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The Nutrition Intake Control Tools in Hydroponic using Microcontroller

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ABSTRACT

The development of the world of technology combined with agricultural science can benefit farmers and of course the community. one of them is farming through the Hydroponic system, the purpose of this study is to find out how to make nutrition control devices on the pakcoy hydroponics using a microcontroller on hydroponics. The method used includes electrical design, systematic, in order to obtain accurate data and information. In this study using the stages of designing hardware and software and integrating the system and the system testing stage. This test uses a pH meter, where the sensor detects a pH with a value of 6-7 pH and when the pH sensor detects a value below 6 it will automatically add nutrients. As well as water temperature and room temperature will regulate the temperature in the water by turning on the waterwheel in the reservoir automatically. and all results are sent to the thinkspeak application via an IoT server, the display that is produced on thinkspeak is the water temperature, room temperature, water temperature, and water pH.

1. Introduction

The development of technology in agriculture today is very fast with the creation of new innovations that can increase the productivity of the quality of agricultural products [1]. This time agricultural cultivation is one of the business that have promising economic prospects in foodstuffs such as rice, corn, tubers, but has grown in the vegetable and fruit sector [2].

The development of the world technology combined with agricultural science can benefit farmers and of course the people who will farm. In addition to providing convenience in the implementation of agricultural technology, it is also able to increase the yield of the agriculture [3]. Therefore we as students are required to be able to create advanced technologies that can be utilized by farmers. In addition to producing staple food, for now many farmers have also ventured into complementary foods such as vegetables [4].

Current vegetables as a main food complementary food is very much needed, because more and more people are aware of health that can be supported by eating healthy natural vegetables regularly, According to the Statiscal Research Agency in 2018, vegetable production is 11.558.449 tons and in 2019 increased by 11.918.571 tons [3][5]. This shows that there must be an increase in vegetable production to offset the increased need for vegetable commodities as a result of an increase in the population of Indonesia [6]. From the many considerations and the increasingly rapid development of agriculture.

Nutrient control in hydroponics uses a pH sensor as a preliminary measure of data input. In addition to using a pH sensor, water also uses room temperature and water temperature. Knowing the temperature of this room because room temperature affects the water temperature, while the water temperature is very influential on plant fertility. Arduino microcontroller is used as a sensor data reader which is then processed and sent to smartphones via the internet which is then displayed in the Android prgram.

2. The Proposed Method/Algorithm

The method used in this research is electrical design, systematic, in order to obtain accurate data and information. In this design starts from the collecting data, making design, making tools, testing, and summarizing the results of the system. The following is a block diagram of a nutrient controller in hydroponics that will send monitoring data through internet media.

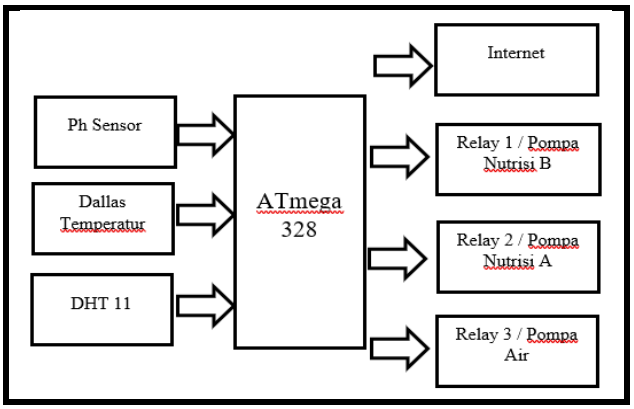

Fig. 1. Tools Designing Diagram Block

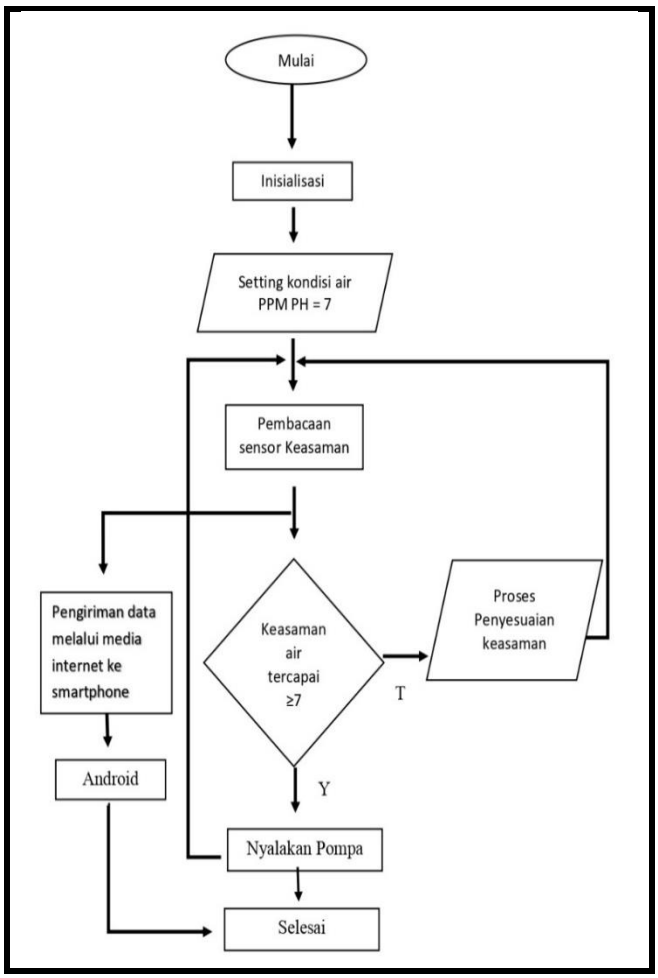

Fig. 2. Sensor Reading Flowchart

1. Literature Study Stage
   This literature study is taken from several data sheets such as journals as a reference that is used as a basic source in processing data. Literature study in this thesis includes the following matters:
   a. Study of the NodeMCU microcontroller operating system;
   b. Study of sensor characteristics of pH, DhT 11, Dallas;

c. Study of controlling systems to stabilize acidity.

2. The Hardware Design and Mufacturing Stage
   In this stage the design is adjusted to the function of the components that will be used, so that it can be realized and the system can run well.
3. Software Design and Manufacturing Stage
   At this Software testing has been made, before *Hardware* and *Software* are integrated into the whole system to run the system.
4. System Integration Stage
   Integrate between hardware and software that has been compiled into a whole system to run the system running well.
5. System Testing and Analysis Stage
   Test the system that has been integrated as a whole for further analysis according to its function. Flowchart system design software works as shown in Figure 2.

3. Result And Discussions

3.1. pH sensor test results

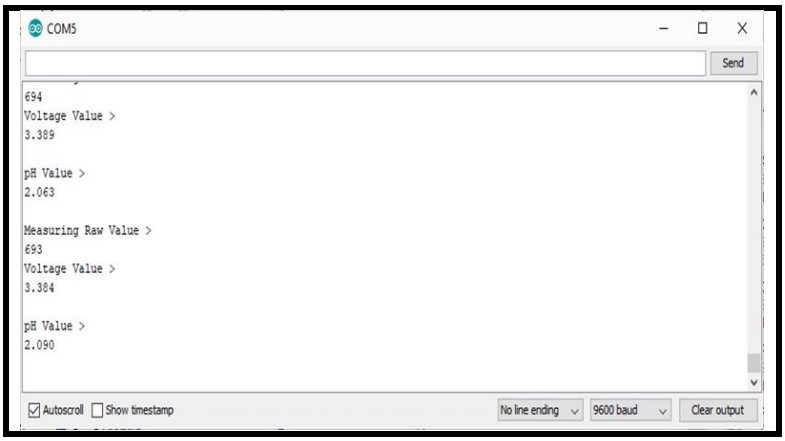

Fig. 3. Serial Print pH Sensor Readings

From the picture above in the serial print shows the voltage value is a number sent from the pH sensor to the microcontroller and then converted by the microcontroller into a pH values, after that the results will be obtained from the amount of pH of the object being tested [7]. From the results of testing the pH sensor shows the sensor can detect the pH of water well.

3.2. Water / Dallas Temperature Sensor Test Results

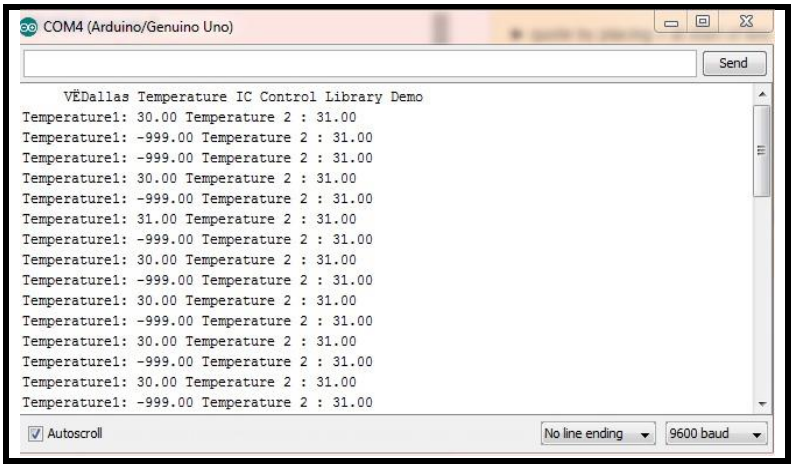

Fig. 4. Serial Print readings of Water Temperature sensors

From the dallas sensor test, it is obtained the value of water temperature in hydroponic plants. Water temperature values vary. The test is carried out at 07.00 am, 12.00 noon and 16.00 pm. A number of changes occur in value, and the change tends to be significant. The total value of the water temperature is influenced by the temperature around the plant starting from the sun to the ambient room temperature.

3.3. Room Temperature Sensor Testing Results / DHT11

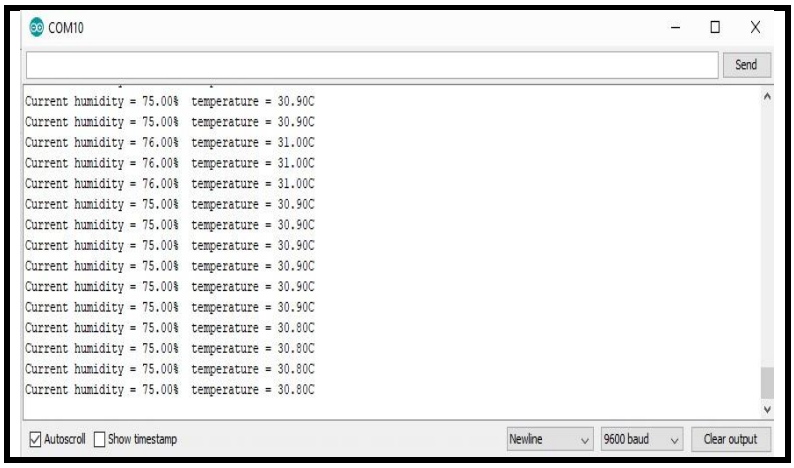

Fig. 5. Serial Print Room Temperature sensor reading

From the testing of the DHT11 sensor, it is obtained the value of the room temperature in hydroponic plants. Room temperature values vary. The test is carried out at 07.00 am, 12.00 noon and 16.00 pm. A number of changes occur in value, and the change tends to be significant. The total value of the temperature of this room is influenced by the temperature around the plant including sun [8].

3.4. Water Pump Test Results

Fig. 6. Water Pump Testing

The water pump testing process is connected to the microcontroller pins or given a voltage of 5 volts. When the water pump is running the water pump is functioning preoperly and is ready for use.

3.5. Internet Network Testing Results

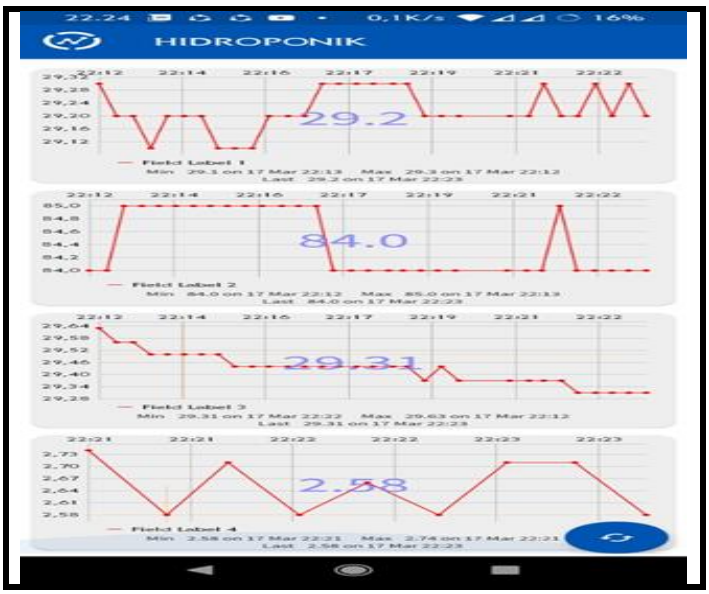

Fig. 7. Internet Network Testing

From the picture above the notification internet network sends a report to the ThinkSpeak application which is an application on Android. The data sent is in the form of monitoring from hydroponics. If the application has received data sent by the microcontroller then the internet network works well.

3.6. Fuzzy Logic Controller Test Results

The conclusion is that if the pH of the water is close to 7, plant growth will get more nutritional value and prevent plants from wilting [9][10].

3.7. Alarm System Test Results

This test is a test to give notification when the water in the reservoir is reduced/exhausted, or it could be when an error occurs in the irrigation system in a hydroponic plant. This test uses an ultrasonic sensor that detects water levels in the reservoir. when the ultrasonic sensor detects water is reduced, the alarm will automatically send information to the ThinkSpeak application using IoT.

Fig. 8. Overall Testing

In this case, we will discuss the results of testing a series of tools which include testing the pH sensor, water temperature sensor/Dallas, room temperature sensor / DHT11, water pump and internet network.

This test is done by providing input voltage to the whole system, then the microcontroller is programmed to activate the pH sensor by providing programming from the microcontroller. Then after being programmed, the pH sensor will detect the pH value of water which if the water pH is below 6.5 it will turn on the pump to add nutrients to the hydroponic distribution tank.

At the entire system works properly, the microcontroller will send monitoring data in the form of reports connected to the internet of think, using a ThinkSpeak server that is integrated directly by the plant owner. The ThinkSpeak report consist of the intensity of water pH, water temperature and room temperature.

4. Conclusion

The design of nutrition intake control devices in hydroponics using a microcontroller is designed using several components such as a pH sensor, NodeMCU, water temperature sensor /Dallas, room temperature sensor/DHT11, water pump, and integrated IOT. So the pH sensor can read the pH intensity of the water. The pH sensor detects 6.5 to 7.0 values of water pH. Water temperature sensors detect 30 to 33 degrees Celcius at 07.00, 12.00 and 16.00. Room temperature sensors detect 32 to 35 degrees Celcius at 07.00, 12.00, and 16.00. and all results are sent to the ThinkSpeak application via IoT.

The pH sensor can read the pH intensity of water. And when the water pH is below 6, the water pump containing nutrients will pump water to the reservoir to raise the pH value of the water to 6.5 to 7 so that the hydroponic plants are fulfilled with nutrients.

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