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Automatic Water Level Control Tem On Hydroponic Plants Based On Arduino

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ABSTRACT
Hydroponic farming techniques are generally carried out by flowing nutritious water into pipes that have been given holes for plants. The water that flows into the pipe comes from a water reservoir (water reservoir) that already contains nutrients. At the beginning of planting the existing water discharge in the reservoir has been adjusted to the needs to flow through the existing pipes. Along with the growth of plants that need water and also the process of evaporation of water, the water discharge in the reservoir will decrease. If left unchecked the water will become less and less, this can cause the pump to deliver water to the pipes not working and nutrients to the plants being disturbed. As an effort to prevent this from happening and to support smart systems in hydroponic farming, this research makes a water level control system in hydroponic water reservoirs automatically using Arduino. The test results show the system is able to control the water flow by increasing the volume of water if the reservoir water discharge is below the 60% level.

Keywords: *Arduino; Hydroponics; Water Level.*

INTRODUCTION
Hydroponic growing media has been widely developed by farmers who do not have large planting areas. This planting medium has also been widely developed in urban areas, especially in housing or urban residents who want to use vacant land to grow crops such as vegetables and other plants. The benefit of this hydroponic growing medium is that it can provide fresh vegetable or other plants without having to buy them at the market, making it easier and saving expenses for urban communities and others(Abdul Jalil 2017).

Hydroponics is the cultivation of plants by utilizing water without using soil with an emphasis on meeting the nutritional needs of plants. The water requirement for hydroponics is less than the water requirement for cultivation with soil. Hydroponics uses water more efficiently, so it is suitable for use in areas with limited water supplies. Hydroponics emerged as an alternative to limited land farming. This system allows vegetables to be grown in less fertile areas / narrow areas that are densely populated. Hydroponic development in Indonesia has bright prospects, both to fulfill domestic needs and seize export opportunities. The commercial application of hydroponics in Indonesia began in 1980 in Jakarta to produce vegetables and fruits of high economic value(Koswara and Kadarisman 2016).

One of the obstacles faced by hydroponic growing media farmers is that they must always control the water level in the plants on a regular basis so that it will be difficult for farmers to control the water level in hydroponic plants that are maintained. Based on these problems, the researcher will provide a solution in the form of a control system and detection of water levels on the Arduino Uno-based hydroponic growing media to make it easier for farmers to control the water in their hydroponic plants.

METHOD
The research method used in making this tool is the waterfall method. It is called a waterfall because the stages that are passed must wait for the completion of the previous stage, namely the requirements stage(Hidayati, Sutresna, and Warsono 2021).

The waterfall method provides a sequential software lifeflow approach starting from data collection, design, and testing. The waterfall method is the most widely used research method for the development stage. The waterfall method is also known as the traditional method or the classical method(Susilo 2018).

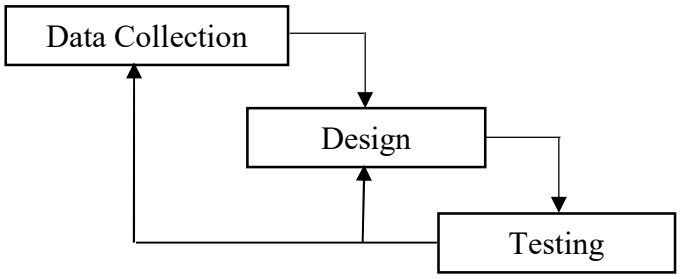

Figure 1. Waterfall Method

- Data Collection, The collection was carried out through a literature study on hydroponics, especially those related to hydroponic irrigation systems.
- Design, At this stage, a water control device is made in a hydroponic reservoir to determine the height of the water level in the reservoir. If the water level is at the minimum level, Arduino will turn on the faucet to drain the raw water into the hydroponic water reservoir.
- Testing, This test is carried out to determine the accuracy of water level readings and the effectiveness of the tool in maintaining sufficient water in the water reservoir.

At the design stage, which is carried out in this research, includes several aspects of making system block diagrams. In hardware design and software design for the automatic water level control system in hydroponics that we have made, we use the main material, namely Arduino Uno.

In this process, the Arduino Uno will receive data from the water level sensor and will send data to the pump that has been set in command automatically via coding to control the water level.

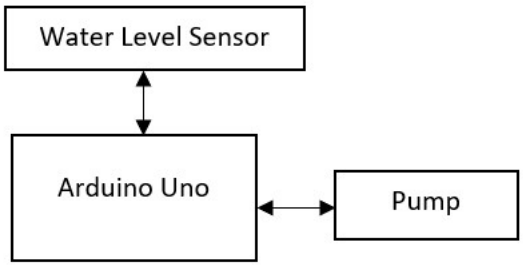

Figure 2. Block Diagrams

Tool Working Principle

Based on the block diagram above, it can be described that the working principle of the water level control system in hydroponics from a water reservoir as input is captured by the sensor and after that instructions are given to the Arduino to be channeled to the pump to control the water level.

System Process Design

In the design, it starts with designing several work tools, then proceeds with designing a series of tools by connecting or integrating components or several devices into a system. Below is the flowchart of the flowchart.

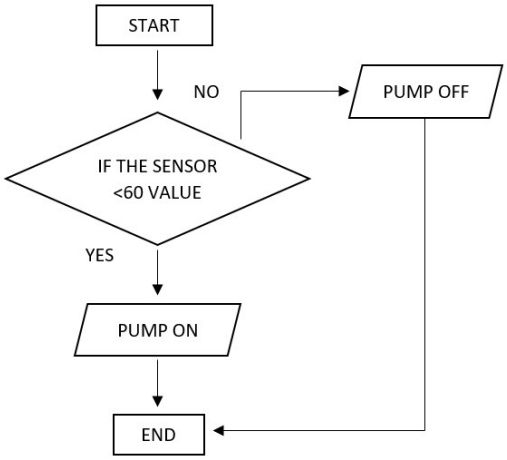

Figure 3. Flowchart

Note: If the water is at a level less than 60 then the pump will automatically turn on, and if the water is at a level more than 60 then the pump will automatically turn off.

Basic theory

Arduino Uno

Arduino Uno is a circuit developed from an ATmega328 based microcontroller. Arduino Uno has 14 digital input / output pins, of which 6 digital legs can be used as PWM (Pulse Width Modulation) signals. The PWM signal is used to regulate the rotational speed of the motor. Arduino Uno has 6 analog input pins, a crystal oscillator with a clock speed of 16 MHz, a USB connection, an electrical connector, an ICSP header pin, and a reset button that functions to repeat the program.(Magdalena, Aribowo, and Halim 2013).

The advantages of Arduino are that it does not need a chip programmer device because it already has a bootloader that will handle program uploads from a computer, Arduino already has a USB communication facility, so laptop users who do not have a serial/RS323 port can use it. The programming language is relatively easy because the Arduino software is equipped with a fairly complete collection of libraries, and Arduino has a ready-to-use module (shield) that can be plugged into the Arduino board. For example, GPS shield, Ethernet, SD Card, and others(Guntoro and Somantri 2013).

Here is a picture of the Arduino Uno.

Figure 4. Arduino Uno

Hydroponic Plants

Hydroponics is the cultivation of plants by utilizing water without using soil with an emphasis on meeting the nutritional needs of plants. The water requirement for hydroponics is less than the water requirement for cultivation with soil. hydroponics uses water more efficiently, so it is suitable to be applied to areas that have a limited water supply.

In the study of hydroponic language, it comes from the words Hydro which means water and ponos which means work. So, hydroponics has a free understanding of farming techniques by emphasizing on meeting the nutritional needs of plants, or in the everyday sense of farming without soil. From this understanding, it can be seen that the emergence of hydroponic planting techniques was initiated by the increasing human attention to the importance of fertilizer needs for plants.

Hydroponic techniques are mostly done on a small scale as a hobby among the people of Indonesia. The choice of plant species to be cultivated for a commercial scale must be considered, because not all agricultural products are of economic value. Types of plants that have high economic value to be cultivated in hydroponics are peppers, tomatoes, zucchini, melon, Japanese eggplant, and lettuce.(Haryanto and Nurwijayanti 2018).

Here is a picture of Hydroponic Plants.

Figure 5. Hydroponic Plants

Pump

The pump is a faucet that is designed to use a solenoid as a control, this faucet is only capable of on and off because the solenoid works in principle in two conditions, namely only on and off(Raufun 2018).

Here is a picture of the pump.

Figure 6. Pump

Required Instruments and Equipment

Data collection instruments in this study, using various research methods such as observation, literature study and documentation used to obtain data. Instruments, tools and materials in question include :

- Arduino Uno
- Water Level Sensor
- Pump

RESULT AND DISCUSSION

The assembly of this tool is done by combining the water level sensor and other components so that they are integrated with each other.

Tool Assembly Results

The following is a photo of a series of tools used to control the water level in hydroponic plants.

Figure 7. Tool Assembly Results

The assembly of this tool is done by combining sensors and other components so that it is formed as shown above.

- Arduino functions as a control system.
- The Water Level Sensor functions as a measure of the incoming water flow.
- The pump functions to control the water content.

Discussion

In this study, there are several components that are interconnected, namely Process Input and Output. The input to this system uses a water level sensor, the function of this sensor is to detect the water level in the reservoir. The process in this research is to use Arduino Uno as a data processing center. The output in this study is to use a pump to fill water into hydroponic reservoirs.

The water level sensor system has been configured to detect low levels of 10 to 50 and high of 60 to 100. The height of the water level in the design of this sensor is the height of the low water level of 10 cm. When the low level sensor detects low level water, Arduino will command the pump. water filler to on and fill water until the sensor detects level 50 then the filler pump will turn off if the sensor detects level 60 to 100.

The result of this research is that the control system built can detect the water level in the hydroponic reservoir and then control the pump with the water level automatically.

The following is a table of overall system test results from the system that has been built;

Table 1. Test Results Table

Water Level	Water Pump	Cond. Value from Website	Status
40	ON	LA <60	Good
50	ON	LA <60	Good
60	OFF	LA <60	Good
70	OFF	LA <60	Good
80	OFF	LA <60	Good

Based on the results of the study, it can be seen that the system can work 100% in detecting the water level in the hydroponic reservoir and can control the water level so that the water condition of the hydroponic growing media is always in normal and stable conditions.

CONCLUSION

Based on the results of the research that has been done, the following conclusions can be drawn:

From this research, the researcher concludes that what is expected in the form of research objectives has been achieved, namely designing a Water Level Control System for Arduino-Based Hydroponic Plants on hydroponic growing media, so that it can help hydroponic farmers in plant care, namely controlling water levels. This is evidenced in the results of system testing.

SUGGESTION

Notes for future researchers based on the explanation above so that further researchers need to add the following :

- Can be used on all types of water tank sizes.
- Can add automatic reservoirs so that when the water in the reservoir runs out, the reservoir will automatically fill with water.

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