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Development Of Automatic Monitoring System For Tomaoes Plant

Muhammad Amirul Asyraf Che Azlan, Lili AzwanTiron
Bachelor of Engineering Technology (HONS) in Electrical
Universiti Kuala Lumpur British Malaysian Institute

Corresponding email: amirul.azlan02@s.unikl.edu.my

Abstract: Tomatoes, or Solanum Lycopersicum, are a very high demand plant in Malaysia or international. Tomato is a native of South America and began to spread to the world by Spaniards. It has about 7000 different species of tomato cultivars worldwide. The typical colour of tomato is usually red but it can be found in black, yellow, orange, and purple colour. Automatic Monitoring System for Tomatoes Plant will be produce to help farmers to monitor and ensure that all the parameters required by tomato plant are met. This project have several types of sensor use to monitor all the parameter needed. The sensor contain in this project are soil moisture sensor, temperature and humidity sensor and UV rays sensor. All of this sensor will help the farmers to monitoring the tomato plant automatically and will reduce use of human energy. The growth of the tomato plant can be maintain by monitoring the water needed by the plant, the humidity surrounding of the plant and level of UV rays exposed to the plant. Based on the previous project they only focus on monitoring the soil moisture and humidity of the plant. That project can maintain the soil moisture level and temperature surrounding the plant. The soil moisture level and humidity are too general and not particular to any of the plants in the project. Tomato plant growth rate can be increase by maintain the specific measurement of the water needed and the humidity surrounding the plant.

Keywords: Monitoring system, Soil moisture sensor,DHT11 sensor, UV rays sensor

1.0 INTRODUCTION

Tomatoes, or Solanum Lycopersicum, are a very high demand plant in Malaysia or international .It is a plant-vegetable fruit under category of Solanaceae family. Tomato is a native of South America and began to spread to the world by Spaniards. It have about 7000 different species of tomato cultivars worldwide. Despite the length process of tomato breeding, botanists have created a large number of cultivars. The typical color of tomato is usually red but it can be found in black, yellow, orange, and purple color. Tomato rich of vitamin and mineral such as vitamin C, lycopene , potassium , fiber, and beta-carotene. The benefit that we can get from it vitamin and mineral are help to maintain blood pressure, can reduce the risk factor for heart disease, prevent from getting cancer and good for the skin. Because of the great demand for tomatoes around the world, tomato cultivation can earn a lot of money.

In Malaysia the production of tomato is more concentrated in the highlands such as Kundasang and Cameron Highland. These location can provide the environment and temperature if then highland that conducive for cultivating tomatoes. Tomato can growth healthier in the suitable temperature and good environment. Hence, most of the farmers planting the tomato in the highland area. The good temperature for tomato to growth healthier is between 18 – 32 C. Soil moisture also important to make sure the tomato growth smoothly. Another factor that can affect the tomato plant is amount of UV rays expose to it. All of this parameters must be monitor by farmer if they want their tomato plant growth healthier without any problem.

So to ensure all the necessary parameters for this plant to live anywhere and easy to care the project name Automatic Monitoring System for Tomatoes Plant will be produce to help farmers to monitor and ensure that all the parameter required by tomato plant are adequate. This project have several types of sensor use to monitor all the parameter needed. The sensor contain in this project are soil moisture sensor, temperature and humidity sensor and UV rays sensor. The soil moisture sensor will measure the moist level of the soil then a dc water pump will generate water from the tank if the moisture level is below from the setting

parameter. The temperature and humidity sensor will combine with mini fan which can maintain the surrounding temperature according to the parameter set. Lastly, the UV rays sensor will detect the amount of UV rays expose to the plant. All of this sensor will help the farmers to monitor the tomato plant automatically and will reduce use of human energy. This project will ensure that the tomato plant will grow healthier because of all the parameters will be monitor.

2.0 LITERATURE REVIEW

2.1 Effect of Humidity and Temperature to the Plant

Plant need photosynthesis to growth if the temperature is low like from 0 to 10 Celsius it will disturbing the rate of the photosynthesis of that plant. As a result, glucose production is reduced, resulting in stunted development. Photosynthesis rates are high because photosynthetic enzymes function very well at the normal temperature like between 10 to 20 Celsius. The rate of photosynthesis will drop when the enzymes operate over it limit temperature which is 20 Celsius. Because of that more carbon dioxide will be absorbed into the plant. When the temperature is above than 40 Celsius the enzymes that do the photosynthesis working start to lose functioning and it shape, and at the same time it affect the photosynthesis rate. (Samuel Marking , 2018)

2.2 Effect of Soil Moisture To The Plant

Drought stress has been shown to be a major limiting factor for plant growth and establishment. Plants are unable to attain their genotype-determined maximum growth potential as a result of this. Cell division, expansion, and differentiation are all elements of the growth process, which is a complex interplay of genetic, physiological, ecological, and morphological processes. Because decreased mitosis and turgor result in restricted cell division and inhibited cell elongation, respectively, moisture stress affects both processes, resulting in diminished growth. (Chadha A &Florentine, 2018)

2.3 Effect of UV Rays To The Plant

UV solar radiation has garnered more attention in recent years it because the UV-B ray increase rapidly which is are harmful to plant growth rate. Plants use a variety of photoreceptors to respond to light. There are about three radiation that been exposed to plant which is UV-A, UV-B AND UV-C. UV-A is less harmful to the plant but it is the most expose to the plant. UV-B radiation can affect the growth rate of the plant because it can block the photosynthesis and make the leaves rot. Photo degradation or enzymatic reactions alter phytohormones, controlling photoprotectors and photosynthetic activities, and interfering with plant growth. Despite the fact that UV-C cannot go through the atmosphere easily and harmful the plant but if it interact with the plant the DNA molecule and protein in the plant will decrease. (Pournavab R &Mendoza A, 2019)

2.4 Automatic Plant Monitoring and Control System

New technologies have been constantly evolving to make people's life easier in every way. When it becomes impossible for the user to monitor the plant's growth on his own, many technologies have been devised to help. For this reason, we've created a new system that can not only monitor but also help the user operate many aspects of the plant. In this setup, the Arduino UNO serves as the central processing unit. A power bank or a battery provides electricity to the entire system. The system is designed to track three parameters that have a significant impact on the plant's growth. Soil moisture, temperature, and humidity are the three variables. The moisture content of the soil was monitored using the HL-69 Moisture Sensor. A tiny submersible dc water pump is also used to regulate the moisture level of the soil in accordance with the plant's needs. The DHT-11 Temperature and Humidity Sensor has been connected to the Arduino UNO, which measures the temperature and humidity around the plant and sends the data to the Arduino UNO. The Arduino UNO is also equipped with a 16x2 LCD display that shows the current state of the aforementioned parameters. In addition, the Arduino UNO is connected to a GSM SIM 900a sensor, which sends notifications and updates. (Malde H & Masekar M, 2020)

2.5 Smart Plant Monitoring System

One of the most easily available forms of connectivity is the internet of things. It can be used for a variety of purposes. In most agricultural operations, proper irrigation is still a challenge. Water supply issues can have an impact on both the soil and the crops. To solve this difficulty, a practical monitoring or controlling system might be quite useful. The Internet of Things (IoT) is used in this project to construct a smart agricultural monitoring system. This can help increase production without compromising soil quality. The important aspect of the system is measuring features like temperature, humidity, and soil moisture. Smart agriculture and updating current traditional farming methods are two options for solving this challenge. As a result, the project's purpose is to leverage Node MCU to construct an IoT-based hydroponic system. A water-driven agriculture system that removes the need for soil is one of the project's key features. Sensor feedback, such as temperature and humidity sensors, as well as electrical physical phenomenon circuits, are used to supply water and nutrients to the crops in this hydroponic automated system. Sensing devices can be used to acquire the data. Sensors such as soil monitoring sensors, light

sensors, and temperature sensors can all be used. Temperature information will be provided by the temperature sensor, soil moisture content will be determined by the soil monitor sensor, and field light intensity will be determined by the light sensor. (Rashiq M & Mohan J , 2021)

3.0 MATERIAL AND METHOD

In this chapter it will show how the project will be produce. It contain of the block diagram, component use and others. This part describes all the phases and procedures for the development of automatic monitoring system for tomatoes plant. All the technical parts, beginning with the explanation of the block diagram and flowchart, were described in the content. Each component's function will be explained clearly. At the end of this section, the process and method used to complete this product have been concluded.

3.1 Block Diagram

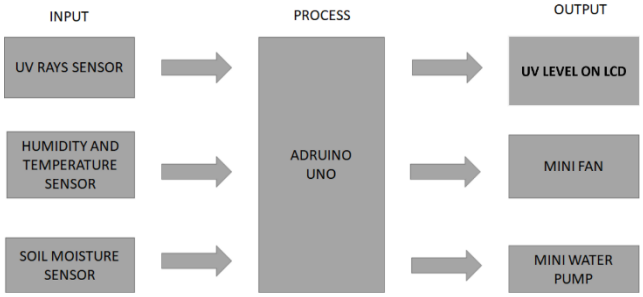

Figure 1: Block diagram

Block diagram description:

1. UV rays sensor will detect the amount of UV rays then it will show on the LCD
2. Humidity and Temperature sensor will measure the surrounding condition and if it does not follow the setting parameter the mini fan will start to run to reduce maintain the humidity and the temperature
3. Soil moisture sensor will measure level of the soil moisture and if it below the setting parameter the mini water will flow out the water.

3.2 Flowchart and Circuit Diagram

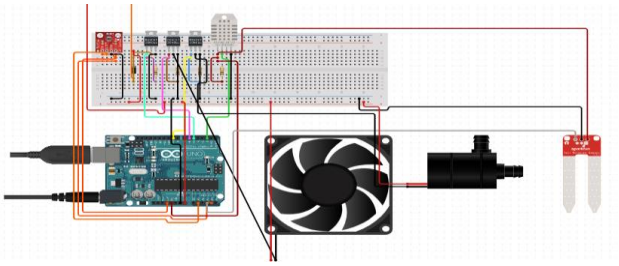

Figure 2: Circuit diagram

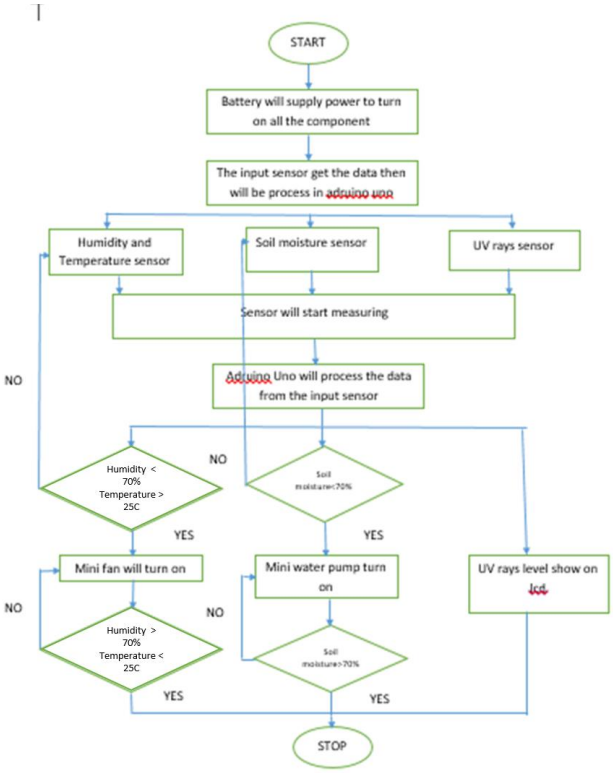

Figure 3: Flowchart

3.3 Component use

Figure 4: Component use

4.0 RESULT

In this chapter it will shown the result from the prototype which monitoring system for the tomatoes plant

4.1 Project overview

Figure 5: Overview of the product

Figure above shown overview of the product which is consist of Arduino UNO, soil moisture sensor, temperature and humidity sensor, UV rays sensor

4.1 Result for soil moisture sensor

Figure 6: Lcd for soil moisture level

Figure 7: Water pump flow out water

For the soil moisture sensor first the sensor will start measuring the moisture level of the soil. After the sensor start measuring if the level is below than 70% the water pump will begin to flow out the as shown in the picture above but if the level is above than 70% the water pump will remain off.

4.2 Result for temperature and humidity sensor

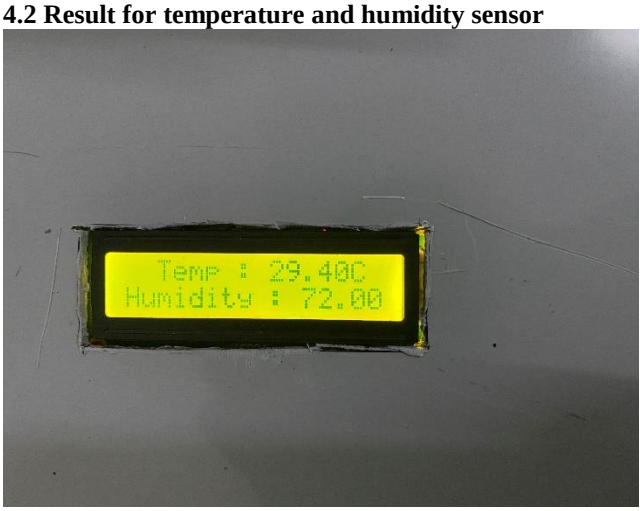

Figure 8: Lcd for DHT sensor

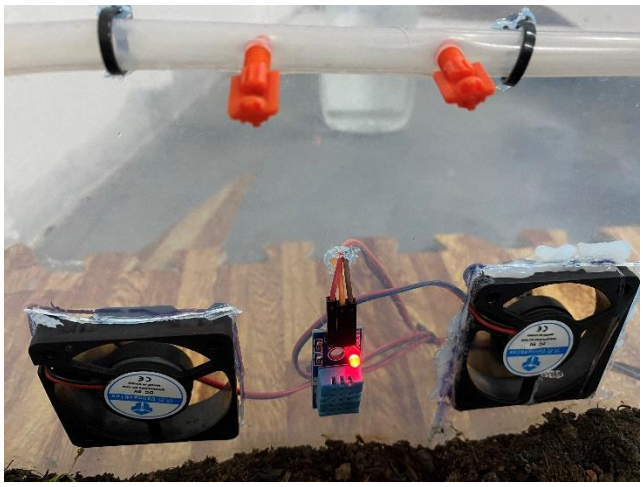

Figure 9: Fan is turn on

For the temperature and humidity sensor the sensor will start measuring the surrounding environment. If the sensor sense that the temperature is above than 25 celcius the fan will turn on to keep the temperature down.

4.3 Result for UV rays sensor

Figure 10: Lcd for UV level

For the UV rays sensor it will detect amount of rays expose to the plant. After that it will give a result whether it low, medium, or high. So the user will notice about it then they can put shade to reduce the amount rays expose to the plant

4.4 Graph for every sensor working

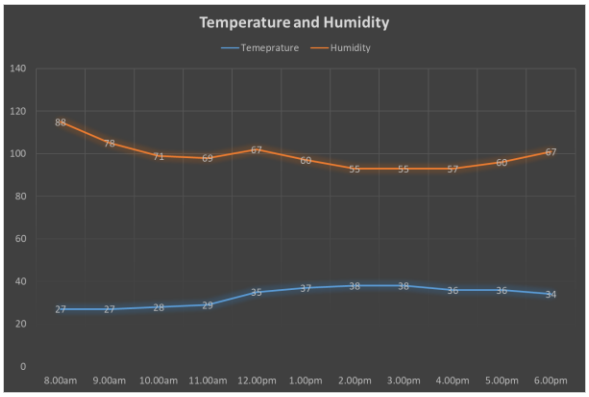

Figure 11: Graph for temperature and humidity

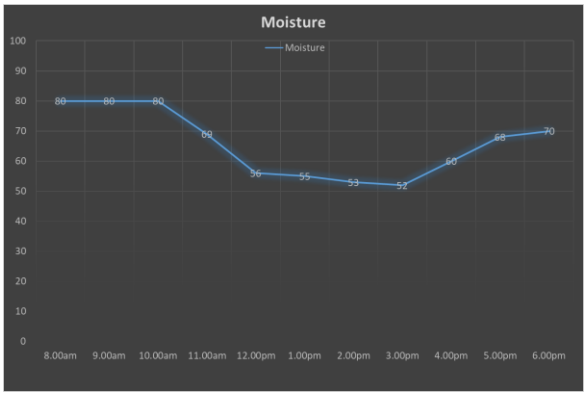

Figure 12: Graph for soil moisture

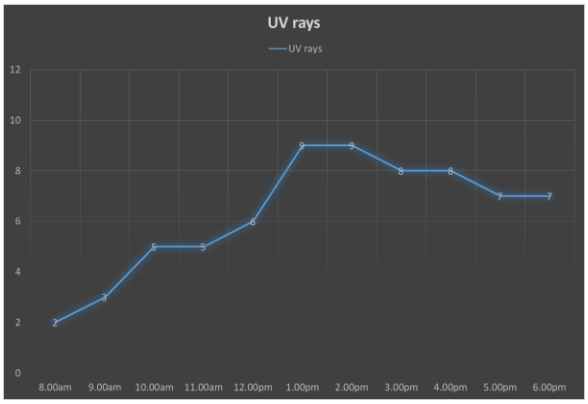

Figure 13: Graph for UV rays level

The result from the above graph is taking from 8 am to 6 pm. The result was taken with the difference of one hour. As we can see the most critical condition is starting from the noon until the evening. So extra precaution needed at that time to make sure the plant can growth healthy.

5.0 DISCUSSINON

This project is focuses on one type of plant which is tomato plant. So, this project only followed the parameter needed by the tomato plant to maintain the growth rate. This project will programs based on the basic need for this plant such as their soil moisture, temperature, humidity and UV rays needed. This program not suitable for other plant if it is use for the other plant the parameter set must be change.

6.0 CONCLUSION

This project will give many benefit to the agriculture sector in Malaysia especially for the farmers that cultivate this plant which is tomato plant. There are many advantages from this project to all the tomato plant farmers in Malaysia. Firstly this project can help farmers to monitor their tomato plant by automatically. With this automatic system it can reduce human energy to monitor the plant than the old way which manually monitor. Next the growth rate of the tomato will increase and full of nutrient because this project will follow all the parameter needed by tomato such as the soil moisture, humidity, temperature and UV rays exposed. The important thing is this project is more efficient than the previous project. Lastly, tomato plant is more suitable to plant in the highland area because of the temperature but with this project the farmers or user will be able to plant tomato anywhere because the system in this project will maintain the parameter needed by the tomato plant.

REFERENCES

Journal

[1] Shamshiri, R. R., Jones, J. W., Thorp, K. R., Ahmad, D., Man, H. C., & Taheri, S. (2018). Review of optimum temperature, humidity, and vapour pressure deficit for microclimate evaluation and control in greenhouse cultivation of tomato: A review. In *International Agrophysics* (Vol. 32, Issue 2, pp. 287–302). Walter de Gruyter GmbH. https://doi.org/10.1515/intag-2017-0005

[2] Chadha, A., Florentine, S. K., Chauhan, B. S., Long, B., & Jayasundera, M. (2018). Influence of soil moisture regimes on growth, photosynthetic capacity, leaf biochemistry and reproductive capabilities of the invasive agronomic weed; Lactuca serriola. *PLoS ONE*, *14*(6). https://doi.org/10.1371/journal.pone.0218191

[3] Pournavab, R. F., Mejía, E. B., Mendoza, A. B., Salas Cruz, L. R., & Heya, M. N. (2019). Ultraviolet radiation effect on seed germination and seedling growth of common species from northeastern Mexico. *Agronomy*, *9*(6). https://doi.org/10.3390/agronomy9060269

[4] Malde, H., Masekar, M., & Panchal, D. (2020). Automatic Plant Monitoring and Control System. *International Research Journal of Engineering and Technology*. www.irjet.net

[5] Rashiq M & Mohan J, Students, D. R., & Kumar B Asst Professor, J. H. (n.d.). *Automated Plant Watering System*. www.ijert.org