IOT Project

Aim

To design and implement a system that monitors the position and orientation of an object using real-time accelerometer and gyroscope data and displays the data on an OLED screen using the Wokwi Simulator.

Problem Statement

In many devices like robots, drones, and fitness trackers, it's important to know how an object moves or rotates. But making such a system with real hardware can be expensive and hard for beginners.

This project offers a simple and low-cost way to understand and try out this idea using a simulator, sensors, and a small display. It's helpful for students or anyone who wants to learn how these systems work.

Scope of the Solution

- Real-time display of orientation data (roll, pitch, yaw).
- Simulated environment using Wokwi.
- Display output on OLED screen.
- GitHub and documentation for further development.

Required Component

- ESP32 Development Board
- MPU6050 Sensor Module
- OLED Display
- Jumper wires
- Wokwi (for simulation)

Code

```
#include <Wire.h>
#include <Adafruit_Sensor.h>
#include <Adafruit_MPU6050.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>

#define SCREEN_WIDTH 128
#define SCREEN_HEIGHT 64

Adafruit_MPU6050 mpu;
Adafruit_SSD1306 display(SCREEN_WIDTH,
SCREEN_HEIGHT, &Wire, -1);

void setup() {
  Serial.begin(115200);
if (!mpu.begin()) {
    Serial.println("Failed to find MPU6050 chip");
    while (1) {
      delay(10);
    }
  }
  Serial.println("Found MPU6050 chip");

  mpu.setAccelerometerRange(MPU6050_RANGE_2_G);
  mpu.setGyroRange(MPU6050_RANGE_250_DEG);
  mpu.setFilterBandwidth(MPU6050_BAND_21_HZ);

  if (!display.begin(SSD1306_SWITCHCAPVCC, 0x3C)) {
    Serial.println(F("SSD1306 allocation failed"));
    for (;;);
  }
  display.display();
  delay(2000);
  display.clearDisplay();
  display.setTextSize(1);
  display.setTextColor(SSD1306_WHITE);
  display.println(F("MPU6050 and OLED"));
  display.display();
  delay(1000);
}
```

```
void loop() {
  sensors_event_t a, g, temp;
  mpu.getEvent(&a, &g, &temp);
  display.clearDisplay();
  display.setCursor(0, 0);

  display.print("AccX: "); display.println(a.acceleration.x);
  display.print("AccY: "); display.println(a.acceleration.y);
  display.print("AccZ: "); display.println(a.acceleration.z);

  display.print("GyroX: ");  display.println(g.gyro.x);
  display.print("GyroY: ");  display.println(g.gyro.y);
  display.print("GyroZ: ");  display.println(g.gyro.z);

  display.display();
  delay(500);
}
```

Flowchart of the code

1. Turn on the Serial Monitor to enable messages on the computer screen.

2. Try to detect the MPU6050 sensor:
    - If the sensor is found, print “Found MPU6050 chip”.
    - If not found, print an error message and stop the program.

3. Set the sensor’s sensitivity:
    - Accelerometer range to ±2g
    - Gyroscope range to ±250 degrees per second
    - Filter bandwidth to 21 Hz

4. Initialize the OLED display:
    - If successful, continue
    - If it fails, print an error and stop the program

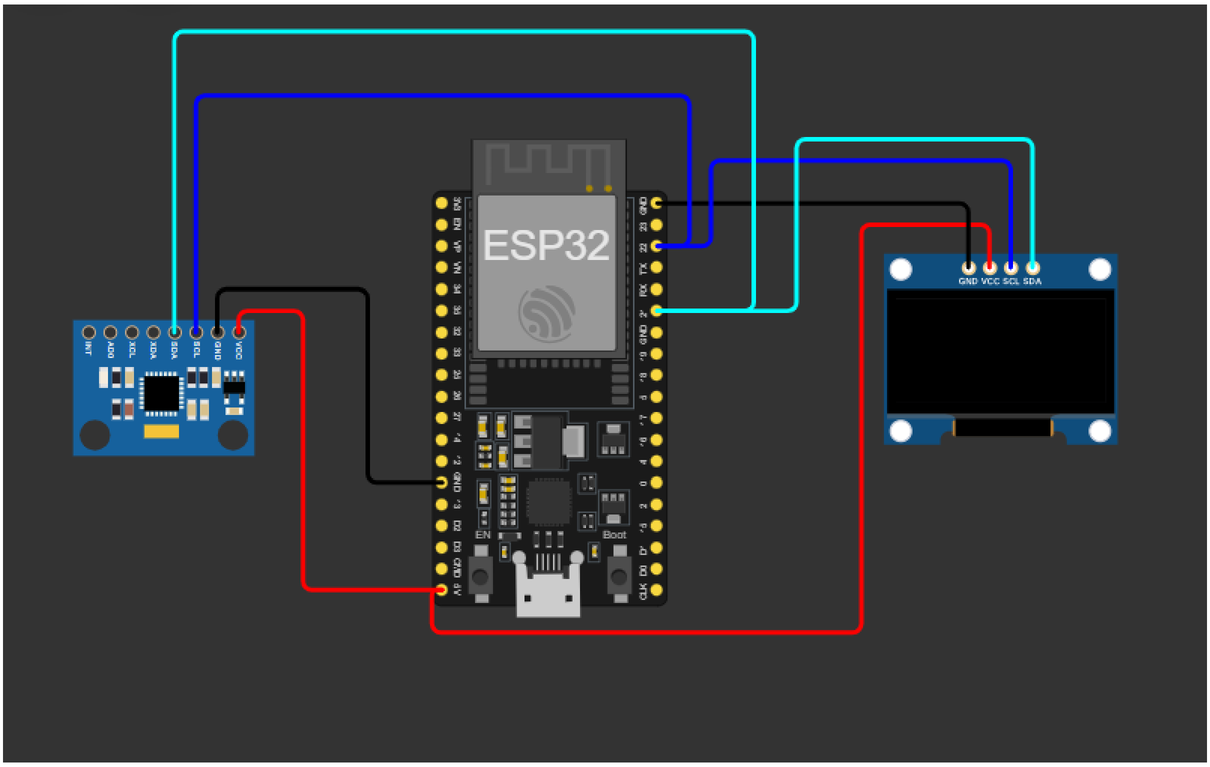
5. Display a welcome message: “MPU6050 and OLED” on the screen for 2 seconds

6. Main Loop:

- Read new data from the sensor:
  Acceleration values (X, Y, Z axis)
  Gyroscope values (X, Y, Z axis)
- Clear the OLED screen to remove old data
- Print the latest sensor values to the OLED screen
- Refresh the display to show updated readings
- Wait for 500 milliseconds

7. Repeat the loop to continue showing live sensor data

Simulated Circuit:



Video of the Demo:

https://drive.google.com/file/d/1bpTtUigJmdgq5zW_CZuIUvWy7FmR0EPv/view?usp=sharing