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Hydroponic: A Review on Hydroponic Monitoring System

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Abstract - ***These days, soil-based agriculture faces challenges from a variety of man-made factors, including urbanisation and industrialization. The decrease of soil fertility and quality is also a result of uncontrolled chemical usage in agriculture, abrupt natural disasters, and climate change. Because of this, researchers have created a brandnew alternative farming method known as soil-less agriculture, or hydroponics. Plants can be grown hydroponically in a nutrient-rich, water-based solution. Many different plants, crops, and vegetables can be grown with hydroponics. When compared to natural soil-based cultivation, hydroponically produced final products typically have greater quality yields, tastes, and nutritional values. This type of agriculture is becoming more and more wellliked worldwide, in both developed and developing nations, and it is also inexpensive, disease-free, and environmentally benign. In many nations, it has excellent prospects in conjunction with advanced space research to address the scarcity of arable land in situations when suitable cultivable land is unavailable. Therefore, hydroponics would be a better method to meet the demand for nutrition in the world while also producing a variety of fruits, vegetables, and feed while advancing the future. Hydroponics may become one of the new methods used in the future to feed the world's population.***

Key Words: Arduino UNO, Deep water culture(DWC),Charcoal filter,TDS sensor,nutirents

1.INTRODUCTION

The agricultural industry is crucial. However, as technology advances, the industrial sector is growing as well. The narrowness of agricultural land is impacted by the rise. One possible way to solve these issues is to implement a hydroponic system. agricultural method. Hydroponics is a technique for growing plants that uses water as a planting media instead of soil and a fertiliser solution that the plants require. Deep Water Culture (DWC) is one of the community's hydroponic methods. DWC is a hydroponic method that feeds plant roots with nutrient solutions directly. The plant's root will always be immersed in a nutritional solution thanks to the DWC technology [1]. This kind of hydroponics, called Deep Water Culture, enables indoor or boxed planting. When planting inside a box, TL lamps can be used in place of natural sunlight. Aerated nutrient solutions are necessary in this DWC hydroponic technique in order to introduce dissolved oxygen to the water, as a deficiency in oxygen will hinder plant roots' ability to absorb nutrients. For plants to maintain their nutritional needs, nutrient solutions must be available to them constantly. The productivity and quality of lettuce grown in hydroponic systems are significantly influenced by nutrition. Determining the quality of lettuce products requires a balanced absorption of nutrients [2].

2. LITERATURE SURVEY

[1]."A survey of smart hydroponics systems" by Fatmata M, Mahdi Musa and Farouq Aliyu : The paper goes on to explain the basics of hydroponics and the various ways in which the system can be implemented. The authors have tried to create as automated model and have tried to find out the optimal root zone of crops such as lettuce. the study Automated system developed to control pH and concentration of nutrient solution evaluated in hydroponic lettuce production carried out control of pH and the concentration of plant does not die.

[2]."Cost effective smart Hydroponics Monitoring and Controlling System Using IOT" by Ullah and A Aktar: The paper presents a cost-effective IoT-based system for monitoring and controlling hydroponic farming parameters such as water level, pH, humidity, and temperature through a mobile application. The literature survey highlights the innovation and improvement in nutrient solution level control for DWC hydroponics, addressing previously overlooked areas. The proposed system leverages modern technology to enhance the efficiency and reliability of hydroponic farming, contributing to better crop management and higher productivity.

[3].In the study "A Development of automatic Microcontroller System for Deep Water Culture pH control on DWC hydroponics uses a pH sensor as a reader of the pH value in solution. In addition, in this study also paid attention to the level of nutrient solution by flowing water into and out of the reservoir. In this study, monitoring the level of nutrient solution is important to maintain the level of nutrient solution that is appropriate to the reservoir.

But monitoring still uses LCDs and remote monitoring and control cannot be carried out. In the study Electrical Conductivity and pH Adjusting System for Hydroponics carried out control of the concentration of nutrient solution and pH using linear regression method on red lettuce and green lettuce.

[4.] "Automated system developed to control pH and concentration of nutrient solution evaluated in hydroponic lettuce production" carried out control of pH and the concentration of plant does not die. This research was carried out by taking sample data by adding AB solution using a solenoid valve. But this research is still done in a simulation and has not been implemented in the real system. In this study a new system will be designed to control the level of nutrient solutions in hydroponic plants of the DWC type using linear regression methods. With the level control system of nutrient solutions using this linear regression method, it is expected that there will be no more hydroponic plants from DWC that die because the roots of the plant are not submerged in nutrient solution. a workable option for ventilation control in practical situations.

[5.]" Sani Saleh Hussaini's "Evaluation of Potential Use of Charcoal as a Filter Material in Water Treatment" Yahaya Hassan Mato: Charcoal has the capability to eliminate pathogenic organisms, turbidity, and dissolved iron from drinking water, according to research.Additionally, the addition of minerals like sodium and potassium to the water through the charcoal base filter made the watertastebetter.

Utilizing organic hydroponics for domesic urban farming The report includes a number of case studies of domestic urban agriculture initiatives that make use of organic hydroponics. These initiatives show that incorporating organic hydroponics into smallscale urban gardening is both feasible and advantageous. In addition to encouraging sustainable living techniques and enhancing local food security, residents have successfully cultivated a wide range of vegetable .

[6]."Electrical Conductivity and pH Adjusting System for Hydroponics by using Linear Regression"The optimization of plant growth has led to a great deal of attention being paid to the research of electrical conductivity (EC) and pH correction in hydroponics systems. Plants that have accurate EC and pH management have efficient nutrient absorption and availability. Conventional techniques frequently call for labor-intensive, prone to human error manual modifications. Recent developments have looked into automated systems that use linear regression methods to provide fine control. In order to improve the efficiency and dependability of hydroponic farming and consequently improve crop yields and resource management, Kaewwiset and Yooyativong (2017) made a substantial contribution by creating a system that use linear regression to forecast and modify EC and pH values in real-time.

[7]."A development of an automatic microcontroller system for Deep Water Culture (DWC)" Modern agriculture has evolved substantially with the advent of autonomous microcontroller systems for hydroponics, namely for Deep Water Culture (DWC). In order to monitor and regulate vital indicators including nutrition levels, pH, water temperature, and dissolved oxygen, these systems combine sensors and microcontrollers. Precise changes are guaranteed by automation, which encourages ideal plant growth and minimizes the requirement for user intervention. Studies demonstrate how these systems can improve crop yields, sustainability, and resource efficiency. Recent research has concentrated on enhancing sensor precision, system dependability, and user interface design to increase the effectiveness and accessibility of automated DWC systems for hydroponic small- and large-scale operations.

[8]."A survey of art tydroponics systems", Due to their advantages in both functionality and aesthetics, art hydroponics systems—which combine hydroponic technology with creative design—are becoming more and more popular. These methods combine effective plant growing with eye-catching design elements including hanging displays, vertical gardens, and modular buildings. According to recent study, maximizing hydroponic techniques and producing artistic value go hand in hand, improving both productivity and attractiveness. Research also emphasize the psychological and ecological advantages of art hydroponics, pointing out that it can enhance mental health, enhance air quality, and encourage environmentally friendly urban living. In addition to promoting sustainable agriculture methods, this interdisciplinary approach stimulates creativity.

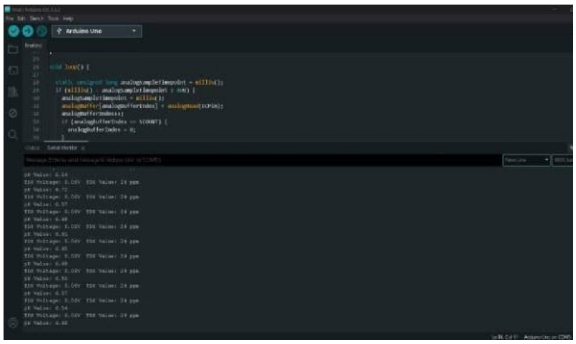

Fig.1 Ph and TDS value

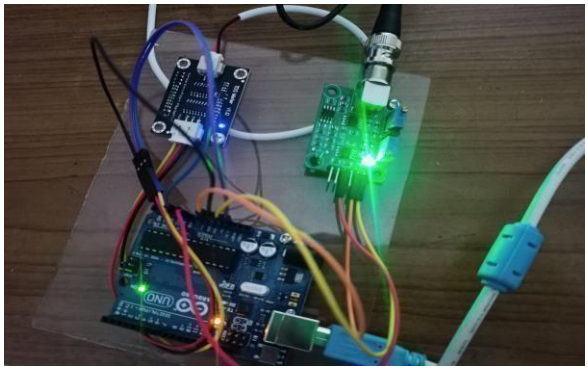

Fig.2. Ph and TDS sensor values .

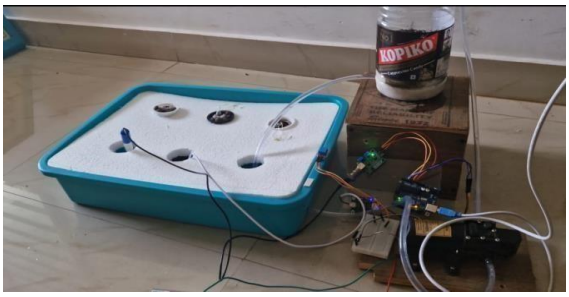

Fig 3. Complete layout of the control system .

Summary and Future scope

The hydroponic method known as Deep Water Culture (DWC) involves immersing plant roots in a nutrientrich water solution. In order to oxygenate the water and encourage healthy root growth and nutrient absorption, it makes use of a reservoir system with an air pump. In DWC systems, charcoal filters are frequently utilized to remove odors and clean the air that circulates in the growing environment. With the DWC supplying effective fertilizer delivery and the charcoal filter preserving air quality, this combination guarantees plants grow in the best conditions possible, making it a popular option for indoor and urban gardening lovers looking for high-yield, clean growing solutions.

Deep Water Culture (DWC) hydroponic systems have made a major development in sustainable agriculture methods with the addition of charcoal water filters. Because activated charcoal can filter out pollutants from water, plants are given healthier, cleaner water that improves nutrient absorption and speeds up growth. This is important because it tackles the issue of water quality in hydroponic systems, which has a big influence on the health and productivity of plants.

DWC systems with charcoal filters provide a workable alternative for indoor and urban farming in light of the growing problems associated with soil degradation and water constraint. These systems are perfect for densely populated places where traditional farming is difficult since they can provide larger yields in less spaces. Additionally, using charcoal filters minimizes the environmental impact and is in line with ecofriendly practices by reducing the need for chemical treatments. There will be a greater need for effective and sustainable food production techniques as the world's population grows. In order to address this demand, DWC hydroponics with charcoal water filters can offer a dependable and environmentally friendly method of growing. These systems have the potential to improve food security, lessen the impact of agriculture, and foster resilience in food production by guaranteeing cleaner water and healthier plants. This creative strategy may be crucial in reshaping agriculture in the future to make it more ecologically friendly, efficient, and sustainable.

3. CONCLUSIONS

In this small project, a charcoal filter is added to Deep Water Culture (DWC) to create a hydroponics monitoring system. This system uses filtration to regulate water quality with the goal of optimising plant development. By purifying the nutritional solution, the charcoal filter promotes the health and growth of plants. Monitoring sensors provide real-time data for modifications by ensuring that critical parameters like pH, EC (Electrical Conductivity), and temperature are within ideal ranges. This integrated method offers an effective and sustainable indoor gardening solution by combining hydroponic farming with smart water management.

REFERENCES

[1] Johan Andri Pratama et al., "Growing Insights and Youth Knowledge in the NFT Hydraulic Application," published by Research and Community Development Center, KONTRIBUSIA, vol. 2, no. 1, 2019.

[2] Yi-hsuan hsieh, ssu-pei li & ting-i lee, "The application of organic hydroponics on homegrown urban agriculture in taiwan, wit Transactions on Ecology and the Environment, Vol 217, pp 987- 995

[3] Adesina Akinmeji, Sanjay Misra, Akshat Agrawal et al. , "COST-EFFECTIVE DESIGN FOR A HYDROPONICS FARM", 1Center of ICT/ICE Research, Covenant University, Ota, Nigeria.

[4] H.-J. Kima, T. Yang, M.-Y. Lin and P.Langenhoven, "Plant propagation for successful hydroponic production",Department of Horticulture and Landscape Achitecture,PurdueUniversity,625 Agriculture Mall Drive, West Lafayette, Indiana 47907,USA.

[5] Baiyin, B.; Tagawa, K.;Yamada, M.; Wang, X.; Yamada, S.;Shao, Y.; An, P.; Yamamoto, S.; Ibaraki,Y. Effect of Nutrient Solution FlowRate on Hydroponic Plant Growthand Root Morphology.Plants202110,1840. https://doi.org/10.3390/plants10091840.

[6] Falmata Modu, Adam Adam, Farouq Aliyu, Audu Mabu, Mahdi Musa, "A survey of art tydroponics systems", ASTES Journal, Vol. 5, No. 1.

[7] Saaid M F, Yahya N A M, Noor M Z H and Ali M S A M 2013 "A development of an automatic microcontroller system for Deep Water Culture" *Proc. - 2013 IEEE 9th Int. Colloq. Signal Process.*

[8] Abou-Hadid A F, Abd-Elmoniem E M, El- Shinawy M Z and Abou-Elsoud M 1996 "Electrical conductivity effect on growth and mineral composition of lettuce plants in hydroponic system" *Acta Hortic.* **434** 59–66

[9] S, Takahashi H W, Camara C A P and Nixdorf S L 2012 "Automated system developed to control pH and concentration of nutrient solution evaluated in hydroponic lettuce production *Comput." Electron. Agric.* 84 53–61

[10] Kaewwiset T and Yooyativong T 2017 "Electrical Conductivity and pH Adjusting System for Hydroponics by using Linear Regression" in *2017*