

Monitoring The Temperature And Humidity Air In The Room Using A Sensor IoT-Based DHT-11

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Abstract

Air is an important element in everyday life. Therefore the air must have quality so as not to have a negative impact on the body. Low air humidity can cause drying of the air membranes, and if the air humidity in a room is too high it can result in high growth of microorganisms. Abnormal humidity levels can become a respiratory problem and interfere with human health. The temperature and humidity monitoring device is designed based on the NodeMCU ESP8266 and the DHT-11 sensor to measure air temperature and humidity. This study aims to make it easier to know the temperature and humidity in real-time. A temperature and humidity monitoring tool based on NodeMCU ESP8266 is designed with a DHT-11 sensor to measure air temperature and humidity. temperature and humidity air monitoring results will then be sent via a wifi network connection and displayed on an Android smartphone.

Keywords: Temperature and Humidity air, NodeMCU ESP8266, DHT-11 sensor

1. Introduction

It is important to know the air condition where people live, especially indoors, because indoor pollution is different from outdoor air pollution. The easiest way to find out whether a room is healthy or not is to know the humidity level of the room. Air humidity itself is different from air temperature, but people in general always consider it the same. The higher the temperature of an object, the hotter the temperature of an object. To measure air temperature quickly, you can use a thermometer, be it a wall thermometer, or by using a laser thermometer. The amount of water vapor in the air is the humidity of the air. Low air humidity can cause drying of the air membranes, and if the air humidity in a room is too high it can result in high growth of microorganisms. Abnormal humidity levels can become a respiratory problem and interfere with human health.

2. Theoretical basis

2.1. Temperature Monitoring

A thermometer is a tool used to measure temperature (temperature), and changes in temperature. The term thermometer comes from the Latin thermo which means temperature and meter which means measure. Temperature is a property that determines whether a system is in thermal equilibrium with other systems or not, if two or more systems are in thermal equilibrium then the systems are said to have the same temperature. Temperature indicates the degree of heat of an object. Simply put, the higher the temperature of an object, the hotter it is, conversely, the lower the temperature of an object, the colder it is. Microscopically, temperature shows the energy possessed by an object. Every atom in an object moves, both in the form of displacement and movement in the form of vibrations.

2.2. Air Humidity

Humidity is the amount of water contained in the air, usually expressed as a percentage. This humidity is related to or influenced by air temperature, and together between temperatures. A condition where the air temperature inside the body becomes very hot on a large scale, due to an evaporation system.

2.3. Room

Space is a material substance, like stone and wood. However, space is generally amorphous and scattered. Universal space has no definition. When an element is placed on a plane, a visual relationship is formed. When other elements begin to be placed in that plane, a double relationship occurs between space and these elements as well as between one element and another.

2.4. DHT-11 Sensor

The DHT11 sensor is a sensor module that functions to sense the temperature and humidity of an object which has an analog voltage output which can be further processed using a microcontroller. This sensor module is included in resistive elements such as temperature measuring devices such as NTC for example. The advantages of this sensor module compared to other sensor modules are in terms of the quality of reading the sensor data, it is more responsive, has speed in sensing the temperature and humidity of objects, and the data read is not easily disturbed. The DHT-11 sensor has a fairly accurate calibration feature for temperature and humidity readings. Calibration data is stored in OTP program memory which is also known as calibration coefficient. This sensor has 4 pins, and there is also a DHT-11 sensor with a breakout PCB which only has 3 pins.

2.5. Internet Of Thing (IOT)

Internet of Things (IoT) is a concept that aims to expand the benefits of continuously connected internet connectivity. As for capabilities such as data sharing, remote control, and so on, they also include objects in the real world. Internet of Things or often called IoT is an idea where all objects in the real world can communicate with each other as part of an integrated system using the internet network as a link.

2.6. Microcontroller

Microcontroller is a functional computer system on a chip. It contains a processor core, memory (a small amount of RAM, program memory, or both), and input-output equipment. In other words, a microcontroller is a digital electronic device that has input and output as well as control with a program that can be written and deleted in a special way, how the microcontroller actually reads and writes data. Microcontrollers are used in automatically controlled products and devices, such as machine control systems, remote controls, office machines, household appliances, heavy equipment, and toys. By reducing the size, cost and power consumption compared to designing using a microprocessor memory and separate input output devices, the presence of a microcontroller makes electrical control for various processes more economical.

2.7. NODEMCU ESP8266

NodeMCU is basically a development of ESP 8266 with e-Lua based firmware. The NodeMcu is equipped with a micro USB port which functions for programming and power supply. Apart from that, NodeMCU is also equipped with push buttons, namely reset and flash buttons. NodeMCU uses the Lua programming language which is a package from esp8266. The Lua language has the same logic and programming structure as C, but the syntax is different. If you use the Lua language, you can use the Lua loader and Lua uploader tools. Apart from the Lua language, NodeMCU also supports the Arduino IDE software by making a few changes to the board manager on the Arduino IDE. Before being used, this board must be flashed first so that it supports the tools to be used.

2.8. WI-FI

"Wireless Fidelity" or abbreviated WiFi is a technology that uses radio waves to connect devices (PC, Laptop, smartphone) to a computer network. Or the definition of WiFi is a technology that uses radio waves so that computers can access the internet. For a WiFi connection, a wireless adapter (without cables) is needed to build a hotspot, so that with a certain coverage, users can access the internet.

2.9. IC Regulator 7805

The 78xx series integrated circuits are a family of fixed-value voltage regulator integrated circuits. The 78xx is the preferred choice for many electronic circuits that require a regulated power supply because it is easy to use and relatively inexpensive. For individual IC specifications, xx is replaced by a two-digit number indicating the designed output voltage, for example the 7805 has a 5 volt output and the 7812 has a 12 volt output.

3. Results and Discussion

The implementation method in this study is generally divided into 5 stages as shown in the following diagram:

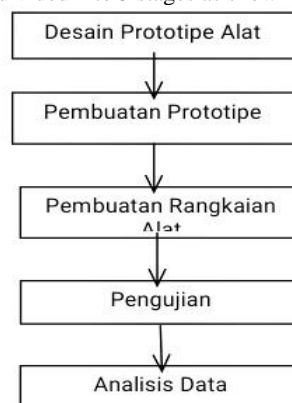


Fig. 1: Research Workflow

3.1. Research Materials

The materials used to monitor room temperature and humidity using IOT-based DHT-11 sensors are as follows:

1. USB data cable and rainbow cable
2. DHT-11 sensors
3. NodeMCU ESP8266
4. Wi-Fi network
5. Smartphones
6. 12 Volt Adapter
7. Glue
8. Soldering
9. Tin
10. PCB board
11. Some bolts and nuts

3.2. Tool Making

Tool making is done manually. The PCB manufacturing process is as follows:

1. Create a PCB schematic using eagle software. The finished schematic is then made to install.
2. In the create to Board process, the ready Schema will be redesigned in such a way
3. The PCB layout is printed using glossy paper or glossy paper.
4. Print a glossy paper layout on a plain PCB using an iron, until the ink sticks to the PCB.
5. The printed PCB is then dissolved using a ferrite chloride (FeCl) solution so that the unused copper layer is lost.
6. PCB track inspection.
7. After the PCB path is neat, drill holes on the PCB according to the printed pattern using a drill.
8. Clean the PCB from screen printing ink.
9. After the PCB is clean, install the required PCB components in the designated places.
10. Install all components according to the design of the tool to be made.

3.3. Current System Analysis

This chapter discusses the working principle of a circuit designed to realize a tool system namely. The discussion focuses on designing tools that are made based on the author's thoughts referring to reference sources related to these tools.

3.4. Block Charts

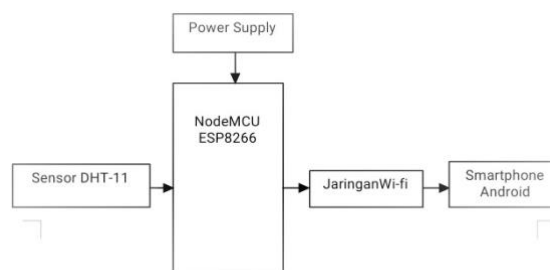


Fig. 2: System Block Diagram

3.5. Functions of Each Block

1. The power supply functions as a power source to turn on the tool system.
2. NodeMCU ESP8266 functions as a processor, receiver and sender of data on the device system.
3. The DHT-11 sensor functions as an input sensor to read the temperature and humidity values in the room.
4. The Wi-Fi network functions as a medium of communication between the device system and the Android smartphone
5. The Android smartphone functions as an output display for DHT-11 sensor readings.

3.6. NodeMCU ESP8266 Suite

The NodeMCU ESP8266 suiteIt serves as the control center of the entire existing system.

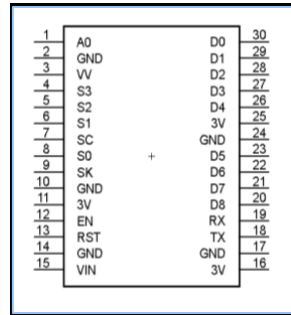


Fig. 3: The NodeMCU ESP8266 circuit

NodeMCU is basically a development of ESP 8266 with e-Lua based firmware. The NodeMcu is equipped with a micro USBport which functions for programming and power supply. Apart from that, NodeMCU is also equipped with push buttons, namely reset and flash buttons. NodeMCU uses the Lua programming language which is a package from esp8266. The Lua language has the same logic and programming structure as C, but the syntax is different. If you use the Lua language, you can use the Lua loader and Lua uploader tools. Apart from the Lua language, NodeMCU also supports the Arduino IDE software by making a few changes to the board manager on the Arduino IDE. Before being used, this board must be flashed first so that it supports the tools to be used. If using the Arduino IDE, use the appropriate firmware, namely the output firmware from AiThinker that supports AT Command. To use the firmware loader tool that is used is the NodeMCU firmware.

3.7. Voltage Stabilizer Circuit (Regulator)

This circuit serves to provide supply voltage from the battery throughout the existing circuit. The output of this regulator circuit is 5 volts

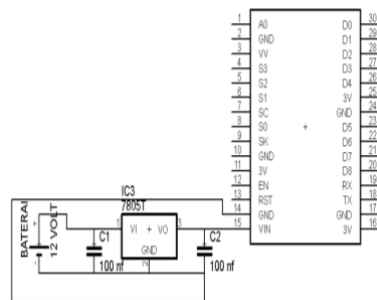


Fig. 4: Regulator circuit

In the circuit above the 12 volt battery is connected to a 100 nF capacitor, then connected to the IC 7805 voltage regulator input to get a 5 volt dc output, this 5 volt dc output will function to supply the NodeMCU ESP8266 system.

3.8. DHT-11 Sensor Circuit

In this circuit, the sensor input is connected to PORTB.A0 NodeMCU ESP8266, namely as a sensor reading, data that enters the microcontroller will be processed and calibrated.

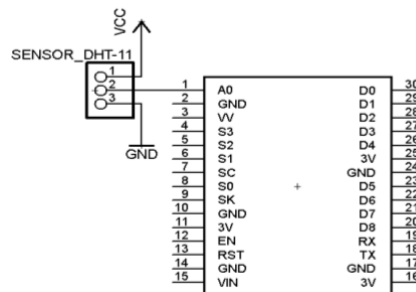


Fig 5: DHT-11 Sensor Circuit

3.9. The whole range of Tool Systems

In this circuit the 7805 regulator circuit functions to provide a voltage supply from the battery to all existing circuits. The output of this regulator circuit is 5 volts. NodeMCU 8266 functions as a processor, data receiver, and WI-FI signal transmitter on the tool system, then the DHT-11 sensor functions as an input sensor to read the temperature and humidity values in the room.

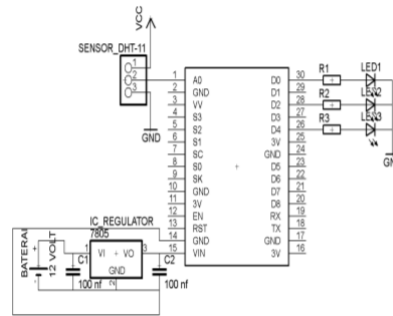


Fig. 6: Overall SeriesTool System

4. Conclusion

After carrying out the design and manufacture stages of the system which are then followed by the testing and analysis phase, the following conclusions can be drawn:

1. NodeMCU ESP8266 functions as a controller, data receiver, and data processor as well as a WI-FI signal receiver that can be connected to Android.
2. The android smartphone functions as a display of the reading results of the tool using the WI-FI communication system.
3. The DHT-11 sensor in the tool system functions as a value reading input temperature and humidity in the room.

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