

Automated Nutrient And pH Dispenser For Aeroponics System Using System IoT

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Abstract- Rapid increase in day by day technologies in Agriculture and Electronic devices combining both using IoT makes the Aeroponics System controlled and smarter. Aeroponics technology is a method of growing plants in a mist or air environment without using any soil as a medium. Its technology is quite impressive and promotes food sustainability. It is implemented in many other countries like USA. It is a method of growing plants using mineral nutrient solution. It is directly supplied to the roots of plant through sprayers using pump, which can be recycled again, and they are not exposed under sunlight. Here we use pH, water, temperature, humidity sensors and microcontrollers to control the nutrient supply and also to maintain the plant growth condition. Automatic Dispenser will mix the nutrient solution based on plants requirement in a proper ratio using the data provided by user and also it maintains pH level time to time. It keeps on monitoring the plants and supplies the nutrients to the roots of the plant whenever it requires.

Keywords- Automatic Nutrient and pH Dispenser, Internet of Things (IoT), sensors, pH and EC.

I. INTRODUCTION

The basic principle of Aeroponics growing is to grow plants suspended in a closed or semi closed environment by spraying the plants dangling roots and lower stem with an atomized or sprayed, nutrient rich water.

There are two types of Aeroponics:

1. High Pressure Aeroponics System.
2. Low Pressure Aeroponics System

1) High Pressure Aeroponics (HPA) is defined as a form of Hydroponics in which the roots are suspended in a chamber with nozzles that delivers nutrients through a mist to the roots between 5-80 micrometers. Most argue that the range is smaller (20-50 Micrometers). This mist is usually derived from some form of pump. This type of system usually has a PSI of 80-150PSI to attain the droplet size. Also, it uses specialized misting heads to attain the correct mist droplet

size. Research from NASA shows that at the 20-50 micron size, the roots can grab the water/nutrient solution right out of the air and instantly absorbs them without any wasted energy. This is the true Aeroponics system.

2) Low Pressure Aeroponics (LPA) is defined as a form of Hydroponics in which the root zone is suspended in a chamber with nozzles which delivers nutrients through a spray. The droplet size is not exact. These systems typically use a plastic spray nozzle, and a typical fountain pump to get their spray out of the nozzles.

An Aeroponics system uses way less water and nutrients because the plant roots are sprayed in intervals at set periods using a precise spray mist of droplets that can be utilized most efficiently by osmosis to nourish the plant. Very little excess nutrient solution is lost to evaporation or runoff. Plant disease is minimized because the roots are left open to air, avoiding soaking in a stagnant moist medium and the root chamber can be kept sterile. The harvesting the individual plant is quite simple and forward likewise, Removal of any plant that may be infected can be removed easily. Nutrient solution is the basic need for plants and we need to supply in time for plants or else it effects on the plant growth and leads to death of the plant.

One as to make sure of all the above points mentioned below while using nutrient solution

1. Informed about plant nutrients and where they come from.
2. Supplying adequate amounts of nutrients to plants.
3. Supplying the correct ratios of nutrients to plants.
4. Monitoring and measuring each plant nutrient at any given time
5. Making economic and workflow conscious decisions about nutrients.

Fig 1: In Aeroponics system the yield is more (small plants with big roots) than normal tradition method (big plant small roots) in less time. In this method 90-95% water is saved comparing to all other type in hydroponics. This method results in forming the separation of the plants from each other,

and the fact that plants are suspended in air and the roots are not entrapped in any kind of matrix.

II. THE LITERATURE REVIEW

As mentioned in automated Aeroponics system for indoor farming using Arduino mentioned about Aeroponics [1]. The development technologies in the agricultural sectors in present era are not only intelligent and advanced but also it has amplified the usage of resources such as human labor,[1] land etc. in the field of Aeroponics system, as it is a very new concept of cultivation and requires additional knowledge and technological support;

The latest invention for the automation on this sector is not only encouraged but also vastly accepted and used. Automation of the Aeroponics system has found many researchers contribution. Web-Based Monitoring and Control System for Aeroponics Growing Chamber [2] and data submission in server with a controlled environment using Raspberry PI has been on a research in 2018 [1].

With a fully automated Aeroponics structure of cultivation, not only plants and food can be cultivated but also the data collection from the sensors can be used for data monitoring for Nutrient Dispenser and studies to enhance cultivation growth using the technology of IoT and equipments [5].

Regarding Aeroponics, Jonas et al., developed an automatic monitoring system to control the environmental and irrigation conditions of a small Aeroponics chamber using Arduino, which controls the irrigation frequency based on the root chamber moisture and all the information is send to a web server and share in Twitter [6]. The data information which is available from above information we can use that for nutrient dispenser so that can mix in a proper ratio and supply to the roots of the plants when ever required based on time set and sensors.

But most of the high level automation processes are expensive and the technology is beyond the understanding and reach of the general people. But on December 2014, a group of teen developed a reasonable solution for this system which was also tested by NASA [7]. Even if a cheaper approach exists, this system and its automation are not well known in our country. Using more economical devices and building user friendly home Aeroponics greenhouse box can be more efficient for spreading the usage of our approach, even the general people can also avail this system on their balcony [8]. This economic and user friendly structure can also be implemented in farms for larger approach [1]. This economic

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The nutrient solution, pH level and EC measurement can be easily maintained and no human errors can occur. It takes the input from sensors via receive data from Aeroponics system ,Using this data, Nutrient Dispenser will control the pH level of the nutrients water in the system by adding stabilizers if it exceeds the acidic limit and also adds the required nutrients needed. Connecting through the electronics devices as mentioned in various papers we will have complete control on the system that can be connected to smart phones and receive alert messages. Using sensors the system can sense the nutrients requirement and will manage to make accurate solution required for plants and it will send to the roots. And one more important thing is it recycles and re uses the nutrient solution.

III. THE PROPOSED SYSTEM

Nutrient and pH dispenser: they are a way for growers to free themselves from their growing space. These devices allow users to automate your growing system, by properly dosing nutrients and pH levels. Nutrient dispensers are able to apply solution as its needed or on a set time schedule [6].

The system has to be automated and controlled through electronic devices and it should keep updating as Programmed using sensors. Maintaining pH level and EC levels are more important. Automatic dispenser can maintain pH and EC level without any errors.

An automated dosing system really does two things: monitoring and dosing.

1. Monitoring: Using a probe positioned in your nutrient reservoir, the system measures your pH, EC levels, and water temperature, and these are the most critical variables for our system.
2. Dosing: it powers several pumps to add nutrients or minerals to our system. It is appropriate for both small system and large system [6].

When u set up the automated system, you calibrate your unit to your desired pH, EC and temperature. You will then connect your inputs to the system for example, we have a reservoir for each of our supplements; part A (main nutrient mix), part B (calcium nitrate with some magnesium sulphate [Epsom salt]), pH down.

The main aim of this paper is to make nutrient dispenser by itself (dosing). Dispenser will directly by taking the input from the sensors and Aeroponics system and also to recycle the same nutrients solution for 2nd cycle also and transfer that to plant's root whenever plant requires.

Fig 2: These will usually be kept in five gallon buckets with a small hose to connect to dosing system. The automated system will take a test every so often, and then, using of pumps that goes with the system, it pulls the supplement from the bucket into your system. Then it creates mist and dispersed to each individual roots of the plants based on timer set. Again we can recycle the nutrients from the container. We should maintain the pH value and EC value according to the plant growing condition. pH dispenser will just manages the pH level in the system reservoir. There are some set points, dose timers and dose intervals which we can change whenever we required according to the system which is programmed and given input to the system.

This automation system can control nutrient variables like: pH level, nutrients mix and temperature. pH and EC can be measured through meters. pH is the measure of the acidity of the system, and determines how plants and other organisms interact with different nutrients. Every crop has specific pH range, but most herbs and greens overlap within a range. Try to keep pH between 5.5 and 6.5 without changing more than .5 per day. EC is a measure of salts in your system- that is, the level of nutrients in your system EC should be kept between 1.2 and 2.0.

We can use 4-5 solutions along with pH and EC, so it automatically mixes the solution without any errors. And also using water sensor it detects the dryness and supplies to the root of plants whenever required [7].

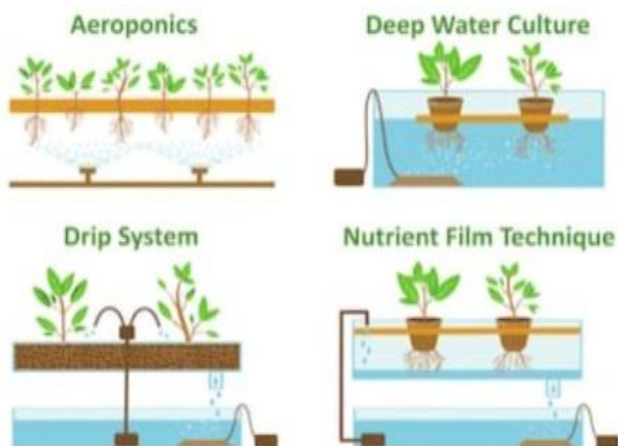


Fig 1: Comparing with Aeroponics system and all other Hydroponic system

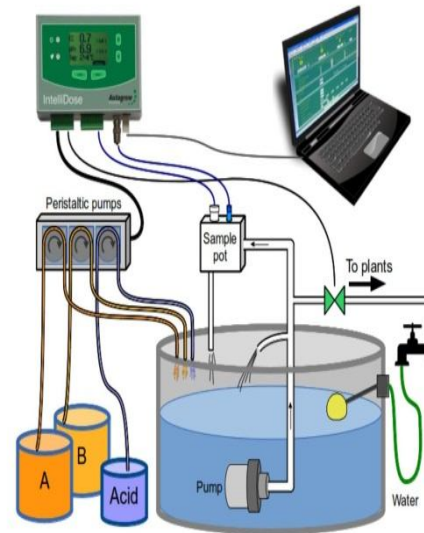


Fig 2 : Flow diagram of the automatic mixing of nutrient solution

IV. CONCLUSION AND FUTURE WORK

Like a routine everyday people have to perform the same monotonous tasks and also if the person is far away from the workspace and could not able to reach or monitor so for this problems Automation nutrient and pH dispenser will do the human job easily ,efficiently and saves time. Keep your freedom to vacate. Adopting this method helps in reduces the labours. This method monitors and controls the flow of the system and updates within specified time.

The system will be in the control of humans and can easily make changes based on the system requirements whenever required. Recycling is done and can save nutrient solution .It avoids over correcting. It reduces shocking your plants.

Using this method in system will reduce time and energy. The level of control over your system means that will dump your system less frequently, which saves you the cost of lost nutrients and results in less waste. The consistent nutrient supply will result in healthier, more robust plants. We can recommend this method to Aeroponics system safely. Automatic dosing system are powering a new generation of Aeroponics growers around the world.

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