Session 02: Interrupt Latency measurement of ESP 32 Microcontroller

Date of the Session: 31 / 12 / 24 **Time of the Session:**_____to____

PREREQUISITE:

- General idea of Interrupts, ESP32 board
- General idea of basic circuit

PRE-LAB:

1. What is the primary purpose of external interrupts in microcontroller development, such as the ESP32?
   To allow to respond to external events or changes in input signals in real-time, improving efficiency

2. Explain the concept of an external interrupt trigger type. How does it influence the interrupt behaviour?
   Defines the condition that activates the interrupt, influencing when triggered.

OBJECTIVE:

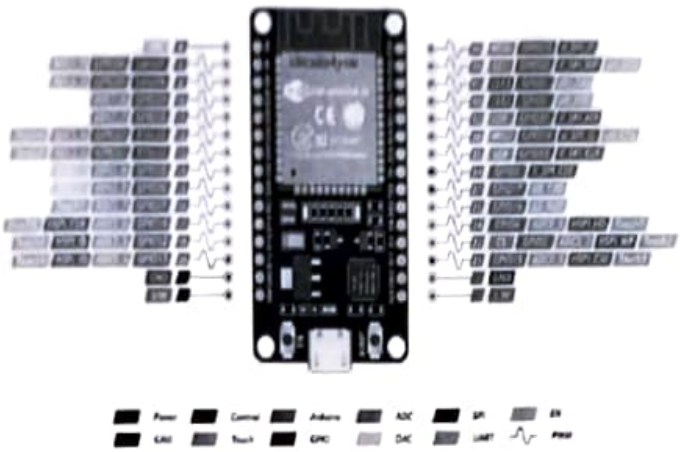
- To Define an output pin (for the LED)
- Define an input pin & Attach interrupt to it
- Write the ISR function to toggle the LED pin on each RISING edge

COMPONENTS REQUIRED:

- ESP32
- Breadboard
- Jumper Wires Pack
- Micro USB Cable

THEORY:

ESP32 Interrupt Pins (External Interrupts in Arduino) GPIO Interrupt:



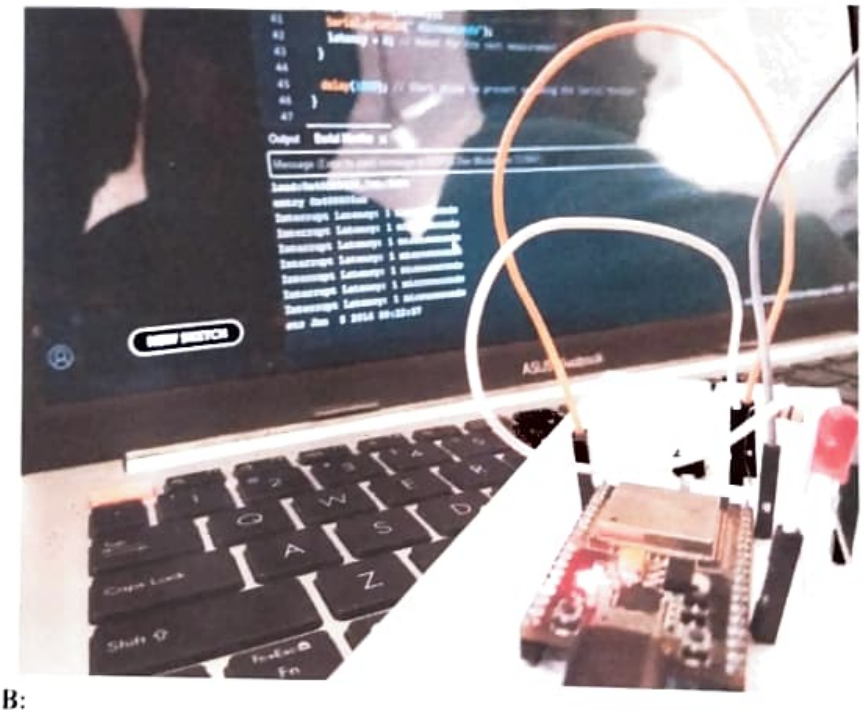
CODE:

```
#include <Arduino.h>
#define GPIO_INPUT_PIN 5
#define GPIO_OUTPUT_PIN 4

volatile uint32_t start_time = 0;
volatile uint32_t end_time = 0;
volatile uint32_t latency = 0;

void IRAM_ATTR handleInterrupt() {
    end_time = micros();
    latency = end_time - start_time;
    digitalWrite(GPIO_OUTPUT_PIN, !digitalRead(GPIO_OUTPUT_PIN));
}

void setup() {
    pinMode(GPIO_INPUT_PIN, INPUT_PULLUP);
    pinMode(GPIO_OUTPUT_PIN, OUTPUT);
    attachInterrupt(GPIO_INPUT_PIN, []() {
        start_time = micros();
        handleInterrupt();
    }, FALLING);
    Serial.begin(115200);
}

void loop() {
    if(latency>0) {
        Serial.print("Interrupt latency: ");
        Serial.print(latency);
        Serial.println(" microseconds");
        latency = 0;
    }
    delay(1000);
}
```

PROCEDURE:

1. Choose the board, COM port, hold down the BOOT button, click upload and keep your finger on the BOOT button pressed.
2. When the Arduino IDE starts sending the code, you can release the button and wait for the flashing process to be completed.
3. Now, the ESP32 is flashed with the new firmware.

OUTPUT:



POST LAB:

Take the snapshot of Tinker CAD simulation and paste here with your REG NO on it.

INTERFERENCE & ANALYSIS

Interrupt latency was successfully obtained

RESULT

Interrupt latency was observed.