EasyChair Preprint

№ 3628

A Survey on Techniques and Technology Used in Hydroponics System

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June 17, 2020

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***Abstract*—** Agriculture is the most vital part of any country because growth of the country is depends on it. Due to fast increase in population, industry and also the decrement of the farmland will cause the issue of food. Population of the country is increasing everyday which so the demand of food also increases. Food is the important things for survival of people on the earth. typically, old method of planting with soil requires more time. By the used of modern farming method we can grow the plant without soil by proving nutrient solution. Hydroponics has become popular to grow plant without soil and by research it shown that plants grown with hydroculture are good quality and require less resource than traditional growing methods. A survey paper where discuss about the technology and techniques used in hydroponics system using IOT, Machine Learning.

***Keywords*— Hydroponics, IOT, Machine Learning, Cloud computing, Fog Computing**

I. INTRODUCTION

One of the major issues facing people today within the current era is that the access to scrub, nutritious and secure food. For the increment of food farmer used the fertilizers, chemicals and pesticides which gives a result in the contamination of soil. So the scientist is doing the research to find the better solution to produce the safe, healthy and secure food so this problem is solved and gets the clean food using hydroponics system.

Hydroponics is the a system were the growth of plant not used soil but it uses water which contain the nutrient which does not contain the chemicals inside the soil. There are many techniques which are used in hydroponics for the better growth of plant which provides nutrient like nutrient film technique (NFT), deep flow technique (DFT), dynamic root floating(DRF) techniques. There are two types of soilless culture water culture, substrate culture. The development of plant in hydroponics is faster than the soil which gives plant with high nutrient and it also controls the quality of output.[7]

IoT today plays a significant role in each sector. Good farming facilitates the farmers to trace the present situation of the plants. By connecting with IoT, farmers can collect the data and check the statistics and analysis based on the information. Internet of Things device capable of controlling pH level, temperature, relative humidity, the inflow and outflow of water, and amount of nutrient solution in a hydroponics system.

Today's agricultural technologies usually diverted to machine learning as it improve the crop yield and reduce the input cost. Machine Learning algorithms insure the farmer for the selection and prediction of crop, weather forecasting, crop diseases prediction and smart irrigation system. Although ML will never give the solution for all the problems of agriculture systems however this techniques provides a powerful tools that can be applied for the various field of agriculture [17]

Cloud computing faces several problems with the exponential rise in Internet of Things (IoT) applications such as high latency, low capacity and network failure. So this problems can be minimized by used of fog computing. In fog computing the IoT data are not directly send to cloud there is intermediate between the cloud and the IoT application so that it increase the efficiency, faster response and greater quality[15][16].

II. LITERATURE SURVEY

In 2018 Chris Jordan G. Aliac at al.[1] In this paper the author proposed an integrated framework for controlling and maintaining hydroponics garden based on IOT. Here through the use of IOT and automation that solved the resource management problem. The systems principal objective is to provide the optimal environment for plant production. The system where monitored pH level, water level, air temperature and humidity also system controlled the irrigation of water and intake of nutrient solution. Cloud are used to stored, managed all sensor data via internet

In 2016 Jumras Pitakphongmetha et al.[2] In this paper to improved the quality of the product and to solved the problem of global warming the author developed a greenhouse which was faced by farmer. The greenhouse is very easy to controlled, maintain the important factors like light, temperature and humidity which is required to the growth of plant. Cloud are used to stored all sensors data to managed the temperature, light etc.

Yuthika Shekhar at al. [3] proposed a IoT based automated intelligent irrigation system in this paper they used a K-Nearest Neighbor classification machine learning algorithm is used to analyze data which takes from the sensor then the analyze data are stored on cloud server which allows farmer to access from the cell phone. This training dataset used by farmer to predict the soil condition for the irrigation..

Desta Yolanda et al.[4] In this paper for the growth of plant and to control the Electrical conductivity and pH level author developed the fuzzy logic here Electrical conductivity and pH condition maintained in prescribed range. Nutrient Film Technique (NFT) used by this author is one of the methods of hydroponic system used to disperse nutrient-containing water to the plant.

Theeramet Kaewwiset et al.[5] The automated EC control system and pH system in reservoir were to be implemented in this report. This control system works when the microcontroller gets the signal output. For microcontrollers introduce an equation of EC and pH change which was derived from linear regression.

Manav Mehra et al[6] In this paper implement the hydroponics system based on IOT by using the deep neural networks. This system automatically controls the multiple input parameters for the hydroponics environment like Ph, EC, air temperature and humidity.

Yakub Eka Nugraha et al.[7] In this paper author build Embedded device to monitor the nutrient content needed for hydroponics. This device used artificial intelligence to find the nutrient requirement for the plant using forward chaining techniques to also calculate the different parameters needed for the plant to use sensors such as conductivity sensors, temperature sensors, etc.

Melchizedek I. Alipio et al.[8] In this study author used a Bayesian Network and developed a hydroponics system which automatically used to check the growth process of crops. Various sensors are installed which monitors and controls the parameters like pH, EC, light intensity etc. for the classification of various values coming from sensors Bayesian Network are used. Result shows that in comparison with the manual control the values of sensors were reduced using Bayesian Network.

V. S. Kumar et al. [9] The robotic vehicle was created in this work by the author that automatically tests, recognizes and classifies the plant species using the feature extraction algorithm. The gardening robot will measures the main parameters like humidity, temperature, soil moisture, heat level, wind and speed and direction. The data generated by Sensors of the robot are stored on cloud storage platform regularly. Maintenance of the garden more effective, sophisticate and efficient which is depends on the generated data and cloud storage. For controlling and monitoring the rover an android application and website was developed which is used by remote area.

Sethavidh Gertphol et al [10] In this study the authors had installed smart hydroponic lettuce farms using the IoT to collect environmental data and monitor activity of the farm in real time. The experiment created a large dataset which used machine learning techniques to construct regression models.

Herman, Nico Surantha et al[11] In this paper author solved some of the challenge faced in the precision agriculture, To solved this challenge he propose a system which is used in precision agriculture and control ,monitor hydroponics based on IoT and fuzzy logic. IoT is used to track plant nutrition and water requirements on a regular basis, while using fuzzy logic to regulate plant nutrition and water supply.

Andreas Kamilaris et al.[12] In this paper author introduced IoT based framework application for smart farming this application used various sensors to collect data in real time this system called Agri-IoT. In this application the farmer can integrate cross domain data stream so that he can make a decision what do the next. Agri-IoT also provide event detection, data analytics the working of sensors, processes, services and operation. Which also include the online information, open dataset available on web.

Kunyanuth Kularbphettong et al[13] In this study author developed successful application to improve the pH sensor stability in hydroculture for the growth of plant. Here researcher's aims is to control and monitor the automatic hydroponics vegetable system using IOT and mobile phone automatically. By self-regulating, the machine can monitor and refill the nutrient, and shows the graphical user interface to handle and regulate it easily.

Yukimasa Kaneda et al.[14] Now a day's smart farming and greenhouse system are more becoming popular and sophisticated to collect data about various farm environment and growth situation but this is used by well expert farmers. In this study author developed smart greenhouse farm based on sliding window support vector machine. In real time this new machine learning algorithm gives accurate prediction. SW-SVR is prediction model adjust current environment situation automatically which also predict time series data with better accuracy and with less time complexity. SW-SVR are minimized the crops controls since the growth of plant depends upon the transpiration of leaves and photosynthesis for that they developed wireless scattered light sensors which is used to measure the area size of leaf so the growth of plant can be identified.

III. Conclusion

Hydroponics system is the best choice from the review study to generate more yields that need less water. In the old farming method require higher cost labor, used of fertilizer and pesticide, also requirement of fertile land now a day's water resources and labor problem is important issue. In hydroponics all above problems are solved by using various techniques of machine learning and IOT concept the farming becomes easier and all sensors data are stored on cloud.

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