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Optimization and Control of Hydroponics Agriculture using IOT

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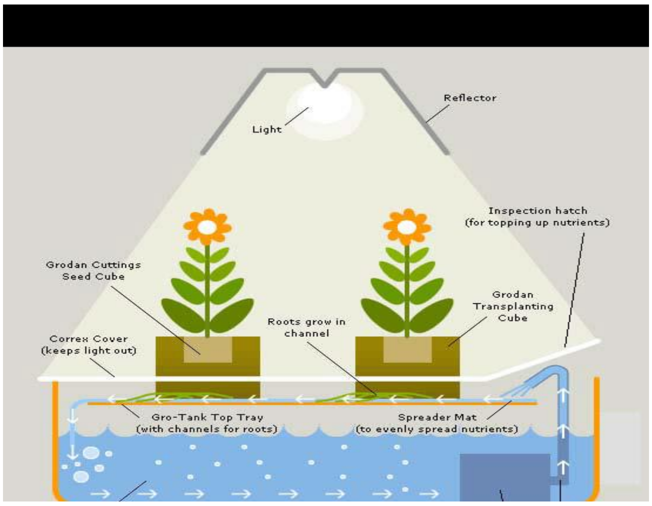
ABSTRACT

In a developing country like India, where agriculture is the backbone of the country, agriculture is plagued by several problems like small and fragmented land holdings, manures, pesticides, chemicals used for agriculture etc. consumers also increasingly demand for the healthy diet that is rich in quality and free of agricultural chemicals and pesticides. Our project fills in the above said difficulties and demands using hydroponics we can go organic. Since it is done in the controlled environment, it can be done anywhere like room terrace, balcony etc. also large amount of plants can be planted in a less place. This type of agriculture could be high yielding if monitored and controlled efficiently. We propose a project that controls the necessary conditions required for the plant to grow hydroponically and also cultivators may control the agriculture remotely using IoT.

Keywords: IoT, Hydroponics and Agriculture.

1. INTRODUCTION

With the advances in technology and the improvement of people's living standards, hydroponic plants become an integral part of daily life. Hydroponic plants not only decorate the environment, but also can delight us. However, traditional plant cultivation has been mainly performed in the soil. It is known that a series of drawbacks can be found for such a way. For example, regular watering and fertilizing have to require more time and labour. With the development of various techniques, the soilless cultivation has become a more mature and popular breeding choice such as hydroponic. Hydroponic is an eco-friendly system to cultivate crop without soil by utilizing aquaculture and hydroponics. At present, hydroponics is mainly used in agricultural production. Modern people have been always engaged in work and they have no more extra time to look after hydroponic plants. Plants need watering and fertilization frequently.



The whole process is compound and onerous. Based on the above shortcomings, the automatic control system is proposed. Unfortunately, current automatic control system is not stable, some unexpected errors occur especially it is difficult to realize the remote monitoring and control. Consequently, it is very necessary to design a smart monitor and control system, especially for people who travel frequently.

The rapid development of sensor, Internet , communication and computer technology, the smart life style will become a popular trend in our future life .To solve the current shortcoming, this study designs a smart monitor and controlling system , which can make it easy to implement the connection of monitoring field and to remote monitoring centres.

This system can monitor the environment of hydroponic device through some sensors in a real-time and stable way, and then accurately, automatically transmit the data of temperature, humidity, light intensity, water level and pH in real time.

2. LITERATURE SURVEY

This chapter discusses the research and finding that have been made regarding this project field. The discussion starts from the development of monitoring system, controlling system and wireless communication as well as its function to acquiring data input and sending output command. All the related research papers and journals that provide thought and concept concerning this project ground also is explained into a simple means.

2.1 Procedure for the Space Certification of a Controller for Soilless Cultivation

Author: V.Arenella, P., F. Leccese, M.

Aeroponics culture differs from conventional hydroponics, aquaponics, and in-vitro (Plant tissue culture) growing because is conducted without a growing medium. By using aeroponics, we get only polluted plants and that is not nutrient and organic.

2.2 A hydroponic approach to estimate responses to nutrients and phytohormones in cotton plants growing and development

Author: Halifax, Nova Scotia

Cotton plant growth is sensitive to temperature. Cool night and low daytime temperatures result in the production of few fruiting branches, but support vegetative growth. However, the effect of day length on germination, flowering and boll formation are influenced by temperature. The optimum temperature of 20oC to 30oC, 18oC to 30oC, 27oC to 35oC are required for vegetative growth, flowering, and boll development, respectively. Temperatures above 38oC are detrimental to growth, development and yield of cotton (FAO, 2001). The cotton plant is also sensitive to frost and a minimum of 200 frost free days is required for growth and yield.

2.3 The design and implementation of a hydroponics control system

Author: Mark Griffiths

The use of the DS3017 RTC caused too many problems with timing issues. The timings were Irregular and it was difficult to use SW to counter balance them. A Phi gets pH board was used first as this was a few Euros cheaper. However the quality was much lower as the calculations for the exact pH level had to be done in the SW. The Atlas Scientific circuits do all the calculations on the HW and they come with a lot more features. The calibration is also much easier with the Atlas Scientific, using the Phi gets board requires the SW to do all of the calculation. This would have increased the code complexity and size too much, therefore it was considered better from a quality point of view to just buy the better HW.

3. PROPOSED SYSTEM

In our project we have proposed an idea that would control the parameters automatically. Also the cultivators can know the conditions of the plant growth and control the parameters remotely using IoT technology.

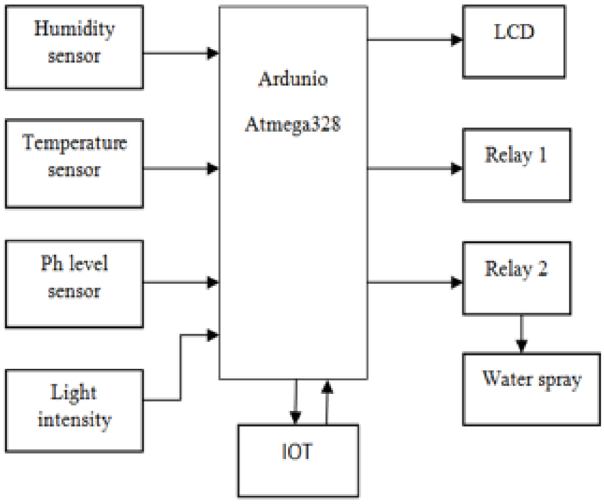
4. EXISTING SYSTEM

In the existing system the hydroponics cultivator can only monitor the necessary conditions required for plant growth such as humidity, temperature, water level, light intensity. The cultivator can know the increase or decrease in necessary parameters and control it.

This system has a disadvantage because the user control these parameters if he is in distance ,since the system needs constant monitoring and control the existing system doesn't satisfy the control of this agriculture completely.

4.1 Block Diagram with Explanation

In order for the controller to be used for growing, a study was made on how people actually use hydroponic systems and these will be the requirements with which I will base the HW and SW on. In addition to this, thought has been given to the people that will actually make the hydroponic system and how the system can be made easy for them.



4.2 Monitoring and Controlling Using IOT

The HW platform will be the Arduino Mega 328. This will be used as it is open source and it provides enough pins to support a 3.2" TFT screen and numerous sensors. In addition, it provides access to pins which support interrupts making it ideal for this project. The available space for SW is 250KB, which is more than enough for this project. It supports EEPROM storage meaning that any user data can be permanently stored.

4.3 Arduino

Arduino is an open-source somatic computing platform built on a simple microcontroller board and a development environment that implements the Processing language. Projects done with Arduino can be individual or they can communicate with software running on a computer. Our design needs to be co-operating, so it can make it much easier to create an environment in which learning can be achieved by doing, receiving feedback and cleansing understanding and building new knowledge.

4.4 pH level

The control of pH is extremely important, not only in hydroponics but in soil as well. Plants lose the capability to absorb different nutrients when the pH differs. Different plants have a particular pH that is optimal for them, generally though most plants prefer a slightly acid growing environment. An ideal pH level is between 5.5 and 7. Changing the pH level too quickly is not a good idea as this will stress the plant out too much. Generally, just make sure that the pH level is between the ranges above.

The controller has the benefits that the pH level of the water is constantly being reported (every five seconds). The user can set limits on the pH levels and so there will be a visual cue on the main screen if the pH level fluctuates outside of the predefined levels. Without the controller the user would need to use an external device, which may be carried out only a few times a day. By which time the pH could be too out of range causing damage to the plants.

4.5 DHT11 Temperature sensor

The controller must be able to measure the air temperature. For this a DHT11 sensor will be used. This was chosen as its temperature range falls well into the range required for growing food, which is 0-50°C It also has a temperature accuracy of ±2°C. However, this can be improved by using an offset in the SW to configure it to the actual temperature using a mercury based thermometer. The sensor can only get new data once every 2 seconds. This should not be a problem though for hydroponics. The chances of a big fluctuation in air temperature within two seconds are not very likely.

4.6 IoT

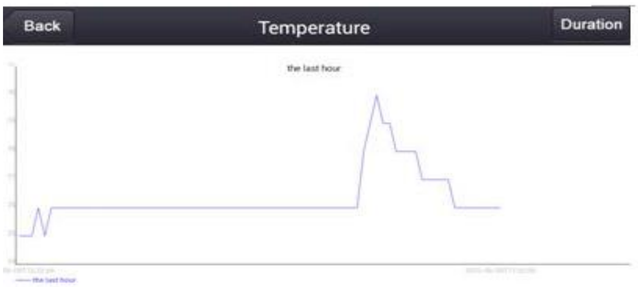
Smart agricultural is a concept quickly gathering on in the agricultural business. Present high-precision crop control, useful data collection, and automated farming techniques, there are clearly many advantages a networked farm has to off

4.7 Humidity sensor

A humidity sensor (or hygrometer) senses, measures and intelligences the relative humidity in the air. It therefore measures both moisture and air temperature. Comparative humidity is the ratio of concrete moisture in the air to the highest amount of moisture that can be believed at that air temperature. The warmer the air temperature is, the more moisture it can hold. Humidity/ droplets sensors use capacitive measurement, which relies on electrical capacitance. Electrical capacity is the ability of two nearby electrical conductors to create an electrical field between them. The sensor is collected of two metal plates and covers a non-conductive polymer film between them.

5. TESTING RESULTS

The experiment application shows that it can obtain the data from sensors timely and sort a proper control of the appliances, which indicates that the designed system has realized the desired functions. Users can see the detail information of humidity, light intensity, water level, In addition, users can make a decision whether or not to turn on the air pump, water pump and lamp remotely according to the learned information.



5.1 Temperature and Humidity Results

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6. CONCLUSION

After a description of soilless culture, a system to control and monitoring hydroponics culture has been presented. For its characteristics, the system is a strong candidate for agriculture applications. . As one of typical applications, more and more people realize the application of the IoT (Internet of Things) will bring broad development to the smart life. Meanwhile, we have an idea that the device of hydroponic can be connected with social communication platform, which can realize a wonderful dream that people can interact with their hydroponic plants on line through a mobile terminal.

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