Implementing Temperature and Humidity Sensing for IoT Systems

Objective

To understand the working principle of environmental sensors (like DHT11/DHT22) and practically integrate them into an IoT system.

1. What are Environmental Sensors?

Sensors act as the "skin" of the IoT system, allowing it to feel the physical world.

- Temperature Sensors: Measure heat intensity.

- Humidity Sensors: Measure the amount of water vapor in the air.

- Combined Sensors: Modules like the DHT11 or DHT22 measure both simultaneously.
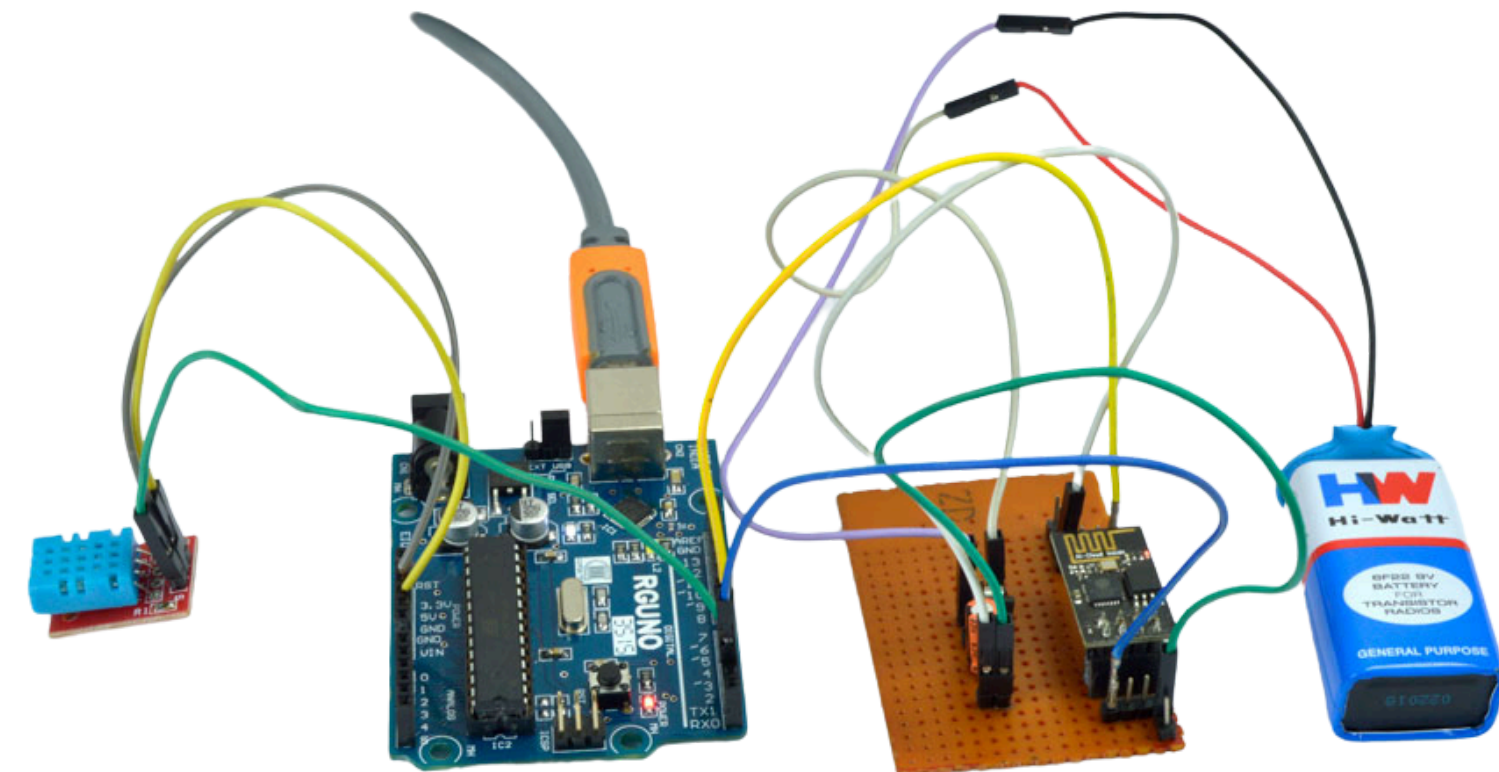
How the Sensor Works

To read the environment, the sensor converts physical changes into electrical signals.

Temperature (Thermistor)

A resistor inside the sensor changes its resistance based on heat. As it gets hotter, electricity flows differently.

Humidity (Capacitive)

A moisture-holding component changes its electrical capacity as air humidity rises or falls.

Chip Processing

An internal chip converts these analog changes into digital data that the microcontroller can read.

Hardware Integration

Connecting the sensor to the microcontroller (e.g., Arduino or ESP32).

VCC (Voltage Common Collector)	GND(Ground)	DATA/OUT
Connect to 3.3V or 5V (Power).	Connect to Ground.	Connect to a GPIO pin (Digital Pin).

This creates the physical path for data to travel.

Software Implementation

Once connected, code is required to read the signals.

01

Include Libraries

specialized code libraries (e.g., DHT.h) are imported to translate the sensor's digital signal.

02

Define Pin

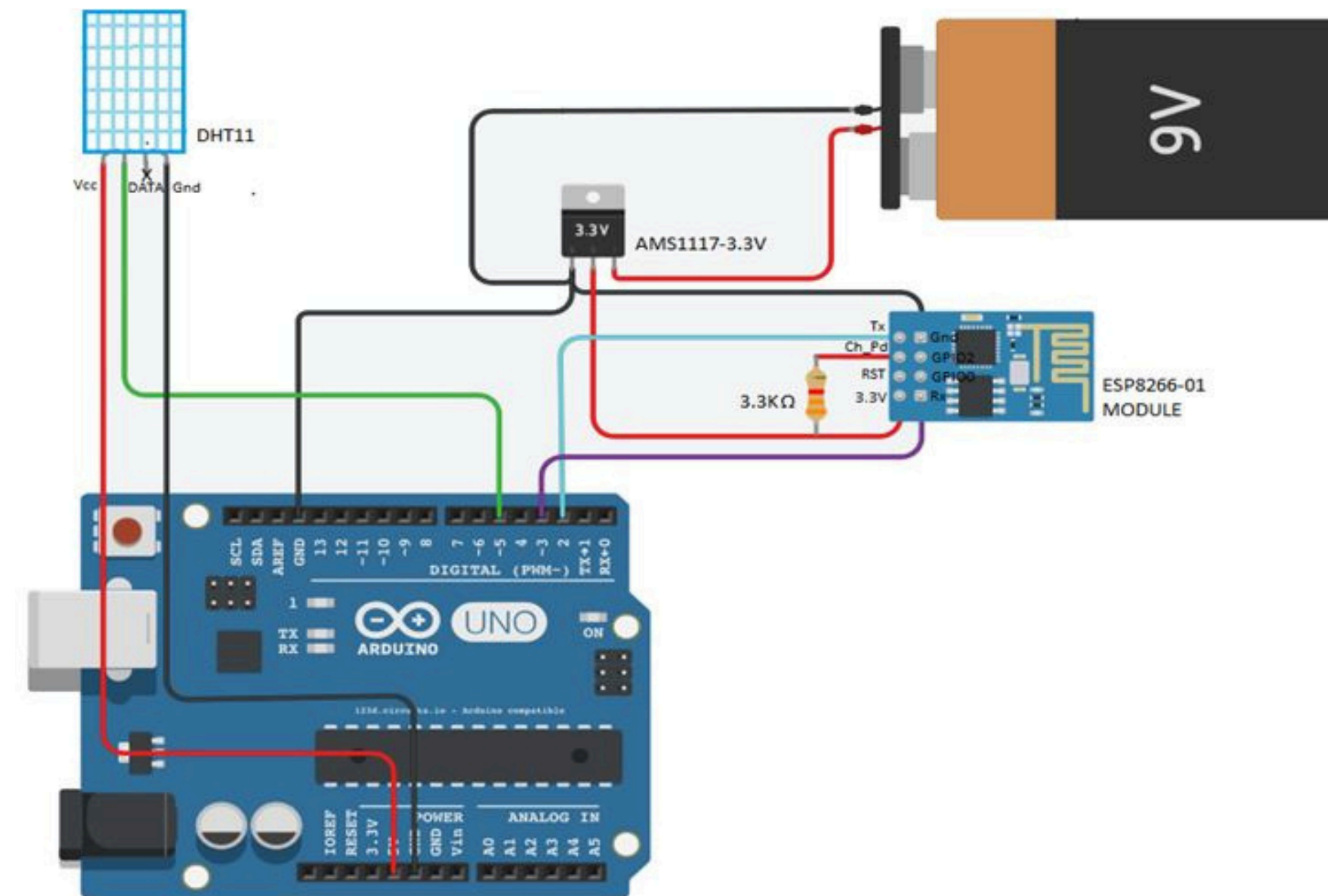Tell the microcontroller which pin the sensor is connected to.

03

Read Data

The code uses a function (e.g., readTemperature()) to fetch the values.

5. Data Processing

The raw data is processed before being sent to the cloud.

→ **Validation**

Check if the reading is a number (not "NaN").

→ **Formatting**

Round the number to a readable format (e.g., 25.5°C).

→ **Alert Logic**

(Optional) If temperature > 30°C, trigger an alert.

Conclusion and Review

Integrating sensors is the foundation of IoT. By connecting a DHT sensor to a microcontroller and using libraries to read data, we can monitor environmental conditions in real-time locally or on the cloud.

Review Questions

- **1. What is the function of a DHT11 sensor?** It measures both ambient temperature and humidity in the environment.

- **2. How many main pins does a standard environmental sensor module use?** It typically uses three pins: VCC (Power), GND (Ground), and DATA (Signal).

- **3. Why do we need a software library?** The library translates the complex raw electrical signals from the sensor into readable numbers (degrees Celsius or humidity percentage) for the code to use.