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Design Of An Internet Of Thought (Iot)-Based Monitoring Soil And Air Moisture Sensor On Bosai Plants

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Abstract

Soil is an important factor for plant growth and development. Soil conditions that are too dry can inhibit root growth and cause the plant's ability to absorb nutrients. Meanwhile, too wet soil can affect root growth and cause disease in plants. One of the information and communication technologies in engineering is the use of the Internet of Things. Facts in the field are difficult to measure manually. For the value of soil and air humidity is very useful to determine the steps or soil handling. The conclusion of the results shows that measuring humidity using soil and air humidity sensors can work well. But the tool needs to be updated even better to get perfect results. And it can help to monitor bonsai plants via a smartphone so it's easy to monitor at any time to monitor plants. And the average tool works about 17 seconds to get the result.

Keywords
Soil Moisture Sensor, NodeMCU ESP8266, Air Humidity HT06, Internet

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INTRODUCTION

Soil is the surface layer of the earth that physically functions as a place for plants to grow by providing nutrients and water as well as supporting roots. To ensure optimal growth in plants, factors such as soil moisture must be taken into account. Soil moisture is also an important factor that influences plant growth and development[1], [2].

Several studies related to the application of IoT in plant monitoring[3]–[6]which shows that IoT is very helpful in knowing the condition of plants[7].IoT has a crucial role in changing the landscape of modern agriculture[8]–[11]. So this research focuses on the effect of soil moisture on the growth of bonsai plants. Bonsai plants were chosen because they are ornamental plants that are in great demand among the public and have high aesthetic value.

Bonsai plants symbolize harmony, peace, orderliness of mind, balance, and all that is good in nature. The growth and health of bonsai plants is influenced by several factors such as soil moisture, temperature, and the need for sufficient water. Therefore, monitoring the growth conditions of bonsai plants needs to be done regularly to get maximum results. Based on the explanation above, the aim of the

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research is to design a tool that can monitor soil and air humidity using a smartphone to make it easier for someone to check soil and air humidity on plants.

METHOD

Literatur Review

NodeMCU Esp8266

NodeMcu is an open source IoT (Internet of Things) platform. NodeMcu uses Lua as a scripting system and can also use Lua for Arduino programming. The NodeMcu ESP8266 is a compact prototyping board that is easy to program via the Arduino IDE. And Esp 8266 is a WiFi chip with a complete TCP/IP protocol stack[12], [13]. This makes the process of making tools easier.

Figure 1. NodeMCU ESP8266

HT06 Air Humidity Sensor

The ht06 air humidity sensor is a sensor that functions to detect whether it is raining or not, which is used in a type of sensor to help plants receive water for reproduction and can help in everyday life.

Figure 2. HT06

Soil Moisture Sensor

Soil Moisture is a soil moisture detection tool, which is accessed using an Arduino microcontroller. This humidity sensor is useful in bonsai plant research systems.

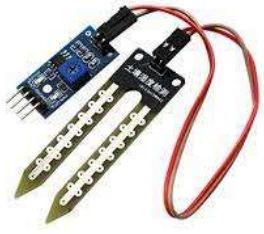

Figure 3. soil moisture sensor

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Arduino IDE

Arduino IDE is an operating tool used to design Arduino IDE programs, even though Arduino is actually used for other operating systems.[14]. The first step in using Arduinno Ide is to install it first to start the program.

App Inventor

App Inventor is a platform that will simplify the process of running applications without learning too much programming vocabulary. With this you can design smartphone applications[15], [16]according to our wishes and can use various layout systems and existing components.

Figure 4. app inventor

Firebase

Firebase is a Google service that provides convenience and even makes it easier for smartphone application developers to develop applications. Firebase or BaaS (Backend as a Service) is a solution offered by Google to make users' work easier.

Research Methodology

Figure 5. Research Stage

Based on Figure 5 above, the research stages can be explained which are divided into:

1. Preparation Stage, at this stage the author begins to prepare the materials needed for research, both hardware and software.
2. Design Stage, at this stage the author begins to design the hardware layout and76the working system of this software.
3. Working Stage, at this stage the author begins the process of assembling the hardware and software that will be used to make it76the system.
4. Integration Stage, this stage is the process of connecting hardware and software to ensure that the two components can be in sync.
5. Testing tools and programs, at this stage the author begins to try testing76system that has been built.

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Soil and Air Moisture Measurement

There are several factors that influence soil and air humidity. These include soil pH and air temperature. The average normal soil pH is 6.5-7.5ph and air 50. It is customary to water bonsai plants in the morning and evening to stabilize the soil so that it remains moist. It is important to control plants in the morning and evening to prevent the plants from dying.

Flow chart

A flowchart is an image that forms a flow diagram from an algorithm to a program. The following is the process of generating data into the system using existing devices. This diagram consists of a system that is built as follows:

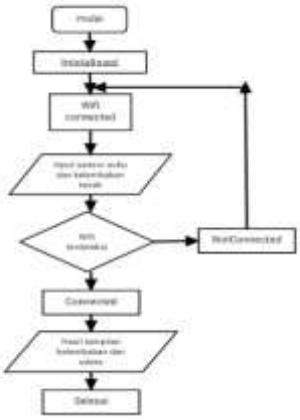

Figure 6. Flowchart

Hardware Design Stage

At the hardware design stage there are several points that can be explained regarding the hardware design process carried out in the research, as follows:

1. The jumper cable is connected to the NodeMCU ESP8266 to the relay
2. Jumper cables to soil moisture sensor and HT06 humidity sensor
3. USB cable connects to NodeMCU ESP8266

RESULTS AND DISCUSSION

This stage is carried out to test the tool to find out whether the tool is designed to work according to plan or not. There are two types of testing tools required, namely hardware testing and software testing.

Device Assembly

The circuit is very easy because the ESP8266 is an Arduino board with the latest technology which is equipped with a WiFi module in it, in other words the Arduino can directly connect to the internet. The following is a picture of the assembly circuit that has been connected between the NodeMCU Esp8266 with jumper cables, the Soil moisture sensor and the HT06 Humidity sensor to the NodeMCU Esp8266 and NodeMCU Esp8266 with a USB cable.

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Figure 6. overall assembly

Installation of simulation tools

The equipment installation stage is the NodeMCU ESP8366 stage, Soil moisture sensor, HT06 air humidity, jumper cables, USB cables that have been assembled will be installed in a simulation tool that uses bonsai plants as research media. The following is a picture of a series of simulation tools.

Figure 7. Suite of simulation tools

Application Deployment

The system design stage is the stages of creating the entire application, starting from the display in Firebase, setting the display and writing code using APP Inventor.

Figure 8. Initial Display

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Based on Figure 8 it can be explained that dThe display design in this second menu functions to monitor the results of soil and air moisture that is being applied to soil and water and later the resulting numbers and information will be displayed on the smartphone. The following is an image of the second display in the second menu in the application.

Figure 9. Monitoring Results Display

The appearance of this application icon is usually used as an identity for the application being created and also to differentiate other applications. Here is what the application looks like.

Figure 10. Application Icon

Database Creation

The process of creating a database to store data sent from the ESP8266, uses the Firebase Realtime Database, one of the facilities provided by Google's Firebase. Below is an image of the Realtime Database page.

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Figure 11. Database Firebase

Testing soil moisture sensor and HT06 air humidity

The results of the Soil moisture sensor and HT06 Humidity were carried out to determine the level of accuracy of the Soil moisture sensor and HT06 Humidity. This test is carried out by connecting the Soil moisture sensor and the HT06 Humidity sensor which is connected to the ESP8266 and then the results will appear on the smartphone.

Table 1. Initial data before watering

No	Plant Name	Age	Total pH	condition
1	Bonsai randu varigata putih	6 years	9	Not enough
2	Bonsai Bougenville	4.5 years	9	Not enough
3	Bonsai asam jawa	5 years	7.5	Good
4	Bonsai kelapa	3 years	9	Not enough
5	Bonsai beringin	10 years	9	Not enough
6	Bonsai sancang	7 years	9	Not enough
7	Bonsai putri malu	1.5 years	8.5	Not enough
8	Bonsai beringin	3.5 years	7.5	Very good

Tabel 2. Data After watering

No	Nama Tanaman	Umur	Jumlah pH	kondisi
1	Bonsai randu varigata putih	6 years	6.5	Very good
2	Bonsai Bougenville	4.5 years	7	Very good
3	Bonsai asam jawa	5 years	6.9	Very good
4	Bonsai kelapa	3 years	7	Very good
5	Bonsai beringin	10 years	7	Very good
6	Bonsai sancang	7 years	7.1	Very good
7	Bonsai putri malu	1.5 years	6.9	Very good
8	Bonsai beringin	3.5 years	6.5	Very good

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Time Delay Testing

As for the time delay test when the HT06 air humidity and soil moisture sensor detect soil moisture, then how long is the delay before you can receive notifications to Android, namely as in the following table:

Tabel 3. Time Testing

No	Time	Status
1	17.53 Sec	Detected
2	15.45 Sec	Detected
3	13.44 Sec	Detected
4	17.94 Sec	Detected
5	23.77 Sec	Detected
6	12.50 Sec	Detected
7	16.30 Sec	Detected
8	21.10 Sec	Detected

CONCLUSIONS

Based on the research results, there are research conclusions, namely 1)This design was created using App Inventor, with the NodeMCU Esp8266 tool. 2)A system design has been created resulting in the design of a monitoring application system for soil and air humidity to help monitor plants so that they are controlled. 3) Soil and air humidity measurement system to complete the monitoring application system so that the results can be monitored via smartphone.

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