Temperature and Humidity Monitoring System on Android Based Wallet House

Ronny
STMIK Widya Cipta Dharma,
Samarinda, 75123, Indonesia
ronnythetains14@gmail.com
Corresponding author

Salmon (iD)
STMIK Widya Cipta Dharma,
Samarinda, 75123, Indonesia
salmon@wicida.ac.id

Ahmad Rofiq Hakim
Politeknik Negeri Samarinda
Samarinda, 75242, Indonesia
rofiq93@gmail.com

Abstract- The quality and quantity of swallow's nest is strongly influenced by temperature and humidity. By utilizing Wi-Fi, users can monitor room temperature and humidity in the swallow house remotely with the Android system. The Android system can make it easier for users to monitor room temperature and humidity in the swallow house at any time. DHT11 sensor which functions as a temperature and humidity detector, NodeMCU ESP8266 microcontroller which functions as a data processor so that the DHT11 sensor detection results can be displayed on a Smartphone via the Blynk application so that users can see directly the results of temperature and humidity measurements in the swallow house room. This research was conducted in Pulau Lanting Village, Jempang District, West Kutai Regency. The data collection methods used are literature study, interviews, and observation. While the system development method used is Waterfall. As well as the supporting software used by the Arduino Integrated Development Environment, and Blynk.

Keywords- Monitoring, Temperature, Humidity, NodeMCU ESP8266, DHT11 Sensor, Android.

I. INTRODUCTION

In life on this earth, temperature and humidity are important factors for humans, animals and plants. Temperature and humidity also determine living things to adapt to their environment. Knowledge of temperature and humidity also affects human success in agriculture, animal husbandry, and so on. Swallow birds are poultry that are cultivated with nests as the main production. Swallow birds have characteristics that are not shared by other birds, the most distinctive feature of this type of bird is its ability to produce nests which have high selling value because they can benefit the world of health.

There are two criteria in determining the quality of swallow nests, First is the shape of the nest, intact nests such as unbroken balconies and smooth backs are of high selling value. The perfect nest form is produced from the swallow house which has an optimal humidity of 80-90% and is harvested on time. if the humidity is too low, the nest is fragile and easily crushed. The second criterion is the color of the nest, the original color of the swallow nest is white, but the color can change from yellow to blood red if the air circulation in the swallow house is not optimal. At high temperatures (30 - 32 ° C) swallow saliva dries quickly, if the humidity is too low it causes the nest to easily crack and porous. Room temperature handling must be a serious concern so that the temperature can be stable in the range 26 - 29 ° C. If the temperature and humidity conditions in the building are unstable, such as the temperature is too high and the humidity is low, it can reduce the productivity of the nest and disturb the comfort of the swallow. One problem that exists in the village of Lanting Island at this time is that the results of swallow nests are not maximized due to a lack of knowledge about room temperature and humidity which can increase the results of swallow nests. Sometimes even though we have created puddles, and husks to maintain temperature and humidity, they cannot also regulate natural conditions that can affect changes in temperature and humidity in the Swallow's house. With this problem, a system tool for monitoring room temperature and humidity in an Android-based swallow house can be made.

II. LITERATURE REVIEW

A. System

According to Susanto (2013) a system is a collection (group) of subsystems / parts / components of any physical or non-physical which are interconnected with each other and work together harmoniously to achieve a specific goal.

According to Gaol (2013), the system is the relationship of one unit to other units that are interconnected with each other and which cannot be separated and lead to a single unit in order to achieve predetermined goals. If one unit is jammed or disturbed, other units will also be disturbed to reach the stated destination.

Based on the above definition, it can be concluded that the system is a collection or series of components that are interconnected, work together, and interact with each other to achieve a predetermined goal.

B. Monitoring

According to Sutabri (2012) Monitoring is defined as a step to assess whether the activities carried out are in accordance with the plan, identify problems that

arise so that they can be immediately resolved, assess whether the work patterns and management used are appropriate to achieve goals, find out the relationship between activities and objectives. to get a measure of progress. According to Aviana (2012) Monitoring is a very important process in organizational activities that can determine whether or not an organizational goal is implemented. The purpose of monitoring is to ensure that the main tasks of the organization can run according to a predetermined plan. Based on the above definition, it can be concluded that monitoring is a step to assess whether the activities carried out are in accordance with the plan, assessing whether the work patterns and management used are appropriate to achieve objectives in accordance with predetermined plans.

C. Temperature

According to Hidayati (2011), the temperature in Picture 1 is a quantity that states the degree of heat and coldness of an object and the tool used to measure temperature is a thermometer. In everyday life, people who measure temperature tend to use their sense of touch to feel the temperature around them. According to Sunardi and Siti (2013), temperature can be defined as a measure of the degree of heat or coldness of an object. To measure the temperature of an object, a device called a thermometer is used. Thermometer is a tool used to measure the temperature of an object. Based on the above definition, it can be concluded that temperature or temperature is a measure to determine the heat or coldness of an object. Tool for measuring temperature is a thermometer.

Picture 1.Thermometer (Temperature Measurement Tool)

D. Swallow

The swallow (Collocalia vestita) in Picture 2, is a bird with pointed wings, a long tail, black color with a brown underside. Swallow birds cannot perch because they have very short legs so they rarely stand on the ground but can stick to walls or roofs. Able to fly in dark places with the help of echolocation, nesting in groups with nests made of saliva. Habitat or collection of swallow communities is only found in the scope of Southeast Asia. Swallow birds are often found in Indonesia, Malaysia, Thailand, Vietnam, the Philippines, Cambodia, and Laos, Swallow birds are not found in European countries, America, or in the African continent. This is because swallow breeds must be in tropical climates with high rainfall. Swallow's Nest has important benefits for health.

1. as a dry cough medicine
2. Maintain skin beauty
3. Overcome lung complaints
4. Treat damaged blood vessels
5. increase appetite
6. source of minerals for the immune system

Picture 2. The Swallow

E. Hardware

According to Vicky (2011), hardware is also called hardware, which is all physical parts of a computer, and is distinguished by the data that is in it or that operates in it, and is distinguished by software that provides instructions for hardware in completing its tasks. Computer hardware can also be interpreted as a tool designed to receive and process data. Each of the hardware contained in the computer has its own task so as to produce a complete and working computer system.

F. DHT sensor 11

The DHT11 sensor in Picture 3 is a sensor module that functions to sensing temperature and humidity objects that have an analog voltage output that can be further processed using a microcontroller. This sensor module is classified into a resistive element such as a temperature measuring device, for example, namely NTC. The advantages of this sensor module compared to other sensor modules are in terms of the quality of the reading of sensing data, which is more responsive, which has speed in terms of sensing temperature and humidity objects, and the data that is read is not easily interfered with. The DHT11 sensor generally features a fairly accurate temperature and humidity reading value calibration. The calibration data is stored in the OTP program memory which is also called the calibration coefficient.

The DHT11 sensor has 2 versions, 4 pin version and 3 pin version. There is no difference in the characteristics of these 2 versions. In the 4 pin version,. Pin 1 is the source voltage, ranging from 3V to 5V. Pin 2 is the output data. The 3rd pin is the NC pin (normally close) aka not used and the 4th pin is Ground. Whereas in the 3 leg version, pin 1 is VCC between 3V to 5V, pin 2 is the output data and pin 3 is Gr
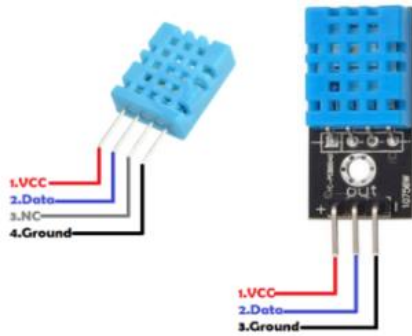
Picture 3. DHT11 Sensor Pin Arrangement

G. NodeMCU ESP8266 microcontroller

The microcontroller in Picture 4 is a controller that is used to control a process or aspects of the environment, an example of a microcontroller application is to monitor a house, when the power goes out, the backup energy is turned on with a sound sensor. In its time, controllers were built from logic components as a whole, making it big and heavy, after that a microprocessor was used so that the entire controller entered into a fairly small PCB, until now we still often see controllers controlled by ordinary microprocessors (Zilog Z80 , Intel 8088, Motorola 6809, etc.). The component reduction process continues, all the components needed to build a controller can be packaged in one chip, In daily discussions and on internet forums the microcontroller is often known as the µC. Free translation of this definition, it can be said that a microcontroller is a micro-sized computer in one IC chip (integrated circuit) which consists of a processor, memory and programmable interface, so it is called a microcomputer because the IC or microcontroller chip consists of a CPU, memory, and I / O which we can control by programming it. I / O is also often referred to as GPIO (General Purpose Input Output Pins) which means pins that we can program as input or output as needed.


Picture 4. NodeMCU Board

H. Android

Android in Picture 5 is an open source software platform for mobile devices. Android contains the operating system, middleware and basic applications. Android provides an open platform for developers to create applications. The base of the Android OS is a Linux 2.6 kernel that has been modified for mobile devices. The definition of Android according to some experts is described as follows.

According to Teguh Arifianto (2011), android is a mobile device on the operating system for linux-based cellular phones. According to Hermawan (2011), Android is a Mobile OS (Operating System) that grows amid other OS that are developing today. Other OS such as Windows Mobile, i-Phone OS, Symbian, and many more. However, this existing OS runs by prioritizing core applications that are built on their own without seeing the considerable potential of third-party applications. Therefore, there are limitations to third-party applications for obtaining original cellphone data, communicating between processes as well as limitations on the distribution of third-party applications for their platforms.

According to Nazaruddin (2012), Android is an operating system for cellular phones based on Linux. Android provides an open platform for developers to create their own applications for use by a variety of mobile devices. Android is commonly used in smartphones and tablet PCs. Functions the same as the Symbian operating system on Nokia, iOS on Apple and BlackBerry OS. In this world there are two types of distributors of the Android operating system. The first is that it has full support from Google or Google Mail Service (GMS) and the second is that it is completely free to distribute without direct Google support, known as Open Handset Distribution (OHD).
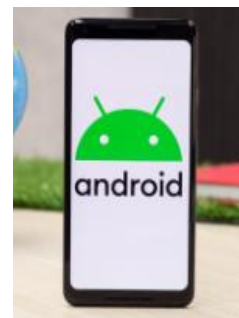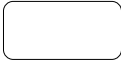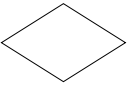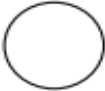

Picture 5. Android OS

I. Flow chart

According to Yatini (2010), the flowchart in Table 1 is a diagram that shows the flow data via information handling programs or systems and operations imposed on the data at critical points along the path. Flowcharts use annotations and symbols, for example, rectangle, rhombus and oval to represent operations. The lines and arrowheads connect these symbols to show the direction of data flow from one point to another. As a graphical diagram showing other programs or systems, flowcharts are useful as a means of helping to show how the proposed program works and as a means of understanding the operation of a program.

Table 1. Flowchart

Symbol	Symbol Name	Information
	Terminator	Used to mark the start and end of a flowchart, this symbol is usually labeled Start and finish.
	Input / Output	Used to present I / O functions that allow data to be entered (input) or displayed (output)
	Branching / Decisions	Used to perform branching, namely an examination of a condition.
	Process / Assignment	Used to perform processes from an input or output or other operations
	Preparation	Used to process initialization / initial pricing (for example in iterating).
	Flow Direction	Used to connect each step in a flowchart and show where the flow of the diagram is.
	On Page connector	Used to relate one step with another step in a flowchart with the onpage state. On page is used to link one step with another step in a page.
	Off Page connector	Used to link one step with another on a different page.

J. Waterfall Model

According to Rosa and Salahuddin (2015), the SDLC waterfall model in Picture 6 is often called a linear sequential model or classical life flow. The waterfall model provides a sequential or sequential approach to the software life flow. Starting from the analysis, design, coding, testing, and the support stage support.
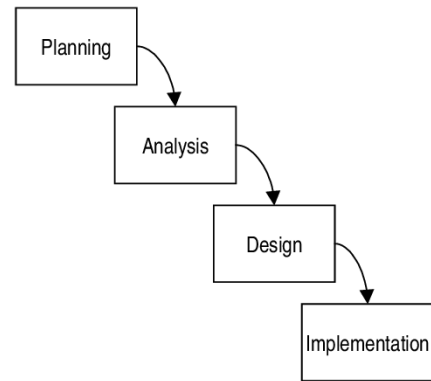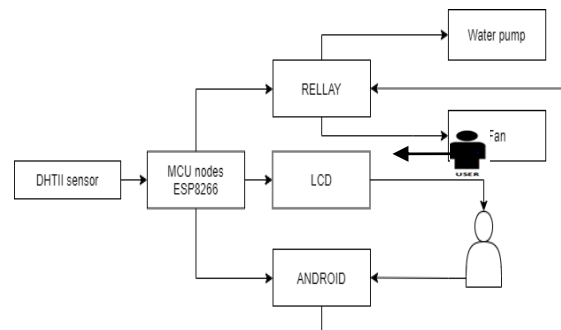

Picture 6. Illustration of Waterfall Model

III. RESEARCH METHODS

A. Hardware Design

The design of the tool in Picture 7 is a very important step in realizing the real system. The purpose of this design is to plan the hardware according to the specifications, how the system works, so that it is expected to streamline time, cost and energy.


Picture 7. Block Diagram

The following is an explanation of the block diagram design of the temperature and humidity monitoring system in the swallow house, the DHT11 sensor detects temperature and humidity then NodeMCU ESP8266process the data that has been obtained from the DHT11 sensor which then the measurement data from the sensor is displayed via the LCD (Liquid Crystal Display) and also to the Smartphone so that the sensor data can be seen directly by the user, then the user will turn on the water pump and fan if the temperature and humidity is not as stable. Each tool has a function.

1. NodeMCU ESP8266:As a controller of all components.
2. DHT11: Temperature and humidity detection sensor.
3. Relay: Switch for ON / OFF Fan and Water Pump.
4. Android: as a remote control, displays the DHT11 measurement results.
5. LCD: as a display to display DHT11 measurement results.
6. Water Pump and Fan: as a room cooler.

B. Flow chart

Flowchart system shown in Picture 8. This system start form initialize & read DHTII, sent the data to Microcontroller processor, until make fan & water pump on or off.
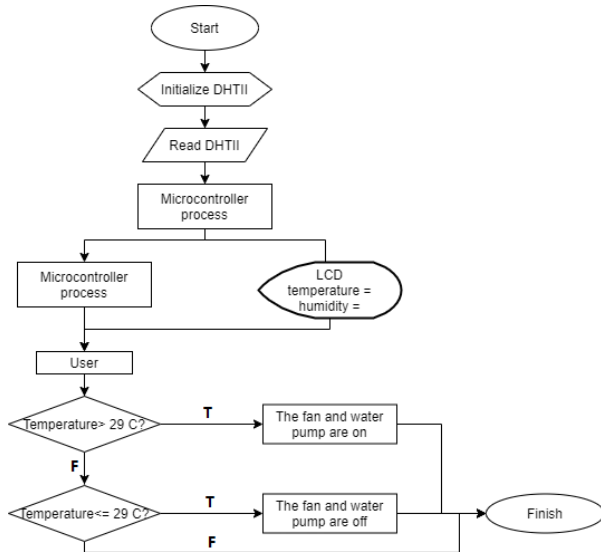

Picture 8. System Flowchart

IV. RESULT AND DISCUSSION

A. Hardware Technology

The hardware or hardware in Picture 9 that is used in the room temperature and humidity monitoring tool in the swallow bird house is the DHT11 sensor which is a temperature and humidity sensor, NodeMCU ESP8266 which is a microcontroller that will process DHT11 sensor data so that it becomes output or output data, fans fan, water pump, relay, LCD, and jumper cables.
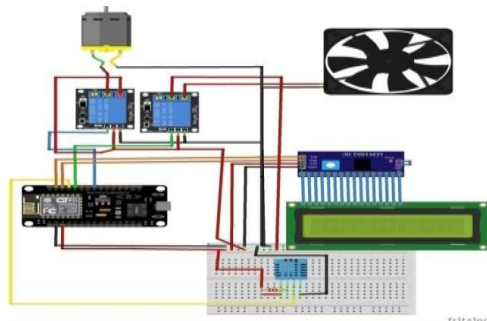
Picture 9. Series of Temperature and Humidity Monitoring Equipment

1. DHT11 sensor
   The sensor in Picture 10 used is a DHT11 sensor, the advantages of this sensor are as follows:
   1) The calibration is already contained in the OTP memory of the DHT11 temperature and humidity sensor.

2) The sensors are stable and have relatively fast readings.
3) Can measure temperature and humidity at the same time.
4) Has good accuracy.
5) Has 31 digital interfacing system certifications, suitable for measuring temperature and humidity.

Picture 10. DHT11

2. ESP8266 NodeMCU microcontroller
   NodeMCU in Picture 11 is an IoT platform that is open source. It consists of hardware in the form of a System On Chip ESP8266 from the ESP8266 made by Espressif System, as well as the firmware used, which uses the Lua scripting programming language. The term NodeMCU by default actually refers to the firmware used instead of the hardware development kit. This development kit is based on the ESP8266 module, which integrates GPIO, PWM (Pulse Width Modulation), IIC, 1-Wire, and ADC (Analog to Digital Converter) all on one board.

Picture 11. NodeMCU ESP8266

The specifications owned by NodeMCU are as follows:
1) *Board* This is based on the ESP8266 serial Wi-Fi SoC (Single on Chip) with onboard USB to TTL, the wireless used is IEE 802.11b / g / n.
2) 2 tantalumcapsitir 100 micro farad and 10 micro farad.
3) 3.3v LDO regulator.
4) *Blue LED* as an indicator.
5) Cp2102 USB to UART bridge.
6) Reset button, USB port and flash button.
7) There are 9 GPIOs in which there are 3 PWM pins, 1 x ADC channel, and RX TX pins.

8) 3 ground pins.
9) S3 and S2 as GPIO pins
10) SI MOSI (Master Output Slave Input), namely the data path from the master and into the slave, SC cmd / sc.
11) SO MISO (Master Slave Input) is the data path out of the slave and into the master.
12) SK which is the SCLK from master to slave which functions as a clock.
13) Pin Vin as a voltage charge.
14) Built in 32-bit MCU.

3. LCD (Liquid Crystal Display)
In the output section, using the LCD in Picture 12, the character type is 16x2 lines, and can display 16 characters per line and only has 2 lines. LCD (Liquid Crystal Display) is equipped with an internal controller so that the LCD scanning process is carried out by the internal controller.

Picture 12. LCD (Liquid Crystal Display) 16x2

4. *Relay*
Relay is an electrically operated switch. Many relays use an electromagnet to operate the switch mechanically, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit with a separate low-power signal, or where several circuits must be controlled by a single signal. The first relays were used on long-distance telegraph circuits as amplifiers.

5. Fan Fan
The fan in Picture 13, here functions as a hardware device that describes the description of the device used as an air conditioner control, the fan used is a 5V fan.

Picture 13. 5V Fan

6. Mini Water Pump
The mini water pump in Picture 14 here functions as a hardware device that illustrates the description

of the tool used as a room cooling control. The mini water pump used is a 5V mini water pump.

Picture 14. 5V Mini Water Pump

7. Use of Tools
When the device that has been designed is turned on in Picture 15, the first thing that is done is the DHT11 sensor detects temperature and humidity, after that the DHT11 sensor data is processed by NodeMCU, then NodeMCU sends DHT11 sensor data to the LCD and smartphone, the user can see the temperature value and humidity on the LCD and smartphone, when the temperature and humidity are unstable, the user can turn on the fan or water pump with the remote control on the smartphone.

Picture 15 Tools When Turned On

C. Software Technology
The software used in programming uses the Arduino Integrated Development Environment application for writing programs on the microcontroller. To display the temperature and humidity results on a Smartphone as well as a remote control using the Blynk application.
1. Programming on the ESP8266 NodeMCU Microcontroller
In the discussion in Picture 16, we will discuss making programs using the Arduino Integrated Development Environment application. In the Arduino Integrated Development Environment application, there is a sketch for typing programs and tools such as verify or compile, upload, new, open and save the project.

Picture 16. Programs on the Arduino IDE

2. Display on the Blynk application
In the Blynk application in Picture 17, there is data on temperature and humidity values as well as the Fan fan button and water pump which are used as a remote control.
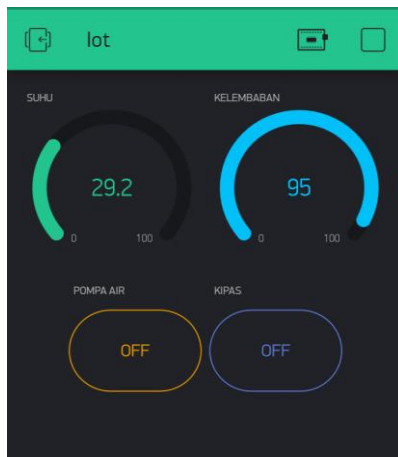
Picture 17. Views on the Blynk Application

V. CONCLUSION

To make a room temperature and humidity monitoring tool in a swallow house based on Android, the main components are needed, namely, NodeMCU ESP8266 as a microcontroller that processes data to produce output, DHT11 sensor as input for temperature and humidity, 16x2 LCD as output display, relay as a switch connect the fan and mini water pump, fan and mini water pump as hardware for air conditioning, and blink as the output display and remote control.

The temperature and humidity monitoring tool in the swallow house that is made has an air conditioning control system so that when the room temperature exceeds a predetermined limit, the fan and water pump will turn on which is controlled by the user. Based on the results of the tests that have been done, it can be concluded that the room temperature and humidity monitoring tools can function properly, where each tool can function properly.

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