National Textile University, Faisalabad

Department of Computer Science

Name:	Muhammad Abdullah
Class:	BSCS-B
Registration No:	23-NTU-CS-1056
Lab Report:	Embedded IoT Systems
Course Code:	
Course Name:	Embedded IoT Systems
Submitted To:	Sir Nasir
Submission Date:	09-10-2025

HOME TASK

Code:

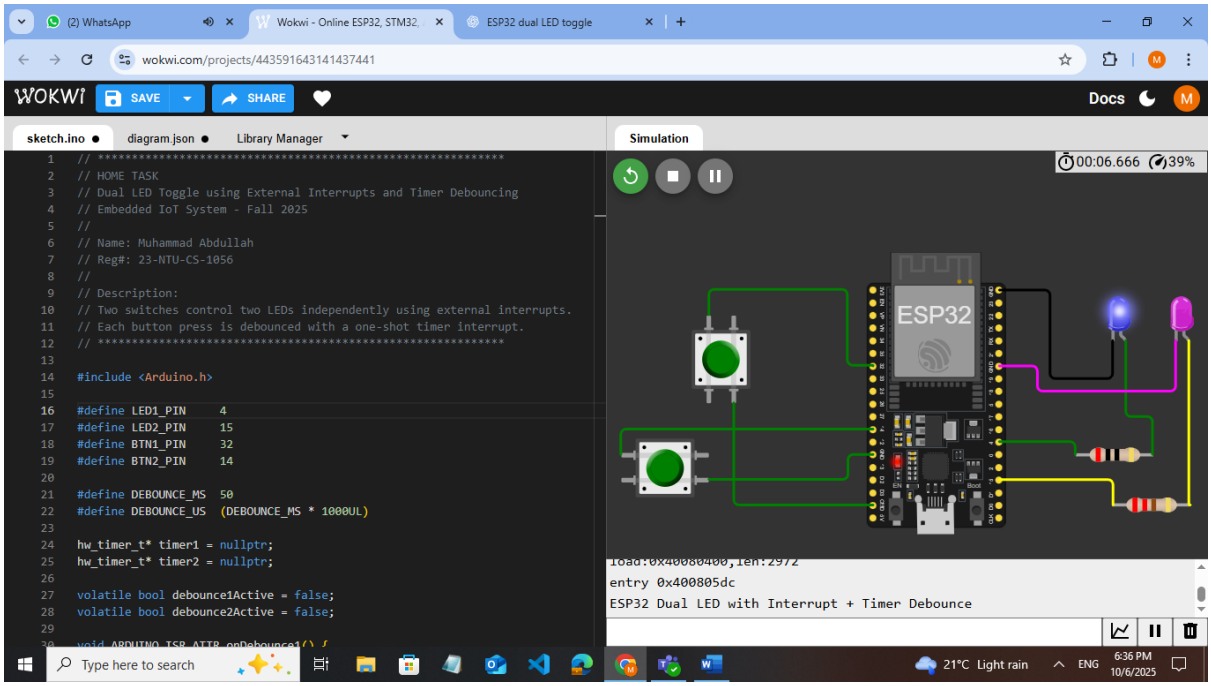
```
// ************************************************************
// HOME TASK
// Dual LED Toggle using External Interrupts and Timer Debouncing
// Embedded IoT System - Fall 2025
//
// Name: Muhammad Abdullah
// Reg#: 23-NTU-CS-1056
//
// Description:
// Two switches control two LEDs independently using external interrupts.
// Each button press is debounced with a one-shot timer interrupt.
// ************************************************************

#include <Arduino.h>

#define LED1_PIN    4
#define LED2_PIN    15
#define BTN1_PIN    32
#define BTN2_PIN    14

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

hw_timer_t* timer1 = nullptr;
hw_timer_t* timer2 = nullptr;
```

```
volatile bool debounce1Active = false;
volatile bool debounce2Active = false;

void ARDUINO_ISR_ATTR onDebounce1() {
  if (digitalRead(BTN1_PIN) == LOW) {
    digitalWrite(LED1_PIN, !digitalRead(LED1_PIN));
  }
  debounce1Active = false;
}

void ARDUINO_ISR_ATTR onDebounce2() {
  if (digitalRead(BTN2_PIN) == LOW) {
    digitalWrite(LED2_PIN, !digitalRead(LED2_PIN));
  }
  debounce2Active = false;
}

void ARDUINO_ISR_ATTR onButton1() {
  if (!debounce1Active) {
    debounce1Active = true;
    timerAlarm(timer1, DEBOUNCE_US, false, 0);
  }
}

void ARDUINO_ISR_ATTR onButton2() {
  if (!debounce2Active) {
    debounce2Active = true;
```

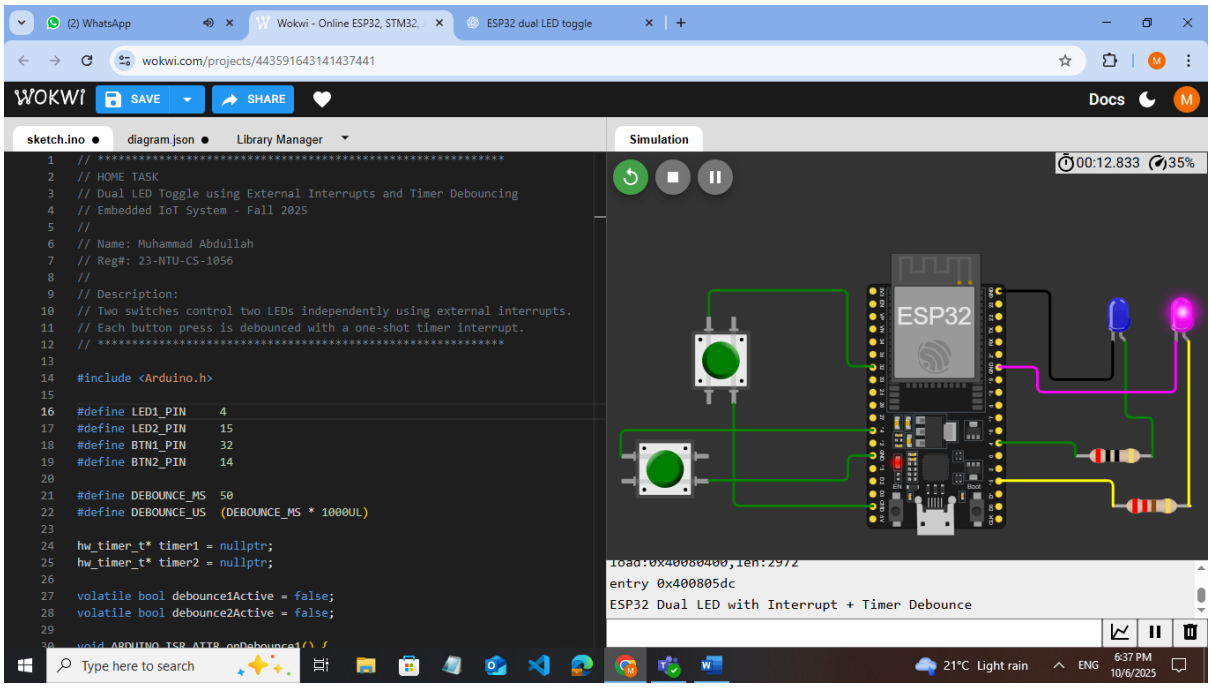
```
    timerAlarm(timer2, DEBOUNCE_US, false, 0);
  }
}

void setup() {
  Serial.begin(115200);
  Serial.println("ESP32 Dual LED with Interrupt + Timer Debounce");

  pinMode(LED1_PIN, OUTPUT);
  pinMode(LED2_PIN, OUTPUT);
  pinMode(BTN1_PIN, INPUT_PULLUP);
  pinMode(BTN2_PIN, INPUT_PULLUP);

  digitalWrite(LED1_PIN, LOW);
  digitalWrite(LED2_PIN, LOW);

  timer1 = timerBegin(1000000);
  timerAttachInterrupt(timer1, &onDebounce1);

  timer2 = timerBegin(1000000);
  timerAttachInterrupt(timer2, &onDebounce2);

  attachInterrupt(BTN1_PIN, onButton1, FALLING);
  attachInterrupt(BTN2_PIN, onButton2, FALLING);
}

void loop() {
```

```
}
```

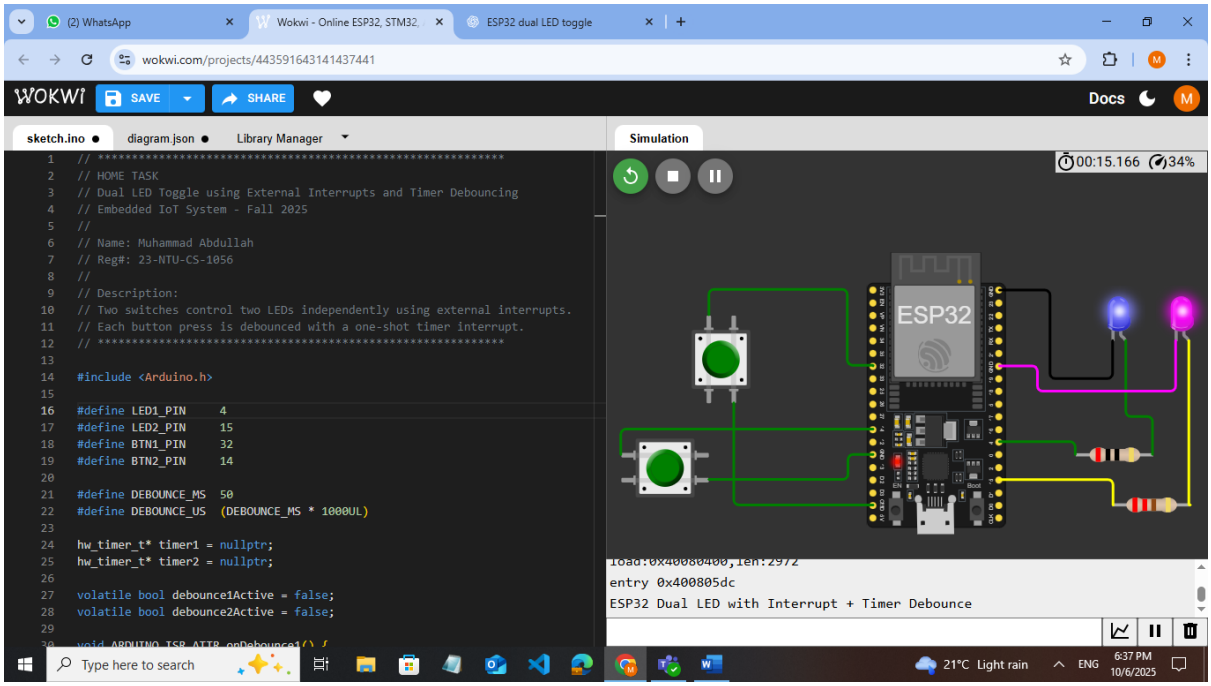
Pictures:




```
// ***************************************************************
// HOME TASK
// Dual LED Toggle using External Interrupts and Timer Debouncing
// Embedded IoT System - Fall 2025
//
// Name: Muhammad Abdullah
// Reg#: 23-NTU-CS-1056
//
// Description:
// Two switches control two LEDs independently using external interrupts.
// Each button press is debounced with a one-shot timer interrupt.
// ***************************************************************

#include <Arduino.h>

#define LED1_PIN     4
#define LED2_PIN     15
#define BTN1_PIN     32
#define BTN2_PIN     14

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

hw_timer_t* timer1 = nullptr;
hw_timer_t* timer2 = nullptr;

volatile bool debounce1Active = false;
volatile bool debounce2Active = false;

void ARDUINO_ISR_ATTR onDebounce1() {
```




```
// ***************************************************************
// HOME TASK
// Dual LED Toggle using External Interrupts and Timer Debouncing
// Embedded IoT System - Fall 2025
//
// Name: Muhammad Abdullah
// Reg#: 23-NTU-CS-1056
//
// Description:
// Two switches control two LEDs independently using external interrupts.
// Each button press is debounced with a one-shot timer interrupt.
// ***************************************************************

#include <Arduino.h>

#define LED1_PIN     4
#define LED2_PIN     15
#define BTN1_PIN     32
#define BTN2_PIN     14

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

hw_timer_t* timer1 = nullptr;
hw_timer_t* timer2 = nullptr;

volatile bool debounce1Active = false;
volatile bool debounce2Active = false;

void ARDUINO_ISR_ATTR onDebounce1() {
```



Wokwi Link:

https://wokwi.com/projects/444071227258133505