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MAKING TEMPERATURE AND AIR HUMIDITY MONITORING EQUIPMENT IN LECTURE HALLS BASED ON THE INTERNET OF THINGS (IOT) AT BINA BANGSA GETSEMPENA UNIVERSITY BANDA ACEH

Ully Muzakir[*1], Nazuarsyah.[2] Putri Indah Lestari[3]
[1,2,3] Universitas Bina Bangsa Getsempena, Banda Aceh, Indonesia

***** Corresponding email: *ully@bbg.ac.id*

ABSTRACT

Human indifference to the surrounding circumstances sometimes makes their health disturbed. Many factors cause a person to be uncomfortable, even to the point of making their health decline. Factors that can make an uncomfortable person disturbed from a health perspective are temperature and air humidity that are not suitable for the human body. Therefore, a tool is needed that can provide information to users about the temperature and humidity of the air in the lecture hall and where they are located. The tool is made using an arduino IDE and a DHT11 sensor as a sensor used to read air temperature and humidity. Then to transmit the value of the DHT11 sensor, WiFi is used in the circuit. The smartphone will receive information on air temperature and humidity in real time. In the application on the smartphone, in addition to indigo temperature and air humidity, there is also a graph indicator that provides good temperature and air humidity information for human. With this tool, it can make it easier for users to find out information on the temperature and humidity of the air in the room where they are located, such as in a lecture hall

Keywords: *Air Temperature and Humidity, Arduino IDE, DHT11, Wifi.*

INTRODUCTION

Technological developments today have reached many fields in human life. It is inseparable from the world of health and households, where with the current technological developments it is easier for humans to get information easily and quickly. In daily life sometimes we always want comfort, where this comfort can be obtained from small things that may not have been paid much attention to so far but it is very important for us. Many people do daily activities indoors, so that someone feels at home for a long time in the room, the room must be made as comfortable as possible. One of them is by paying attention to the temperature and humidity of the air in the lecture room. Air temperature and humidity are one of the comfort factors that are often considered, it's just that many people ignore the temperature and humidity of the air in a room. Even though this air humidity is also an important thing in providing comfort to someone when indoors. Temperature and Humidity The air is too dry and can cause a person to have difficulty breathing and make the body sweat, while if the air humidity is too low it can cause a person to experience scaly skin. The level of thermal comfort of Indonesians at temperatures between 24°C to 28°C and relative air humidity is 70% to 80%.

Problems may occur when the lecture hall is busy or not under supervision. Failure of lecture hall equipment can result in data loss and even financial losses. Knowing the problems in the lecture hall quickly can avoid disruptions and losses. Lecture halls are important resources for companies because there are applications and databases that are important for the sustainability of the company, so lecture halls and all network devices in this space need to be monitored in real and continuously. An important factor that needs to be monitored in the lecture hall is the temperature and humidity of the air through the page and providing early warnings through the Thingspeak app. The rising temperature in the lecture hall causes the cooling fan to work optimally to cool the device. In addition to the problem of lecture hall staff who do not work for a full 24 hours, they are also unable to anticipate damage or malfunction of the lecture hall cooling system that can occur at any time. Sudden damage to the air conditioning in the lecture hall when there was no officer in the lecture hall. Purnomolan, (2017). Damage to the components of the appliance due to high room temperature or room temperature that is too low. The lecture room must have an air conditioner such as an Air Conditioner (AC) with continuous living conditions with a temperature between 16 – 20 °C. If the room temperature is not maintained properly, tools such as those made of wood such as tables, chairs, whiteboards and windows. are not protected safely so that the service life of tools and materials is shorter and cannot function, so that the practice of lecture halls at Bina Bangsa Getsempena University cannot run properly. Nazuarsyah. et al. (2022).

METHODS

Place and Time of Research

This research was carried out in the lecture hall of the campus of Bina Bangsa Getsempena University Banda Aceh. This research was conducted in November 2024 - January 2024.

The flow of this research has several stages between:

1. Literature Studies

   Literature studies are carried out with the aim of obtaining information or input that can be used as a reference in the web page. This is done by reading journals related to the problem being researched.
2. Identify Needs

   At the stage of need identification, the identification is carried out on the needs needed both in the design process and the website creation process. At this stage, the process was carried out to find problems related to the manufacture of temperature and air humidity monitoring equipment in the internet of things (IoT)-based lecture hall at Bina Bangsa Getsempena University, Banda Aceh.
3. Tool Planning

   The design of this system is carried out to make it easier to make the equipment at the stage of making the tool. This design uses a literature study method. Among them is designing a temperature and air humidity monitoring device.
4. Tool Testing/successful

   At this stage, the process of testing is carried out on programming, to find out whether the results of the system are in accordance with the planned goals or not. If the system is in accordance with the desired needs, the system will display data on the relevant device.
5. Data Analysis

   At this stage, the process is carried out processing data to produce meaningful information. Data analysis is carried out on various types of data, both quantitative and qualitative.

Tools and Materials

Material

- Buzzer
- NodeMCU ESP 8266
- DHT11 Air Temperature and Humidity Sensor
- LCD I2C
- Carger 12 V Micro USB Cable

- Jumper Cables (Male to Female and Female to Female)
- Breadboard
- Tool Case / Box Note / Acrylic

Tool

- Arduino IDE
- Thingspeak

Tool Design and Designer

The form of this research is research and development which consists of several stages, namely the device design stage at this stage is carried out at the stage of designing a control system consisting of a DHT11 sensor, LCD (Liquid Crystal Display) and Buzzer then connected to a Microcontroller or NodeMCU ESP8266 the device to be controlled, namely air temperature and humidity.

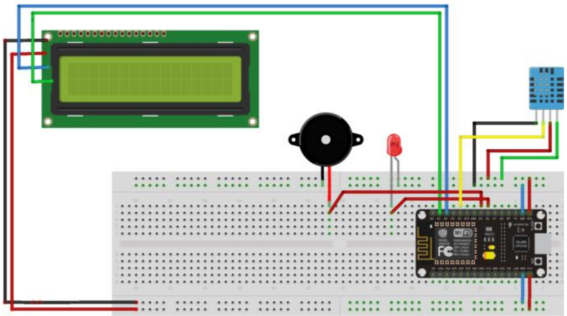

Figure 1. Design and Design of the tool

1. Tool Design Stage

The design of temperature monitoring equipment consists of 2 parts, namely temperature measuring instruments and temperature and air humidity monitoring applications. In the design method, the air temperature and humidity measuring instrument will be connected to the IoT platform (web-based application) and android application. The IoT platform will be able to store temperature data and display temperature graphs in real-time, and the public link of the IoT platform is stored in the android application so that the temperature graph can also be monitored through a mobile smartphone.

2. Tool Manufacturing Stage

The manufacture of temperature monitoring equipment begins with the manufacture of a series of tools. The suite of tools consists of a NodeMCU esp8266, DS18B20 sensor, I2C LCD, buzzer, jumper cable, micro usb cable, charger, and breadboard. The series of tools is arranged on a breadboard so that there is no need to solder the tools, the stages of making the tools are as follows:

Stages of making tools:

a. Buzzers are used to indicate the electronic components that produce sounds, usually used in a variety of applications to provide indications or warnings.
b. NodemCU ESP8266 used for Wi-Fi-based microcontrollers which are popular in Internet of Things (IoT) projects and various other electronic applications. Because it has an integrated Wi-Fi module, NodeMCU ESP8266 allows for internet connections or wireless networks, making it an ideal choice for projects that require access to networks or data communications.
c. DHT11 Temperature and Humidity Sensor Used to measure temperature and humidity in data center rooms. This sensor provides temperature values in degrees Celsius and humidity in percentages.
d. Carger 12 V micro USB cable is used to connect the NodeMCU to a computer or to a laptop.
e. I2C LCDs are used to display various information in the form of text on microcontroller or IoT-based projects. receive data from the NodeMCU ESP8266 process and display the processed information in the form of characters as outputs.
f. Jumper Cables (Male to Female and Female to Female)
   - Male to female jumper cable: used to connect the male pin (usually from the microcontroller) to the female pin on another device while
   - Female to Female is used to connect two components with male pins, e.g. sensors to microcontrollers or other modules
g. Breadboard is connected into jumper cables, NodeMCU or Microcontroller, Temperature sensor and I2C LCD. so that the current is increasingly connected to the Beardbord Board.
h. Tool Case/Box Note/Acrylic is used to protect components and secure from water and dust.

3. Application Creation Stage

The creation of an android-based temperature monitoring application aims to be a tool to monitor temperature and air humidity that can be accessed through smartphones.

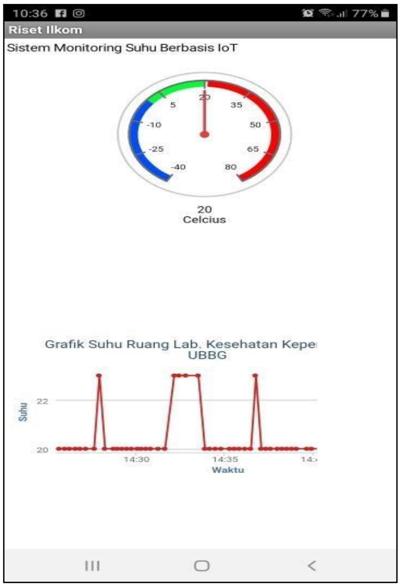

Figure 2.Application creation stage

This application will display real-time and continuous values and graphs of temperature and air humidity in a room coming from an IoT platform using an internet connection. The stages of making an android application are carried out after the creation of a temperature and air humidity measuring device on the IoT platform IoT.

4. Tool Testing Stage

Testing is divided into two main parts: calibration testing and performance testing against existing conditions. Data collection is carried out every one minute based on recommendations from the International Electrotechnical Commission (IEC). The testing stage of the tool aims to obtain test results through test data and perform functional checks on hardware and software. Functional checks on the hardware are: DHT11 sensor (whether it can detect the temperature of the classroom); relay (does normally open/close work properly); LCD (whether the LCD can display temperature data information); buzzer (whether it beeps at class temperature >20 °C); NodeMCU esp8266 (whether it can read and display temperature data, whether it is connected to the internet, and whether it can transmit temperature data to IoT platforms). The check on the software is whether the application can display temperature data information.

Humidity is a level of wet air environment caused by the presence of water vapor. The level of saturation is greatly influenced by temperature. Rossi et al. (2018). If the partial vapor pressure is equal to the saturated water vapor pressure, then compaction will occur. Yulianti et al. (2021).

Mathematically, relative humidity (RH) is defined as the percentage of comparison between partial water vapor pressure and saturated water vapor pressure. Humidity can be interpreted in several ways. Relative Humidity in general is able to represent the meaning of humidity. Fakhrurozi et al. (2021). To understand Relative Humidity, you must first know Absolute Humidity. Absolute Humidity is the amount of water vapor in a certain volume of air that is affected by temperature and pressure. Jupriyadi, et al. (2021).

The DHT11 (Humidity) sensor is a sensor with digital signal calibration that is able to provide temperature and humidity information. Riskiono et al. (2020). This sensor is classified as a component that has a good level of stability, and is coupled with the ability of an 8-bit microcontroller such as Arduino. Lestari F et al (2021). The DHT11 calibration coefficient is stored in the OTP of the memory program, so that when the internal sensor detects something, then this module reads the sensor coefficient, Wajiran, et al. (2020).

RESULTS AND DISCUSSION

Results of system development

Temperature and humidity monitoring system consists of NodemCU The temperature and humidity monitoring system consists of a NodeMCU ESP8266 as a control center and as a device used to connect to the internet. because it is equipped with a WiFi ESP8266 module and a DHT11 sensor that functions as a temperature and humidity sensor. The device is also equipped with an I2C LCD which functions to display temperature and air humidity values in the lecture room. These components are connected into a series that functions to take temperature and air humidity data which will later become a source of information to find out the condition of the lecture hall periodically.

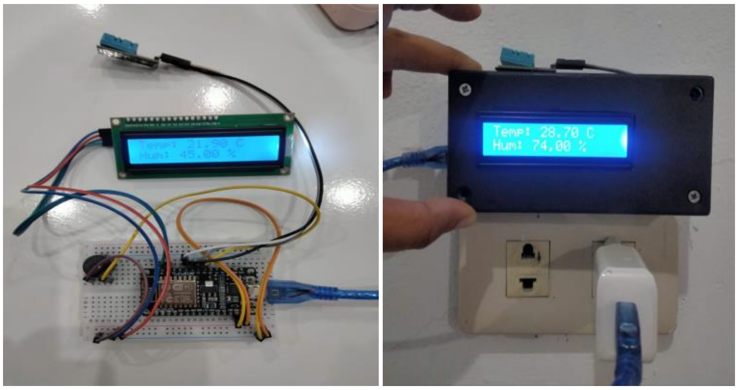

Figure 3. Results of System Development

Monitoring System Testing

Testing a tool monitoring system is a stage carried out by the author by testing directly on a case study, this test aims to determine the success rate of a tool or system that can work as expected.

System flowchart

A flowchart is a description in the form of a flow diagram of an algorithm in a program that expresses the direction of the program's flow in solving a problem. The following is a flowchart from the Implementation of the Internet of Things (IoT) to simulate temperature and humidity in the lecture hall using arduino, web and DHT11 temperature sensor.

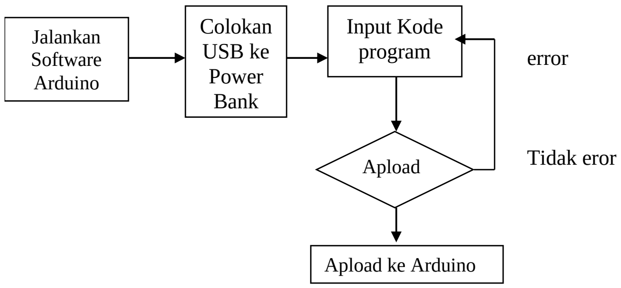

Figure 4. Sensor Testing

Website testing

Testing was conducted by accessing the IoT platform through an app in ThingSpeak on a mobile device to view real-time air temperature and humidity data. As a result, the display of data can be accessed well and accurately on various devices. So that an officer can easily get information on temperature and air humidity. In the application, a graph is created, where this graph will change according to the temperature and humidity conditions of the air read by the DHT11 sensor. If the temperature is too high or too low then the graph will change. If the air humidity is too high or too low, then the chart indicator will change. If the temperature and humidity of the air are right for humans, the temperature is 24°C to 28°C or the air humidity is 30°C to 40°C, then the graph indicator will change, this indicates that the temperature and humidity of the air are good for humans.

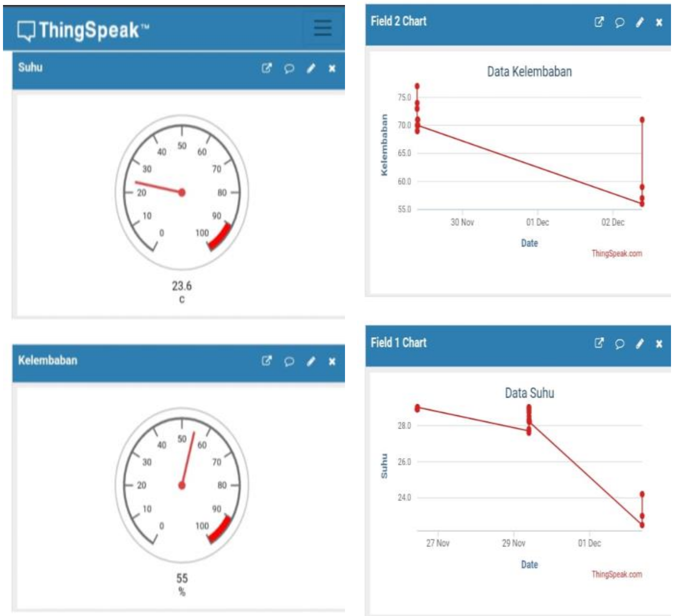

Figure 5.Website testing

Program Code Testing

The NodemCU microcontroller as a control tool for the DHT11 sensor, contains some program code that is sketched starting from defining the DHT11 sensor. The microcontroller can be connected to the ThingSpeak web through the internet using Hostpot, so it requires a special library with sketch programs such as ThingSpeak and Esp8266. Asmawati et al. (2019).

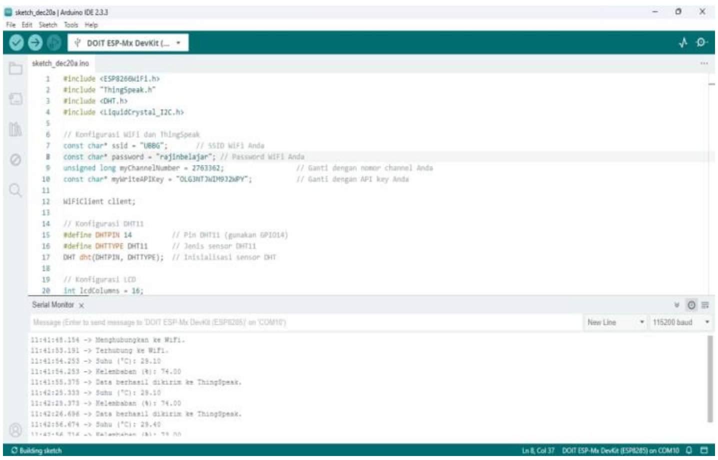

Figure 6. Program Code Testing

IoT Network Connection Testing

The monitoring system connectivity test aims to be carried out so that the temperature and air humidity monitoring system can be connected to the internet to carry out the data transmission process, the first stage in the wifi connectivity testing procedure is to ensure that the hotspot on the mobile smartphone is connected. Testing of ESP38266 capabilities in connecting devices with Wi-Fi networks and transmitting data to IoT platforms. The connection is successfully made with data updated every 30 seconds. A smartphone functions as a router (connects), while a hotspot functions to share an internet network connection. Then the next step is to enter the ssid and password hotspot into the aduino IDE program. Testing was carried out 10 (ten) times and all were successful. Speed testing The internet network is carried out at Bina Bangsa Getsempena University.

Figure 7. Network connection testing

Temperature and Humidity Measurement Results

During the test, several measurements of temperature and air humidity were carried out in the lecture hall at the University of Bina Bangsa Getin in conjunction with Banda Aceh. The results of air temperature and humidity measurements in the lecture hall are as follows:

Table 1. Results of temperature and air humidity testing in lecture halls.

Testing to	**Time**	**Temperature (C°)**	**Humidity (RH%)**	**LCD**
1	09:14	23.60 c°	55.00 %	Can display air temperature and humidity
2	08:21	23.60 c°	68.00 %	Can display air temperature and humidity
3	16:28	24.50 c°	44.00 %	Can display air temperature and humidity
4	08:45	22.30 c°	65.00 %	Can display air temperature and humidity

Testing to	Time	Temperature (C°)	Humidity (RH%)	LCD
5	10:41	25.70 c°	57.00 %	Can display air temperature and humidity
6	08:35	24.4 c °	63.00 %	Can display air temperature and humidity
7	08:39	21.90 c °	45.00%	Can display air temperature and humidity
8	08:31	25.50 c °	42.00%	Can display air temperature and humidity
9	16:55	27.70 c °	43.00%	Can display air temperature and humidity
10	09:03	25.80 c °	43.00%	Can display air temperature and humidity

Overall Tool Testing

Testing the tool as a whole is carried out by testing directly, here is a table that is the test results of the entire tool.

Table 2. Overall tool testing

Testing To	Sensor DHT11			LCD
	Time	Temperature (C°)	Humidity (RH%)	
1	09:14	23.60 c°	55.00 %	Can display air temperature and humidity
2	08:21	23.60 c°	68.00 %	Can display air temperature and humidity
3	16:28	24.50 c°	44.00%	Can display air temperature and humidity
4	08:45	22.30 c°	65.00%	Can display air temperature and humidity
5	10:41	25.70 c°	57.00%	Can display air temperature and humidity
6	08:35	24.4 c °	63.00%	Can display air temperature and humidity
7	08:39	21.90 c °	45.00%	Can display air temperature and humidity
8	08:31	25.50 c °	42%	Can display air temperature and humidity
9	16:55	27.70 c °	43.00%	Can display air temperature and humidity
10	09:03	25.80 c °	43.00%	Can display air temperature and humidity

CONCLUSION

Based on the results of testing, processing, and analysis that have been carried out, it can be concluded as follows:

The design of a temperature and air humidity monitoring system in an internet of things (iot)-based lecture hall using the DHT11 sensor can work well. The results of temperature and humidity measurements in the lecture hall can be displayed with an LCD with a size of 16x2 and sent to the ThingSpeak website via a wifi internet connection. The temperature and humidity data graph can be accessed on the ThingSpeak page using a mobile smartphone with an average value of non-conformity from 10 data collections.

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