# IOT BASED WEATHER MONITORING SYSTEM

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## I. INTRODUCTION

When it comes to efficient weather monitoring, you have the choice between wired and wireless systems. .Wireless communication has revolutionized the way we stay connected. It enables information transfer over various distances without the constraints of physical wires. This advancement has made weather monitoring incredibly convenient, eliminating the need for a physical presence at the monitoring location.
In essence, wireless communication involves the seamless exchange of data over varying distances. This can range from short distances, such as a few meters (similar to a television remote control), to extended ranges covering thousands or even millions of kilometers, as seen in radio communications.
In summary, wireless technology has transformed weather monitoring, offering unparalleled convenience and flexibility. GSM technology, in particular, has emerged as a cost-effective and reliable option for building wireless weather monitoring systems, comprising essential components for accurate data collection and analysis.

## II. COMPONENTS DESCRIPTION

### A. MATERIALS REQUIRED

1] ESP8266 NodeMCU: In today's interconnected world, the Internet of Things (IoT) has emerged as a transformative force. IoT applications are reshaping industries and revolutionizing the way we interact with devices and data. At the heart of this technological revolution lies the ESP8266 NodeMCU—an open-source IoT platform that packs a punch. In this article

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The ESP8266 NodeMCU is more than just a mouthful—it's a game-changer in the world of IoT. At its core, it's a compact yet powerful development board equipped with firmware tailored to run the ESP8266 Wi-Fi System on Chip Module. The NodeMCU comes with the ESP8266 Wi-Fi Module, offering seamless connectivity options. This module opens up a world of possibilities for remote monitoring, control, and data transfer.
The integrated GPIO (General-Purpose Input/Output) pins empower you to interface with a wide range of sensors and actuators, making your IoT projects highly adaptable.

What truly sets NodeMCU apart is its affordability. When compared to other IoT development boards like the Intel Galileo, Raspberry Pi, or UDOO, NodeMCU stands out as a cost-effective solution without compromising on functionality.

Programming NodeMCU is a straightforward process, thanks to its compatibility with the popular Arduino Integrated Development Environment (IDE). This opens up a wealth of libraries and resources for your projects.

In a world increasingly reliant on connectivity and data, the ESP8266 NodeMCU emerges as a beacon of innovation. Its feature-rich design, ease of programming, and budget-friendly nature make it the ultimate choice for developing IoT applications and prototype projects. With NodeMCU, you have the power to turn your IoT visions into reality

2] The DHT11: The DHT11 is a humidity and temperature sensor, known for its precision and ease of use. It is a compact device that can be easily integrated into various projects, making it a popular choice among electronics enthusiasts and professionals

The DHT11 sensor consists of three pins:

Pin 1 (VCC): This is the voltage supply pin, typically connected to a voltage source between 3.3 to 5 volts.

Pin 2 (Data): Pin 2 is where the magic happens. It provides a digital form of output, making it easy to interface with microcontrollers.

Pin 3 (Ground): Pin 3 is the ground connection, ensuring proper circuit completion..

One of the standout features of the DHT11 sensor is its ability to measure humidity within a broad range. It can accurately measure humidity levels ranging from 20% to 90% Relative Humidity (RH). This makes it suitable for a wide array of applications, from indoor climate control to industrial processes. The DHT11 sensor boasts an accuracy of ±5% RH, ensuring that the humidity data it provides is reliable and trustworthy.

Apart from humidity, the DHT11 sensor is also proficient in measuring temperature. It can effectively measure temperatures within the range of 0°C to 60°C. The DHT11 sensor delivers in this aspect as well, with an impressive accuracy of ±2°C.

The DHT11 sensor stands as a testament to the power of simplicity and precision in sensor technology. Its ability to accurately measure humidity and temperature within a wide range makes it a valuable tool in various industries

3] USB 2.0 - A-Male to B-Male Cord - 6 Feet (1.8 Meters), Black · Connects USB 2.0 Devices.

4] L293d motor driver: The L293D is a 16-pin Motor Driver IC, designed to facilitate precise control over DC motors. Its primary function is to allow bidirectional control of these motors, meaning you can rotate them in both directions with ease.. The L293D is designed to provide bidirectional drive currents of up to 600 mA (per channel) at voltages from 4.5 V to 36 V (at pin 8!). You can use it to control small dc motors

Pin 1, 9, 16 (Enable Pins): These pins enable the respective motor channels. Applying a logical high (usually +5V) to these pins activates the motor.

Pin 4, 5, 12, 13 (Input Pins): These pins control the direction of the motors. By manipulating the logical state of these pins, you can determine whether the motor rotates forward or backward.

Pin 3, 6, 11, 14 (Output Pins): These pins are connected to the DC motor terminals and drive the motor based on the input received from the input pins

5] Dc Motor:Small - Voltage Range: Typically designed to operate between 3 volts (V) to 9 volts (V), making them suitable for a variety of low-power applications.

Physical Dimensions: With a length of approximately 30mm and a diameter of 24mm, these motors are compact and can fit into tight spaces.

Weight: Weighing in at just 7 grams, these motors are lightweight yet robust.

Rotations Per Minute (RPM): These motors are known for their high RPM, with some models reaching up to 8,500 RPM, ensuring swift and precise motion.

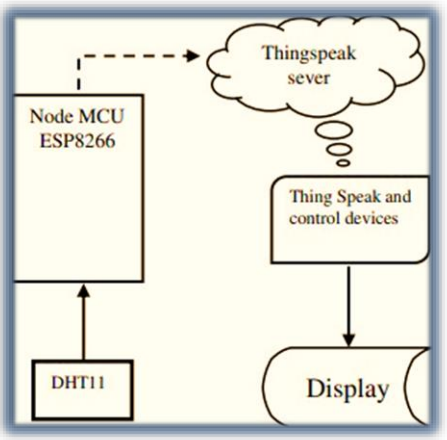
6] 9v battery: A 9V Alkaline Battery is a portable power source that provides a constant and reliable voltage of 9 volts. It is a type of primary battery, meaning it is non-rechargeable and designed for single use.

7] Battery connector: 9V Female Battery



**B. SOFTWARE REQUIRED**

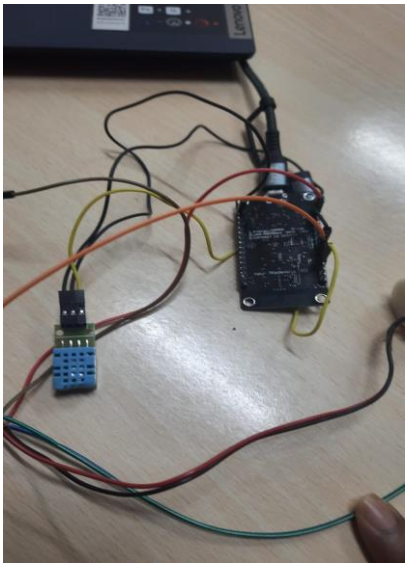
In software, Thingspeak cloud server is used.
ThingSpeak is an IoT platform that simplifies the process of collecting, analyzing, and visualizing data from various sensors or devices. It offers a cloud-based environment where users can store and manage their sensor data conveniently.
To begin using ThingSpeak, you need to create a channel, which serves as a container for your sensor data. Each channel is uniquely identified, and you can create multiple channels for different IoT applications.
Once your channel is set up, ThingSpeak provides you with API keys. These keys are essential for connecting your IoT devices to the platform securely. In our case, we'll use Node MCU to interact with ThingSpeak.
With the API keys in place, Node MCU can now transmit sensor data to ThingSpeak. In our scenario, we'll focus on temperature and humidity values as our sensor data.
For real-time monitoring, ThingSpeak provides a refresh rate of approximately 30 seconds. This means that the displayed data is updated at 30-second intervals, ensuring that users receive the most current information from their IoT devices.

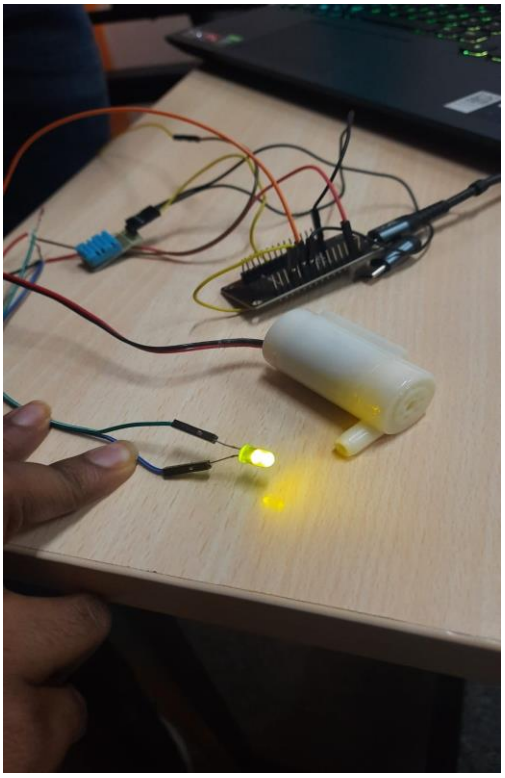


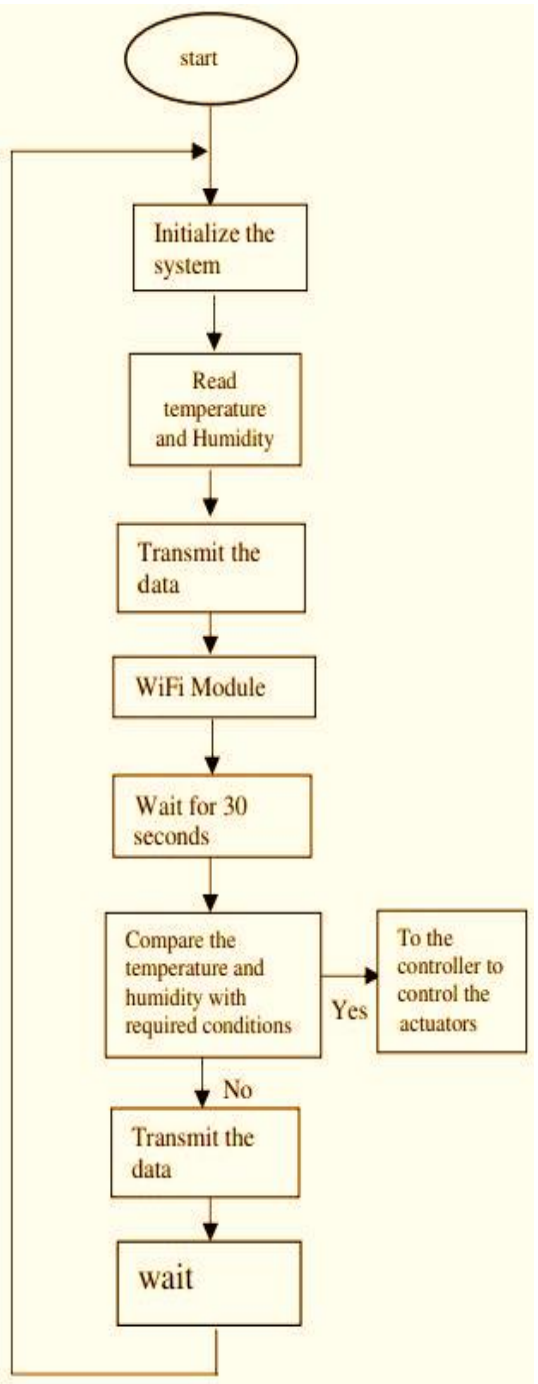

## III. Implementation

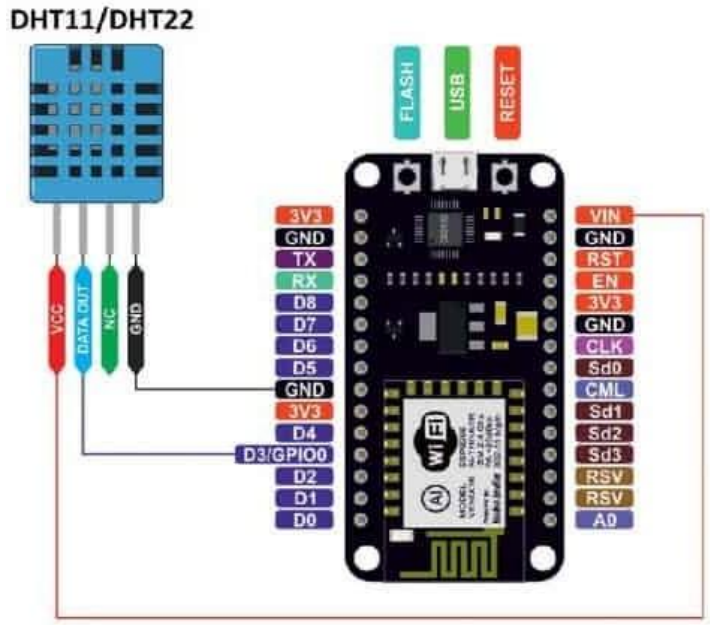
The IoT-based temperature and humidity monitoring system with Node MCU can be divided into two crucial sections: hardware implementation and software implementation. This approach ensures a seamless integration of technology into our daily lives.
At the heart of the temperature monitoring system lies the DHT11 sensor. This sensor is the epitome of simplicity and efficiency. It operates on a basic principle: it has an integrated circuit that produces a voltage output proportional to the temperature in degrees Celsius. The sensor takes care of non-linear effects, ensuring accurate temperature readings..
The DHT11 sensor is directly connected to the ESP8266 controller equipped with a WiFi module. This allows it to transmit temperature data via the internet to the ThingSpeak platform, where the data is processed and analyzed.

In a bid to maintain optimal comfort, the system employs a relay to control a fan. When the temperature surpasses 30 degrees Celsius, the relay springs into action, activating the fan. This intelligent response to temperature fluctuations ensures that your living or working space remains comfortable, even during the hottest days.
The system takes its cues from the surrounding environment. By monitoring the data from the sensing elements, it makes informed decisions regarding fan activation. This means that the fans are only turned on or off when necessary, aligning with the current environmental conditions and ensuring energy efficiency.






start
Initialize the system
Read temperature and Humidity
Transmit the data
WiFi Module
Wait for 30 seconds
Compare the temperature and humidity with required conditions
Yes
To the controller to control the actuators
No
Transmit the data
wait

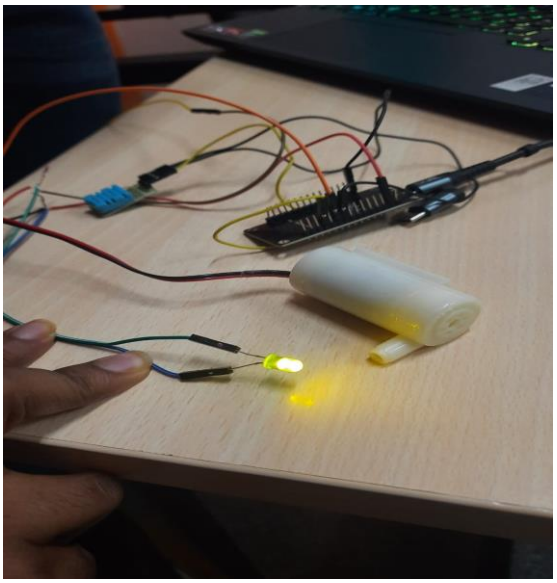



[Fig-6: Arduino board connection]

[Fig-7]

## IV. RESULTS

The Proposed system prototype was built and in this system, temperature and humidity values are displayed in ThingSpeak web browser from where users can get the current latest data and statistics.



## V. CONCLUSION

In an era where technology is reshaping our lives at an unprecedented pace, it's fascinating to witness how manual processes have evolved into automated systems that save time and energy. Among the many aspects of our lives that technology has touched, the monitoring of temperature and humidity stands out as a crucial development. These values play a pivotal role in diverse fields, from agriculture to industry, and even weather prediction.
The Internet of Things (IoT) has ushered in a new era of temperature and humidity monitoring. In IoT-based systems, sensors gather real-time data and transmit it to central hubs. This data is then made accessible via the internet, providing users with up-to-the-minute information about their environment.
Our proposed IoT-based temperature and humidity monitoring and control system offer several key features:
1. Real-time Monitoring: Users can access real-time data on temperature and humidity from anywhere with an internet connection. This empowers them to make immediate adjustments when necessary.
2. Data Storage: The system stores historical data, allowing users to track trends and make predictions based on past values. This is particularly valuable in fields like agriculture and weather prediction.
3. Graphical Representation: Data is presented in graphical form, making it easy for users to visualize temperature and humidity trends over time. Graphs provide a clear picture of how conditions have evolved.

The adoption of IoT-based temperature and humidity monitoring and control systems marks a significant step forward in various industries. From ensuring crop health to preserving invaluable cultural artifacts, these systems enhance precision and efficiency.

## VI. FUTURE SCOPE

The present is a time of incredible technological advancements, but the future holds even more exciting possibilities. One such advancement that promises a brighter and more connected future is the expansion of IoT-based temperature and humidity monitoring systems.
IoT-based temperature and humidity monitoring systems have already proven their worth in various applications. From agriculture to industries, these systems have provided real-time data and insights. However, their potential reaches far beyond their current use.

One promising aspect of the future scope is the application of these systems in developing cities. As urbanization accelerates, there is a growing need to monitor and manage environmental conditions. IoT-based systems can play a pivotal role in gathering data that helps city planners make informed decisions about infrastructure and resource allocation.
As we look ahead, the future of IoT-based temperature and humidity monitoring systems appears incredibly promising. These systems will not only continue to serve their current applications but will also expand into new frontiers, from developing cities to the industrial zones of tomorrow.

The integration of mobile applications will make these systems more accessible than ever, ensuring that users can tap into real-time insights and make informed decisions on the go.

In a world that is becoming increasingly interconnected, IoT-based monitoring systems stand as a testament to our ability to harness technology for a brighter and more connected future.