



# IOT BASED TEMPERATURE AND HUMIDITY CONTROLLER USING NODE MCU ESP8266 AND BLYNK IOT INTERGATION

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**Abstract - The internet of things (IOT) has changed the world the way we communicate with and manage our homes. This paper study and implementation of IOT-based Temperature and Humidity Controller using Node MCU gives the ability to connect the cloud. Here we can monitor and control according to the environmental conditions in real time. This system uses a Node MCU microcontroller, equipped with Wi-Fi capabilities, to interface with temperature and humidity sensors like the DHT11. Data from these sensors is continuously monitored and transmitted to a cloud platform, allowing users to remotely observe and manage the environment via a smartphone, Computer, or any smart devices. When the temperature or humidity deviates from the set thresholds, the controller activates connected actuators, such as fans, heaters, or humidifiers, to restore the desired conditions. This IoT-based solution is energy-efficient and enhances user convenience, making it ideal for applications in smart homes, greenhouses, and industrial settings.**

**Key words: Internet of things (IOT); Home Automation; Arduino IDE; Blynk IOT; temperature and humidity sensor.**

**1. Introduction:** The integration of the Internet of Things (IOT), home automation has witnessed tremendous technological breakthroughs that have revolutionized the globe by enabling us to manage, monitor, and watch our home appliances, hence making human life easier [1-8]. Smart home automation allows us to control and access information on how to operate our home appliances from any smart device, like a laptop, phone, tube light, and mobile phone, from anywhere in the world [9-14]. A technology known as the Internet of Things (IOT) is typically used to connect, control, and manage your devices and appliances via the internet [15-20]. With the help of a system made up of sensors and internet-connected household equipment or devices, we can communicate virtually. Runtime humidity readings, light control, air conditioning, heaters, fans, and many more devices can all be made easier to operate with a smart home automation system. Additionally, it lets users regulate the security and safety majors as they see fit. [21-24]. The Internet of Things (IOT) is a simple, traditional, and efficient method of connecting, managing, and keeping an eye on electrical equipment. It is also used to regulate and alter various parameters, such ambient temperature and humidity,



via the internet [25-29]. Depending on the needs, such as turning on lights when it becomes dark, Mandula et.al., (2015) offered a system that can be used to monitor and regulate data that can be sensed by the sensor, such as light, temperature, body movement, humidity, etc. Additionally, it is utilized for timely data storage in Gmail [30]. Pothanaicker et.al., (2016) gave a presentation that essentially explained how software coding in a computer system can be used to control household appliances. In addition to saving energy, it provides access to household equipment via a website that can be controlled even when we are not at home and there is Wi-Fi available [31]. Singh et.al., designed a system in 2017 that can perform various jobs based on the needs at home. This enables remote control via the internet. This project's primary goal is to reduce interference and human labor. The goals of the smart home automation system include developing wireless technology communication with the aid of the cloud or networking without the need for wires. The cloud should be used to store data from various sensors. Depending on the situation, the owner can use the internet to control one or more home appliance devices. [32] A project by Kodali et.al., was released in 2016. Its primary goal is to introduce a wire-free security system or alarm that may notify the owner via the Internet if any activity takes place outside of the designated area. Furthermore, sensors can be used for smart home systems [33]. A smart home automation system was created in 2017 by Sharma et.al., to link and control an Android smartphone via the internet. We can connect to the system and control it by downloading a mobile application. From the smartphone, we may control the cooler, tube light, air conditioner, and fan [34]. Soliman et.al., designed and presented a home automation system in 2017 using the Lab-view platform and an Arduino microcontroller board. Two pieces of hardware are utilized in this project to build the following system: a laptop serves as a local server or control panel, and Lab-view serves as a conduit for connecting to and managing the Arduino microcontroller board. The gadget reacts to the homeowner's instructions [35]. According to Satapathy et.al., (2018), Arduino MCU boards are popular because they are less expensive, simple to install, and offer security in addition to smart home control. Wi-Fi is linked in order to control. Using smartphone apps, owners can link their home appliances and steal data [36]. Hossain et.al., introduced a smart home automation system in 2018 that provides information about the device connected via a movement sensor, server, and switch, among other components [37]. According to reports from Kansai University 2454 in 2020, wire-less machine learning, communications, additional systems, and real-time information appear to be present. The government has implemented a number of initiatives to build Internet of Things applications for smart cities, transportation, healthcare, and residences [38-41]. Sharma et al. developed a smart home automation system in 2017 that connects and controls an Android smartphone online. We can connect to the system and control it by downloading a mobile application. From the smartphone, we may control the cooler, tube light, air conditioner, and fan [42]. Soliman et al. designed and presented a home automation system in 2017 using the Lab-view platform and an Arduino

microcontroller board [43]. T.K.Panda et al. published a system in 2023, about the smart operating of the home appliances with a micro controller NodeMCU ESP8266 from distance end with the blynk iot application [44].

## 2. Design:

In the following project the hardware component required are NodeMCU ESP8266, which is microcontroller with a inbuild ROM and RAM etc. And a temperature and humidity sensor that is DHT11 which will collect the data from the informant that is temperature and humidity in digital form. Another component that is relay which is a relay is an electrically operated switch.

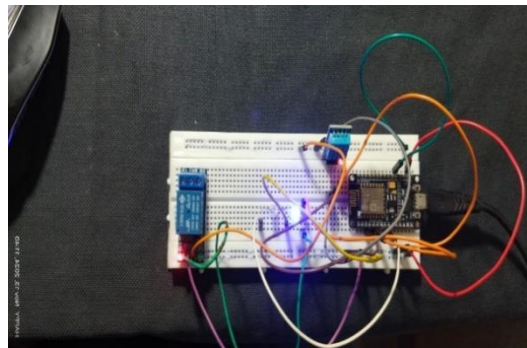


Figure 1: circuit diagram

Download and install the Arduino IDE in our desktop and Blynk IOT in the mobile from the play store. Then download all the corresponding files of ESP8266, DHT11 and Blynk IOT in the Arduino IDE as NodeMCU is a separate from Arduino board so we need to add a separate board for NodeMCU in Arduino ide. If you have already installed Arduino Ide in your PC After all, write the corresponding code to connect the Node MCU to the internet and can be control with the help of Blynk IOT application which is installed in the mobile.

Some step to program into NodeMCU with Arduino IDE.

Navigate to File–Preferences after opening the Arduino IDE.

To exit the Preferences page, copy the URL below into the Additional boards Manager box and click OK.

Then Goto Tools – Board – Board Manager.



Install it by typing esp8266 into the search bar. A new NodeMCU board appears in your Arduino IDE after installation.

Now that every stage has been finished, let's begin programming.

Now we will write all the respective code of the pseudocode.

### 3. Simulation parameter:

Table1: Components required to design the circuits

SLNO.	COMPONENTS:	QUANTITY:
01.	NODE MCU (ESP8266)	01
02.	DHT11 TEMPERATURE AND HUMIDITY SENSOR	01
03.	RELAY	01
04.	LED	01
05.	JUMPER WIRE	10

### 4. Specification of component:

1. **NODE MCU (ESP8266):** The Node MCU (ESP8266) is a small, affordable development board that makes it easy to create Wi-Fi-enabled projects. It is built around the ESP8266 microcontroller chip, which can connect to the internet and has several pins for connecting other electronic components. You can program it using the Arduino IDE, MicroPython, or Lua. It's popular for making smart devices, home automation systems, and other IoT (Internet of Things) projects because it's simple to use and cost-effective.



2. **DHT11 TEMPERATURE AND HUMIDITY SENSOR:** The DHT11 is a simple, less-cost sensor that measures both temperature and humidity. It has a built-in chip that converts the readings into digital signals, making it easy to connect to microcontrollers like Arduino or Raspberry Pi. The DHT11 is simple to use and is often used in DIY electronics projects to monitor environmental conditions. It can measure temperatures from 0°C to 50°C and humidity from 20% to 90% with reasonable accuracy.
3. **RELAY:** A relay is an electronic device that act as a switch which allows a low-power signal, like the signal from microcontroller, to control a higher-power device, such as a light or motor. It uses an electromagnet to open or close its internal switch, letting you turn devices on or off without directly connecting them to a small control circuit. Relays are commonly used to safely control high-voltage or high-current devices in home automation and other electronic projects.
4. **LED:** An LED is a small, light source that glows when electricity passes through it. Unlike regular light bulbs, LEDs use very little power and last much longer. They come in different colors and are commonly used in things like display screens, indicators on electronics, and lighting for homes and vehicles. LEDs are popular in electronics because they are durable, cost-effective, and produce very little heat.
5. **JUMPER WIRE:** A wire which is short and flexible used to make connections or used in the junction to connect between different parts of an electronic circuit is known as jumper wire. These wires have connectors at both ends, making it easy to connect components like sensors, microcontrollers, or breadboards without the need for soldering. Jumper wires are commonly used in prototyping to quickly test and build electronic projects, and they come in various colors to help keep track of different connections.

## 5. Software implementation:

The software implantation code is written is Arduino IDE to connect the hardware Node MCU ESP8266 with blynk IOT application. So, that we can connect and control our Node MCU from mobile with the help of internet.

Initialize Libraries and Pin Definitions:

Define Blynk template ID, template name, and authentication token.



Include necessary libraries (DHT sensor, ESP8266 WiFi, Blynk).

Define DHT sensor pin (D2) and type (DHT11).

Initialize DHT sensor with the defined pin and type.

Define WiFi SSID and password.

Initialize Blynk Timer.

Setup Function:

Set D4 and D6 as output pins.

Begin Blynk connection using the authentication token, SSID, and password.

Start serial communication at 115200 baud rate.

Begin DHT sensor.

Blynk Write Function:

Read value from Blynk app on virtual pin V0.

Control LED connected to D4 based on the value from the Blynk app.

Loop Function:

Run Blynk.

Run Blynk Timer.

Wait for 3 seconds.

Sensor Reading:

Read humidity and temperature from DHT sensor.

Check if readings are valid.

If not valid, print error message to Serial Monitor and exit function.

Output Results:

Print humidity and temperature values to Serial Monitor.

Control LEDs Based on Sensor Readings:

If temperature > 24°C, turn on LED connected to D6.

If temperature  $< 28^{\circ}\text{C}$ , turn off LED connected to D6.

If humidity  $> 70\%$ , turn on LED connected to D4.

If humidity  $< 70\%$ , turn off LED connected to D4.

## 6. Result analysis:

Case.1 Whenever humidity is more than the predefined value given by the user then the corresponding pin connected to the relay switch is ON. As other led do not respond except the blue LED because we are not interrupting any other factor such as temperature present here.

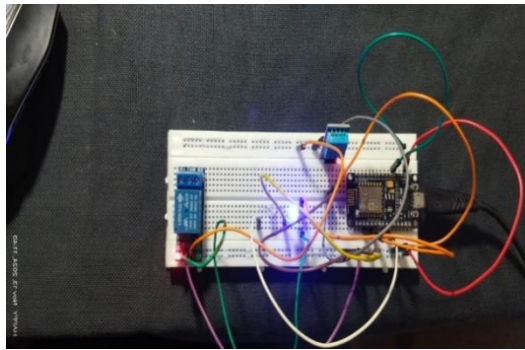


Figure-2 Output when switch is ON

Case.2 Whenever humidity is less than the predefined value given by the user then the corresponding pin connected to the relay switch is OFF. As other led do not respond except the blue LED because we are not interrupting any other factor such as temperature present here.

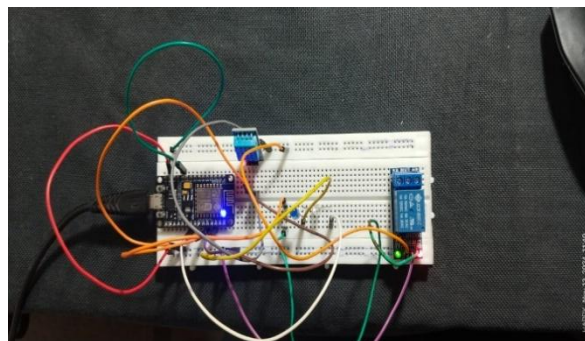


Figure -3 Output when switch is OFF

Case.3 Whenever temperature is less than the predefined value given by the user then the corresponding pin connected to the relay switch is ON. As other led do not respond except the blue LED because we are not interrupting any other factor such as temperature present here.

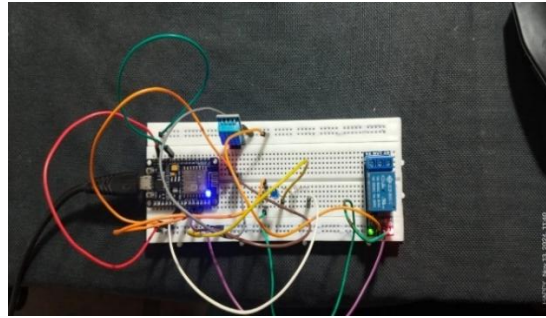


Figure -4 Output when switch is ON

Case.4 Whenever temperature is less than the predefined value given by the user then the corresponding pin connected to the relay switch is ON. As other led do not respond except the blue LED because we are not interrupting any other factor such as temperature present here.

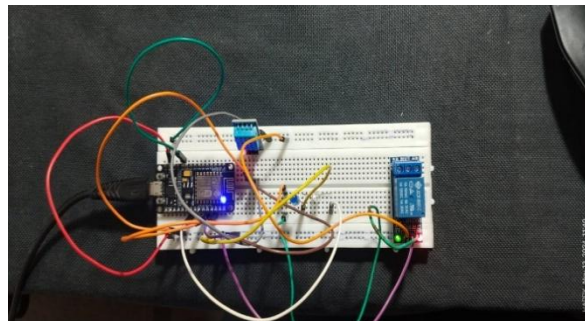


Figure -5 Output when switch is ON

## 7. CONCLUSION

In the above project, when the temperature and the humidity come down from the threshold value entered by the use the corresponding pin that is connected to the relay will turn OFF. Similarly, when the temperature and the humidity go up from the threshold value entered by the use the corresponding pin that is connected to the relay will turn ON.



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