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Automated Aquaponic Farming Using Node MCU

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ABSTRACT

The emphasis of the aquaponics systems was on boosting the viability and economics of both indoor and outdoor fish farming. We must reevaluate agriculture sciences in light of factors like sustainability, growth, and economically efficient improvements to farmer health; this means that we must create environmentally friendly technology. Aquaponics is a new innovation created by combining aquaculture and hydroponics. It adheres to the principles of sustainable agriculture (wastewater bio-filtration by plants) and gives us the opportunity to increase economic efficiency by adding a second source of food production (organic vegetables) to create nutrient-rich food.

Keywords : Aquaponics, Aquatic Farming, Hydroponics, Aquaculture, Automation,IoT, Node-MCU

I. INTRODUCTION

The words "aqua" and "ponics" are combined to form the term "aquaponics." Aqua refers to aquaculture, which is the practice of raising fish in a controlled environment, and "ponics" is a Latin word that means "to work," and cultivation is done in soilless media. Today, the population's desire for food has multiplied and in fact reached a crisis point, with conventional agriculture barely able to keep up with demand and farmers struggling with issues like high fertilizer costs, limited land for farming, and a lack of water for irrigation. A novel method called aquaponics, which incorporates automation and imitates a natural environment, has been developed to address these issues.

Being a modern, computer-driven methodology, there is a huge potential for automation and, as a result, a wide range of applications in agriculture. The method is very effective, cost-effective, affordable, and devoid of several other concerns associated with traditional agriculture. Regular farming practices and aquaculture are combined in aquaponics.

In this approach, the raised fish consumes its food and excretes waste, which is then employed as the ideal fertilizer for the essential crop. The link between water, aquaculture design, and nutritional values is described by aquaponics. The power is circulated through the bio-integration of various components as plants grow in waterways. As a result, they are very advantageous for the food system, and the majority of food crops obtained through conventional farming employ

powerful pesticides that pose substantial health risks.Recirculating aquaculture and hydroponics are the two types of agricultural production that are combined in aquaponic systems. The main problems with these two systems are addressed by aquaponics, including the need for nutrient-rich water that can act as a fertilizer for hydroponically grown plants and the need for sustainable methods of filtering or discarding nutrient-rich fish waste in aquaculture.

Thusthe result, aquaponics is highly recommended, and the aquaponics control system can be fully automated to generate more agricultural products, plants, and veggies.

II. LITERATURE SURVEY

Different geographical areas have different climate conditions and soil quality. Some soils have various structures and significant amounts of sand or clay. When combined with river erosion, wind erosion, and other natural disasters, some soils include concrete, and asphalt, as well as high amounts of pesticides and fertilizers used during agriculture. This poses serious health risks to those who consume food.

However, aquaponics solves these problems since it gets rid of weeds and the system recycles the nutrient-rich water. In the system, there is no hazardous run-off.Only 10% of the total water utilized in conventional agricultural cultivation is used in aquaponics. It is therefore quite effective and helpful for places that are prone to drought.Smart Aquaponics Systems Overview:Explore the concept of smart aquaponics systems and their advantages over traditional aquaponics.

Sensor Technologies:Discuss the various types of sensors used in smart aquaponics, including pH sensors, temperature sensors, dissolved oxygen sensors, and nutrient sensors.Investigate the role of IoT (Internet of Things) in collecting and transmitting data from sensors in real-time.Examine how intelligent aquaponics might be incorporated into more extensive systems of sustainable agriculture to increase food security.

You might start by browsing academic databases like PubMed, IEEE Xplore, ScienceDirect, and Google Scholar to conduct your literature review. To identify pertinent research articles, conference papers, and books, use appropriate keywords like "smart aquaponics systems," "IoT in aquaponics," "aquaponics automation," and "aquaponics sensor technology." For useful ideas and case studies, you can also read reports and publications from government and aquaponics groups[10]-[16].

In order to develop a thorough grasp of the state of smart aquaponics systems and their potential in sustainable agriculture, keep in mind to critically examine the sources you uncover and synthesize the data.

III. LIMITATIONS AND EXISTING WORK

Control and Monitoring of the Environment:

Limitation: It can be difficult to keep the ideal environmental conditions for both fish and plants. It's important to regularly monitor and regulate factors including water temperature, pH, dissolved oxygen levels, and nutrient concentrations.

Existing Work: These characteristics can be managed with the aid of automated monitoring and control systems with sensors and actuators. Based on past data and current measurements, machine learning and AI algorithms are utilized to forecast and modify situations.

The welfare of Fish:

Limitation: Because fish might become stressed due to changes in the environment or poor care, maintaining optimal fish welfare can be difficult.

Existing Work: To create better management tactics, researchers are examining the behavior, health, and stress responses of fish. Feedback loops are a feature that intelligent systems can use to adjust to the needs of the fish.

Limited Crop Varieties:

Limitation: The variety of crops that can be cultivated is limited by the fact that some plants are more suited for hydroponic growing than others.

Existing Work: Studies are being conducted to increase the number of appropriate crops and enhance growing conditions for a wider range of plants. Work on nutrient formulations and crop-specific environmental controls fall under this category. [17]-[21]

IV. CONCLUSION

The new design choices are anticipated to significantly improve water quality, which will favorably impact fish output and growth. Today's world faces a very real and serious challenge to food security. The capacity to address these challenges of resource conservation and access to a consistent and high-quality food source is what makes aquaponic food production so alluring. Additionally, because an aquaponic system is so straightforward and user-friendly, it may be able to assist families who are most in need.

Meeting the demand of the escalating food crisis at the lowest possible cost is the key problem facing the agricultural sector. The approach to be used should be user-friendly, effective, and trustworthy given the cost factors. Our data demonstrate that aquaponics can satisfy each need. As with any technology, there are a few very minor drawbacks and concerns with this approach, but when compared to conventional agriculture, the advantages are undeniably greater.The production of nutrients that promote plant and fish growth is another benefit of this system. As a result, in this system, expensive chemicals are replaced by less expensive fish feed, which results in a significant cost advantage in cultivation compared to traditional farming, which costs more money and uses harmful fertilizers and chemicals that contaminate the crop and are harmful to food consumers.

As a result, this system is most similar to the natural ecosystem.

The system is more productive than other agricultural methods and creates no waste because it doesn't need to discharge water.

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VI. REFERENCES

[1] Rakocy JE, Hargreaves JA. Nutrient accumulation in a recirculating aquaculture system integrated with hydroponic vegetable production. In: Techniques for modern aquaculture, proceedings of a conference, Spokane; 1993. P. 148–58.

[2] Ms. Sabale Snehal Rajendra1 , Mrs. Shirkande Aparna Shrinivas2 1, 2 “Hydroponics Farming Using IoT” International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 10 Issue IV Apr 2022- Available at www.ijraset.com © IJRASET

[3] A list of authors includes Martins CIM, Eding EH, Verdegem MCJ, Heinsbroek LTN, Schneider O, Blancheton J-P, and others. European recirculating aquaculture system advancements: An environmental sustainability approach. 83–93. Aquacult Eng. 2010;43(3).

[4] Watten B., Busch R. Small-scale recirculating water system for tropical production of tilapia (Sarotherodonaurea) and tomatoes (Lycopersiconesculentum). Aquaculture 41(3):271-283 (1984).

[5] Nhut DT, Huong MTN, Khiem D V, Da Silva JAT. Compact3U as a novel lighting source for the propagation of somehorticultural plants. J Appl Horticult. 2006;8(1):15–20.

[6] Rajendra AB, Rajkumar N, Shreyas, V.

'Autonomous remotecontrolled car using machine learning', COMPUSOFT, An International Journal of Advanced Computer Technology, 2019; 8(8): 3307-3311.

[7] Shete AP, Verma AK, Tandel RS, Prakash C, Tiwari VK,Hussain T. Optimization of water circulation period for the culture of goldfish with spinach in aquaponic system.Journal of Agriculture Science 2013; 5(4):26-30.

[8] Vijaysinh U. Bansude, (2016).“ Fingerprint Based Security System For Banks.” International Research Journal of Engineering and Technology (IRJET),1907-1911.

[9] S. T. Shirkande and M. J. Lengare, "Optimization of Underwater Image Enhancement Technique by Combining WCID and Wavelet Transformation Technique," *2017 International Conference on Computing, Communication, Control and Automation (ICCUBEA)*, Pune, India, 2017, pp. 1-6, doi: 10.1109/ICCUBEA.2017.8463759.

[10] Gaikwad, Yogesh J. "A Review on Self Learning based Methods for Real World Single Image Super Resolution." (2021).

[11] V. Khetani, Y. Gandhi and R. R. Patil, "A Study on Different Sign Language Recognition Techniques," 2021 International Conference on Computing, Communication and Green Engineering (CCGE), Pune, India, 2021, pp. 1-4, doi: 10.1109/CCGE50943.2021.9776399.

[12] Vaddadi, S., Arnepalli, P. R., Thatikonda, R., & Padthe, A. (2022). Effective malware detection approach based on deep learning in Cyber-Physical Systems. International Journal of Computer Science and Information Technology, 14(6), 01-12.

[13] Thatikonda, R., Vaddadi, S.A., Arnepalli, P.R.R. et al. Securing biomedical databases based on fuzzy method through blockchain technology. Soft Comput (2023). https://doi.org/10.1007/s00500-023-08355-x

[14] Rashmi, R. Patil, et al. "Rdpc: Secure cloud storage with deduplication technique." 2020 fourth international conference on I-SMAC (IoT in social, mobile, analytics and cloud)(I-SMAC). IEEE, 2020.

[15] Khetani, V., Gandhi, Y., Bhattacharya, S., Ajani, S. N., & Limkar, S. (2023). Cross-Domain Analysis of ML and DL: Evaluating their Impact in Diverse Domains. International Journal of Intelligent Systems and Applications in Engineering, 11(7s), 253-262.

[16] Khetani, V., Nicholas, J., Bongirwar, A., & Yeole, A. (2014). Securing web accounts using graphical password authentication through watermarking. International Journal of Computer Trends and Technology, 9(6), 269-274.

[17] Kale, R., Shirkande, S. T., Pawar, R., Chitre, A., Deokate, S. T., Rajput, S. D., & Kumar, J. R. R. (2023). CR System with Efficient Spectrum Sensing and Optimized Handoff Latency to Get Best Quality of Service. International Journal of Intelligent Systems and Applications in Engineering, 11(10s), 829-839.

[18] Nagtilak, S., Rai, S., & Kale, R. (2020). Internet of things: A survey on distributed attack detection using deep learning approach. In Proceeding of International Conference on Computational Science and Applications: ICCSA 2019 (pp. 157-165). Springer Singapore.

[19] Mane, Deepak, and Aniket Hirve. "Study of various approaches in machine translation for Sanskrit language." International Journal of Advancements in Research & Technology 2.4 (2013): 383.

[20] Shivadekar, S., Kataria, B., Limkar, S. et al. Design of an efficient multimodal engine for preemption and post-treatment recommendations for skin diseases via a deep learning-based hybrid bioinspired process. Soft Comput (2023). https://doi.org/10.1007/s00500-023-08709-5

[21] Shivadekar, Samit, et al. "Deep Learning Based

Image Classification of Lungs Radiography for Detecting COVID-19 using a Deep CNN and ResNet 50." International Journal of Intelligent Systems and Applications in Engineering 11.1s (2023): 241-250.

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