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Soil Moisture Monitoring Using Nodemcu-Based Soil Moisture Sensor With Blynk Application Output

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Abstract

Currently, soil moisture monitoring is only done manually, which is less accurate, even though sometimes we need a soil moisture monitoring tool to determine the soil water content in plants. This research uses a Soil Moisture sensor to measure soil moisture and the NodeMCU ESP8266 microcontroller as the main controller. The system is designed to provide accurate and efficient soil moisture monitoring through the Internet of Things (IoT). Integrating Blynk as a monitoring application offers easy access to real-time soil moisture data via mobile devices. This system is designed to help users monitor soil moisture in real time using NodeMCU as the main platform and Blynk for user interaction. Through this system, users are expected to avoid the risk of water shortages by knowing the soil water content in real-time. Based on testing, this soil moisture monitoring product has a success rate of 88.2% for soil moisture accuracy and an average user satisfaction rate of 60%.

Keywords: *Humidity, Sensor, Application*

Abstrak

Saat ini pemantauan kelembapan tanah hanya melalui perkiraan manual saja sehingga kurang akurat, padahal terkadang kita membutuhkan alat monitoring kelembapan tanah untuk mengetahui kadar air tanah di tanaman. Penelitian ini menggunakan sensor Soil moisture untuk mengukur kelembapan tanah dan mikrokontroler NodeMCU ESP8266 sebagai otak utama. Sistem ini dirancang untuk memberikan monitoring kelembapan tanah secara akurat dan efisien melalui Internet of Things(IoT). Integrasi Blynk sebagai aplikasi pemantauan memberikan kemudahan akses data kelembapan tanah secara real-time melalui perangkat seluler. Sistem ini dirancang untuk membantu pengguna dalam monitoring kelembapan tanah secara realtime dengan mengunakan NodeMCU sebagai platform utama dan aplikas Blynk untuk interaksi pengguna. Melalui ystem ini, diharapkan pengguna dapat menghindari risiko terkait kekeringan air akibat hanya mengetahui kadar air secara real-time. Berdasarkan pengujian, produk monitoring kelembapan tanah ini memiliki tingkat keberhasilan sebesar 88,2% untuk kelembapan tanah dan rata-rata tingkat kepuasan pengguna sebesar 60%.

Kata-kata kunci: *Kelembapan, Sensor, Aplikasi*

1. Introduction

Farming is currently one of the jobs of many people in Indonesia, not only those who live in rural areas but also in urban areas. City people often choose to farm in their backyards, beautifying the house and creating a pleasant atmosphere **[1]**. However, many farmers face problems such as crop failure or less-than-optimal yields, often caused by soil conditions that do not match the needs of the plants.

Soil moisture plays an important role in determining plant productivity. Too dry soil can inhibit plant growth, while excessive moisture can cause root rot and decreased crop yields **[2].** Soil moisture is also related to soil quality and ecosystem health. Unbalanced moisture can affect soil structure and reduce overall soil quality **[3].**

Some technological products developed to monitor soil moisture include a soil moisture control system using Arduino Uno with a soil moisture sensor and LCD output developed by Odi Nurdiawan **[4].** Husdi also adapted a similar product, differentiating the type of soil moisture sensor and the output displayed on a website so that soil moisture data can be accessed online **[5].** In addition, Hendra Macos developed a tool that measures humidity and air temperature for papaya farming with an LCD output **[6].**

Other studies also show advances in soil moisture monitoring technology, such as IoT-based systems that enable remote monitoring **[7].** This technology uses sensors and communication platforms to collect and present real-time soil moisture data **[8].** These studies need products that allow direct and remote soil moisture monitoring using an Android application **[9]**.

Based on the above problems, the author created "Soil Moisture Monitoring Using Nodemcu ESP8266 Based Soil Moisture With LCD Output and Blynk Application" using the Blynk application to monitor soil moisture very effectively. Soil moisture sensors have several advantages, making them an important tool in agriculture and land management. First, this sensor can provide real-time data on soil moisture levels, so farmers can manage irrigation more efficiently and avoid over-irrigation or lack of water **[10].**

Second, these sensors are relatively easy to integrate with automated systems, such as IoT devices, for remote monitoring **[11].** In addition, the use of soil moisture sensors can help increase crop productivity by ensuring that plants receive the right amount of water as needed. With increasingly advanced technology, soil moisture sensors also offer higher accuracy and better durability in various environmental conditions.

In addition, the Blynk application has a feature that can provide notifications when soil moisture reaches an undesirable level or requires more attention. This is very useful for farmers or agricultural landowners who want to manage soil moisture efficiently and increase agricultural yields. Monitoring soil moisture using the Blynk application can make it easier without monitoring it directly in the field.

2. Method

Research and development methods or research and development methods are used to produce certain products and test the effectiveness of these products **[12] [13]**. The stages of Research & Development used in this study are as follows:

a. R&D potential and problems

It can start from the existence of a problem; potential is anything that, if utilized, will have added value. Problems can be used as potential if they can be utilized. In this first step, the researcher found a problem in using a manual method.

b. Information collection

After the potential and problems can be shown factually and up to date, various information and literature studies are collected to be used as material for product planning that is expected to overcome the problem.

c. Product Design Planning

In this case, the researcher created a soil moisture monitoring design. At this stage, the researcher prepares a product design or sketch, and the components needed in the manufacturing process.

d. Product Development

In the product development process, the product is assembled according to the design that has been made. Then validated whether the product is feasible or not. If feasible, it will proceed to the next stage, if not, it will be revised.

e. Product Testing

The product will be tested through experiments to see if it is in accordance with the expected working method and results.

f. Product Improvement

After conducting product trials and analyzing the collected data. Then the product is improved.

The design of the tool to be built is as shown in **Figure 1.**

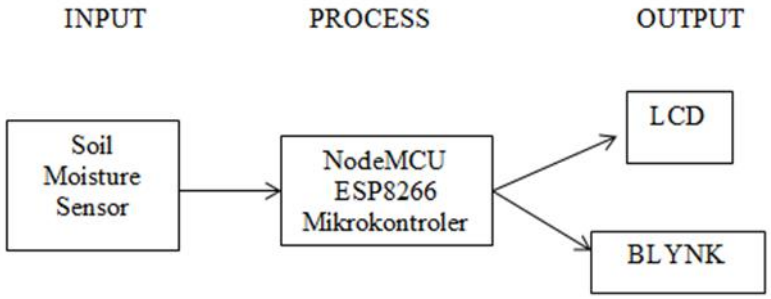

Figure 1 Soil Moisture Monitoring Block Diagram

Figure 1 shows the Block Diagram of Soil Moisture Monitoring with three main parts, namely Input, Process, and Output. The input part of this system consists of a soil moisture sensor. Process (Nodemcu ESP8266 Microcontroller) after data from the moisture sensor is received, the data is sent to the Nodemcu ESP8266 microcontroller. The output of this development consists of LCD and Blynk.

3. Results and Discussion

Whole Circuit Testing. Previously tested circuits are combined to test the whole circuit. After the series is combined, downloading and uploading the program begins. Using the Arduino IDE software, install the program and test the entire circuit by looking at the soil moisture monitoring work created. The following are the results of overall circuit testing.

Figure 2. Soil Moisture Monitoring

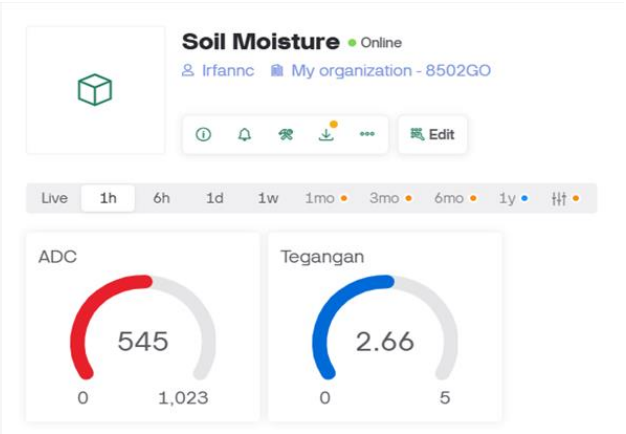

Figure 3. Blynk application

Figure 2. shows that all circuits are on and all components are running normally. Figure 3. shows that the application is online and displays data from NodeMCU. The test results are displayed in a table. Data collection was carried out from Monday to Friday for 5 days. The results are presented in a table for the soil moisture monitoring test.

Table 1. Soil Moisture Measurement Results

No	Day	Soil Moisture		Error	Success
		LCD	Soil Meter		
1.	Monday	582	600	18,0%	82,0%
2.	Tuesday	595	600	5.0%	95,0%
3.	Wednesday	685	700	15,0%	85,0%
4.	Thursday	692	700	8,0%	92,0%
5.	Friday	687	700	13,0%	87,0%
Average				11,8%	88,2%

Table 1 shows the results of the soil moisture measurement test. Researchers use a soil meter as a reference. Based on the results of the temperature test table, the average error rate is 11.8%, so this product's success rate is 88.2%. The greater the ADC value on the LCD, the drier it will be, while the smaller the value on the LCD, the wetter it will be.

Based on answering questions from the formulation of the problem of the test results above, a percentage of 20 user samples who have seen the presentation results of the NodeMCU-based soil moisture monitoring product using the Blynk application can be made. From these questions, it can be concluded that the highest presentation level is as follows:

(11 Respondents/ 55%)

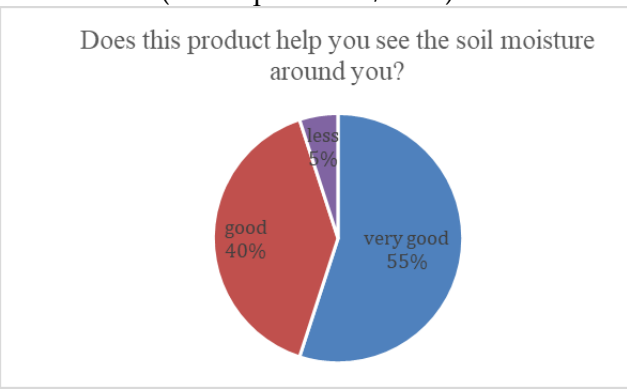

Figure 4. Percentage of Respondents to Product Monitoring Questions
(8 Respondents/ 40%)

(13 Respondents/ 65%)

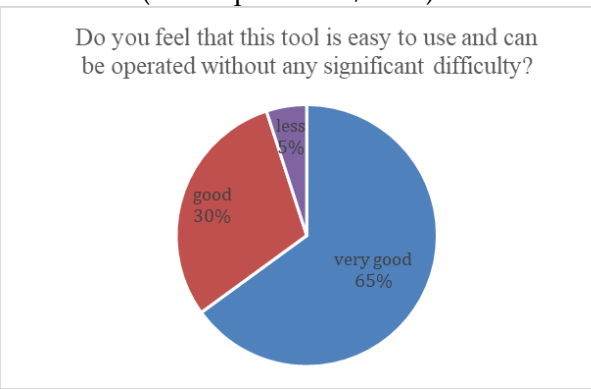

Figure 5. Percentage of Respondents to Product Ease Questions

(8 Responden/ 40%)

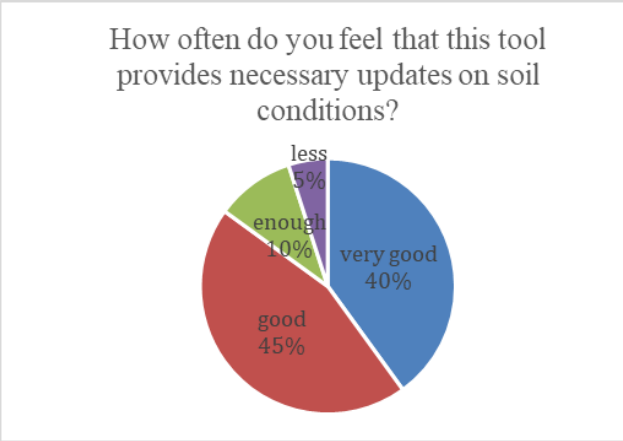

Figure 6. Percentage of Respondents to Air Quality Update Questions (10 Responden/ 50%)

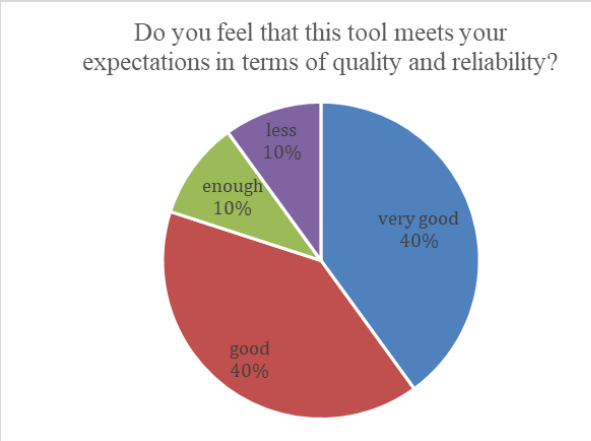

Figure 7. Percentage of Respondents to Product Expectation Questions (14Responden/ 64%)

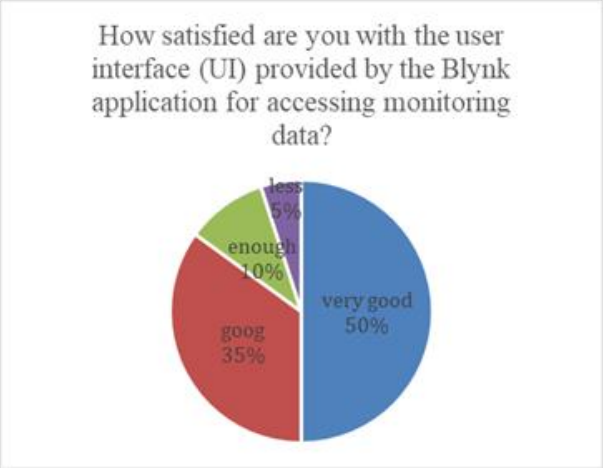

Figure 8. Percentage of Respondents to Questions on the Blynk Application UI Display (12Responden/ 60%)

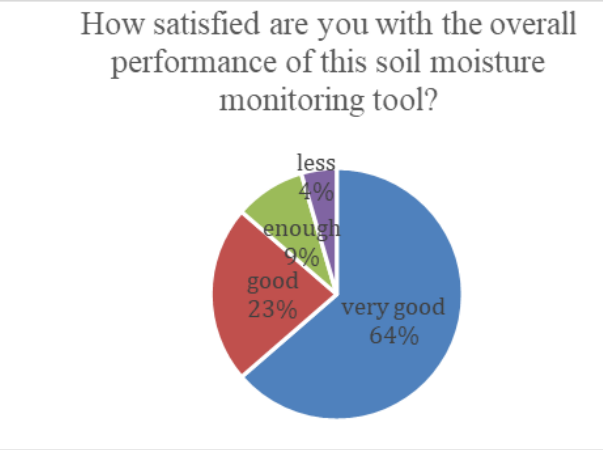

Figure 9. Percentage of Respondents to Overall Product Performance Questions

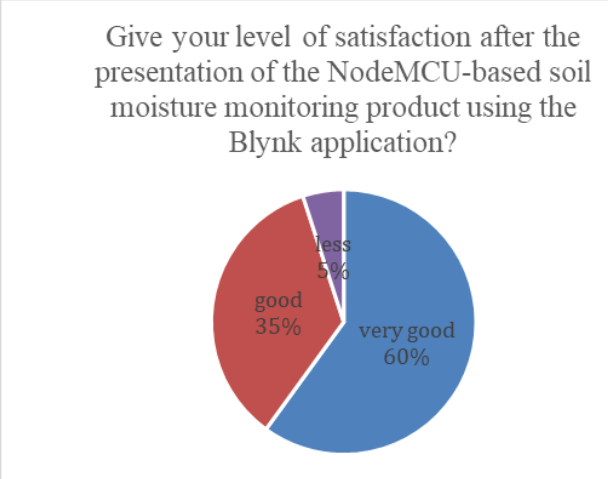

Figure 10. Percentage of Respondents with Product Satisfaction Level

Based on the data above, it can be concluded that the soil moisture monitoring product provides an average user satisfaction level of 60%, and the evaluation of its effectiveness level needs further consideration. This evaluation can include factors such as the accuracy of the data provided, the availability of features that suit user needs, and user convenience. Thus, to improve its effectiveness, a comprehensive evaluation of all these aspects is needed and continuous improvement is carried out according to user feedback.

4. Conclusion

Based on observations and testing of the tool as a whole and per part, the following conclusions can be obtained: 1) How to monitor soil moisture using the Blynk application, making it easier and more efficient in monitoring soil moisture. Based on the results of the questionnaire filled out by the user, it can be concluded that the user is satisfied with the tool used, 2) In this humidity monitoring product, it has a success rate of 88.2% for soil moisture, 3) After looking at the percentage of respondents, it can be concluded that the soil moisture monitoring product provides an average user satisfaction rate of 60%.

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