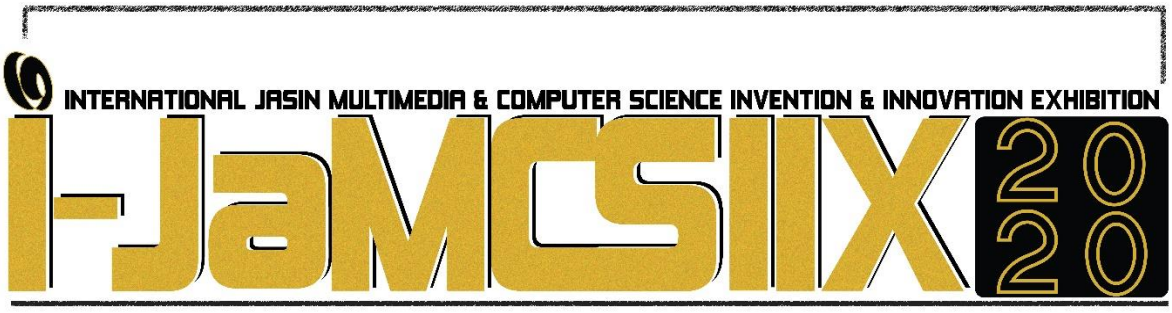

Hydroponics Management System Based Internet of Things

Mohamad Haziq Mohd Razif, Mohamad Zhafran Hussin, Nor Diyana Md Sin, Hedzlin Zainuddin , Saiful Firdaus Abdul Shukor
Faculty of Electrical Engineering, Universiti Teknologi MARA Cawangan Johor, Kampus Pasir Gudang,
81750 Masai, Johor, Malaysia.
haziqrazif@outlook.com

ABSTRACT

Nowadays, planting by using soils seems no more relevant as in the year of 1600th scientists had found an alternative method of growing plants much more faster which by using only water as a planting medium. Years by years, this method had been improvised until today but only focusing in the industrial sector and most of them only able to monitor the condition of plant. Hydroponic Management System Based Internet of Things is a project that combines biology and electrical engineering knowledge where the growth of a specific species of plant is being monitored and controlled based on their optimum and ideal factors such as the presence of water as planting medium, surrounding temperature, relative humidity, light intensity and also the pH of water. This product believes that if all the five parameters of plants could be controlled and maintained based on the requirements of each species of plant, the best quality of plant productivity could be produced. In this project, analog sensors are used to sense the condition of a selected species of plant such as the water level, surrounding temperature, etc. and all the value of parameters will be displayed on LCDs and also will be uploaded through the Internet of Things (IoT) application – ThingSpeak. To maintain a constant value of parameters, a few output components will be used if the values are out of their range. Commonly, hydroponics only involved in industrial sector, but this project will bring it into home so that everybody will be able to plant.

KEYWORDS : Hydroponics, Internet of Things, Sensors, Arduino

1 INTRODUCTION

Planting might be satisfactory when it comes out with good products. It is everyone's dream to grow any kind of plant at home during childhood such as strawberries. However, as we grow older, we realize that it is almost impossible to grow strawberries because most of areas in our country such Malaysia climates are not an ideal environments to fulfill the biological conditions of strawberries, where it requires specific conditions such as 5.5 pH of soil [1], ambient temperature around 20°C to 25°C with relative humidity ranges between 65% to 75% [1] which are something cannot be grown in this country. This is proven by many researchers that different plants are required a specific environment. In the modern world through the

advancement of science and technology knowledge, these biological requirements can be fulfilled even at home. In addition, all parameters are not only be monitored via LCD screens and internet sources, but it also be controlled automatically without any human effort to monitor and control manually. With advanced microprocessor capabilities combined with IoT integration, any plant can be grown in any country as long as all the plant needs are being monitored and controlled under certain conditions. The aim of this project is to build a prototype of automated hydroponics system by targeting better end product. A comparison method where a hydroponic plant is required to be set up with all inputs that gives information to the system based on plant requirements.

2 OBJECTIVE

The objectives of this product are :

1. To design a prototype of an automated hydroponic system by using Arduino MEGA 2560.
2. To monitor and grow healthier plants efficiently via ThingSpeak apps.
3. To analyze the effectiveness of an automated hydroponic system.

3 SIGNIFICANCE(S)

Hydroponic has been commonly used in industrial sector where a large number of plants are grown together. It is something rare to see this method to be used in home area due to lack of knowledge on the benefits of hydroponic compared to soil method [2] amongst people where it is proven to be more efficient and helps in cost savings. Furthermore, this prototype of project is also designed to be user friendly where it does not require a lot of spaces to be used at home. By the end, it is hoped that the effort of combining electrical engineering and biology knowledge into this one project could spark future generations to continue this some sort of legacy of combining knowledge into our daily lives thus eliminate the boundaries between any knowledge.

4 METHODOLOGY/TECHNIQUE

Four (4) sensors are used such as an ultrasonic sensor (HC-SR04), temperature/humidity sensor (DHT11), light intensity sensor (BH1750) and pH sensor (PH-4502C) to sense the selected input parameters. Furthermore, Arduino MEGA 2560 and NodeMCU ESP8266 are used as microcontroller and communication system respectively. There are six (6) outputs are involved such as 5V water pump, 5V cooling fans, 5V mist makers, ultra-violet light (UV light), Liquid Crystal Display (LCD) screens and ThingSpeak application. Fig. 1 shows the block diagram of this product.

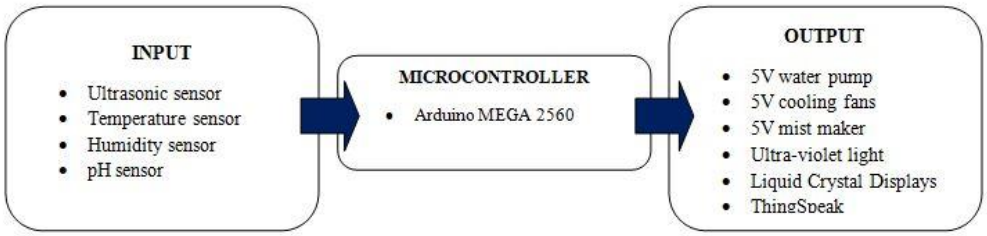

Fig. 1 Block diagram

In this invention, a plant species of the vegetable type is selected as a model, where it requires desired condition. The requirement parameters are recommended to be ideal

temperature ranges between 7 °C to 24 °C, 95% to 100% of relative humidity, 6.0 to 7.5 pH of water and 14 to 16 hours of optimum period for sunlight. The project also will be targeting to build a simpler, more practical artificial hydroponic model and user-friendly design that allows users to move around and set up prototypes easily. In addition, this project comes with displaying all values and parameters of plant on the Liquid Crystal Display (LCD) screens and sending all gather information through the ThingSpeak application. It will allow users to monitor plants even when not at home.

The program starts when there is any change in the range of the parameters that are set by using *if* and *else* statements. If water level in hydroponic tank is below than the range required, water pump located in the treatment plant will turn on and the flow of water is required fulfilling the hydroponic tank. Next, if the ambient is below than the desired temperature, the cooling fan will turn on to decrease the surrounding until the ideal temperature is reached. The change of surrounding temperature will affect the relative humidity as a higher temperature will make a lower relative humidity. To stabilize this parameter, the mist maker will be turned on in order to generate cool mist until the optimum of relative humidity is achieved. To ensure the best light level supplied to the plant, the UV light will turn on when the level of sunlight is not enough for the photosynthesis process of plant. A pH sensor helps in monitoring the level of hydrogen ions in hydroponic tank either acidic, neutral or alkaline. All the values of sensors will be displayed on both 20x4 LCD screens and can also be accessed through ThingSpeak application. Fig. 2 shows a flowchart of the product which decides command of the output once sensor senses any change in the parameter.

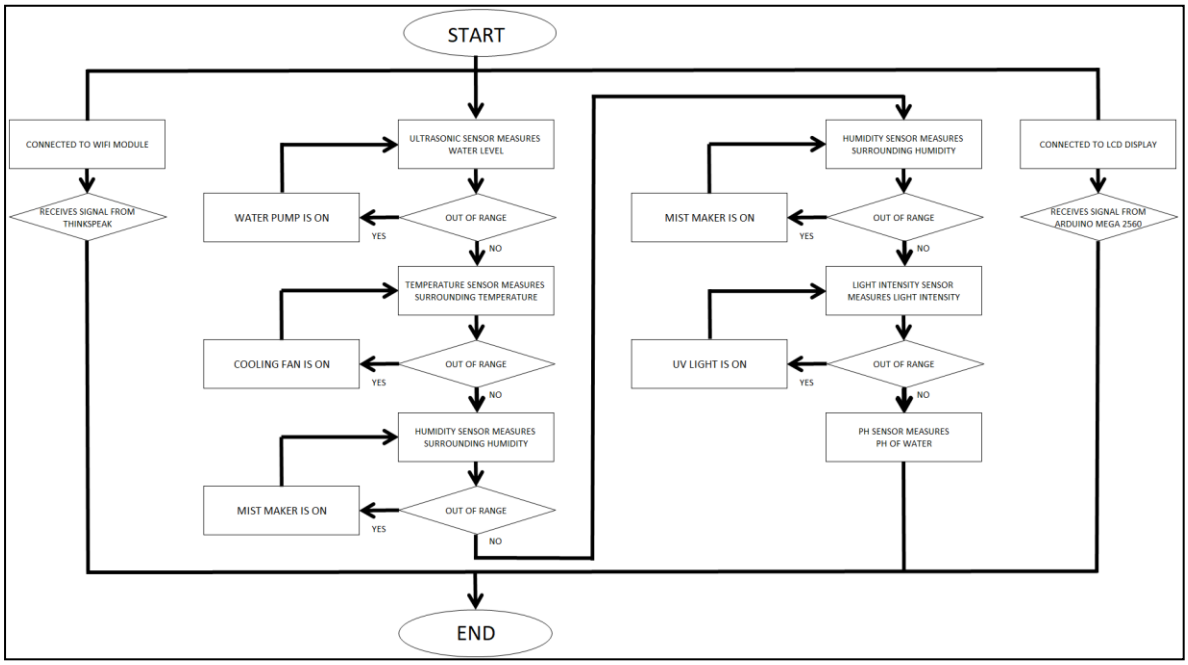

Fig. 2 Flowchart of production

5 RESULT

The value of water level in the hydroponic tank is shown centimetre (cm), the surrounding temperature in degree Celcius (°C), the relative humidity in percentage (%) and the light intensity in lumen (Lux) on the LCD 1 while the value of pH of wáter is shown in LCD 2. Fig. 3 shows the values of each parameter taken from the four sensors.

Fig. 3 LCD displaying sensor values

During day, light level is in the range of the optimum level due to the presence of sunlight. As the time goes by, the sunlight gets dimmer so the light sensor to trigger ultra-violet light on. Fig. 4 and 5 show the prototype of the product during day and night respectively.

Fig. 4 During day

Fig. 5 During night

6 CONCLUSION

This project has been successfully done where the automated control system integrated with Internet of Things (IoT). It has enabled farmers to automate and control the several parameters in hydroponics plants and become a reality for farmers to harvest every plant that can be grown in any country. Theoretically, it has proven in the biological *sense that plants can grow as long as their basic needs are met no matter where they live. Through this innovation, it can be created something new and cheaper that it has potentially more useful to human civilization. Therefore, this product seems to be a good platform to help people realize that hydroponics can also be implemented in residential areas especially in urban areas and not just focusing on large-scale industrial sectors. In addition, the hydroponic growing method also saves water usage as it only requires constant water in the tank and unlike the soil method that needs to be watered daily.*

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