National Textile University, Faisalabad

Department of Computer Science

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Class:	BSCS_B 5th Semester
Registration No:	23-NTU-CS-1077
Assignment:	01
Course Name:	Embedded Iot System
Submitted To:	**Sir Nasir Mehmood**
Submission Date:	25/10/2025

Description

Task_1

Multi-Device Control using ESP32 (LEDs, Buttons, OLED, and Buzzer)

Description:
In this task, an **ESP32 DevKit-C V4** is programmed to control **three LEDs**, **two push buttons**, a **buzzer**, and an **OLED display** using the **Adafruit SSD1306** library.

Working:

- Each **button press** performs a specific action — such as toggling LEDs or turning ON the buzzer.
- The **OLED display** shows clear text messages for user feedback like "LED ON", "LED OFF", or "Buzzer Active".
- LEDs are connected to **GPIO 2, 4, and 5**, the buzzer to **GPIO 15**, and buttons to **GPIO 26 and 27** with internal pull-ups.
- The **I^{2}C OLED** uses **GPIO 21 (SDA)** and **GPIO 22 (SCL)** with address 0x3C.
- Proper resistors (420Ω) are used with LEDs to limit current.
- The system was simulated on **Wokwi** to test circuit behavior.

Time & Execution:
On pressing a button, the ESP32 reads the input, updates the respective LED/buzzer state, and instantly displays the message on the OLED. The whole response time is **less than 1 second**, ensuring real-time feedback.

Objective:
To learn how to interface multiple input/output devices with ESP32 and display real-time feedback using an OLED display.

Task_2

This task demonstrates **button press duration detection** using an **ESP32**, differentiating between **short** and **long presses**.
The system includes a **push button**, **LED**, **buzzer**, and **OLED display** for feedback.

Working:

- When the button (GPIO 25) is pressed and released, the code calculates how long it was held using millis().

- If the press duration is **less than 1.5 seconds**, it is treated as a **short press**, and the **LED (GPIO 5)** toggles its state.
- If the press is **longer than 1.5 seconds**, a **buzzer (GPIO 18)** activates for 0.5 seconds to indicate a **long press**.
- The **OLED (I^{2}C: SDA 21, SCL 22)** displays messages like “Short Press → LED Toggle” or “Long Press → Buzzer”.
- The system resets automatically after each press for the next detection.

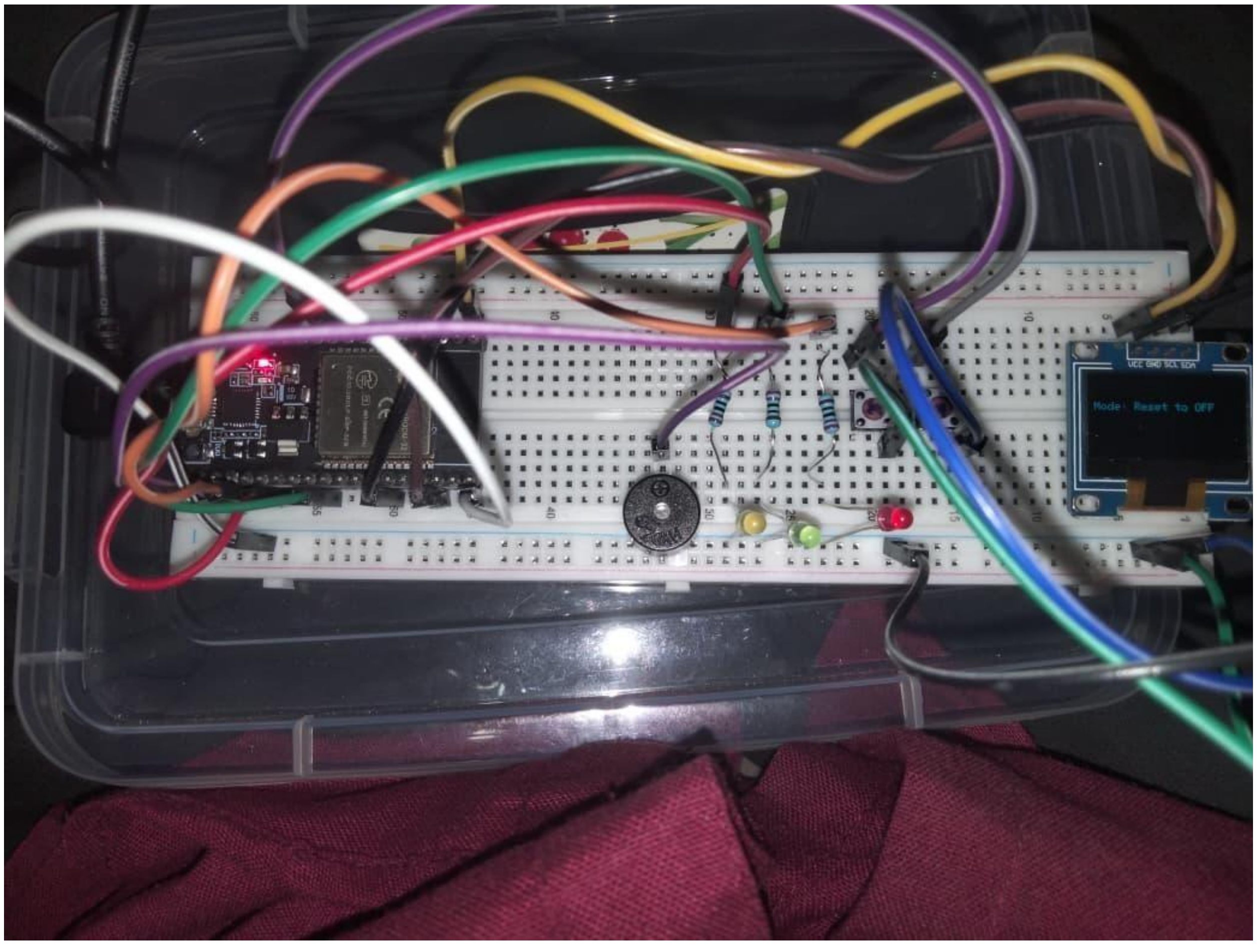
Time & Execution:

- Short press duration: **< 1.5 seconds**
- Long press duration: **> 1.5 seconds**
- OLED updates instantly after each event with clear text.

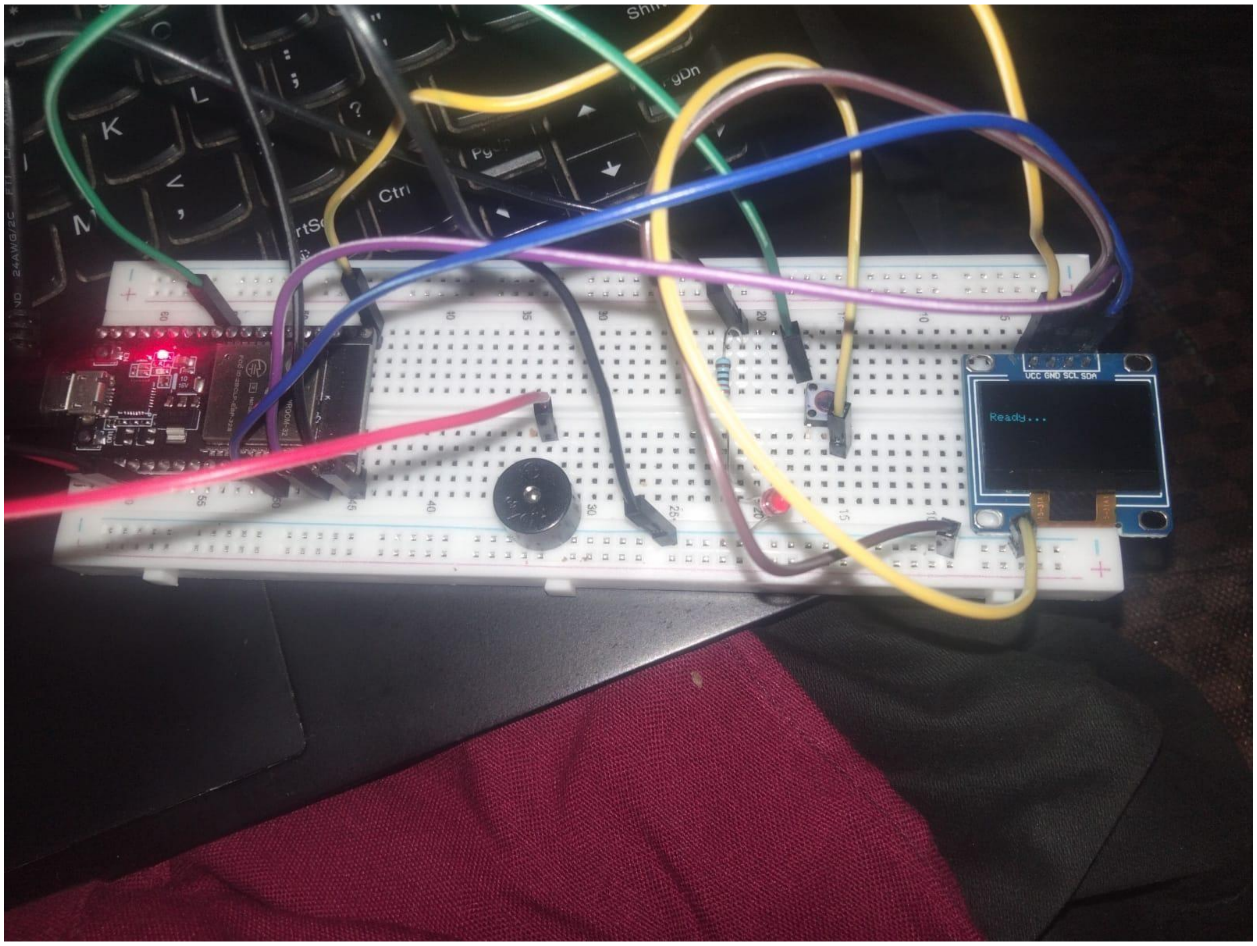
Objective:
To understand how to measure input duration using **millis()**, differentiate user input types, and provide feedback through both **LEDs**, **buzzer**, and **display**.

Picture of Kits

Task_01



Task_02



Handwritten Code

Task_01

Assignment #1

Task#1 code:

```
/* Project: LED Mode controller with OLED
   and buzzer
   Name: Umar Mushtaq
   Reg NO: 23-NTU-CS-1077
*/

#include <Arduino.h>
# include <wire.h>
# include <Adafruit_GFX.h>
# include <Adafruit_SSD1306>

// --- Pin definations ---
#define LED1 2
#define LED2 4
#define LED3 5
#define BTN_MODE 26
#define BTN-RESET 27
#define BUZZER 15
```

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```
// --- object Display on OLED ---
Adafruit_SSD1306 display(128, 64, &wire, -1)

// --- variables for mode controll ---
int mode = 0;
unsigned long PreMillis = 0;
bool ledstate = false;

// --- Function: show message on OLED
void showmsg(string msg){
        display.clearDisplay();
        display.setText(1);
        display.setColor(white);
        display.setCursor(0, 20);
        display.Print("Mode: ");
        display.Println(msg);
        display.display();
}

// --- function beep sound ---
void beepBuzzer(int freq, int dur){
    tone(Buzzer, freq,dur);
    delay(dur + 50);
    noTone(Buzzer); }
```

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```
void setup() {
        Pinmode(LED1, outPut)
        PinMode(LED2, output)
        Pin Mode(LED3, output)
        PinMode(BTN_Mode, output)
        Pin Mode(BTN_RESET, output)
        PinMode(Buzzer, output).

display.begin(SSD1306_SWITCHCAPAVCC, 0X3C)
display.cleardisplay();
display.display();
showmsg("Both off")
void loop() {
    if (digitalRead(BTN_Mode) == LOW) {
    delay(200);
     mode++;
     if (mode > 4) mode = 1)
switch (mode) {
     case 1:
        digitalWrite(LED1, LOW);
        digital write (LED2, LOW);
        Showmsg("Both OFF");
        beepBuzzer(800, 120);
```

```
break
case 2;
     showMsg("Alternate Blink");
     beepBuzzer(1000, 120);
     break;
case 3;
      digitalWrite(LED1, HIGH)
      digitalWrite(LED2, HIGH)
      showMsg("Both ON");
      beepBuzzer(1200,120);
      break;
case 4;
      showMsg("PWM Fade");
      BeepBuzzer(1500, 120);
      break;
   }
}
if (digitalRead(BTN_RESET)==low{
   delay(200);
   mode=1;
   digitalWrite(LED1, LOW);
   digitalWrite (LED2, LOW);
   analogewrite(LED3, 0);
```

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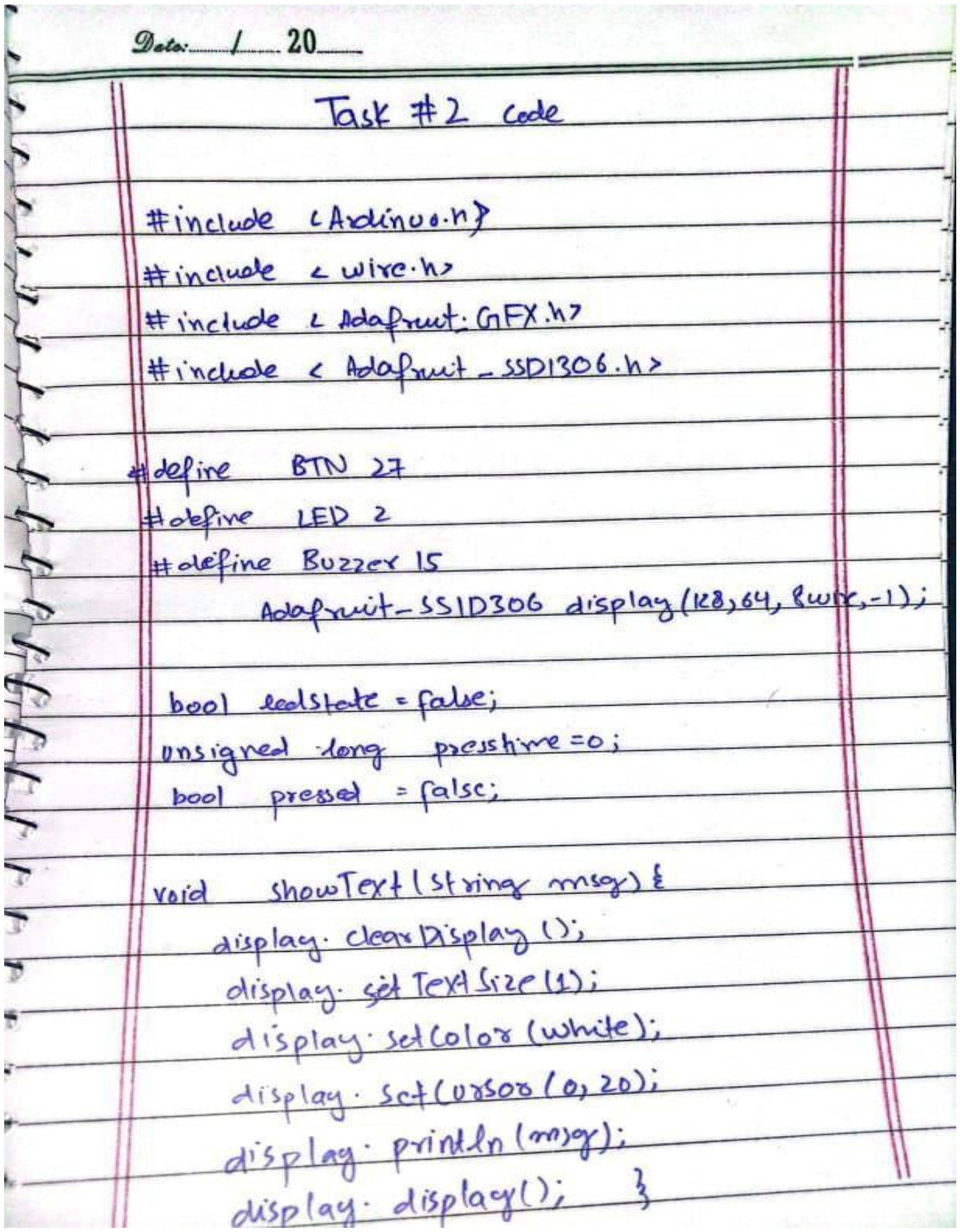
```
void setup(){
        PinMode (BTN, INPUT_PULLUP);
        Pin Mode(LED, OUTPUT);
        Pin Mode (Buzzer, OUTPUT)
display.begin(SSD1306_SWITCHCAVCC, 0X3c)
 showText("Ready..."); }
 void loop() {
 if (digitalRead (BTN)== low 88 ! pressed){
  pressed = true;
   presstime = millis (); }
 if (digital Read (BTN)== HIGH 88 pressed) {
 unsigned long duration= millis()-presstime;
  pressed = false;
   if (duration > 1500){
    tone (Buzzer, 1000, 500),
    Show text ("long press -> Buzzer"));
else
    ledState = ! state
    digitalWrite (LED, ledstate);
    Show text("short press -> LED
                          Toggle),
  }
 }
```

Task_02



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Task #2 code

```
#include <Arduino.h>
#include <wire.h>
#include <Adafruit_GFX.h>
#include < Adafruit_SSD1306.h>

#define   BTN 27
#define   LED 2
#define  Buzzer 15
        Adafruit_SSID306 display(128,64, &wire,-1);

bool ledState = false;
unsigned long  presstime =0;
bool  pressed  = false;

void   showText(string msg) {
    display. clearDisplay ();
    display. set TextSize (1);
    display. setColor (white);
    display. setCursor (0, 20);
    display. println (msg);
    display. display();    }
```

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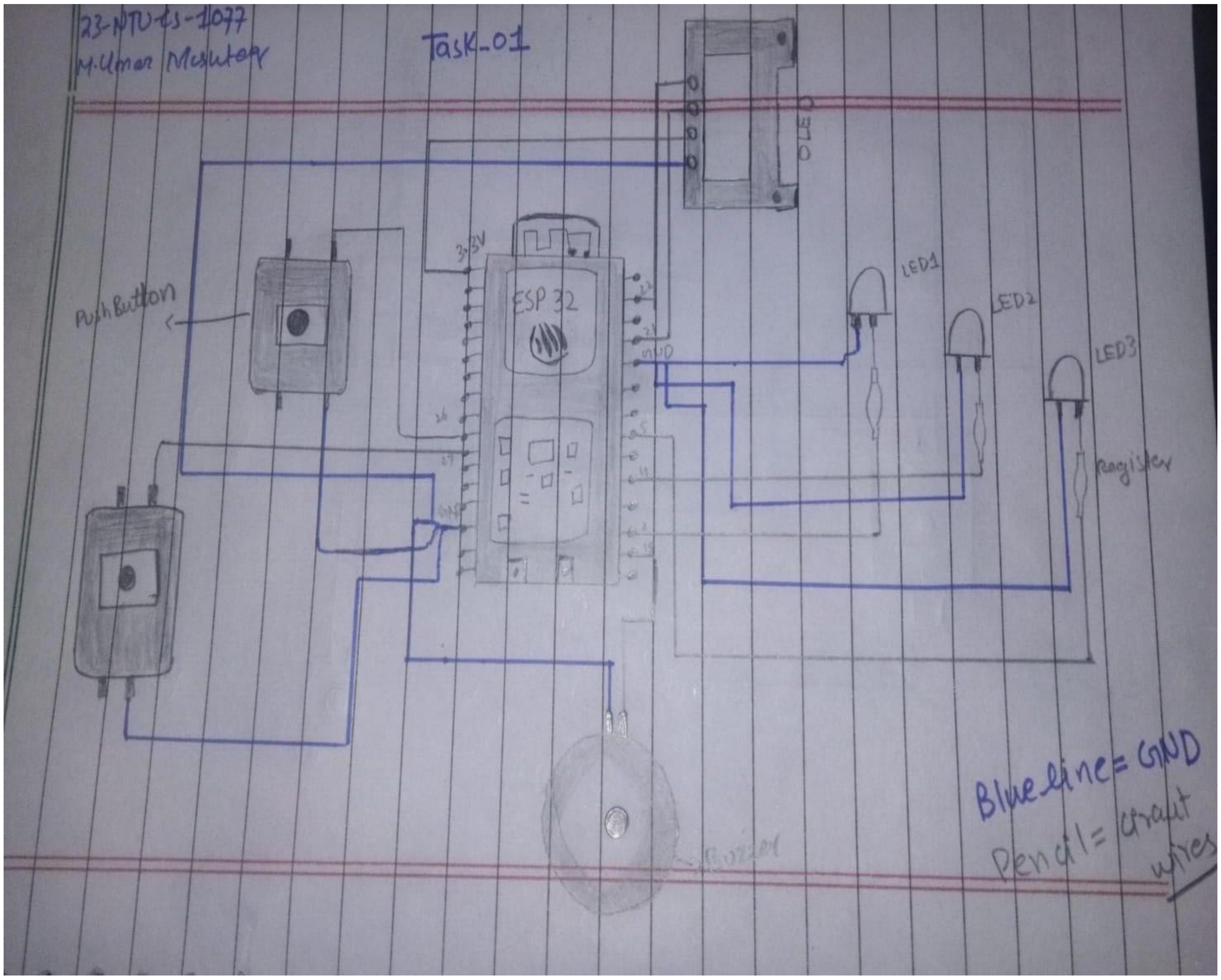
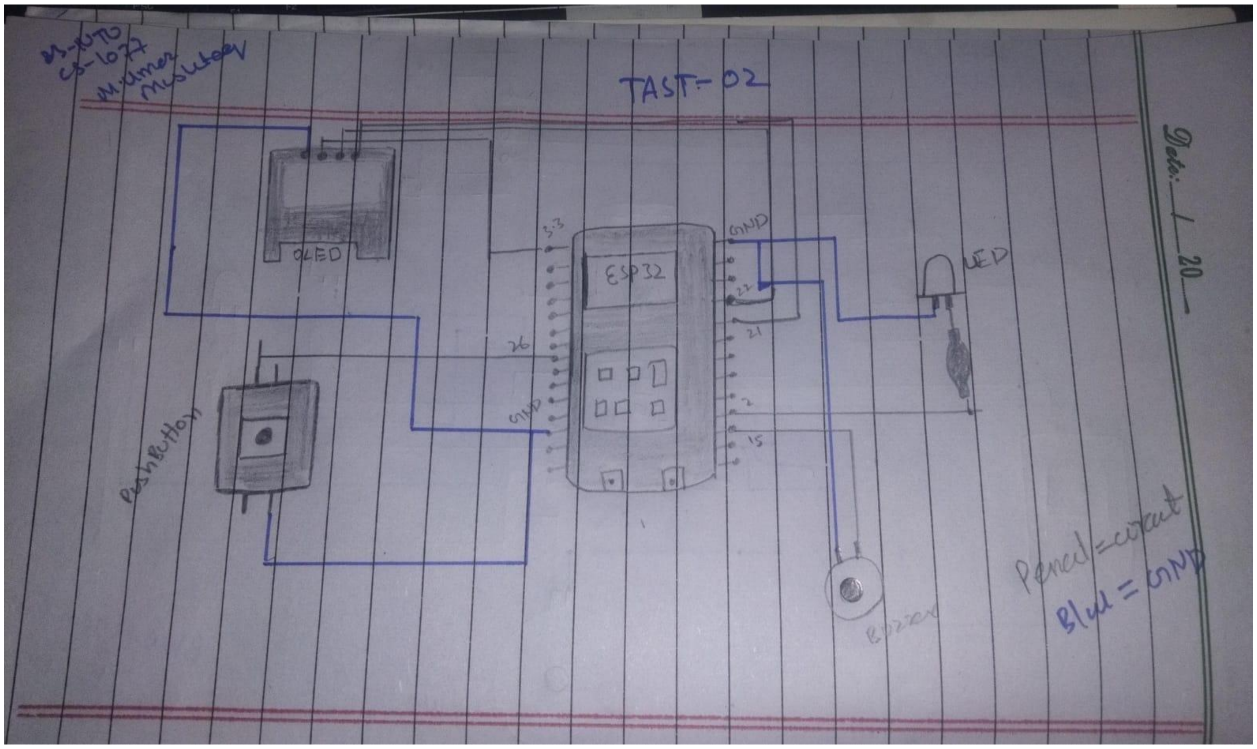
```
showMsg("Reset to OFF");
 beepBuzzer(400,200);  }
  if (mode==2){
     if (millis)() - preMillis >=500){
     preMillis = millis();
     ledstate = !ledstate;
     digitalWrite (LED1, ledstate);
     digitalWrite(LED2, !ledstate);  }
 }
 if (mode= =4){
     for (int i=0 ; i<=255; i++){
      analogwrite(LED3, i);
      delay (5);
 }
  for (int i=0; i=255; i--; ){
       analogWrite (LED3, i);
       delay (5);
     }
  }
}
```

Handmade Diagram

Task_01



Task_02



Wokwi Link

Task_01 https://wokwi.com/projects/445223337931397121

Task_02 https://wokwi.com/projects/445776781415259137

Github Repo Link

https://github.com/noniiiiiiiiiiiiiiii/1077embedded-iot-system-cs-b.git