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Department of Computer Science

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Semester and Section	BS CS 5th A
Assignment no:	01 Task 3 Part 1
Course :	EM-IOT
Submitted to:	Sir Nasir Mehmood
Submission Date:	10/26/2025

Assignmnet no 1 :

Task 3-part 1 : Implementation of code

Code :

```
#include <Arduino.h>
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>
// OLED SETUP
#define SCREEN_WIDTH 128
#define SCREEN_HEIGHT 64
#define OLED_ADDR 0x3C
Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, -1);

//Pin Map means which Pin are using  for what purpose
#define LED_PIN1 19 // First LED_Pin 1
#define LED_PIN2 18 // Second LED_Pin 2
#define LED_PIN3 15  // PWM LED_PIN 3  (fading)
#define BTN1_MODE 4// Button 1 For mode change
#define BTN2_RESET 5 // Reset Button

// Variables like volatile ,uint8_t type
volatile bool modeBtn1Pressed = false;
volatile bool resetBtn2Pressed = false;
//Debounce variable
uint8_t mode = 0;         //current operating mode upto  0 to 3
unsigned long lastDebounce = 0; // last debounce time
const unsigned long debounceDelay = 200; // debounce delay
```

```
//Blink variable for alternate blink
unsigned long blinkTimer = 0;// Previous Blink value for blink control
const unsigned long blinkInterval = 500; // Blinl delay
//For PWM fade
int fadeValue = 0;// current brightness 0-255
int fadeDir = 1;//direction of fade as (1=up, -1=down)


// To Handle the ISR For t te function and Handle the button pressed
debounce
void handleMode() {
  unsigned long now = millis();
  if (now - lastDebounce > debounceDelay) {
    modeBtn1Pressed = true;
    lastDebounce = now;
  }
}
//For reset Button handle debounce
void handleReset() {
  unsigned long now = millis();
  if (now - lastDebounce > debounceDelay) {
    resetBtn2Pressed = true;
    lastDebounce = now;
  }
}
//OLED SETUP To display Different Led states ON OLED
void updateOLED(const String &line1, const String &line2 = "",const
String &line3 = "") {
```

```
  display.clearDisplay();
  display.setTextSize(1);
  display.setTextColor(SSD1306_WHITE);
  int yPos = 0;
  display.setCursor(0, yPos);
  display.println(line1);
  yPos += 15; // Move down for next line
  if (line2 != "") {
    display.setTextSize(1);
    display.setCursor(0, yPos);
    display.println(line2);
    yPos += 15; // Move down to further next line
  }
   if (line3 != "") {
    display.setTextSize(1);
    display.setCursor(0, yPos);
   }
  display.display();
}
//Button pressed modes which result to different led states
void setMode(uint8_t newMode) {
  mode = newMode;
  analogWrite(LED_PIN3, 0); // stop PWM on LED_PIN3
  switch (mode) {
    case 0: //First case 0 Both OFF
      digitalWrite(LED_PIN1, LOW);
      digitalWrite(LED_PIN2, LOW);
```

```
      updateOLED("Mode 0: Both Leds OFF");
      break;
    case 1: //Second case 1 Alternate Blink
      updateOLED("Mode 1: Alternate Blink for Leds");
      break;
    case 2: // Third case 2 both ON
      digitalWrite(LED_PIN1, HIGH);
      digitalWrite(LED_PIN2, HIGH);
      updateOLED("Mode 2: Both Leds ON");
      break;
    case 3: // Fouth case 3 For third Led PWM fade
      updateOLED("Mode 3: LED3 PWM Fade");
      break;
  }
}
//SETUP
void setup() {
  Serial.begin(115200);
  Wire.begin();
  display.begin(SSD1306_SWITCHCAPVCC, OLED_ADDR);
  display.clearDisplay();
  display.display();

  //Pin mode to proivde input or ouptut
  pinMode(LED_PIN1, OUTPUT);
  pinMode(LED_PIN2, OUTPUT);
  pinMode(LED_PIN3, OUTPUT);
```

```
  pinMode(BTN1_MODE, INPUT_PULLUP);
  pinMode(BTN2_RESET, INPUT_PULLUP);
  //Attach interrupt funtcion call  state falling
  attachInterrupt(digitalPinToInterrupt(BTN1_MODE), handleMode,
FALLING);
  attachInterrupt(digitalPinToInterrupt(BTN2_RESET), handleReset,
FALLING);
  //Intialize system
  setMode(0);
  updateOLED("System Ready");
}


//Loop setup
void loop() {
  //Handling Both button states using if_else
  if (modeBtn1Pressed) {
    modeBtn1Pressed = false;
    mode = (mode + 1) % 4;
    setMode(mode);//set states from o to 3
  }


  if (resetBtn2Pressed) {
    resetBtn2Pressed = false;
    // Show Reset message first
    updateOLED("Reset Button Pressed!", "Returning to Mode 0");
    delay(800); // small delay so user can see message
    setMode(0);// set to 0 state
```

```
  }
  //Led Behaviour handle through button like
  //if case 1 so alternate blink
  if (mode == 1) { // Alternate blink
    if (millis() - blinkTimer >= blinkInterval) {
      blinkTimer = millis();
      digitalWrite(LED_PIN1, !digitalRead(LED_PIN1));
      digitalWrite(LED_PIN2, !digitalRead(LED_PIN2));
    }
  } //if case 3 so LED_PIN 3 Fade
  else if (mode == 3) { // PWM fade LED_PIN3
    fadeValue += fadeDir * 5;
    if (fadeValue >= 255 || fadeValue <= 0) fadeDir *= -1;
    analogWrite(LED_PIN3, fadeValue);
    delay(20);// smooth fading
  }
}
```

Explanation of code :

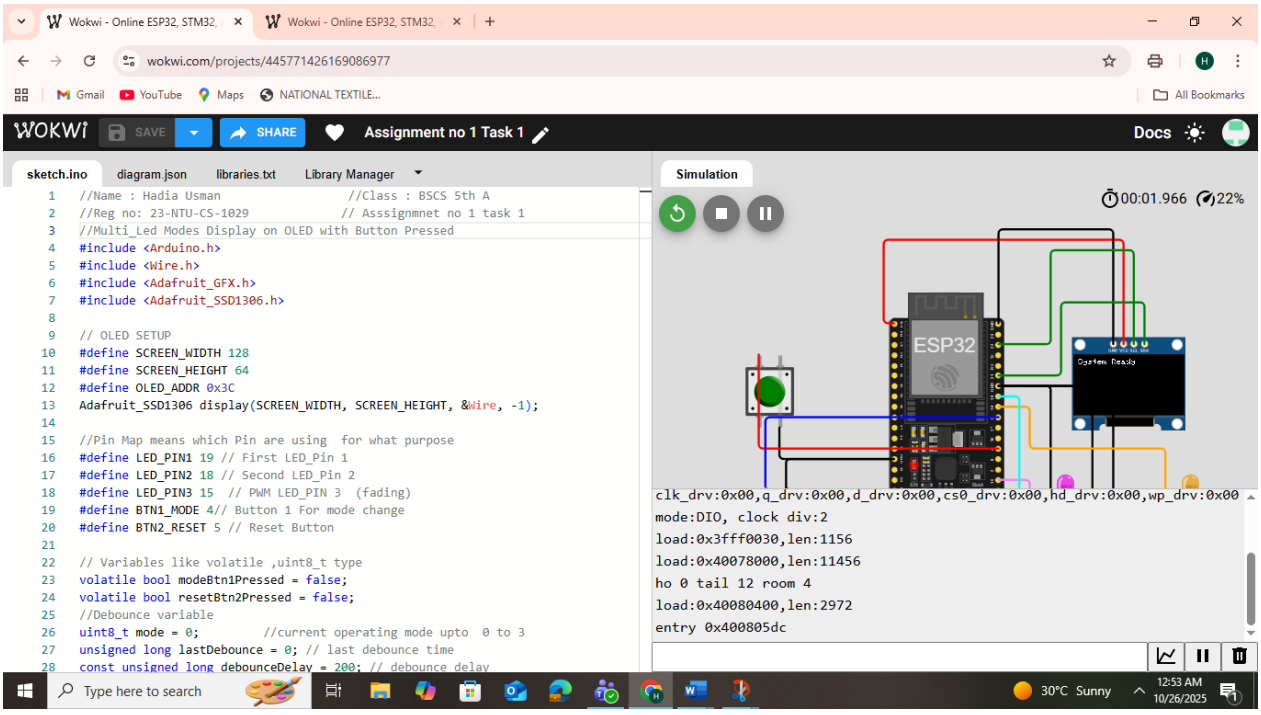
The Multi-Led Mode Code displays four different modes of led and their current state on OLED with the help of buttons .One Button **Btn1** is used to manage and operate the different Led Modes . When Btn1 is pressed so the three Leds goes through these modes :

- **Both Led1 and Led 2 Off**
- **Alternate Led1 and Led 2 Blink**
- **Both Led1 and Led 2 On**
- **PWM Fade for Led 3**

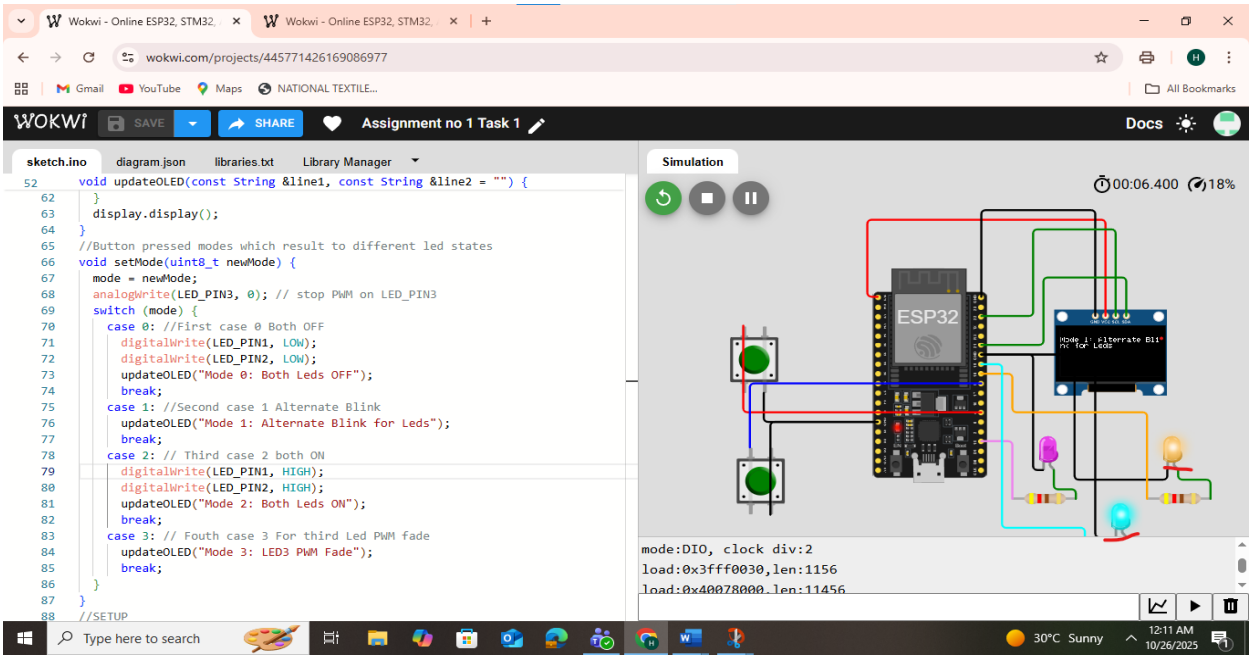
For the second button **Btn2** we have **Reset** state which have all the three leds back to mode 0.In order to , control button press we use attach interrupts and debounce to prevent the false triggers .The blinking and fading uses mills() function and **PWM** for the smooth timing without blocking other operations .The **OLED** provides real time stimulation and feedback and make the system more interactive and easy to control and under stand .

OUTPUT:

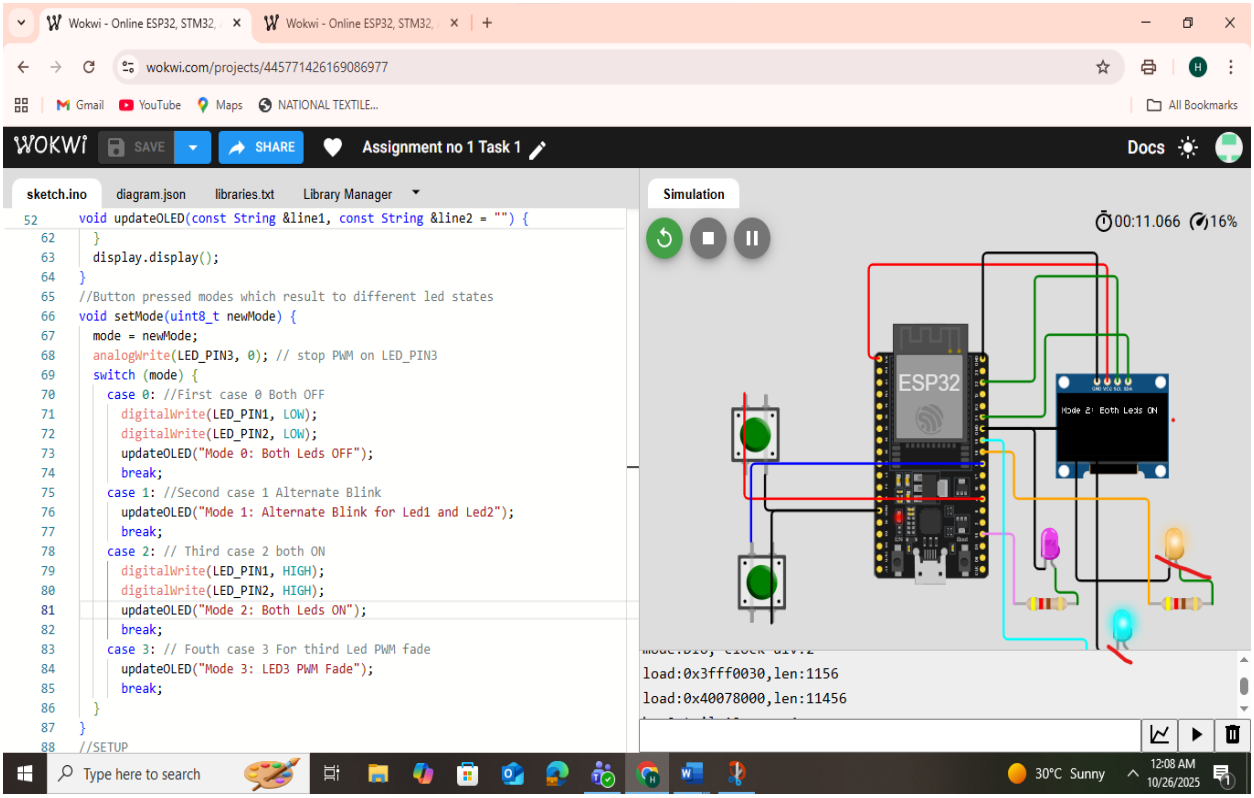
Intialize System : Shows System Ready :



Alternate Led Blink State :

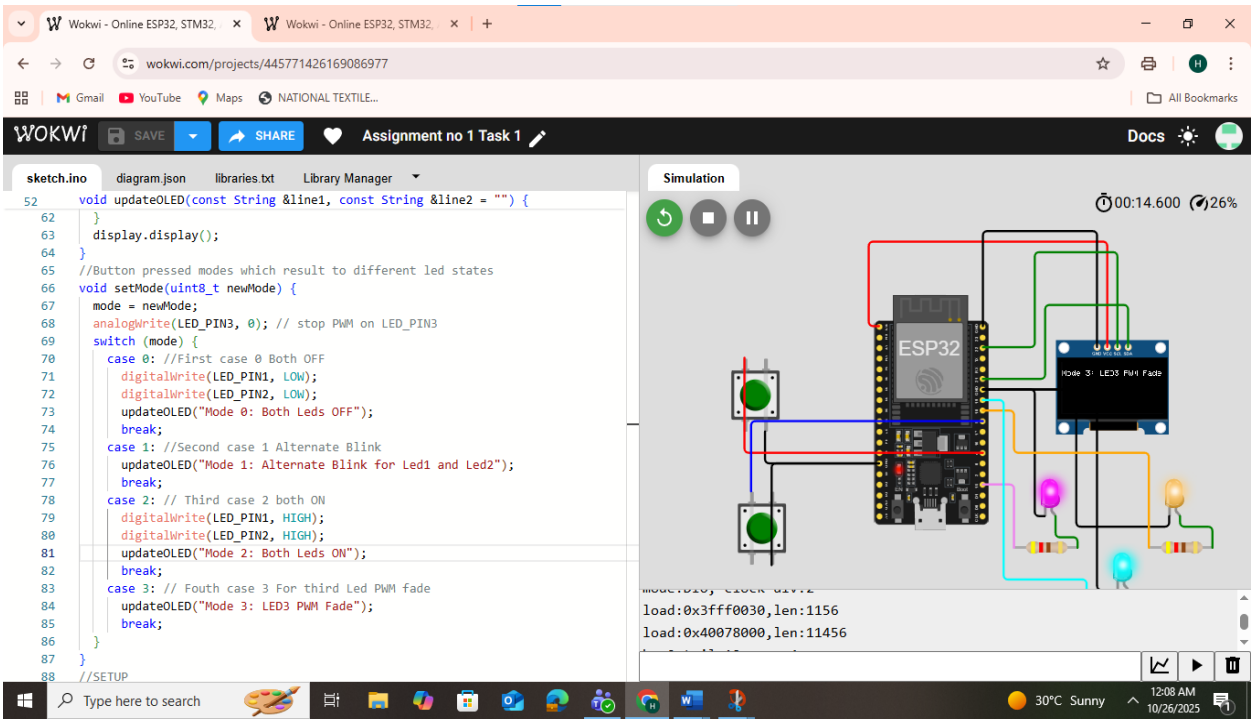


Both Leds On :



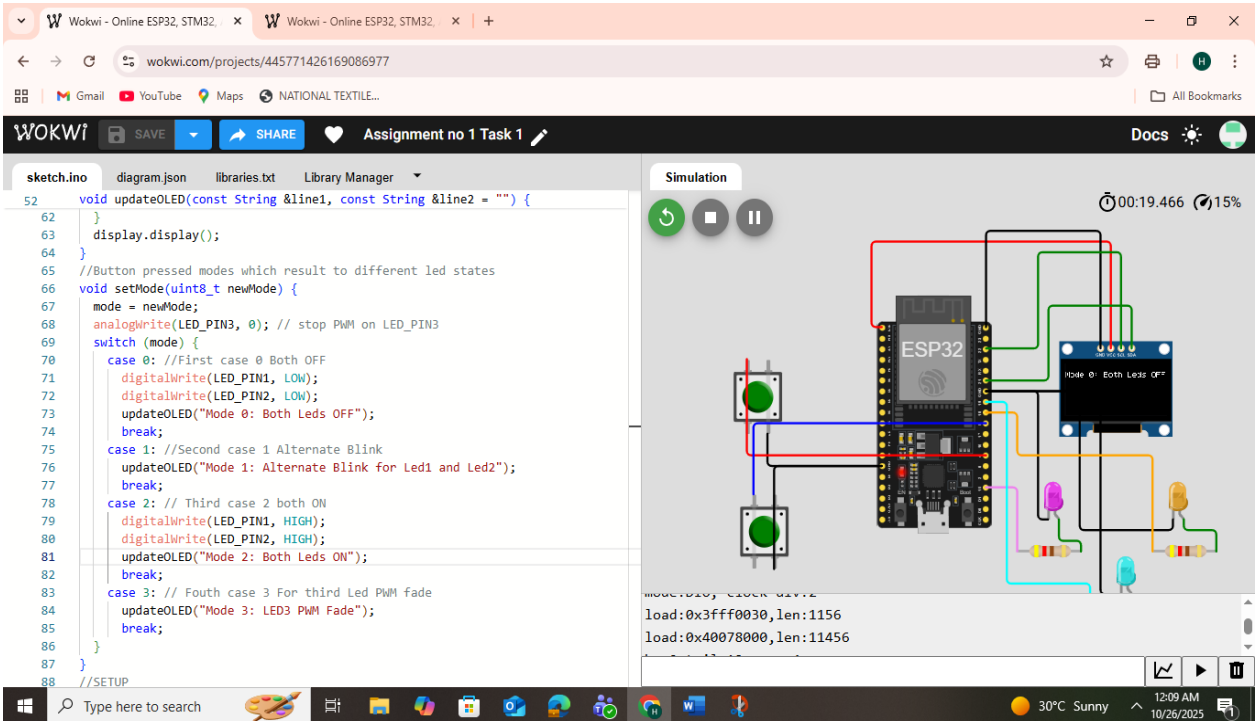

```
52  void updateOLED(const String &line1, const String &line2 = "") {
62    }
63    display.display();
64  }
65  //Button pressed modes which result to different led states
66  void setMode(uint8_t newMode) {
67    mode = newMode;
68    analogWrite(LED_PIN3, 0); // stop PWM on LED_PIN3
69    switch (mode) {
70      case 0: //First case 0 Both OFF
71        digitalWrite(LED_PIN1, LOW);
72        digitalWrite(LED_PIN2, LOW);
73        updateOLED("Mode 0: Both Leds OFF");
74        break;
75      case 1: //Second case 1 Alternate Blink
76        updateOLED("Mode 1: Alternate Blink for Led1 and Led2");
77        break;
78      case 2: // Third case 2 both ON
79        digitalWrite(LED_PIN1, HIGH);
80        digitalWrite(LED_PIN2, HIGH);
81        updateOLED("Mode 2: Both Leds ON");
82        break;
83      case 3: // Fouth case 3 For third Led PWM fade
84        updateOLED("Mode 3: LED3 PWM Fade");
85        break;
86    }
87  }
88  //SETUP
```

PWM Fade for Led 3 :



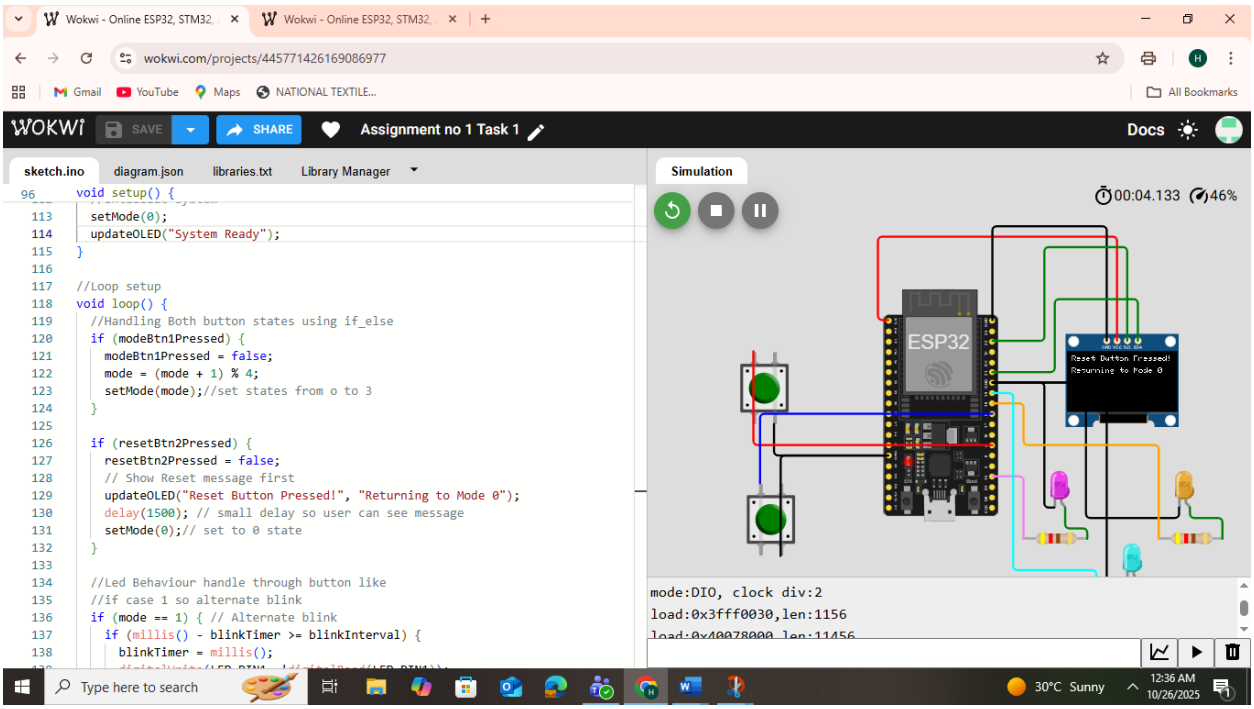

```
52  void updateOLED(const String &line1, const String &line2 = "") {
62    }
63    display.display();
64  }
65  //Button pressed modes which result to different led states
66  void setMode(uint8_t newMode) {
67    mode = newMode;
68    analogWrite(LED_PIN3, 0); // stop PWM on LED_PIN3
69    switch (mode) {
70      case 0: //First case 0 Both OFF
71        digitalWrite(LED_PIN1, LOW);
72        digitalWrite(LED_PIN2, LOW);
73        updateOLED("Mode 0: Both Leds OFF");
74        break;
75      case 1: //Second case 1 Alternate Blink
76        updateOLED("Mode 1: Alternate Blink for Led1 and Led2");
77        break;
78      case 2: // Third case 2 both ON
79        digitalWrite(LED_PIN1, HIGH);
80        digitalWrite(LED_PIN2, HIGH);
81        updateOLED("Mode 2: Both Leds ON");
82        break;
83      case 3: // Fouth case 3 For third Led PWM fade
84        updateOLED("Mode 3: LED3 PWM Fade");
85        break;
86    }
87  }
88  //SETUP
```

Both Leds OFF :




```
52  void updateOLED(const String &line1, const String &line2 = "") {
62    }
63    display.display();
64  }
65  //Button pressed modes which result to different led states
66  void setMode(uint8_t newMode) {
67    mode = newMode;
68    analogWrite(LED_PIN3, 0); // stop PWM on LED_PIN3
69    switch (mode) {
70      case 0: //First case 0 Both OFF
71        digitalWrite(LED_PIN1, LOW);
72        digitalWrite(LED_PIN2, LOW);
73        updateOLED("Mode 0: Both Leds OFF");
74        break;
75      case 1: //Second case 1 Alternate Blink
76        updateOLED("Mode 1: Alternate Blink for Led1 and Led2");
77        break;
78      case 2: // Third case 2 both ON
79        digitalWrite(LED_PIN1, HIGH);
80        digitalWrite(LED_PIN2, HIGH);
81        updateOLED("Mode 2: Both Leds ON");
82        break;
83      case 3: // Fouth case 3 For third Led PWM fade
84        updateOLED("Mode 3: LED3 PWM Fade");
85        break;
86    }
87  }
88  //SETUP
```

Reset State :




```
96  void setup() {
113   setMode(0);
114   updateOLED("System Ready");
115 }
116
117 //Loop setup
118 void loop() {
119   //Handling Both button states using if_else
120   if (modeBtn1Pressed) {
121     modeBtn1Pressed = false;
122     mode = (mode + 1) % 4;
123     setMode(mode);//set states from o to 3
124   }
125
126   if (resetBtn2Pressed) {
127     resetBtn2Pressed = false;
128     // Show Reset message first
129     updateOLED("Reset Button Pressed!", "Returning to Mode 0");
130     delay(1500); // small delay so user can see message
131     setMode(0);// set to 0 state
132   }
133
134   //Led Behaviour handle through button like
135   //if case 1 so alternate blink
136   if (mode == 1) { // Alternate blink
137     if (millis() - blinkTimer >= blinkInterval) {
138       blinkTimer = millis();
```

Wokwi Project Link :

https://wokwi.com/projects/445771426169086977

Loom Video Link :

https://www.loom.com/share/fc8756dcaa6643eb9209871b3cdaa4f0

Diagram Sketching :

Task 3-Part 1: