



IOT-BASED SOIL PH AND MOISTURE MONITORING TOOL FOR ORNAMENTAL PLANTS

Nujiya Restu Fauzian^{1*}, Agus Ramdhani Nugraha²

^{1,2}Informatics Engineering Study Program, STMIK DCI, Indonesia

Correspondence: E-mail: nujiya21@gmail.com

ABSTRACT

Soil plays an important role in human life. In agriculture, the choice of soil type can determine the success rate of farming. Some soil parameters that need to be studied are temperature, moisture and pH, because these three parameters have a very important role in plant fertility.

Conduct a literature review to understand existing IoT technologies, available pH sensors, pH level monitoring systems, and related research in ornamental plants. Design the overall system, including the selection of the pH sensor, humidity sensor, and IoT platform to be used. Plants are plants that are nurtured and cared for to benefit or harvested when they reach a certain time. Plants are very useful to fulfill human needs. Soil fertility is the ability of soil to provide nutrients, water and oxygen in a balanced state for plants. Soil reaction indicates the acidity or alkalinity of the soil expressed by the pH value. The purpose of developing this tool may be to assist ornamental plant owners in managing the environmental conditions of their plants more efficiently and accurately. By using IoT-based tools, it is expected to provide convenience in monitoring and controlling environmental factors that affect the growth and health of ornamental plants.

ARTICLE INFO

Keyword:

Humidity, Ph, Soil, Plant..

Introduction

Land has an important role in human life. Soil is used by humans in various fields, for example in agriculture, plantations, transportation, housing, tourism and others. In agriculture, the choice of soil type can determine the success rate of farming. Agricultural land that will be used for farming requires an assessment of its physical properties so that the land can be used optimally. Measured parameters can be used as reference data for farmers to determine the type of plant. Some soil parameters that need to be studied are temperature, moisture and pH, because these three parameters have a very important role in plant fertility [1]. Internet of Things or known by the abbreviation IoT is an object in the real world that is integrated into an integrated system that communicates with other systems via the internet network [2]-[4].

In general, IoT devices consist of sensors as a medium for collecting data, the internet as a communication medium and a server as a collector of information received by sensors and for analysis. Based on previous research, a prototype development was carried out to create a more efficient system for caring for plants. For this reason, a prototype of an automatic monitoring tool for pH levels and humidity in ornamental plants based on the Internet of Things was designed.

By utilizing the existing pH level monitoring system. The designer develops the control system using an android device (smartphone), which utilizes an internet connection as a control and monitoring of soil pH conditions, temperature, air humidity and soil moisture. Researchers used three sensors in this study, namely the soil pH sensor, Capacitive Soil Moisture Sensor and DHT11 sensor, the soil pH sensor is used to measure acidity and alkaline levels in the soil, the Capacitive Soil Moisture Sensor is used to measure soil moisture levels, while the DHT11 sensor functions as a monitor of air temperature and humidity values around plants. This research is based on the NodeMCU microcontroller and the Blynk application as an IoT platform installed on a smartphone.

2. THEORETICAL FOUNDATION

2.1 Understanding Plants

Plants are plants that are nurtured and cared for in order to benefit or be harvested when a certain time has come. Plants are very useful to fulfill human needs.

2.2 DEFINITION OF SOIL PH

Soil fertility is the ability of soil to provide nutrients, water and oxygen in a balanced state for plants. This ability is influenced by the physical, chemical, and biological properties of the soil. From a chemical point of view, soil fertility means the ability of the soil to provide sufficient nutrients for plants [7]. Soil reaction indicates the acidity or alkalinity of the soil expressed by the pH value. pH is defined as the relative acidity or basicity of a material. The pH scale covers from values of 0 (zero) to 14. A pH value of 7 is said to be neutral. Below a pH value of 7 is said to be acidic, while above a pH value of 7 is said to be basic.

2.3 MONITORING

Monitoring is the process of continuous or periodic observation, monitoring, and data collection to observe progress, performance, or changes in a system, environment, or activity. The main purpose of monitoring is to gain a better understanding of a condition or process by monitoring certain parameters.

2.4 INTERNET OF THINGS

Internet of Things or known by the abbreviation IoT is an object in the real world that is integrated into an integrated system that communicates with other systems through the internet network [2]-[4]. In general, IoT devices consist of sensors as a medium for collecting data, the internet as a communication medium and a server as a collector of information received by sensors and for analysis.

2.5 SENSOR PH

The pH sensor is a sensor that detects the acidity (acid) or alkalinity (alkali) of the soil. The pH scale that can be measured by this soil pH sensor has a range of 3.5 to 8, this sensor can be directly connected to the analog pin of an Arduino or other microcontroller, without having to use an additional module.

2.6 NODEMCU ESP8266

NodeMCU is a module used to communicate via the internet and can be used independently or connected to Arduino [12]. There are several I/O pins on this electronic board that can be developed to become a monitoring or controlling application for the Internet of Things system.

2.7 BLYNK APPLICATION

Blynk serves as an internet controller for Arduino, Raspberry Pi, and ESP8266 modules and other devices operating on Android and iOS operating systems. The Blynk app is very easy to

use on Android and IOS devices. The Blynk app does not rely on any particular chip or component. However, to communicate with the hardware used, the board must have wifi access. The main components of the Blynk app are Libraries, Servers, and apps. The Blynk server handles all communication between the smartphone and the hardware.(Syukhron, 2021).

2.8 SOIL MOISTURE SENSOR

Soil moisture sensor is a moisture sensor that can detect moisture in soil. This sensor consists of two probes to pass current through the soil, then read the resistance to get the moisture level value [11].

2.9 SENSOR DHT11

The DHT11 sensor is a sensor module that detects temperature and humidity. This sensor module belongs to a resistive device element such as an NTC temperature measuring device. The way the dht11 sensor works is by measuring changes in resistance caused by temperature and humidity, then sending digital signal data consisting of high pulses and low pulses to the microcontroller which represents temperature and humidity values [5].

3. Results and Discussion

IoT-based monitoring tool for pH and humidity levels in ornamental plants. The pH level produced by the plant or soil will be read by the soil pH sensor which is then monitored through the blynk application or LCD screen. then monitored through the blynk application or LCD screen. Based on the results of the analysis and research conducted by the author, the workings of the pH level monitoring tool above still do the workings relying on the ATmega328P Microcontroller, namely by connecting the monitoring data with the LCD, so the results are only limited to the pH level data at any time. Therefore, the underlying author will make a tool that can monitor plants automatically. The author intends to create a tool, namely the Ph Level and Humidity Monitoring Tool for IoT-Based Ornamental Plants. Where in the tool is not limited to the pH level data listed on the LCD but can be seen on a smartphone, in the monitoring system using the Blynk platform application that can see monitoring via a smartphone from starting ph levels, temperature, air humidity, and soil moisture.

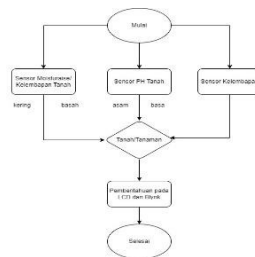
3.1 ANALYSIS OF USAGE PROBLEMS

The process of monitoring ph levels and humidity in ornamental plants based on IoT is as follows :

1. Monitoring ph levels using a soil ph sensor.

2. Monitoring soil moisture using a soil moisture sensor
3. Monitoring air humidity using a DHT11 sensor
4. Monitoring air temperature using a DHT11 sensor
5. If the value of the ph level is more than 7 then it is said that the soil is alkaline
6. If the ph level value is less than 7, it is said that the soil is acidic 6.

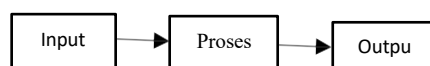
3.2 FLOWCHART PH AND HUMIDITY MONITORING DEVICE



Gambar 3. 1
Flowchart Alat Monitoring Kadar Ph dan Kelembapan

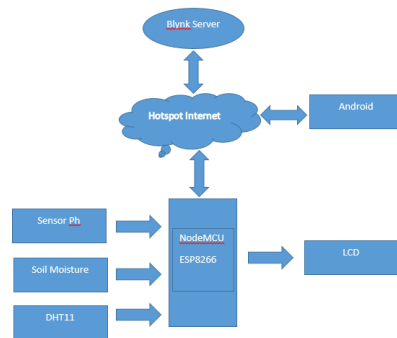
3.3. TOOL WORKING PRINCIPLE

A microcontroller system that uses Nodemcu as a microcontroller component and is equipped with other electronic components can be directly filled with programs that suit the needs and functions of its implementation. This system is designed to measure the level of acid-base and humidity in plants or soil. The basic concept of the working system is as follows.



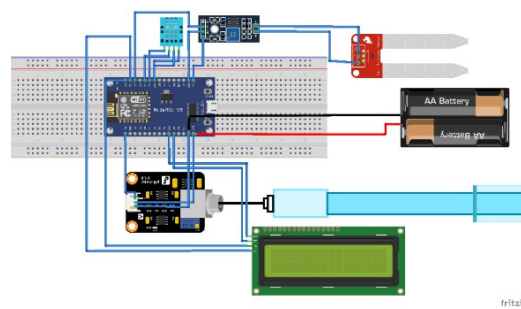
Gambar 4. 1
Konsep dasar Sistem kerja

3.4. SOIL PH AND MOISTURE MONITORING SYSTEM FLOW



Gambar 4. 2
Alur Sistem Monitoring PH Tanah dan Kelembapan

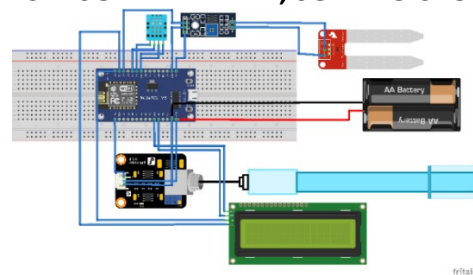
3.5. HARDWARE DESIGN



Gambar 4. 3

Perancangan Perangkat Keras

3.6. PERANCANGAN SENSOR PH TANAH, SOIL MOISTURE, DHT11 DAN LCD



Gambar 4. 3

Module sensor PH Tanah, Soil Moisture, DHT11 dan LCD

3.7. Software Design

In building this final project requires software to control and monitor the Soil Ph System and Humidity Based on Internet Of Things (IOT), namely as follows :

1. Arduino IDE

Arduino IDE (Integrated Development Environment) software is software used to perform various processes related to microcontroller programming. Arduino IDE already supports various current operating systems such as Windows, Mac, and Linux.

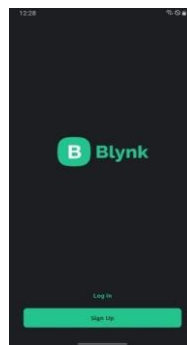


Gambar 4. 5

Tampilan Arduino software IDE

2. Aplikasi Blynk

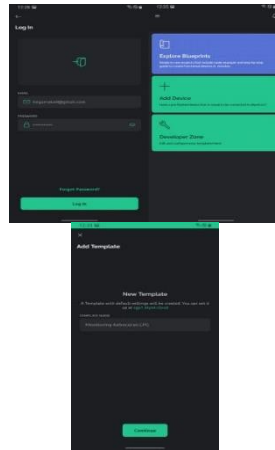
The Blynk application is programming that functions as a receiver on a smartphone.



Gambar 4. 6 Tampilan Awal Blynk

How to create a user interface on Blynk as follows :

- a. Open the Blynk application, then create an account to get an auth token which will be sent to email. After creating a project by giving the name "Monitoring Kadar Ph" and the hardware used then select creat.



Gambar 4. 7

Tampilan Blynk

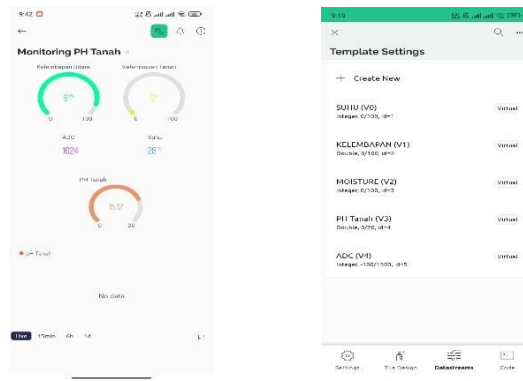
- b. *Add widgets to support the Ph monitoring display by selecting the plus menu display. There are several widget components including Labeled Value, Gauge, SuperChart, Button and Notifications. Adding components is done by selecting the available components.*



Gambar 4. 8

Tampilan Widget Box Blynk

- c. *After setting the required widget box, the last step is to enter in which is used to display the widget box and place the components as desired.*



Gambar 4. 9

Tampilan Komponen Blynk

III. IMPLEMENTATION

System implementation is the final process of implementing a designed system, where this stage is the stage of implementing the system so that it is ready to operate and as an effort to realize the system that has been designed. In this chapter will be described about the testing of the system of analysis and design results that have been made in the form of making software and hardware. This test includes components per part and as a whole, as well as testing the results of the performance of the tool that is expected to run as planned. This test is carried out with the aim of knowing the work system of each input, process and output component to match the expected target.

4.1. USABLE HARDWARE AT MINIMUM SPECIFICATIONS

1. Laptop :

- a. Processor Intel Dual Core 1,80 GHz
- b. RAM 512 MB
- c. Kapasitas Harddisk yang dipakai 10 MB

2. Nodemcu ES8266 : 1 buah

3. Ph Tanah : 1 buah

4. Soil moisture : 1 buah

5. DHT11 : 1 buah

6. LCD : 1 buah

7. Baterai 9 v : 1 buah

8. Kabel Jumper di sesuaikan

4.2. DEVICE INSTALLATION

Device installation is the process of designing each part of the hardware component to form a device, namely the Internet Of Things-based Soil PH and Humidity Monitoring System connected to the Blynk application.

4.3. Soil Ph Sensor Module and LCD



Gambar 5. 1

Rangkaian Module Sensor Ph Tanah dan LCD

4.4. RANGKAIAN MODULE SENSOR SOIL MOISTURE DAN DHT11



Gambar 5. 2

Rangkaian Module Sensor Soil Moisture dan DHT11

IV. CONCLUSIONS

5.1. CONCLUSIONS

Conclusion Based on the research that has been conducted, it can be concluded that the research focuses on developing a monitoring tool to measure soil pH levels and humidity in ornamental plants. The tool uses Internet of Things (IoT) technology as its base, suggesting that there will be the use of sensors and internet connectivity to collect data in real-time. The purpose of developing this tool may be to assist houseplant owners in managing the environmental conditions of their plants more efficiently and accurately. By using IoT-based tools, it is expected to provide convenience in monitoring and controlling environmental factors that affect the growth and health of ornamental plants.

5.2. ADVICE

This tool can be developed even better, both in terms of function and wider application. Suggestions that can be given are that the function of the tool is expected to be expanded so that it can not only measure pH from 3.5 to 8, but can measure pH from 1 to 14.

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