MICROCONTROLLER PROJECT

Microcontroller Based System Design -24ERT2115

WEATHER MONITORING SYSTEM USING ESP8266 NODEMCU

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1 Introduction

This micro project aims to design and develop a Weather Monitoring System using the ESP8266 NodeMCU WiFi Development Board. The system will measure temperature, humidity using sensors (such as DHT11 for temperature and humidity. The NodeMCU will collect data from the sensors and transmit it over WiFi to a cloud server or IoT dashboard for real-time monitoring. Such a system is highly useful for smart cities, agriculture, and environmental studies.

2 Objectives

1. To measure real-time weather parameters like temperature, humidity and light intensity using sensors (DHT11 and LDR).

2. To transmit collected data to an online platform (like ThingSpeak or Blynk) using the ESP8266 Wi-Fi module.

3. To develop a low-cost, energy-efficient weather monitoring setup suitable for smart homes or environmental studies.

4. To analyze environmental changes over time by storing and viewing data trends.

3 Block Diagram

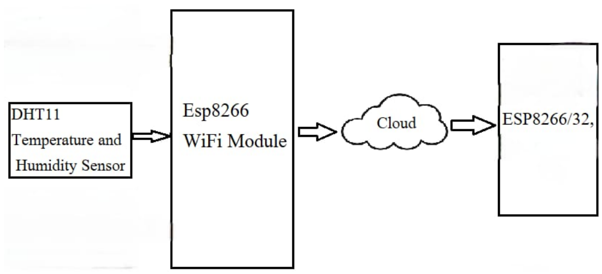

Figure 1: Block Diagram

Explanation: Sensors measure environmental parameters and send the data to the ESP8266 NodeMCU. The NodeMCU processes and transmits the data through WiFi to a cloud server or dashboard for real-time monitoring and analysis.

4 Working Principle:

A Weather Monitoring System measures and displays atmospheric conditions like temperature, humidity

Working Principle – Step by Step

Step 1: Powering the System

The ESP8266 board is powered through a USB cable or adapter (5V input).

The DHT11 sensor is connected to the 3.3V or 5V and GND pins of the ESP8266.

Step 2: Sensing Weather Data
The DHT11 sensor continuously monitors the surrounding environment.
It has:
A temperature sensing thermistor,
A humidity sensor (resistive type).
The sensor converts the analog environmental data into digital signals internally.

Step 3: Data Communication
DHT11 sends this digital data serially to the ESP8266 through a single data pin using a specific timing-based protocol.

Step 4: Data Processing by ESP8266
The ESP8266 receives the raw data and checks its checksum to verify accuracy.
Step 5: Wi-Fi and Cloud Upload
The ESP8266's Wi-Fi module connects to a configured wireless network.
Step 6: Data Display and Monitoring
The weather data can be: Displayed locally on an LCD or OLED screen

5 Components Used

1. NodeMCU ESP8266:
Acts as the main microcontroller of the project.
It reads data from the sensors and sends it to the LCD display or an IoT platform.
Has built-in Wi-Fi, so it can connect to the internet for data uploading and remote monitoring.

2. DHT11 Sensor:
Measures the temperature and humidity of the surroundings.
Sends the measured data to the NodeMCU in digital form.

3. LDR (Light Dependent Resistor):
Detects light intensity in the environment.
Its resistance changes with the amount of light falling on it (less resistance in bright light, more in darkness).
Helps to measure sunlight level.

4. Breadboard:
Used for connecting all components without soldering.
Helps to easily build and modify the circuit during testing.

5. Jumper Wires (Male to Male / Male to Female):
Used to connect components on the breadboard and NodeMCU.
Provide electrical connections for signal and power.

6. USB Cable (Micro USB for NodeMCU):
Provides a power supply to the NodeMCU.
Also used for uploading code from the computer to the NodeMCU via Arduino IDE.

6 Circuit Diagram

The simplified circuit diagram is illustrated below:

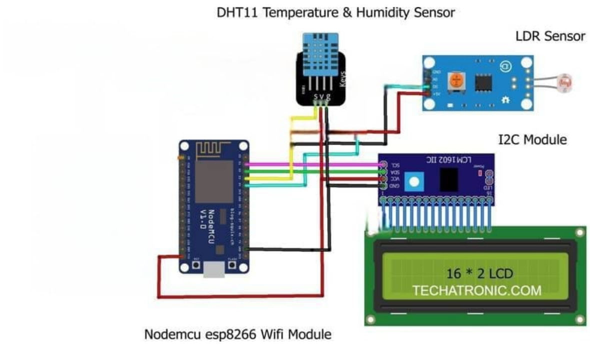

Figure 2: Circuit Diagram

Explanation: The DHT22 sensor is powered using 3.3V from the NodeMCU. Its data pin is connected to a GPIO pin of the NodeMCU.

7 Image Of The Model:

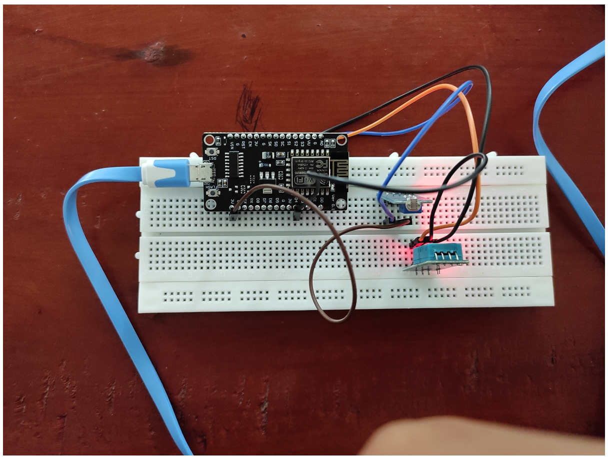

Figure 3: Image Of The Model

8 Applications:

1. Smart Agriculture – Helps farmers monitor temperature and humidity in real-time to protect crops and optimize irrigation.

2. Home Automation – Automatically controls fans, air conditioners, or humidifiers based on weather data to maintain comfortable indoor conditions.

3. Environmental Monitoring – Tracks local climate conditions for environmental research and pollution studies.

4. Weather Stations – Used in schools or communities as a mini weather station to

collect and display live weather data on an LCD or web dashboard.

5. Disaster Management Systems – Provides early warning signals during extreme temperature or humidity changes to prevent weather-related damages

9 Expected Outcomes

- Real-time measurement of temperature, humidity.
- Wireless data transmission using WiFi.
- Visualization of environmental parameters on IoT dashboard/mobile app.
- Low-cost, portable, and scalable system suitable for IoT applications.

— End of Report —