

Simple Aeroponics Using IoT

Tanusree Debnath¹, Sheetal B Rajkumar², Divya C³, Sri Goda R⁴, Prof. Sathisha G⁵

^{1,2,3,4} Dept of Computer Science and Engineering

⁵ Assistant Professor, Dept of Computer Science and Engineering

^{1,2,3,4,5} Atria Institute Of Technology, Bangalore

Abstract- Our paper represent a systematic design and implementation on a simple aeroponics system which is a system prototype for plant growing with proper nutrient distribution .We also use a monitoring system based on internet things (iot) to check the plants growing rate. This monitoring control system use some components like a ph sensor, light sensor ,temperature sensor, microcontroller etc. This prototype is successfully implemented on both low pressure and high pressure aeroponics system .The most advantage of this prototype is we can do the whole set up at home individually ,it's cost is less with respect to hydroponic system.

Keywords- Aeroponics ,Plant growing chamber ,Monitoring and control system, Internet of things(IoT) ,Sensors.

I. INTRODUCTION

The process of growing plants in an Environment without using soil is called Aeroponics system .Because a vast area with a large population and for good health of people it is very important to improve agricultural productivity. In this paper we discuss about search a prototype which support improvement of Agricultural productivity with low cost .We use sprinklers to spray water nutrient to the plant. For which we make a vast difference from hydroponic system because here use less water with less setup cost. Current problems in agricultural sector is low productivity , inefficient marketing ,High cost of farming supplies ,less field available for farming.

II. LITERATURE SURVEY

The previously implemented system started with growing the plants in the aeroponic system. Later it was enhanced to using the Internet of things (IoT) . This system used sensors to monitor the temperature, humidity, pH of the water as well as sense the level of light/sunlight being received by the plants. But monitoring was one of the difficult tasks to be done as the sensor data received had to be interpreted and based on the analysis, appropriate controls needed to be taken.

Previously these systems were monitored through mobile applications. The issue with the system is the

dependency on water pump. Generally, the water pump has to be relatively large in Aeroponics because the high pressure is needed to micro spray the roots. This means the electricity demand is greater and a solar power backup system is needed.

Problem statements: Agriculture is one of the important aspect of human life. Humans and animals are dependent on food. Human activities have led to a greater climatic changes. Growing food crops in this environment is a difficult question every country faces.

India has been helping the farmers with subsidies and other facilities. It has allocated 5.8% from its financial budget to farmers.

This project of Aeroponics uses 95% - 98% of less water than the traditional or sprinkler methods of farming. The cost of farming can be greatly reduced and this method doubles the farming production in a small period of time. Hence, this method will help farmers reduce their cost of production and also double the farmer's salary.

Existing System: The traditional methods was replaced with green house farming. In Greenhouse Technology provides favorable environment condition to the plants.

But the disadvantage that came along with this system are:

- Expensive setup
- Labour intensive
- High operational cost
- High amount of plastic waste

This system was later advanced to a newer technology of hydroponics system.

This method uses no soil to grow the plants but rather uses water as a growing medium.

But this system uses excess amount of water to grow the plants.

III. PROPOSED SYSTEM

This system has been automated controlled by electronics devices by maintaining proper PH level ,EC level ,temperature of Aeroponics System Chamber. This chamber is embedded with Internet of things.

Our paper represent a systematic design and implementation on a simple Aeroponics system which is a system prototype for plant growing with proper nutrient distribution .

We also use a monitoring system based on internet things (iot) to check the plants growing rate.This monitoring control system use some components like a ph sensor, light sensor ,temperature sensor, microcontroller etc.

This prototype is successfully implemented and the most advantage of this prototype is we can do the whole set up at home individually ,it's cost is less with respect to hydroponic system.

IV. METHODOLOGY OF THE PROPOSED SYSTEM

In Basic Aeroponics system setup we used plant growing chamber,control and monitoring.

Plant growing chamber- It is the Chamber where plants grow. We use a big plastic tank for this as shown in figure. Plants roots are placed using net pots through tank cover and are the roots are left hanging in the chamber and the Nutrient solution is sprayed to the roots using sprinklers (nozzles).

Monitoring and control System- This system consists of mainly two parts namely monitoring and control system. We use ESP32 boards integrated with ph, temperature and EC sensor and a timer and updated of data in the MQTT dashboard.

The steps that are followed in the growing plants in the aeroponics chamber are as follows:

Seedling: It is the very important and first step .we put the seeds into the cocopeat for germination. It takes 6-9 days depending on the types of vegetable to become very little baby plants. After that these baby plants will be there for 20-25 days to grow future till they are not ready to transfer to the Aeroponics Chamber.

Within this time, we made the Aeroponics Chamber setup and the Monitoring & Control system setup.

Aeroponics chamber Setup: This Plant growing Chamber is a big plastic box consists of net pots to hold the plants, sprinklers to spray water nutrients to the plants root. Other then that pump ,water nutrient solution reservoir relay timer etc are connected to it as shown in figure.

SYSTEM DESIGN

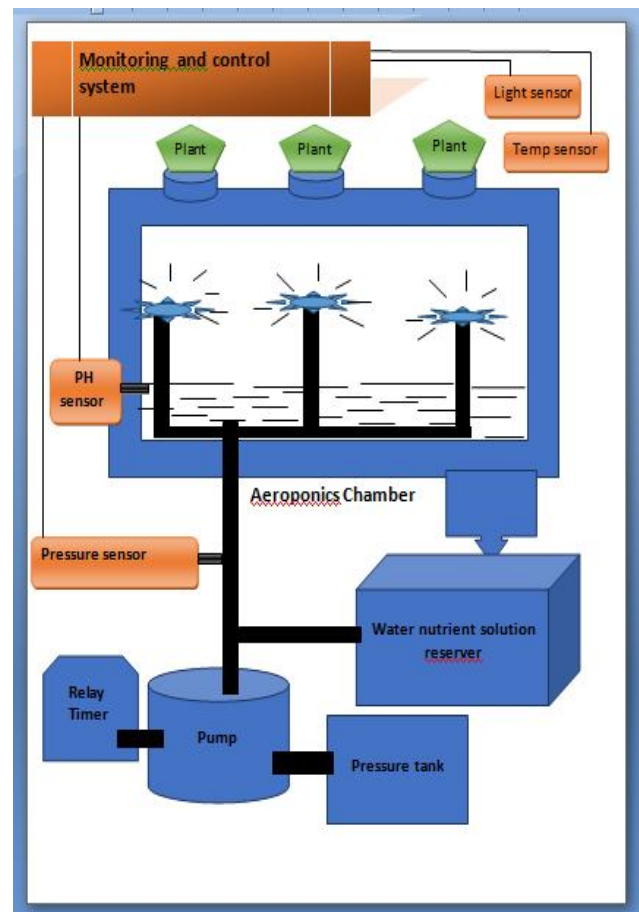


Fig:- Simple Aeroponics System design With Iot.

Monitoring and Control System Setup:It consists of a System(i.e Computer or smart phone)to get the automatic updates of data like - pH level of the nutrients solution,temperature, light,EC level, plants growing rate etc. For sensors that we use some sensors like temperature sensor,light sensors, pH sensor etc.All this setup is embedded with Internet Of Things .

Transfer plants to the Plants growing Chamber:While plants are ready to transfer, then transfer each of the plant to the net-pot holder of the Aeroponics chamber.This time one should be very careful because baby plants roots aren't so strong at this moment .

Continuous monitoring with help the help of control

System: After plants are properly transferred to the chamber, spray proper nutrients solution to the plants root. We continually monitoring the growing rates of each plants .Sometimes we have to make little changes in nutrients solution because some plants need little bit different nutrients solution as long as they grow. But it completely depends upon the plants types.

To understand the setup in better way one should know about of the components. Some of the important components are listed and explained below: -

1. Coco peat: We use coco peat instead of soil because it improves water retention, aeration and decrease the risk of the soil fungus and root diseases. It has the ability to store and release nutrients to plants for extended periods of time. It holds 8-9 times its weight in water.

2. High pressure water pump: This is called the heart of the system. The purpose of the pressurized or nutrient up to enough so that when the nutrient flows through a nozzle that it can create a mist. Most nozzle need a pressure above 60-80 PSI to generate the misting that we need, so this pump is used for water purification so that that means that this pump is safe for us to use in this system.

3. Electrical solenoid valve: it is a simple mechanism that starts and spawns the flow of nutrients through the pipes so instead of turning a valve to turn on and off your water this is like a valve that is controlled electrically when you add electricity to these wires that valves opens up when you turn off the electricity to these wires about closes, so all this does is turning the water on and off .This is used to control the misting to our system, So we will need to attach this to a timer that can turn the valve on in durations of seconds and duration of minutes that will control the sprain interval for our system to be controlled by timer which is connected in the system.

4. Misting Nozzles: The purpose of the nozzle is to atomize the nutrients for few minutes so that water reaches the plant roots a particularly velocity through the nozzles. In nozzles there are 2 different nozzles, First nozzles produces the drop size around 100 microns which is a little bit too high for our needs and Second nozzle is rated for producing droplet size around 50-60 microns which is ideal for our high pressure Aeroponics system. The nozzles come in different spray patterns for our purpose a nozzle that has a coal spray pattern we will choose our nozzle between either a twelve thousand or eight thousand of the edge.

5. Timer: In Aeroponics system, the roots of the plants hang in the air. The standard manufacture of Aeroponic systems includes a pump timer that cycles one minute on and four minutes off to spray water to roots . This is known as a Recycling timer.

6. Sensors: Sensors is a device which measures some physical quantity and convert that measurement reading and into a digital representation. There are different types of sensors which we use in our system.

6.1 pH and temperature- it is used for pH levels data acquisition from the nutrition tank, a pH sensor, Lutron PE-03 (Fig.4) is used. The output of this sensor is connected to a signal conditioning circuit (Fig.5) that amplify the output signal while transmitting it to the ADC pin of the microcontroller. Maintaining the temperature is also an important factor as the roots are directly exposed to water. The normal temperature when plants are placed in soil is maintained at a very less temperature by the soil itself. This is mimicked by using blowers. Hence, the temperature sensor data will help in turning off and on the blowers in the root zone.

6.2 EC sensor - The sensor are used to find the proper conductivity levels of the nutrient solution. It is very much necessary to maintain the EC levels of the water. Proper EC value will ensure the amount of ions present in the water is exactly the amount required by the plants. This plays a very important role to maintain the health of the plant and prevent it from nutrient deficiency.

V. FUTURE SCOPES

Aeroponics is a soil-less culture has capability to grow plants in a conditioned, pest and disease free environment. This Aeroponics can Enhance disease-free yield to leads India to be at top growers and exporters of vegetables in upcoming future. This is a simple and easy way of soil-less culture can overcome all the constraints that are present in soil culture production.

This Aeroponics System will be so useful to the people who are really interested in Agriculture and stay in city where they don't get soil, free field. At that time they use this prototype to grow vegetables in their home.

This system further enhanced by implementing the solar system along with the monitoring and controlling system.

Then the system consists of 2 parts, namely

- monitoring & control system
- solar panel system.

Then it will be little costly but very useful for Agricultural people.

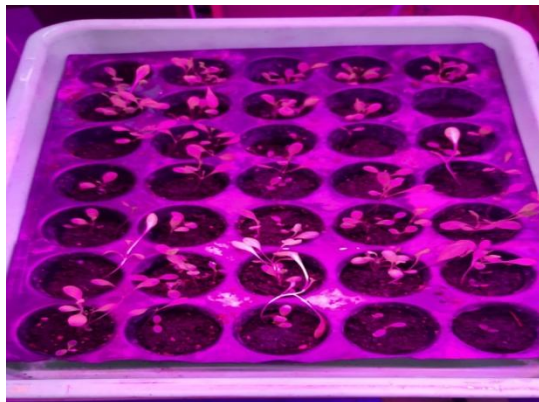
It can be further enhanced by adding smart light adjustments, automatic nutrients mixing system ,automatic adjust water nutrients spray based on root sensors and updated date from control system.

VI. CONCLUSION

This proposed system has been set up with proper measurement has been observed throughout after some specific period of time. We observed proper growing of plant in this system. Monitoring & control system is also monitor and control it properly and as a result we get healthy growing plants.



Seedling process



After Six days



After Fifteen days

Our proposed system is an independent system for the urban Indoor small farming without using soil. Since we use some advanced technology, implement it with Iot its become very easy to monitoring plants growing rate.



After fifty-four days in Plant growing Chamber

The Arrangement will be make more efficient and progress by measuring the quality of the Nutrient solution. To make use of this prototype efficiently people should know the proper nutrient solutions for each types of plants for that they can consult with Agricultural Scientists, Farm doctors.

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