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AUTOMATED HYDROPONIC SYSTEM

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Abstract: HYDROPONICS derives its name from the Greek HYDRO-PONOS meaning water/labor. Literally, "Hydroponics" means "Water Work." Due to increase in urbanization and industrialization, Agriculture land is decreasing rapidly. Due to rising problem of draught, shortage of water has greatly affected Agriculture. Hydroponic method is instrumental in growing a plant with minimum and recyclable water. Hydroponics is a technique of growing a plant in water with nutrient solution mixed with it in soil less technique with continuous supply of oxygen at room temperature with indirect light. System uses less water and fertilizer as compared to soil system. Hydroponics has no part in the human work. The growth rate and quality of plant are enhance as roots gets nutrients and oxygen directly from water medium. The measured and monitored parameters are pH, humidity, electrical conductivity of water and concentration of nutrients in water and these are useful for maintain the optimum plant growth with the help of automated hydroponic plant.

Keywords: *Water Work, Agriculture Land, Water Nutrient, PLC.*

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I INTRODUCTION

This master's thesis focuses on making an open source hydroponics controller. The significance of hydroponics is in providing a way for the average person to grow their own food without the need of soil, for example, for people living in flats and inner city areas. Correct pH, EC and temperature levels of the water are critically important in hydroponics. Therefore, the help of a controller that monitors these factors is invaluable and will ensure higher success and efficiency rates of the grower.

At the moment, however, such controllers are expensive and none of them are open source. Occasionally people will say they have made a controller themselves, but they never give the code or plans away. The end goal of the project is to design and build a hydroponics controller in which the hardware and software are open source.

The controller itself controls lights, a water pump and a fan to aid in the growing of food. The use of appropriate lighting would make it possible for people living in conditions of little light. By providing an open source controller it will allow more people to access hydroponic growing. This will be achieved as the controller will be cheaper and will allow busy people to grow the food as the controller will take care of most of the aspects involved. For example, making sure the pH/EC level or water/air temperature is correct.

II IMPLEMENTATION METHODOLOGIES

Essentially hydroponics can be summarized as "gardening without soil". Instead plants get the extra nutrients they need from a water based solution, which ispassed over their roots. Passing the water over the roots is possible by hand. However it is generally impractical when you have more than a couple of plants. An automated system gives the advantage of working the pumps and timers for you, ensuring that the plants will always get the required nutrients and raising the success rate of the plants. The controller offers the advantage that the plants can be watered, even if the user is away from the house.

III COMPONENT AND SPECIFICATION

A. Nutrient Solution

These nutrients are divided into two categories: macronutrients and micronutrients. Macronutrients are those that plants need in large amounts, including carbon, phosphorous, hydrogen, nitrogen, oxygen, sulfur, potassium, magnesium, and calcium. Micronutrients are needed in tiny amounts but are essential. These include zinc, nickel, boron,

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copper, iron, manganese, molybdenum, boron, and chlorine. Without these essential elements, plants are unable to build molecules, undergo enzymatic reactions, and complete the life cycle. For hydroponic gardeners, this means that without proper nutrients they cannot produce fruit or vegetables that what they do produce would be sub-part.

B. PH

PH is also an essential element to consider. The pH valueof a nutrient solution has a huge impact on the amount of nutrition a plant can absorb. It is essential to check pH levels on a regular basis, preferably daily, even if you are careful about measuring and mixing your nutrient solution correctly. Different plants have slightly different requirements for pH value and nutrient concentration. If you are going to be growing a large variety of plants in your system, make sure to research the requirements for each so that you can group them in terms of their needs.

C. Electrical Conductivity

After pH level, the second most important element to measure in the water solution is the EC level. EC is a measure of the concentration of nutrients in the solution. However as each nutrient has a different salt content, you could have a high concentration of one nutrient and a lack of another.

D. Water Temperature

In order for the nutrients to be properly absorbed by the plants the temperature of the water should be in the range of 18-26°C. If the water temperature is too low, then a water heater can be used to warm it back up again. The controller reports the water temperature in real time back to the user on the main screen.

The user has the ability to set the lower and upper limits of the water temperature. The user, if they are using a water heater, can set it so that if the temperature falls too low, then the water heater will switch on. It switches off if the water becomes too warm, ensuring that the temperature remains constant. This feature is more useful if the user is using the controller outside, like in a greenhouse.

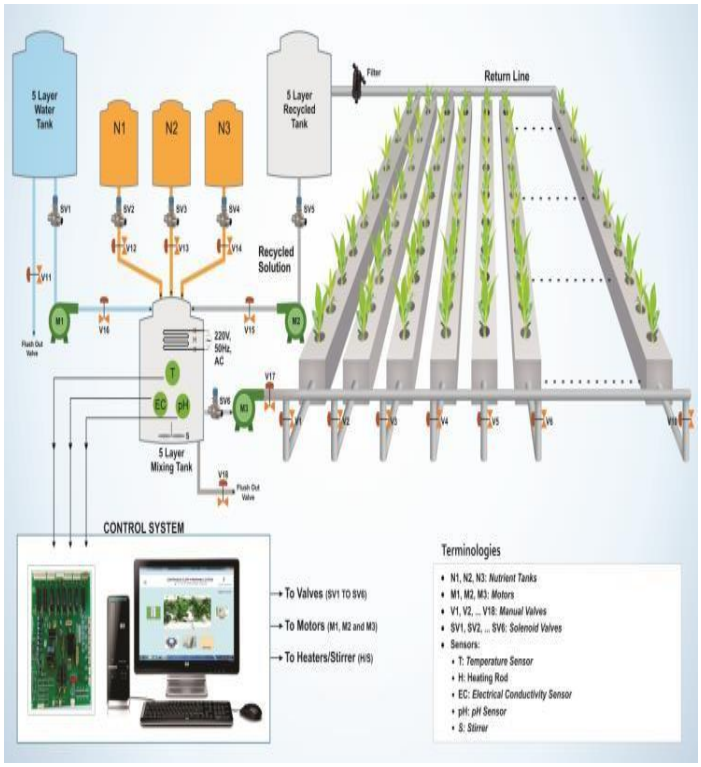
E. Air Temperature

The controller reports the air temperature in real time back to the user on the main screen. Like the other main screen reports, if the value falls outside of a user specified range, a red light will show on the screen. If the temperature is within the range it will be green. The controller has currently no way of controlling the air temperature. A possible extension of the project would be that a fan could be controlled if the air temperature is too high.

F. Light Level

Not just a hydroponics problem, but light level is a general problem of growers. If light levels are too low, the controller can be used to turn on a grow light. As the system will control external remote plugs, it means that the user has flexibility in the devices they choose.

IV BLOCK DIAGRAM



A. Description

The overall hydroponic consists of six different water tanks. Three of them contain nutrients (N1, N2, N3).From the remaining three tanks one is used for raw water storage second one used for storage of recycled water and the rest one is used for mixing the nutrients into the water.

The mixing tank contains different sensors in it e.g. Temperature sensor, pH sensor, Electrical conductivity sensor (EC level) etc. Instead of these sensors water heater is also connected in the mixing tank. The feedback water is then goes through filter and then stored in recycled water tank. This system contains three different water motors to feed the water. Drip system is used for watering of plants.PLC (programmable logic controller) is used as a control system.

B. Automated Hydroponic System

In Automated hydroponic system plants are placed in a growing medium and nutrients are delivered directly to the roots on the basis of time. PLC is the main part of automated hydroponic system. Programmable logic controller is used for the parameter control. The Real-time Clock component in PLC is use to set timer for nutrient pump. Timers are set daily. When timer is activated, Relay will be activated and nutrient pump will deliver Nutrient solution for time to time.

When timer is deactivated the relay will be off and nutrient pump will stop to supply more nutrients in to water

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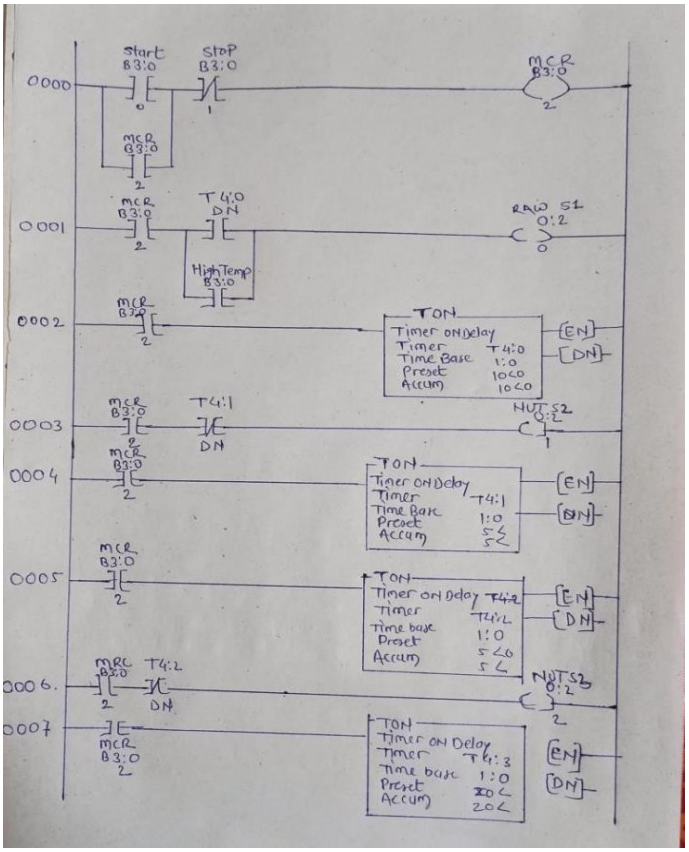
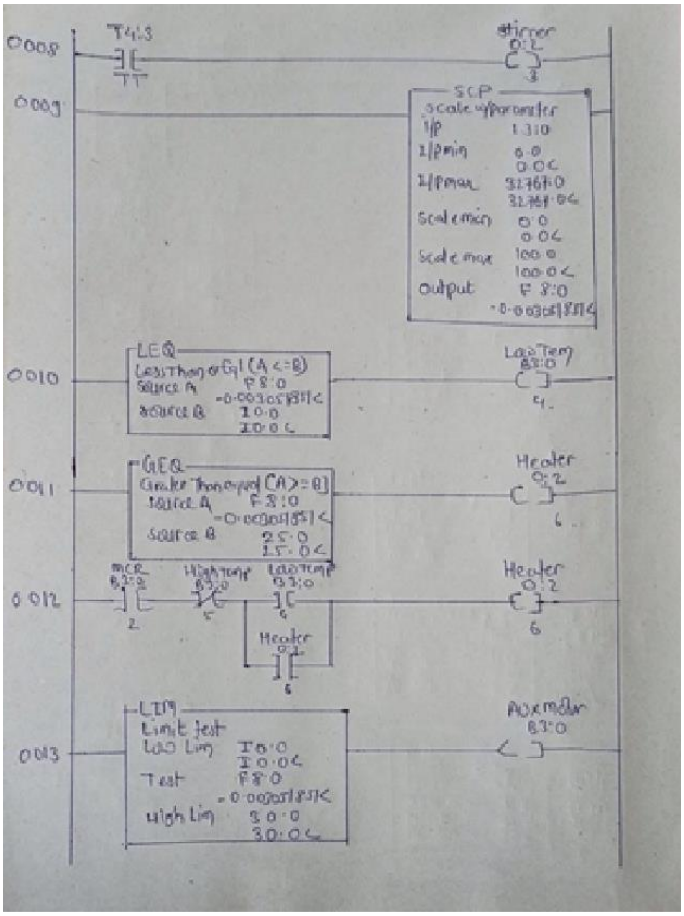
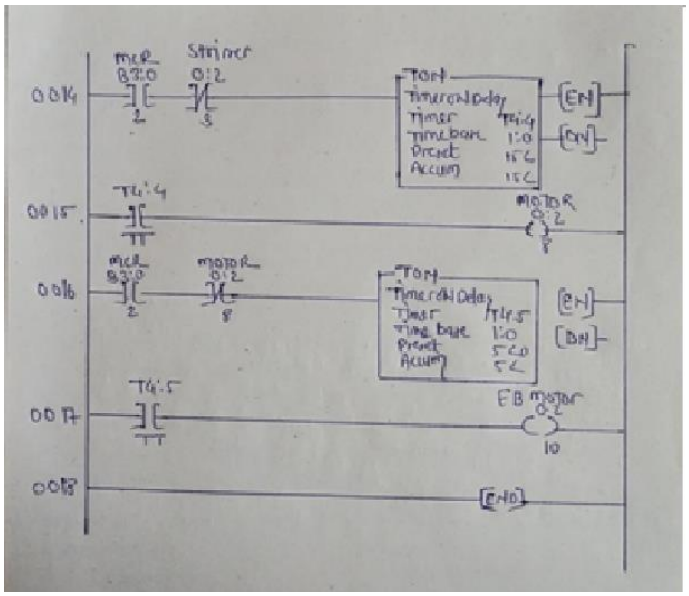
C.Ladder Diagram Of PLC Based Automated Hydroponic system







The above figure shows the PLC ladder diagram programming for automated hydroponic system. In the above ladder diagram programming timers are used to ON/OFF the relay on the time to time basis for supply of water. In above figure 3 tanks are use, 1 is for raw water, and remaining for nutrient. Another tank is provided for feedback water. There is 2 motor pump are use 1 is in mixture tank and another in feedback tank. Mixer tank provided by strirrer to mix raw water and nutrient to make nutrient solution to provide plants in hydroponic ponds. To control the temperature in automated hydroponic system, PT100 sensor is used. As the temperature increases or decreases then the controlling action is provided by PLC.

D.Basic Component

Plant needs five things Nutrients, water, Light, air and support. We can provide all these five things in automated hydroponic system. We saw that hydroponic plants grow well with less use of water and fertilizer. Growth rate of hydroponic plant is 40-50% faster than soil system. It

V.ADVANTAGES & DIS-ADVANTAGES

Advantages

- You can grow anywhere.
- Uses 20 times less water than soil based farming.
- You'll use 20% less space for growing.
- Save water and fertilizer.
- Effective use of nutrients.
- Better growth rate than soil.

Disadvantages

- Initial set up cost of hydroponic system is high.
- System failure threats.
- Experiences and technical knowledge.

VI.CONCLUSION AND FUTURE SCOPE

Plant needs five things Nutrients, water, Light, air and support. We can provide all these five things in automated hydroponic system. We saw that hydroponic plants grow well with less use of water and fertilizer. Growth rate of hydroponic plant is 40-50% faster than soil system.

It is seen that automated hydroponic system requires less attention, care, on the other hand it also requires less space

FUTURE SCOPE

- With hydroponic farming method, More cultivars of staple crops can be grown and consumption of soil and water will be reduce or just not require.
- This is one of the fast growing farming sector and can govern food production in the future. It provides the right amount and right type of nutrients and saves space. Soil related problems are also eliminated
- Hydroponic farms requires less of space and water, and growth is alarmingly quick than the traditional farming, fruits and vegetables will be grown quickly. With surplus food available for everyone, there will not be fight for the hunger.
- In this innovative process water is also saved, which means more water is available for various other purposes.
- In world India is biggest food and vegetable producer therefore in future this smart farming method is more beneficial.

REFERENCES

[1]Book: - programmable Logic Controller by Vijay R. Jadhav.

[2]IJSTE - International Journal of Science Technology & Engineering | Volume 2 | Issue 10 | April 2016 ISSN (online): 2349-784X.

[3]International Conference on Trends in Electronics and Informatics ICEI 2017, Mr. Rahul Nalwade, Mr.Tushar Mote, Assistant professor, JSPM'S JSCOE.

[4]Hydroponics. Date of retrieval 22.02.2014 http://en.wikipedia.org/wiki/Hydroponics

[5]IJSTE - International Journal of Science Technology & Engineering | Volume 2 | Issue 10 | April 2016 ISSN (online): 2349-784X.

[6]Ellis, N.K., Jensen, M., Larsen, J. and Oebker, N.,—Nutriculture Systems—Growing Plants Without Soil‖. Station Bulletin No. 44. Purdue University, Lafayette, Indiana.(1974)

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