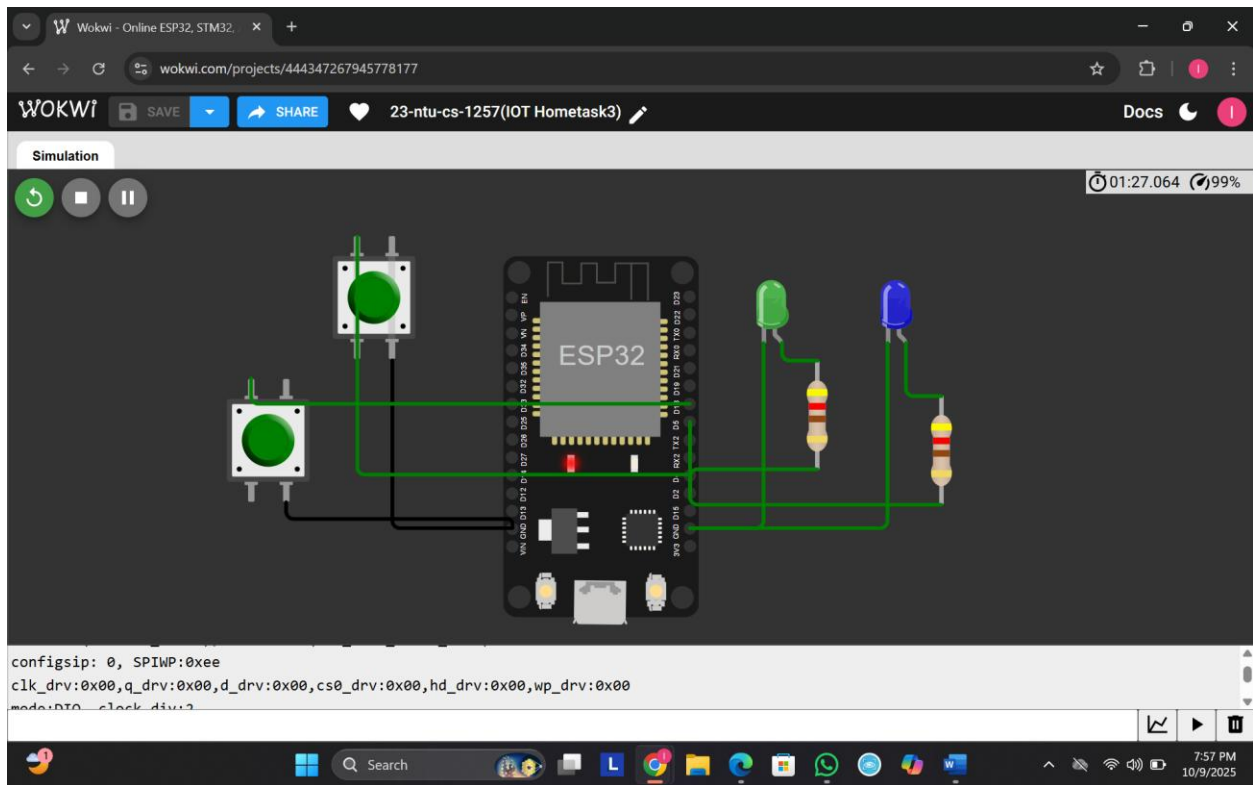
Wokwi - Online ESP32, STM32

wokwi.com/projects/444347267945778177

WOKWI SAVE SHARE 23-ntu-cs-1257(IOT Hometask3) Docs

Simulation

01:27.064 99%



configsip: 0, SPIWP:0xee  
clk\_drv:0x00,q\_drv:0x00,d\_drv:0x00,cs0\_drv:0x00,hd\_drv:0x00,wp\_drv:0x00  
mode=DIO\_clock\_div=2

7:57 PM 10/9/2025