

Practical IoT (Internet of Things)

BSCIS – DCIS, PIEAS

Lab 02: Reading Temperature and Humidity from DHT11 / DHT22 Sensor

Objective

- Learn how to interface the DHT11 / DHT22 sensor with WeMos D1 Mini (ESP8266).
- Read temperature and humidity data from the sensor.
- Display the readings on the Serial Monitor.

Required Components

- WeMos D1 Mini (ESP8266)
- DHT11 / DHT22 Sensor
- 10kΩ Resistor (optional for stability)
- Breadboard & Jumper Wires
- LED (optional, for threshold alerts)
- USB cable for programming

Understanding the Sensors

1. DHT11 Sensor:

- Temperature Range: 0–50°C
- Humidity Range: 20–90% RH
- Accuracy: $\pm 2^\circ\text{C}$ for temperature, $\pm 5\%$ RH for humidity
- Note: Lower resolution and accuracy; suitable for basic applications.
- Data Communication: 1-Wire Protocol (single data pin for both temperature and humidity)

2. DHT22 Sensor:

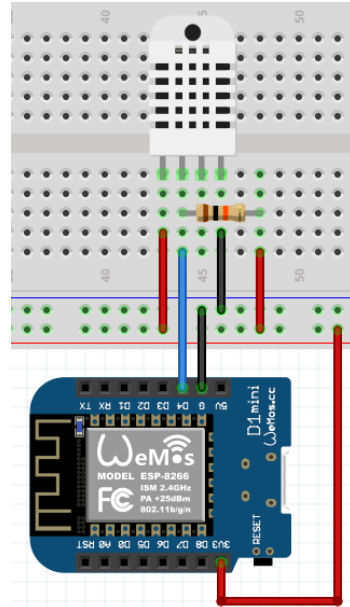
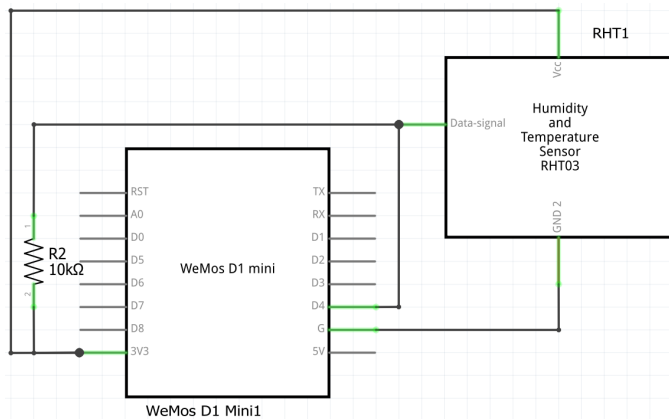
- Temperature Range: -40–80°C
- Humidity Range: 0–100% RH
- Accuracy: $\pm 0.5^\circ\text{C}$ for temperature, $\pm 2\text{--}5\%$ RH for humidity
- Note: Higher resolution and wider range; preferred for more precise applications.
- Data Communication: 1-Wire Protocol (single data pin for both temperature and humidity)

Circuit Diagram:

For either sensor, the wiring is similar:

- VCC: Connect to 3.3V (or 5V, based on your sensor specification) on the WeMos D1 Mini.

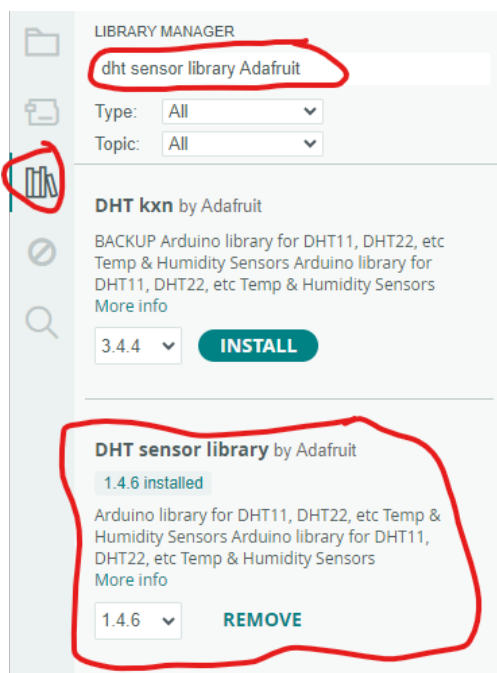
- GND: Connect to Ground.
- Data: Connect to a digital pin (e.g., D4) on the WeMos D1 Mini.
- Optionally, use a 10kΩ resistor as a pull-up between VCC and the Data line if not integrated on the sensor module.
- If using DHT11 Shield for WeMos D1 Mini (Snapfit type). Simply use D4 pin in your sketch.



Installing Required Library

Before coding, install the DHT sensor library in the Arduino IDE:

- Open Arduino IDE.
- Go to Sketch → Include Library → Manage Libraries...
- Search for "DHT sensor library by Adafruit" and install it.
- Also install the "Adafruit Unified Sensor" library.



Task 1: Read Temperature & Humidity on Serial Monitor

Code: Basic DHT11 Reading

The following code works for both sensors. To switch between the DHT11 and DHT22, modify the **DHTTYPE** definition accordingly.

```
1  #include <Adafruit_Sensor.h>
2  #include <DHT.h>
3  #include <DHT_U.h>
4
5  #define DHTPIN D4           // Data pin connected to the sensor (GPIO2)
6  #define DHTTYPE DHT22      // Change to DHT11 for using the DHT11 sensor
7
8  DHT dht(DHTPIN, DHTTYPE);
9
10 void setup() {
11     Serial.begin(115200);
12     Serial.println("DHT Sensor Reading");
13     dht.begin();
14 }
15
16 void loop() {
17     // Wait a few seconds between measurements.
18     delay(2000);
19
20     // Reading temperature and humidity values.
21     float humidity = dht.readHumidity();
22     float temperature = dht.readTemperature(); // Temperature in Celsius
23
24     // Check if any reads failed and exit early (to try again).
25     if (isnan(humidity) || isnan(temperature)) {
26         Serial.println("Failed to read from DHT sensor!");
27         return;
28     }
29
30     // Print the readings to the Serial Monitor.
31     Serial.print("Humidity: ");
32     Serial.print(humidity);
33     Serial.print(" %\t");
34     Serial.print("Temperature: ");
35     Serial.print(temperature);
36     Serial.println(" °C");
37 }
```

Explanation:

- **Library Initialization:** The code begins by including the necessary libraries and creating a DHT object.
- **Sensor Selection:** #define DHTTYPE DHT22 configures the code for the DHT22 sensor; change it to DHT11 if needed.
- **Data Reading:** The loop() function reads temperature and humidity every 2 seconds, ensuring reliable sensor operation.
- **Error Handling:** The code checks for failed readings (resulting in NaN values) and prints an error message.

Submission Requirements:

Submit a single PDF containing:

- **Your Arduino Code:** The Arduino sketches for both the basic and debounced button control.
- **Circuit Diagram:** A photo or schematic of your breadboard setup.
- **Data Log:** A screenshot of the Serial Monitor showing successful readings.
- **Short Description:** A 1-2 page explanation of your design choices, challenges faced, and lessons learned regarding digital I/O in IoT.

Conclusion:

- Understanding and interfacing with sensors like the DHT11 and DHT22 is fundamental to IoT applications.
- Both sensors offer valuable data, with the DHT22 providing higher accuracy and a wider range.
- This lab builds the foundation for integrating sensor data into broader IoT systems.

Grading Rubric:

Criterion	Points	Description
Circuit Setup	30	Accurate wiring and a clear schematic for the sensor setup.
Code Functionality	30	The Arduino sketch correctly reads and outputs sensor data.
Documentation & Report	25	Clear explanation of sensor differences and code functionality.
Data Log	15	Clear screen shot of data log with good formatting of display