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Temperature and Humidity Control Device In The Server Room PT.BFI Finance Tbk. Karawaci Based on Internet Of Things (IoT)

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Abstract

The monitoring system for server room temperature and humidity at PT.BFI Finance which can increase the efficiency of electrical power using Arduino. At this time, technological advances are very fast, one of which is the presence of the Internet of Things, therefore the server room monitoring system at PT.BFI Finanace will use a temperature and humidity measuring device with an Arduino Uno microcontroller, Ethernet shield, Arduino Nano, buzzer, fan and the DHT22 sensor, which is able to overcome the weaknesses of existing server room monitoring. The purpose of this research is to make a temperature and humidity measuring device in the server room as a monitoring tool. The result of this research is a monitoring system for temperature and humidity conditions in the server room with a device whose temperature and humidity values will be stored in the MYSQL database, then displayed on a web application that will assist officers in monitoring the server room.

I. INTRODUCTION

The world is undergoing a strong current towards modern technology, undergoing a flow in information technology towards the so-called Internet of things IoT or Internet of objects, which is the integration of things with the world of the Internet, by adding hardware or/and software to be intelligent so that they can communicate with each other and participate effectively in all aspects of daily life, thus enabling new forms of communication between people and things, an Internet of things is the integration of things with the world of the Internet, by adding hardware or/and software[1]

The Internet of Things (IoT) is a relatively new technology that is quickly becoming mainstream. IoT, on the other hand, connects actual items to the internet, such as lamps, televisions, and even household appliances, and allows users to tailor their experiences based on their preferences. Because IoT devices are always linked to the internet, they may be accessed and used at any time and from any location. [2].

Server is a computer system that serves and controls access to clients connected to it. All the activities we do on the internet always involve servers. Server plays a very important role because of its heavy duty to serve clients. Therefore, the server should not experience interference. However, there are times when the server performance can be disrupted. One of the reasons is that when the server overheats, its performance will decrease. In addition to overheating, the influencing factor is the humidity of the server room, high humidity in the room will affect the lifespan of the components in the server[3].

Server room is a room that is used to store server computers and network devices. The asset server room is important for implementing information technology as a support in daily activities. The server room contains applications and databases that store information and value, therefore the server room must always be in good condition[2].

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Currently, there are still many server admins who still control it manually without monitoring remotely, which

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currently requires remote control and monitoring by an admin. so that it can be easier to find out the state of the server and can control it more easily without an admin in the server room, therefore, we need a system that can control and monitor temperature remotely in real time, and with this system it is expected to be useful for admin in the server room. Although many types of sensors, especially temperature sensors, have a narrow measuring range and low accuracy, they have a high cost. Besides, this temperature and humidity mentoring uses the Telegram application on Android[4]. The temperature and humidity monitoring system uses a DHT 22 sensor, ATMega 328 Microcontroller, GPRS (General Packet Radio Service) Shield and SIM900L

II. Related Works/Literature Review

A. Temperature

Temperature is a physical variable that can be measured and controlled for various purposes. Temperature observations from the Federal Office of Meteorology and Climate Geophysics (BMKG) are also important. This temperature is a weather parameter. Weather is the state of the atmosphere at any given time, expressed in terms of high and low parameter values for temperature, pressure, wind, humidity, and various other phenomena. As the light intensity increases, the temperature also increases, the humidity becomes lower, the evaporation is larger, the rain clouds increase, and precipitation occurs during condensation.[5].

The degree of heat or cold that is measured on a certain scale using a thermometer is temperature. The temperature unit commonly used is degrees Celsius (0C). While in the UK and several other countries expressed in degrees Fahrenheit (0F). Temperature can also be interpreted as a physical property of an object that describes the average kinetic energy of the movement of molecules[2].

B. Server

Server is a set of computers that contain programs that are able to produce information and the information is distributed to client computers that access it.[6] Servers In simple terms it can be one computer for several application services, or if the network is more complex and complicated, then the server can be set up only to provide one or a few services, while other services are submitted to other servers, so collaboration and cooperation occurs here. several servers to provide services and information to multiple clients By default server applications must be installed separately depending on needs, but some developers combine several servers into one package, making it easier for administrators to install, with just one install, several servers are automatically installed[7]. Based on the function the server is divided into:

1. Web server: A server that serves to provide http protocol services, examples of web applications\ servers, namely: apache, Microsoft IIS, Tomcat, Nginx, etc
2. Database server: Server that serves to store data centrally and distribute to clients via wireless or wired networks, Examples of database servers: MySQL, Postgres, MS SQL Server, Oracle, Interbase, etc
3. FTP Server: Filezilla, FTPd, pro-FTPd, Wu-FTPd, ftpX, Troll-FTPd
4. Mail Server: Mercury, Merak, sendmail, postix, etc
5. Print / File server : Samba Serve
6. DNS Server: Server that functions to translate host addresses into IP addresses, for example: Bind
7. DHCP Server: Server in charge of automatically assigning IP addresses to client computers
8. Proxy server: this application is implemented to limit access rights to the internet or to a server.
9. So that the number of users can be limited or there is a filter to the mass media, whichever one accessible.

C. IoT

The Internet of Things is a network of interconnected computing devices, mechanical and digital equipment, materials, animals, and people with Unique Identifiers. An IoT ecosystem consists of web-enabled smart devices that receive, send, and act on data from their environment. IoT allows companies to rethink how they do business and provides them with the tools to improve their strategies. Organizations across a wide range of industries are rapidly turning to IoT to increase operational efficiency[6].

D. Sensor DHT22

The DHT sensor is a temperature and humidity sensor from Aosong Electronic which consists of two parts, namely a capacitive humidity sensor and a thermistor. This sensor does not require a signal control circuit and ADC because it uses a microcontroller chip with a digital signal output (Aosong, 2012). DHT has many variants, one of which is DHT22 (AM2302)[8]

III. METHODS

Research design

The research method applied in this research is the development of the waterfall method. Method waterfall is an information system development model systematic and sequential[9]. Waterfall Method has the following stages[10]:

1) Requirements analysis and definition
   System services, constraints, and objectives are defined by the results of consultation with users which are then defined in detail and serve as system specifications.
2) System and software design
   The system design stage allocates system requirements both hardware and software and software by shaping the architecture the system as a whole. Software design involves identifying and delineating abstractions software base systems and their relationships.
3) Implementation and unit testing At this stage, the software design is realized as a series of programs or program units. Testing involves verifying that each the unit meets its specifications.
4) Integration and system testing The individual units of the program or programs are combined and tested as a complete system to ensure is it in accordance with the software requirements or no. After testing, the software can sent to customer
5) Operation and maintenance
   Usually (though not always), this stage is the longest. The system is installed and used for real. Maintenance.

IV. RESULTS

A. Tool Design

The components used in making the system are as follows;

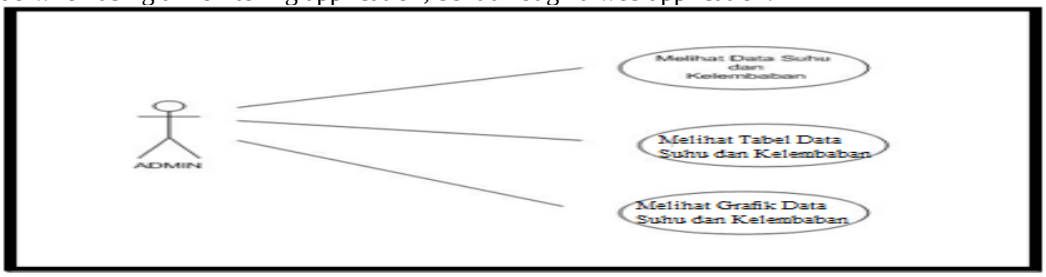
Tabel 1. Components used

NO	NAME OF TOOLS
1	MCU Nodes
2	Ethernet Shield
3	Sensors DHT11/DHT22
4	USB Cable
5	Breadboards
6	Jumper Cable
7	PC/Laptop

B. App Design

1. **Use Case Diagram**

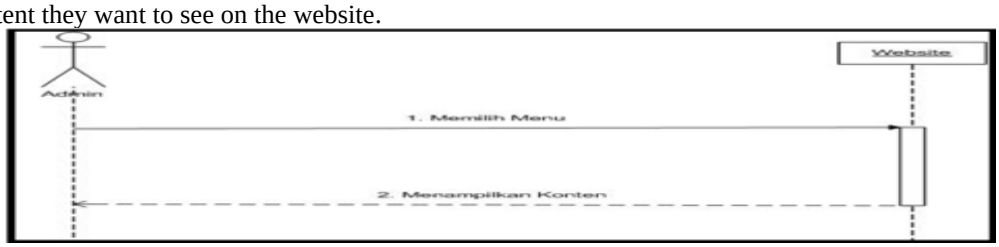
   In this section, it will be explained about the design of use case diagrams for temperature and humidity monitoring applications in the PT. BFI finance. The use case below explains what interactions the admin can do when using a monitoring application, be it through a web application.



Picture 1. *Use Case Diagram web application*.

2. **Sequence Diagram**

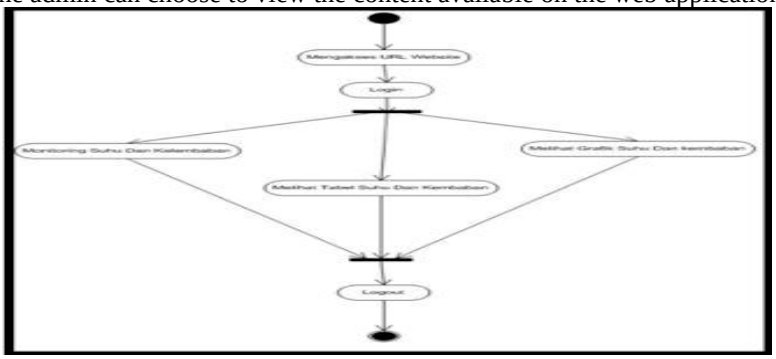
The sequence diagram that will be displayed is based on the use case diagram of the monitoring application described previously. The following sequence diagram shows the interactions needed so that admins can see the content they want to see on the website.



Picture 2. *Sequence Diagram monitoring web application*

3. **Activity Diagram**

The activity diagram will also discuss the flow that the admin can take in running a web application. In this diagram explain, the admin can choose to view the content available on the web application.



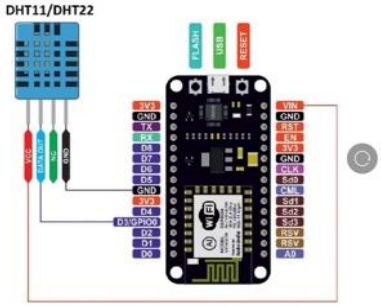
Picture 3. Web Application Activity Diagram

4. **Architectural Design**

In this section, we will explain about architectural design for both systems and Web-based applications.

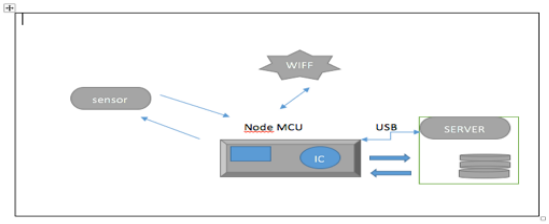
a. Tool Circuit Schematic

The design of a series of tools from Arduino Uno, Ethernet Shield, DHT22 Sensor, Arduino Nano, which is connected via the Arduino Uno board and Ethernet Shield functions for temperature and humidity data values. And also Arduino Nano will send a signal to the fan and buzzer to turn on when the temperature and humidity exceed safe limits.



Picture 4. Tool Circuit Schematic

b. Architectural Design of Temperature and Humidity Monitoring System



Picture 5. Architectural Design of Temperature and Humidity Monitoring System

c. Web-based Application Architecture Design

In this architecture the Admin will be connected via the internet. The admin will make a request to the server to get information about the latest temperature and humidity conditions. Before starting to create programming code, we need to first create a view, so that in the process later the programming code that is created can blend well with the previously designed display.

Picture 6. Main Page Display Design

The picture above is the design of the main page display on the web when the admin has successfully logged in to be able to access the features on the web, namely there is a control menu consisting of temperature and humidity monitoring, temperature and humidity tables, temperature and humidity graphs and logout to exit. application.

V. DISCUSSION

A. Monitoring System Implementation

The monitoring system consists of the MCU Node as a central control, Ethernet Shiled as a data sender to the PC, Temperature and humidity sensors as a data retrieval tool, and the MCU Node as a driver. as a source of information to determine the state of the server room. The MCU node used in this system has the following specifications:

a. Microcontroller : ATmega328P
b. Operating Volt : 5V
c. SRAM: 2KB (ATmega328P)
d. Digital I/O Pins : 14 (of which 6 provider PWM outputs)
e. Flash Memory : 32 KB (ATmega328)
of which 0.5 KB used by bootloader
Clock Speed : 16 MHz
Operating System : Windows
Programming Language : Wiring.

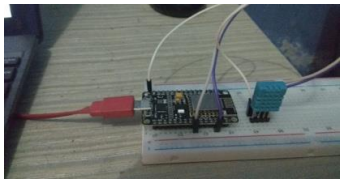
Picture 7. Node MCU ESP 8266

The MCU node is from the ESP8266 made by the Espressif system as well as the firmware used using the Lua scripting programming language. The term NodeMCU by default actually refers to the firmware used rather than the hardware development kit. nanum NodeMCU has packaged SP8266 into a compact board with features like a microcontroller + capacity for access to wifi as well as a USB to serial communication chip. So that the programmer only needs an extension of the exact USB data cable that uses it as a data cable and an Android smartphone charging cable.

Picture 8. Sensor DHT11

The temperature and humidity sensor device will use the DHT11 as a tool to acquire room temperature and humidity data. Sensors will be assembled on a circuitboard with the addition of several other devices. One of the added devices is a microcontroller to send data, namely Ethernet Shiled so that the temperature sensor device is known as a USB device. Device under certain conditions. As previously explained, the three devices will be connected so that the data retrieval process can be carried out. The sensors will be connected to the MCU Node and Ethernet Shield using USB, while the MCU Node will be connected to a local network that has internet access in order to transmit temperature and humidity data to the database.

The image below will show a monitoring system that is connected to each other and is in a mockup



Picture 9. An interconnected monitoring system

b. **Web Application Implementation**

This section will explain the specifications of the devices used in accessing the web and the test results when accessing web pages using the specified device.

Device Specification

The web application that has been created will be placed on a web server and will be accessed by the admin from a computer using a web browser. At this trial stage, an experiment will be carried out to access the web page as an admin which will then try to access the web page which contains information on the server room temperature and several other features. The computers used for testing the temperature monitoring web access are as follows:

1. Processor : Intel ® Core ™ i3-4030U
2. RAM: 2048 MB
3. Hard disk: 500 GB
4. Input: Standard keyboard and mouse
5. Monitor: LED 14”
6. Operating System: Windows 10 Professional 64-bit
7. Browser : Google Chrome Version 44

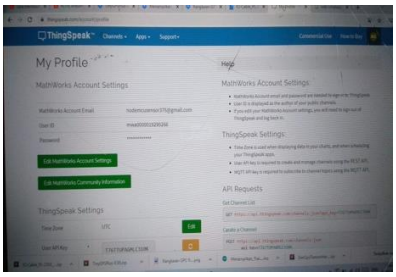
After the computer that will be used for testing is ready, then a trial will be carried out to access the web page.

Web App Trial

The test is done by accessing it from the admin computer, then the web pages will be searched one by one to find out whether all web pages are functioning properly without any errors.

Login Page

This page is the login page that will appear the first time you access the temperature monitoring web. This page contains Username and Password.



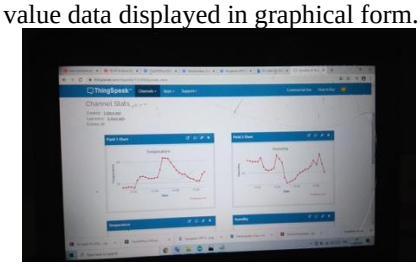
Picture 10. Main page login page view

Info page of temperature table and graph data

On this page there are two contents at once, the first is the content which contains the table of information regarding the last temperature and humidity values acquired by the temperature and humidity sensor, the main values displayed are in Celsius for temperature and Percent for humidity.

Picture 11. Graph of Temperature and Humidity Table

Further content is at the bottom of the temperature and humidity info table. This content will provide information in the form of temperature and humidity value data displayed in graphical form.



Picture 12. Display of temperature chart data content Information in the form of temperature and humidity value data

The trial results of systems and applications that have been designed previously, both in terms of appearance and in terms of programs have been running well. Arduino Uno and Ethernet Shield can already run commands to get the temperature and humidity values from the temperature and humidity sensors, and then send them to the database, besides that the Arduino Nano works well without any significant obstacles.

In terms of programs, the web application has been running well, and there are no errors that might make the web application not work. The appearance of the web application has also been made in such a way that it can adjust the shape of the admin's computer monitor screen, so it is hoped that every admin will get a good view of the content

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