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Original Article

An Intelligent System for Monitoring Various Parameters in Irrigation System using IoT

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Abstract - *An intelligent system for monitoring environmental parameters using Node MCU is proposed. This Intelligent system monitors the changes in environmental parameters in different regions. The sensor senses the data and sends it to the slave controller (Node MCU). And then, the controller sends the obtained data to Thing Speak. A gateway between sensor nodes and the cloud is provided by Thing Speak. Using Thing HTTP, the data is uploaded to the cloud and shown on a webpage. Additionally, the information can be obtained through calls or SMS. A few experiments were carried out in various environments and at multiple altitudes using the proposed technology. The results were contrasted with historical weather information. It was discovered that the system's acquired data was much more accurate than typical weather information provided online. With this project, we can monitor temperature and humidity. When the humidity and temperature values exceed or are less than the required threshold values, it sends the alerts either through a message or through a call based on the user's requirement. Then the users can alter their process based on these alert messages to get good results. With this project, we can also adjust the threshold values based on users' suitable requirements.*

Keywords - *NodeMCU, Thing Speak, IFTTT.*

1. Introduction

The "Internet of things" (IoT) is a term used to describe physical objects (or collections of such objects) that are outfitted with sensors, computing power, software, and other technologies and may also exchange data with other devices through the help of internet or other communications networks [1]. Devices need to be individually addressable and connected to a network, not the entire internet, which has led to criticism of the name "internet of things" [3]. IOT is the new trending technology that has changed the existing world for the past 20 years. But this technology must be used with proper care since it also leads to massive damage to humankind. One step in the industry and government efforts to address the risks connected with the growth of IoT technology and products, particularly in the fields of privacy and security, agriculture, automatic control systems, and many others, is the establishment of global and local standards, guidelines, and regulatory frameworks [5]. These IOT devices can connect and communicate with other devices, and moreover, they can be controlled remotely or over the internet. Environmental parameters like temperature, humidity, and turbidity are the parameters that help us to analyze environmental characteristics. The presence of humidity is helpful in indicating the dew, fog, and precipitation [7].

Temperature measures the coldness or hotness of an object to its surroundings [9]. Its units are Celsius, Fahrenheit, and Kelvin. Humidity usually referred to as moisture, is a measurement of the amount of water vapor in the atmosphere [12-14]. The measurement of body temperature can help to detect problems in our bodies. Applications like laboratories, paper manufacturing, radiators etc., are the places where temperature monitoring plays a major role. Relative Humidity (RH) is directly proportional to temperature [16]. It means if the temperature is stable in your system, then the relative humidity is also stable. Humidity also depends on the pressure of the systems [18]. Applications like building materials, Pharmaceuticals etc., are the places humidity monitoring places an important role [9]. The project's findings give an explanation for the statistical analysis and global real-time temperature and humidity monitoring [20].

2. Methodology

2.1. Proposed Methodology

Any environmental conditions are tracked, and data is sent to the cloud—most cru- cially the real-time environmental parameters. Any environmental anomalies can be stored in Thing Speak, where anyone can monitor the situation using the internet. Suppose we combine the internet with cutting-edge technology like near-field

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communications, real-time localization, and embedded sensors. In that case, we might be able to comprehend and react to our surroundings better. If the environment's condition changes, this system sends alert messages alerting the user to take action.

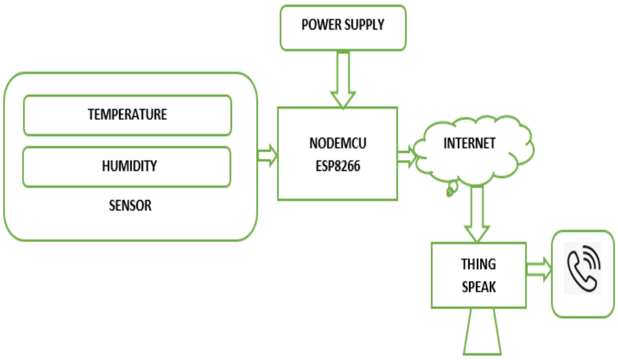

Fig. 1 The Block Diagram.

The system comprises a DHT11 sensor, a low-cost temperature and hu- midity sensor, and a Node MCU ESP8266 microcontroller with a Wi-Fi module. Fig. 1 depicts the system's functional flow. A DHT11 sensor measures the temperature and humidity in real-time and delivers the information to a microcontroller equipped with a Node MCU ESP8266 Wi-Fi module. Then the information is transmitted over the internet to the Thing Speak cloud. The entire data generated by the DHT11 sensor is stored in the Thing Speak cloud. Then through Thing HTTP, the Thing Speak is connected to the If This Then That (IFTTT) to get the alert messages whenever the Temperature and Humidity values exceed or are less than the threshold values or ranges. Fig.1 shows the Block Diagram.

2.2. Node MCU ESP8266 Microcontroller: A Wi-Fi Module

Node MCU ESP8266 is a 32-bit microcontroller and a Wi-Fi module. It is more often used in a variety of applications. It gives users access to module's GPIO (General Purpose Input/Output), which can either be an input or an output pin with pro- grammable behavior. There are 16 GPIO pins in the processor chip; some are utilized for interfacing with other System on Chip parts like flash memory for storing the data. The remaining 11 GPIO pins are used for GPIO functions. Node MCU is a trans receiver; that is, it acts as both the transmitter and receiver. The code from the IDE can be transferred to this microcontroller through a USB cable.Fig.2 represents the Node MCU ESP8266 microcontroller, a Wi-Fi module.

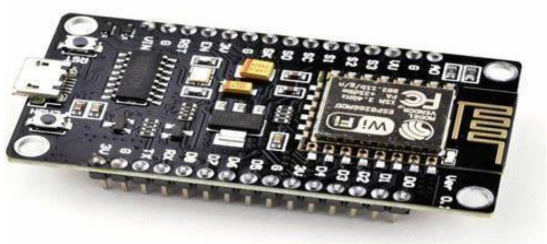

Fig. 2 The NodeMCU ESP8266 microcontroller, a Wi-Fi module.

2.3. DHT11 Sensor

The most important advantage of choosing the DHT11 sensor is that we can measure both temperature and humidity with this sensor itself. Moreover, we can also measure gas with this sensor. Instead of two different sensors, we can use only one sensor, and this is cheap too. DHT11 sensor has 3 pins. VCC, OUTPUT and GND. This sensor also has strong anti-interference, rapid response, good precision and digital signal output. This sensor can easily be interfaced with microcontrollers like Node MCU, Arduino, Raspberry Pi etc. A sensor and a module are options for the DHT 11 sensor. The pull-up resistor and a power-on LED distinguish a sensor from a module.

The thermistor and capacitor make up the DHT 11 sensor. Temperature is measured with a thermometer. A thermistor adjusts its resistance in response to variations in temperature. The thermistor that is most frequently used has a negative temperature coefficient. It implies that the resistance value lowers as the temperature rises. The dielectric between the two electrodes of the capacitor, which contains two electrodes, is a substrate that may hold moisture. The measurement of humidity is based on changes in capacitance. It can measure temperatures between 0 and 50 degrees Celsius with 2 degrees accuracy. It can measure humidity with a 2 percent accuracy range of 20 to 80 percent. The DHT11 sensor has a sampling rate of 1Hz. It indicates that the sensor takes a reading once every second. The operational voltage range for this sensor is 3 to 5V. This sensor's maximum current consumption is 2.5 mA. Fig.3 represents the DHT11 sensor.

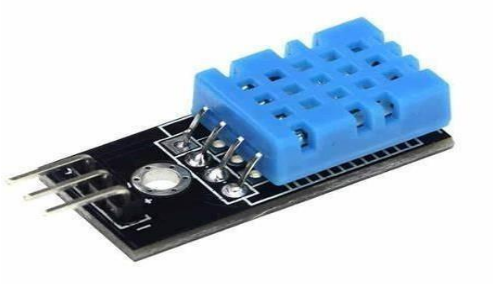

Fig. 3 The DHT11 Sensor.

2.4. Connection of Hardware

Node MCU ESP8266 with Wi-Fi module, DHT 11 Sensor, Bread Board, and Connecting Wires are the hardware components we need. The 3V pin of the Node MCU ESP8266 should be linked to the VCC pin of the DHT 11 Sensor. The DHT 11 Sensor's OUTPUT pin needs to be linked to the Node MCU ESP8266's D2 port. The Node MCU ESP8266's Ground pin should be linked to the GND pin of the DHT 11 Sensor. After the connection is completed, the appropriate code should be uploaded to the Node MCU ESP8266 from the Arduino IDE using a USB cable. Fig.4 shows the connection of hardware.

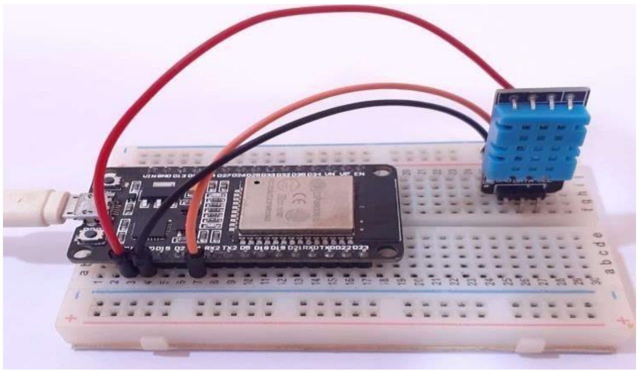

Fig. 4 The Connection of hardware.

2.5. Implementation of Thing Speak

Thing Speak is free, open-source software that lets people talk with internet-connected gadgets. It was created in Ruby. It facilitates data access, retrieval, and logging by providing an API to social network websites and mobile devices. Thing Speak is integrated with the mathematical computing platform MATLAB from Math Works, enabling users to analyze and visualize uploaded data using MATLAB without purchasing a MATLAB license from Math Works. By exchanging information, IoT systems provide a simple yet effective way to collaborate with different devices and applications. The responsibility for messaging transmission to connected clients falls on IoT services. Thing Speak is an IoT platform for collecting and storing sensor data for developing IoT applications on the cloud. The Thing Speak Apps on the IoT platform enable you to evaluate, and in MATLAB, you can visualize your data before taking action. Thing Speak generates an API key which needs to be pasted in the appropriate code so that the hardware can be linked to the Thing Speak. Here the entire data can be monitored and stored, which helps to analyze the information. Thing Speak was originally designed as a service for supporting IoT applications. Fig.5 shows the Thing Speak platform.

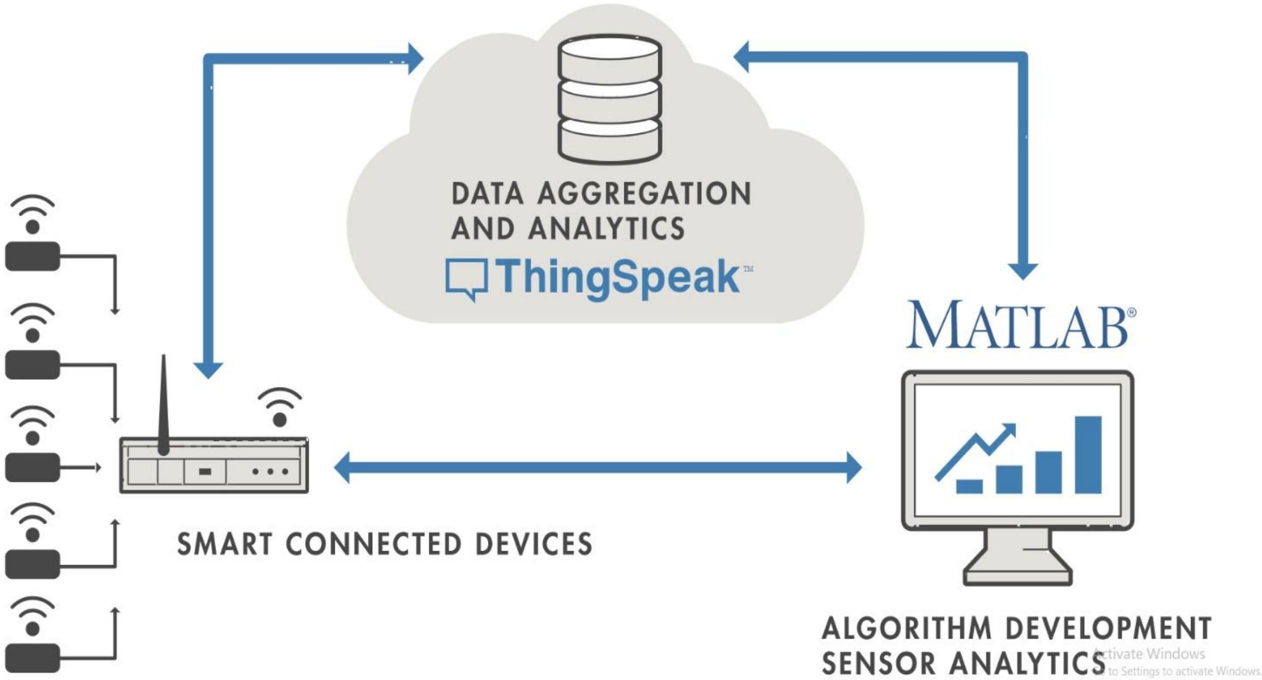

Fig. 5 Thing Speak platform.

2.6. Implementation of If This Then That (IFTTT)

If This Then That, or IFTTT, is a privately owned business that operates online digital automation systems that it makes available as a service. Its platforms give users, who numbered 18 million as of 2020, a visual interface for creating cross-platform if statements. IFTTT collaborates with various providers of common services and integrates them through its platform using open APIs. They provide IFTTT with event notifications and carry out commands that apply the responses. IFTTT's fundamental building blocks are services, formerly referred to as channels. They primarily define a collection of information from a specific digital service, like YouTube or eBay. Services can also represent operations governed by specific APIs, such as SMS. They may occasionally reflect data related to the weather or markets. Each service has a unique set of actions and triggers. The Applets are created in this platform, taking input as Webhooks. It is web connectivity which is used to connect the devices. Then set the output as Notifications for sending the alerts in the form of SMS or the output as VoIP for transmitting the signals in the form of voice Calls. Fig.6 shows the creation of Applets.

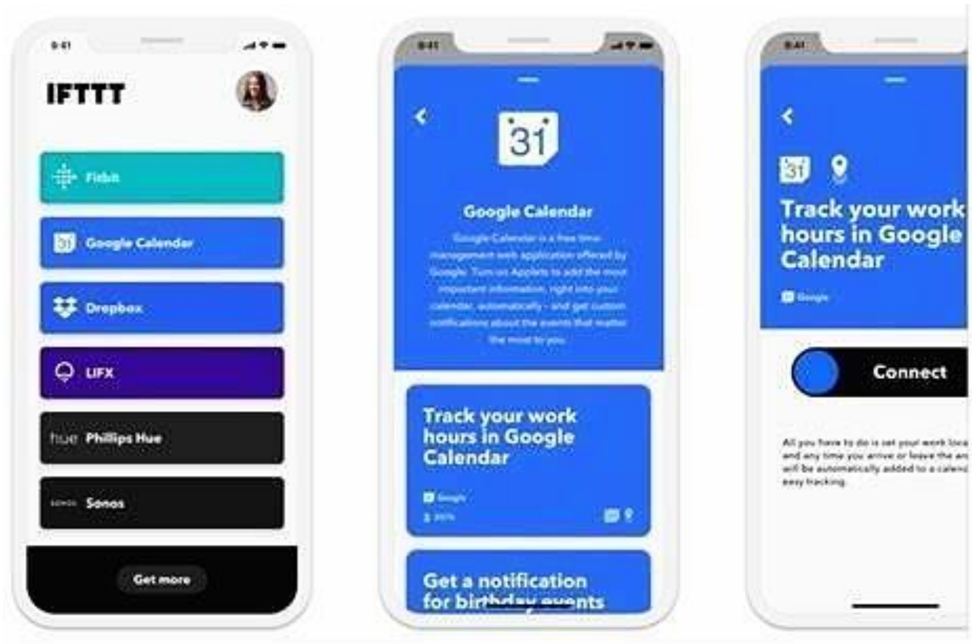

Fig. 6 The creation of Applets.

3. Result

Fig.7 shows the Temperature and Humidity values of real-time environments like normal room conditions, hot water, under cold room conditions etc. In Thing Speak, we created two fields. One is for Temperature, and the other is for Humidity. The below figure shows that field 1 is used for temperature and field 2 is used for humidity. Whenever the temperature exceeds 30 degrees Celsius, we will get an alert through a voice Call.Fig.8 shows the alert through call whenever the temperature exceeds the threshold value. We can change the threshold values based on the user's requirement. Fig.7 shows the Temperature and Humidity measured values in Arduino IDE. Fig.9 shows that temperature and humidity measured values in Arduino IDE. For irrigation applications, an intelligent monitoring system utilizing IoT is deployed.

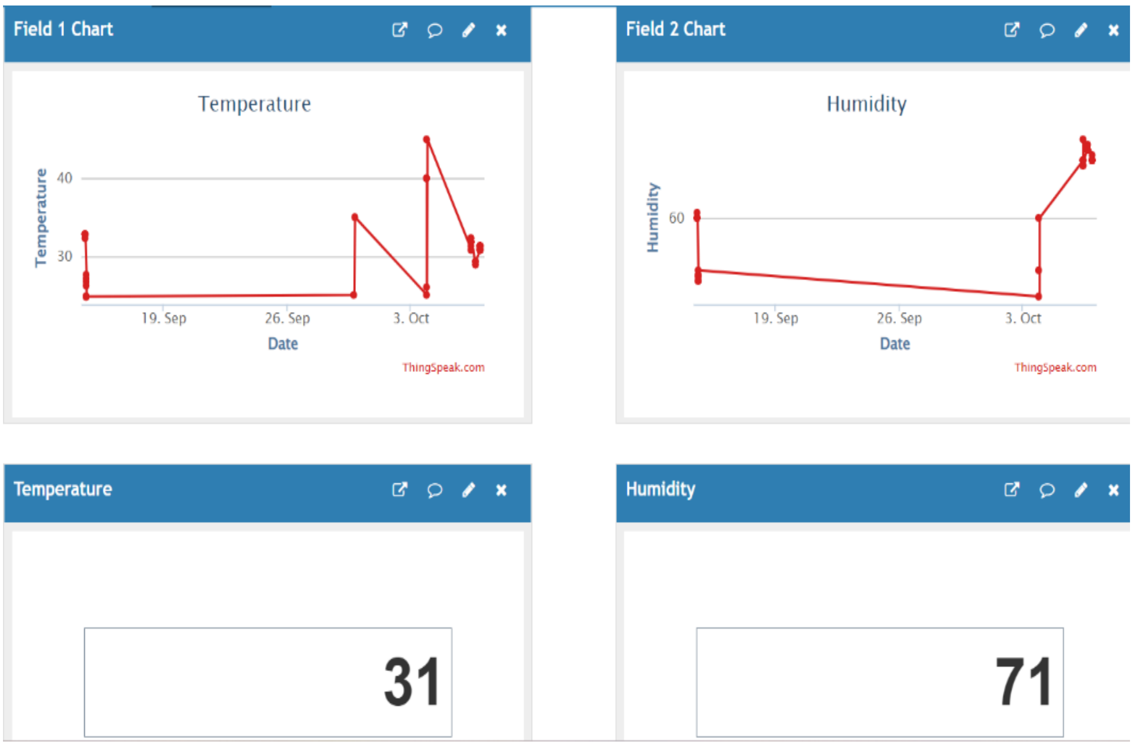

Fig. 7 Temperature and Humidity values of real-time environments on Thing Speak.

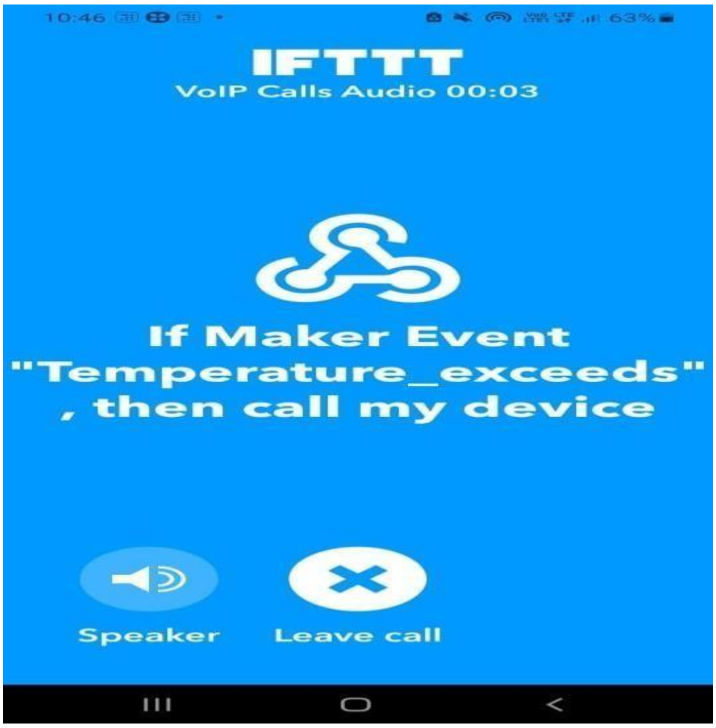

Fig. 8 The alert through call when the temperature exceeds the threshold value.

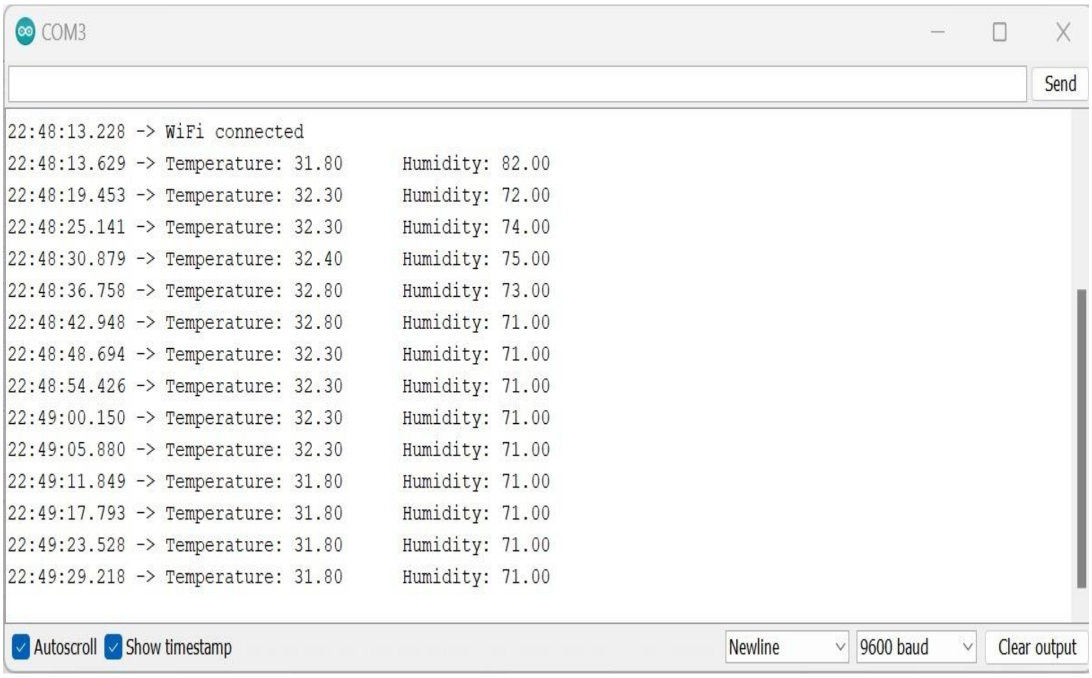

Fig. 9 The Temperature and Humidity measured values in Arduino IDE.

4. Conclusion

The suggested IoT-based real-time environmental monitoring system provides a reliable and quick method for keeping track of environmental variables, including temperature and humidity. Node MCU is offered as a monitoring system for environmental factors. Using the DHT11 sensor, the suggested system gathers various environmental data and transmits it via SMS or a web page. The created prototype was used in testing at various locations and altitudes. Since this device immediately provides alert messages when the temperature and humidity values are less than or more than the appropriate amount, the results of the studies were summarized, and information about the environment could be provided to users who used the data as an aid then the customer can alter the procedure, aiding in good outcomes. The proposed approach is new since it added two gauges (Temperature and Humidity) with data verified using the

Thing Speak platform. The proposed system is more than just a model for gathering data. It collects information and translates it into an indicator for the farmers that aids their output. The suggested system's accuracy is always a cause for concern, and high-level data analysis must be done to correlate data. Additionally, the threshold values can be modified to suit the user's needs. With the aid of a DHT11 composite sensor, this project displays the results of temperature and humidity variations that occur in real-time and delivers alert messages.

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