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Soil Moisture Control and Monitoring System Prototype Using the Internet of Things Network Based on Arduino Via Telegram Application

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Abstract

The purpose of this research is to find out and get adequate information about soil moisture so that it can be utilized and maximized, especially in terms of farming so that it can help to suppress the effects of global environmental warming in this era of globalization and increasingly modern technology. The object of this research is the measurement of soil moisture which can be seen through the control and monitoring system prototype using the internet of things (IOT) network based on Arduino via the telegram application using props. The findings of this study can be concluded as follows; First, soil moisture can be found through the Arduino-based network using the telegram application. Second, with the ease of technology like this, it will greatly facilitate the lives of many people, especially in terms of farming so that they can better know the soil moisture content and the process of watering plants regularly every day. Third, with the ease of technology in terms of farming, it can help to minimize the effects of global warming on the growing environment.

I. INTRODUCTION

Water content is the amount of water contained in an object, such as soil (also called soil moisture). Water content is one of the important things which can determine the level of soil fertility and moisture to match the required moisture content. The characteristics and structure of the soil play a very important role in storing water so that plants will quickly absorb the water supply in the soil which of course will dry out faster and must be watered as often as possible so that soil moisture can be maintained properly and plants do not wither easily. Internet of things (IoT) is a new concept and trend in the world of technology with a concept where an object is able to transmit data using a network to carry out an activity and makes it easier to use tools and devices connected to internet connectivity.

II. RELATED WORKS/LITERATURE REVIEW (OPTIONAL)

Internet of things (IoT)

According to [1], the Internet of Things or also known as IoT is a concept that aims to expand the benefits of continuously connected internet connectivity. The ability of this IoT is to share data, remote control of surrounding objects that can be connected via a global network through embedded and active sensors to obtain information data. Furthermore, according to another definition, IoT is a concept or scenario of an object that has the ability to transfer data over the network from device to computer or application used to monitor the performance of the device used. Meanwhile, the term IoT became known in 1999, which was first mentioned in Kevin Ashton's presentation as Co-Founder and Executive Director of the AUTO-ID Center. With the development of internet infrastructure where not only computers or smartphones can connect to the internet, but can be used on devices or devices connected to the network and equipment including objects that are connected using local and global networks using sensors.

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Arduino IDE

According to [1],, the Arduino Integrated Development Environment (Arduino IDE) is "… is a cross-platform application (for Windows, Mac OS, Linux) that is written in functions from C and C ++". The Arduino IDE is used to write and upload programs with the help of third party vendors.

The Arduino IDE supports C and C ++ languages by using special coding rules, which as a supplier of software libraries of wiring projects it provides many common input and output procedures.

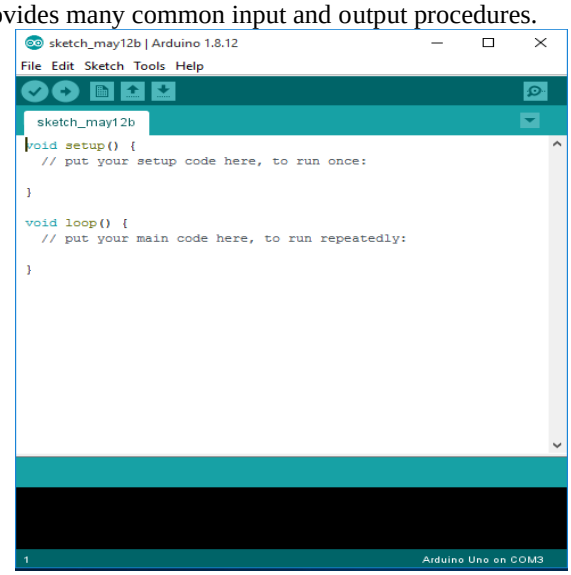

Figure 1 The Arduino IDE supports C and C ++ language

Telegram

Telegram is a cloud-based, non-profit, multiplatform instant messaging service since August 2013. Telegram is available for mobile phone devices and computer systems. Users can send messages and exchange photos, videos, stickers, audios and other types of files [2].

Figure 2 Telegram

Node MCU ESP 8266

It is an open source IoT platform and development kit that uses a programming language to assist in prototyping IoT products with the Arduino IDE [3].

Figure 3 Node MCU ESP 8266

Soil Moisture

Soil moisture is the amount of water that is retained in the ground after excess water is drained, if the soil has a high water content, the excess groundwater is reduced through evaporation, transpiration and underground water transport. Chili is a plant that is not drought tolerant, but also not resistant to standing water. Water is needed in sufficient quantity, not excessive or insufficient. Ideal soil moisture for growth and yield of red chilies ranges from 60-80% of field capacity. (Sarwani, Red Chili Cultivation Technology) [4]. On the other hand, a climate of less than 60% makes chilies dry and interferes with their generative growth, especially during flower formation, pollination and fruit formation. Humidity that exceeds 80% stimulates the growth of fungi that have the potential to attack and damage plants.

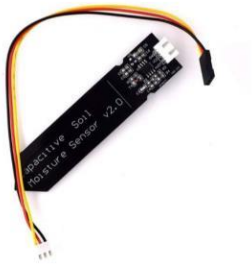

Figure 4 Soil Moisture

Water Pump

A water pump is a tool or machine for moving or raising water from one place to another so that it can flow.

Figure 5 Water Pump

Relay

Relay is a switch (switch) that is operated electrically and is an electromechanical component consisting of two main parts, namely electromagnet (coil) and mechanical (a set of switch contacts).

Figure 6 Relay

III. METHODS

The construction of an algorithm is usually described through a flowchart image. Flowchart is a graphic depiction of the steps and sequence of procedures of a program [5]. Flowcharts help analysts and programmers to solve problems into smaller segments and help in analyzing other alternatives in operation.

In mathematics or computer science, algorithms are step-by-step procedures for calculations. Algorithms are used for computation, data processing, and automatic reasoning [6]. This section will explain about the device method algorithm which can be described in the flowchart below:

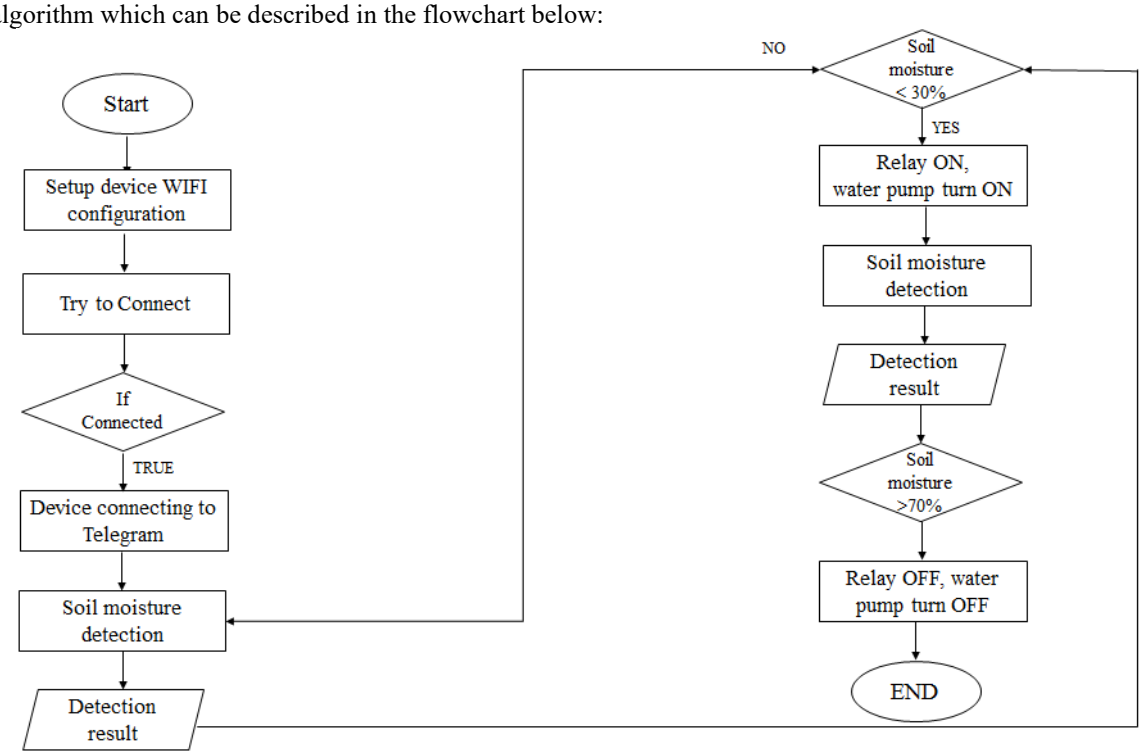

Figure 7 Method Algorithm

The system design method is needed in conducting an initial analysis of determining the level of soil moisture conditions in the plants to be studied, where in this study the plants to be studied are chili plants.

The structure of determining plant moisture includes dry plant soil and moist plant soil conditions so that it is good for plant growth [7]. Based on the reading of the sensor data value, the value range of the sensor readings ranges from the number 0-1023 bits which shows the moisture value of a soil. The higher the sensor will indicate that the drier the soil moisture conditions and vice versa, the lower the value read by the sensor, the more humid the soil moisture conditions will be.

So, in this case, in order to make the research easier, the sensor value changes into a percentage value (%). Refer to the manual calculation of soil moisture by the tool to convert the sensor value to a percent value using the following equation:

$$\text{Percent Value} = \frac{1023 - \text{Sensor Value}}{1023} \times 100\%$$

The equation above explains the sensor value which is 1023 and multiplied by 100 to get a value of 0.1023 for every 0.01 percent. This change in value is intended so that the props can immediately detect the percentage of soil moisture, which means that the lower the percentage detected by the tool, the drier the soil moisture conditions and vice versa, if the higher the percentage that can be detected by the tool, the more humid the soil moisture conditions will be.

That the average difference in the measurement results of the tools made against the American Standard Method is 1.042%. So it can be interpreted that the Soil Moisture Sensor V2.0 can measure soil moisture with relatively good measurement results as can be seen in the table below.

Table 1. Good Measurement

Value	Percent Value Sensor (%)
1.023,00	0%
1.022,90	0,01%
1.012,77	1%
920,70	10%
818,40	20%
716,10	30%
613,80	40%
511,50	50%
409,20	60%
306,90	70%
204,60	80%
102,30	90%
0	100%

IV. RESULTS

Of the several criteria used in these journals, the researcher considered which criteria were most widely used and also considered the availability of data for the criteria to be used [7]. Final in this study the criteria used are:

1.Sensor Information
2.Pump Indicator (Switch On/Off).
3.Lamp Indicator (Switch On/Off).
4.Dry Setting / Wet Setting.

Figure 8 Sensor Information

If the display is ready and after that you want to see soil moisture then click the "Sensor Info" button, so that the command will be read by the device and then the device will send a notification to the Telegram application.

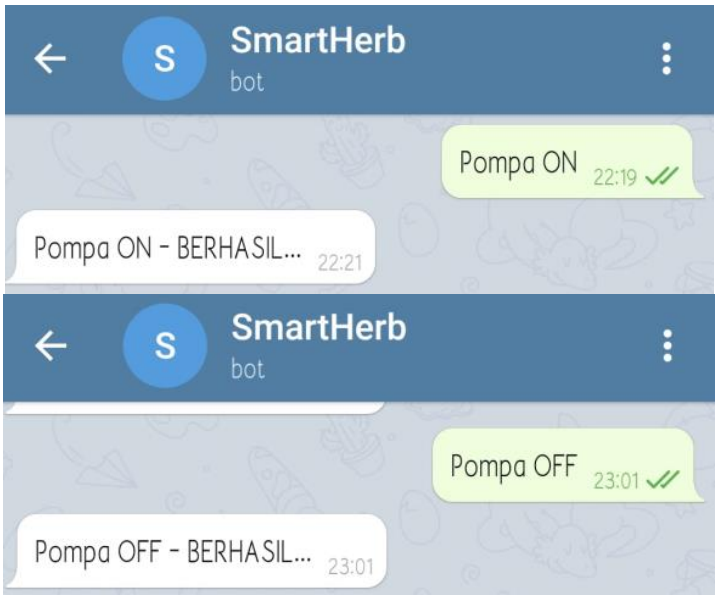

Figure 9 Pump Indicator (Switch On/Off)
"Pump ON" and "Pump OFF" buttons are for turning the water pump on and off manually.

Figure 10 Lamp Indicator (Switch On/Off)
Button 'Light ON' and 'Lamp OFF' to turn the light on and off manually

Figure 11 Dry Setting / Wet Setting

'Dry Setting' button to adjust the final soil dryness level. Meanwhile, the button "Setting Wet" is to adjust the highest limit of soil moisture level.

V. CONCLUSIONS

Based on the results obtained in this study, the following conclusions can be obtained:

System testing through a prototype control system and soil moisture monitoring using the Arduino-based IoT network using the telegram application has been successful and can work as expected. Testing tools and applications can be accessed easily through the Telegram application which has a friendly user interface, making it easier for users to apply. Applications can help users to detect or determine the moisture content of soil moisture and monitor plants remotely and at any time through the Telegram application, so that plants do not easily wither due to neglect or forget to water plants in their daily activities.

REFERENCES

[1] Wikipedia, "Internet untuk Segala," Agustus 2017. [Online]. Available: https://id.wikipedia.org/wiki/Internet_untuk_Segala.

[2] Telegram, "Telegram Era Baru Mengirim Pesan," [Online]. Available: https://telegram.org/?setln=id.

[3] C. P. Yahwe, "Rancang Bangun Prototype System Monitoring Kelembaban Tanah Melalui SMS Berdasarkan Hasil Penyiraman Tanaman Studi Kasus Tanaman Cabai dan Tomat," *semanTIK,* vol. 2, no. 1, pp. 97-110, 2011.

[4] H. "Monitoring Kelembaban Tanah Pertanian Menggunakan Soil Moisture Sensor FC-28 dan Arduino Uno," *ILKOM Jurnal Ilmiah,* vol. 10, no. 2, pp. 237-243, 2018.

[5] A. Susanto, Bimbingan dan Konseling di Sekolah: Konsep, Teori, dan Aplikasinya, Jakarta: QMPC Network, 2018.

[6] E. Y. Anggraeni, Pengantar Sistem Informasi, Yogyakarta: Penerbit Andi, 2017.

[7] J. S. Saputra, "Prototype Sistem Monitoring Suhu dan Kelembaban Pada Kandang Ayam Broiler Berbasis Internet Of Things," *Jurnal PROSISKO,* vol. 7, no. 1, pp. 72-83, 2020.

[8] R. Nufusula, "Rancang Bangun Chat Bot Pada Server Pulsa," *Journal of Information System,* pp. 80-88, Mei 2018.