Towards Precision Agriculture: Developing an IOT – Based Hydroponics System with Advanced Monitoring and Automation Capability

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ABSTRACT :

Hydroponic is a modern agriculture which can produce healthy plant and vegetables. Most people nowadays are willing to have garden at their house. However, most people have difficulty in growing plants at their house. It is because of the limited area for planting at their house. Besides that, they have difficulties in determining how much water is needed for the plants as well as the presence of unpredictable weather which can cause the plant to become wilt. To solve these problems, by developing the Towards Precision Agriculture: Developing an IoT-based Hydroponics System with Advanced Monitoring and Automation Capabilities. Towards Precision Agriculture: Developing an IoT-based Hydroponics System with Advanced Monitoring and Automation Capabilities helps by monitoring temperature, humidity, water level and soil moisture. Sensors that were used in this project are DHT22, water level sensor and soil moisture sensor. All the sensors are controlled by a microcontroller, NodeMCU ESP8266 and the data are stored in MySQL database. In addition, the user can monitor status hydroponic on dashboard which display the current and past data.

Keywords: Hydroponic Farming, Internet of things (IoT), crucial parameters, connectivity, monitoring, control system, crop.

Introduction :

This chapter provides the background of the research and motivation to develop the IoT Based Hydroponic Wick System. This chapter also provides about the problem of the current situation relating to the project, objectives of the project and project significance.

1.1. Objectives

The aim of this project is to develop an IoT-Based Hydroponic Wick System to help the people for indoor planting. In order to achieve the aim, the following objectives must be achieved:
    i.   To design a web-based interface for status monitoring of indoor garden.
    ii.   To develop prototype of IoT monitoring system for hydroponics in small space and at any time to monitor the plant.
    iii. To evaluate the functionality of IoT monitoring system for hydroponic using Blackbox Testing method.

1.2. Summary

In a conclusion, this project develops the Towards Precision Agriculture: Developing an IoT-based Hydroponics System with Advanced Monitoring and Automation Capabilities which can help the user to have indoor garden in their house. The research objective will guide to complete the project. Besides, there were several objectives will act as a guidance in completing the project in accordance to the scope. Lastly, this project will give a benefit to user to monitor their plant and researcher to learn and make some improvement to their project.

2. Methodology :

This chapter is about the methodology proposed to develop the IoT Based Hydroponic Wick System. Methodology describes the ways and methods applied in completing the project, according to the objectives of this project. Generally, methods and techniques were elaborated in specification, design, programming and testing.

Fig showed the four phases that involved in completing this project. The first phase was specification related to the project. In the specification, a background of study has been conducted by identify the factor and variables to be used in completing the project. In this project, background of study was conducted on hydroponic wick system that will implement the IoT. The second phase is Design. This phase will proceed after the first phase was done. This technique describes the how to design the prototype of project. The next phase is programming which is develop the hardware and software component. This phase also describes the technique and tools that will be used to integrate the hardware and software component. Testing is the last phase in developing this project. In this phase, it will be describing the tasks that will be perform in testing phase.

3. Construction :

This chapter will provide further discussion about project design and development process. The project design and development that implemented from the beginning to the final process until the application is ready to use will be shown in stages. the requirement to build the hardware part of prototype. There are four main requirement which is NodeMCU ESP8266, DHT22, water level sensor and soil moisture sensor. the software requirements in developing Towards Precision Agriculture: Developing an IoT-based Hydroponics System with Advanced Monitoring and Automation Capabilities. There are three software were used to developing this project which is Arduino IDE, Fritzing and Visual Studio Code.
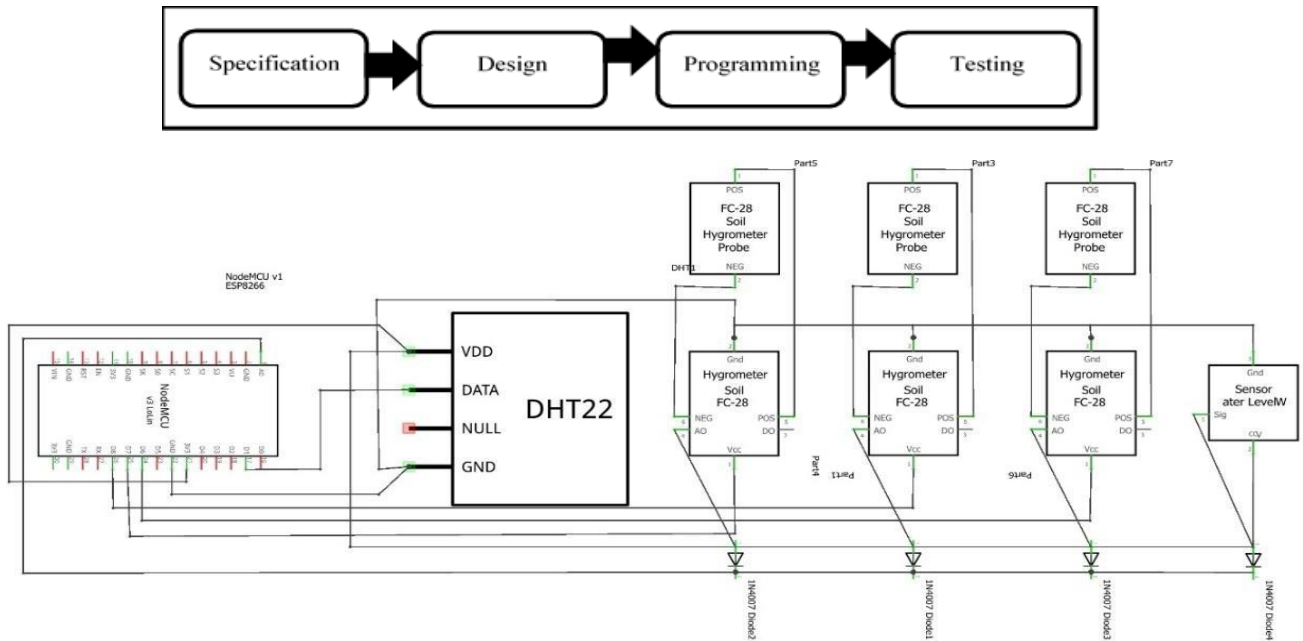
4. Results and Findings :

In this chapter, results and findings of this project will be discussed in detail. This will be done based on analysis and statistic of conducted evaluation. This chapter will be discussed about the functionality evaluation which is fulfils the requirements of objective three (3): To evaluate the functionality of IoT Monitoring Hydroponic Wick System using Black Box Testing Method
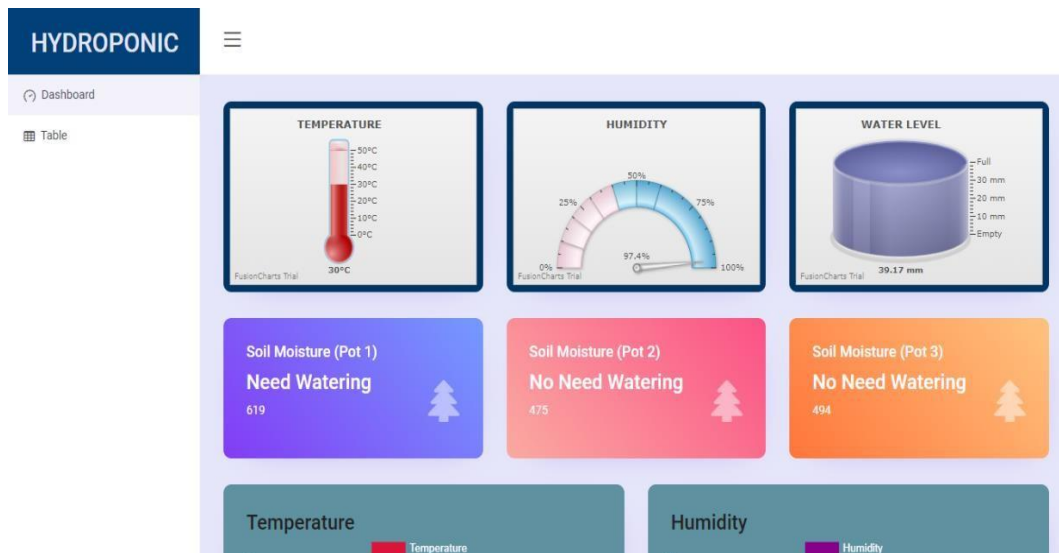
Dashboard Towards Precision Agriculture: Developing an IoT-based Hydroponics System with Advanced Monitoring and Automation Capabilities

Conclusion :

In conclusion, this project has met the first objective which is to design web-based interface for status monitoring of indoor garden. The web application was created based on windows platform using PHP and JavaScript language. This project also achieved the second objective which is develop prototype of IoT monitoring system for hydroponic in small space and at any time to monitor the plant. By developing the prototype in small space, this will help the user to grow hydroponic plant in their house which only required a small space. Lastly, the third objective of this project is to evaluate the functionality of IoT monitoring for hydroponic using Blackbox Testing method. This has been through the sensor validation done. These results showed that prototype worked the way it was supposed to be and in a consistent manner.

Recommendation for Future Work :

In the process to develop this prototype, there are a lot of things that have completed in order to achieved the objective of the project. This project was developed in the limited time scope in order to complete this project. Future enhancement of the project that can be recommended to developed a better system for the future are:

➢ Provide the automatic pump of nutrient solution for maintain the soil moisture. This feature will be very needed for user where they do no need to watering the plant when the plant is drying.

➢ Provide the other sensor such as light sensor and pH sensor. Both sensors are needed for hydroponic plant growth which light sensor required for the plant to get the amount of light and pH sensor for having the correct pH of nutrient solution.

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