Drone-Based Environmental Data Logger using ESP32

Abstract

This project focuses on the development of a drone-compatible environmental data logging system. Utilizing the ESP32 microcontroller, DHT22 temperature and humidity sensor, and an OLED display, the system captures and displays real-time environmental data. It is designed to simulate how drones can assist in agricultural monitoring, pollution detection, and post-disaster environmental tracking.

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1. Project Overview

This project simulates an IoT module that can be mounted on a drone to log temperature and humidity data in real-time using ESP32. The data is displayed on an OLED screen. This is useful in various applications such as agricultural monitoring, pollution control, and disaster zone tracking.

2. Components

Component	Description
ESP32 Dev Module	Microcontroller with WiFi & Bluetooth
DHT22 Sensor	Measures temperature and humidity
SSD1306 OLED Display (128x64)	Displays real-time data
Wires	Auto-connected in Wokwi simulator

3. Circuit Connections

□ DHT22 Sensor → ESP32

DHT22 Pin	Connect To	Notes
VCC	3.3V	Power supply
DATA	GPIO 15	Signal pin in code
GND	GND	Ground

□ OLED Display (SSD1306 I2C) → ESP32

OLED Pin	Connect To	Notes
GND	GND	Ground
VCC	3.3V	Power supply
SCL	GPIO 22	I2C Clock
SDA	GPIO 21	I2C Data

4. Code Explanation

The code initializes the OLED and DHT22 sensor in the setup. In the loop, it reads temperature and humidity values. If successful, it displays the values on the OLED and prints them to the Serial Monitor. If the sensor fails to read, an error is displayed.

5. Setup() Function

```
Serial.begin(115200);
dht.begin();

if (!display.begin(SSD1306_SWITCHCAPVCC, 0x3C)) {
  Serial.println("SSD1306 allocation failed");
  for (;;);
}
display.clearDisplay();
display.setTextSize(1);
display.setTextColor(SSD1306_WHITE);
display.setCursor(0, 0);
display.println("Drone Env Logger");
display.display();
Serial.println("Drone Environment Logger Initialized");
delay(2000);
```

6. Loop() Function

```
float temp = dht.readTemperature();
float hum = dht.readHumidity();
display.clearDisplay();
display.setCursor(0, 0);
display.println("Drone Env Logger");

if (isnan(temp) || isnan(hum)) {
  display.println("Sensor error!");
  Serial.println("Sensor Error: Failed to read from DHT22");
} else {
  display.print("Temp: ");
  display.print(temp);
  display.println(" C");
  display.print("Hum : ");
  display.print(hum);
  display.println(" %");

  Serial.print("Temperature: ");
  Serial.print(temp);
  Serial.print(" °C | Humidity: ");
  Serial.print(hum);
  Serial.println(" %");
}

display.display();
delay(2000);
```

---

7. Sample Output

OLED:

```
Drone Env Logger
Temp: 28.5 C
Hum : 60.0 %
```

Serial Monitor:

```
Temperature: 28.5 °C | Humidity: 60.0 %
```

8. Applications and Extensions

- Agricultural environmental monitoring
- Pollution level tracking
- Weather and disaster zone surveillance

9. Useful Notes

- Ensure correct I2C address for OLED (usually 0x3C)
- DHT22 is preferred over DHT11 for better accuracy
- Make sure sensor delays are appropriate (2 seconds for DHT22)

10. Conclusion

This project demonstrates how to create a compact drone-mounted environmental monitoring system. It logs real-time temperature and humidity readings using the DHT22 sensor and displays them on an OLED. This type of system can be crucial for smart agriculture, environmental research, and emergency response.