



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 4, April 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

 ijirset@gmail.com

 www.ijirset.com



AQUACULTURE USING IOT

¹ Dr. Sanjeev Kulkarni, ² Akshay Kumar P V, ³ Aslaha Mashitha, ⁴ Nithesh C M, ⁵ Prajwal V K

¹, Associate Professor, Dept. of Information Science and Engineering, Yenepoya Institute of Technology, Moodbidri, India.

^{2,3,4,5}, Students, Dept. of Information Science and Engineering, Yenepoya Institute of Technology, Moodbidri, India.

ABSTRACT: The cultivation of fish and vegetables is made more professional and accurate via the use of aquaponics, a developing and advanced kind of agriculture. For the purpose of hydrating and feeding plants and fish, this method makes use of cutting-edge technology. In order to solve a technical issue that arises in traditional aquaponics, this paper provides a technological solution employing wireless sensors, a communication network, and a GUI application. It also discusses some technical issues that farmers who practice aquaponics experience. A system was created to automate fish feeding in accordance with the passing of time and demand and keep track of pH and TDS in the aquaponic systems. Through an Android-based application, pH and TDS measurements are tracked, and fish feeding is regulated. A timetable and a set feed weight are used to feed the fish. Real-time pH and TDS monitoring is carried out by the system.

KEYWORDS: Robotics, Internet of Things, pH level, overall dissolved solids, scheduling, aquaponics systems, Smart Fish Farm

I. INTRODUCTION

The Internet of Things (IoT) is already being used by different systems to monitor and regulate the agriculture, primarily aquaponics techniques IoT enables the Internet to be used to link devices like detectors and actuators that control them. Given how heavily polluted with pesticides and incorrectly applied chemicals the fish and vegetables sold on the market are, the imaginative method of producing them has won the backing of a significant portion of the populace.

It is a thought to use fish tank water for both veggie and fish farming. There is a fish tank with water and feeding fish. The planting bed above it is used for the cultivation of vegetables. The planting bed is supported by a gravel and mud filter bed. The fish tank receives the filtered water that has been collected by the gravel filter, which is then collected and pumped back to the fish tank. The gravel filter receives water from the fish tank after it has been piped to the grow bed containing the veggies. The genius of this idea is that the veggies grow five times more quickly than in regular soil farming because the water in the fish tank is considerably more nutrient-rich than ordinary water since it has been enhanced with nutrients from fish excrement and other chemical changes. A sustainable farming method called aquaponics combines hydroponics, or growing plants without soil, with aquaculture, or raising fish. By supplying nutrients to the plants and cleansing the water for the fish, this system fosters a symbiotic interaction between fish and plants. Fish are commonly kept in ponds or tanks in an aquaponics system where they expel waste in the form of ammonia. The bacteria in the water transform this ammonia into nitrite, which is eventually transformed into nitrate, which provides nutrients for the plants. Plants cultivated in nutrient-rich trays or beds, such as those filled with gravel or clay pebbles, absorb nutrients from the water and utilize them to thrive. The brilliant idea of this notion is that because the water in the fish tank has been strengthened with nutrients from fish waste and other chemical changes, it is significantly more nutrient-rich than ordinary water and the vegetables grow five times more fast than in traditional soil farming. A benefit of aquaponics is that it uses less water and land than conventional agriculture to provide year-round, fresh, healthful, and sustainable food in any environment. Due to its ability to reduce farming's impact on the environment and do away with the need for chemical pesticides and fertilizers, aquaponics is also a very effective technique of producing food.

The scalability of aquaponics is another advantage. Both small-scale home gardening and massive commercial food production can be done with it. It is a fantastic choice for urban farming and community gardens since it can be utilized in urban locations with little available land. A low-maintenance farming technique is aquaponics since the system is



mainly self-regulating. To keep the environment healthy, fish and plants cooperate.

II. PROBLEM STATEMENT

Due to abrupt climate fluctuations that create changes in water quality characteristics, commercial aquaculture is facing a number of challenges. Aqua farmers use manual testing to determine the state of the water's different parameters. However, manual testing takes a long time and produces inaccurate findings since the factors used to gauge water quality are constantly changing. observing the feeding Using IoT technologies, behaviour However, manual testing takes a long time and produces inaccurate findings since the factors used to gauge water quality are constantly changing. The fish tank's water quality will depend on the bell siphon's effectiveness, and the plants' ability to develop more quickly will be accelerated by the water's present moisture. It has been shown that grow beds shouldn't be left too wet for more than four hours, nor should they be left overly dry or overflooded. This is crucial for veggies' rapid development.

III. PROPOSED METHODOLOGY

Investigation into the agricultural environment revealed that integrating IoT to automate the system will significantly boost farming productivity. Furthermore, the farmers we spoke to showed a keen interest in a variety of demands that can only be satisfied by IoT applications. For instance, several Aquaponics farmers have suggested that they should be able to operate the system online, especially when they are away from the farm. They must constantly monitor the farm and the goods it generates.

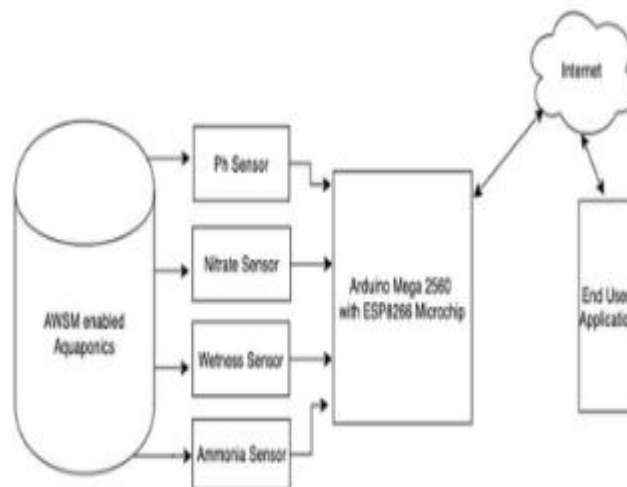


Figure 1: Representation of the system's design process and architecture.

The primary hurdles faced by aquaponics farmers include the total automated processes and monitoring of plants and fish, which is highly desirable. Additionally, since aquaponics farming is precision agriculture, where accuracy is essential, automation and the use of sensors would tremendously assist aquaponics farmers. This article focuses on employing an interactive interface application that is loaded on a PC or mobile device to automatically feed fish, monitor water quality, and keep plants' moisture levels at an appropriate level. An intelligent suggestion system has been constructed to aid farmers in managing crops, fish, and vegetables while keeping track on growth.

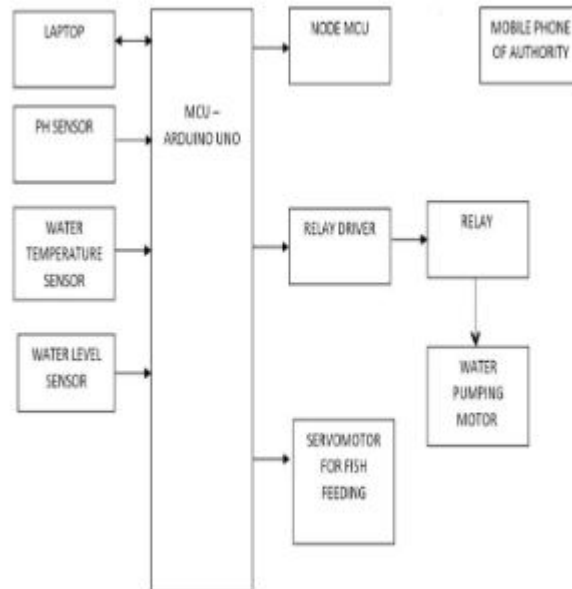


Figure 2: The proposed model's Working Model.

Using an IoT mobile application, a user may keep tabs on the water's level, temperature, pH, and colour. Any time the water parameters change, the user will be notified.

Servomotor-based feeder opening and shutting allows for time-based fish feeding.

Installation of Sensors: IoT sensors may be used to track the water temperature, pH levels, dissolved oxygen levels, and nutrient levels in an aquaponic system. A central control system may be connected to the sensors, which can be put all across the system.

Data Gathering and Analysis: Data gathered from IoT sensors may be forwarded to a cloud-based platform for analysis. There, it can be used to monitor the health and development of plants and fish, optimize water consumption, and identify and address any problems.

Automated Control: The aquaponic system may be automated in a number of ways, including managing lighting and temperature, modifying fertilizer doses, controlling water flow and oxygen levels, and more.

Remote Monitoring and Control: Using a smartphone or other device, an IoT-enabled aquaponic system may be remotely monitored and managed. Farmers may be able to check on the system from any location, get notifications when problems develop, and modify the system as necessary thanks to this.

Predictive Analytics: The aquaponic system's IoT data may be utilized to create predictive analytics models that can foresee systemic changes and allow preventative action to be done.

Improved Resource Management: The IoT system may aid in the efficient and waste-free use of resources including water, electricity, and fertilizers.

Increased productivity and Quality: IoT can aid in enhancing the productivity and quality of fish and vegetables by monitoring and managing different aquaponic system parameters.

Better Traceability: The Internet of Things (IoT) technology may give better traceability of the whole aquaponic system, from seed to harvest, making it simpler to identify and address possible concerns and giving customers more assurance in the sustainability and safety of the goods.

Integration with Other Systems: To maximize output and satisfy customer demand, IoT-enabled aquaponic systems may be combined with other systems, such as weather forecasting systems and market demand systems.

Scalability: An IoT-enabled aquaponic system allows for the expansion of production with the addition of more sensors and machinery as needed without raising labour expenses. This may contribute to the sustainability and economic viability of aquaponic farming.

FIELD STUDY AND VALIDATION

Aquaponics field studies often entail monitoring and gathering information on the system's performance, including plant growth, fish health, water quality, and nutrient levels. This may be achieved by installing sensors and data recorders to gauge the water's pH, temperature, dissolved oxygen content, and ammonia levels. Observations are also made by researchers to monitor fish and plant development, nutrient absorption, and system functioning. The system is optimized in order to raise its effectiveness and sustainability.

pH Value Sensor: A pH sensor is a device that measures the pH of Water. It might be a solid-state electrode or a glass electrode. The controller or computer uses the data from the sensor to change the pH level using a dosing pump or other method.

Temperature Sensor: A temperature sensor gauges the temperature of the water using a thermocouple or thermistor, typically. It may be mounted in a variety of places, including the water tank, grow bed, and fish tank. Data is sent to a controller, which can use a heater or cooler to change the temperature.

Water Level Sensor: A water level sensor measures the water level using a pressure sensor or a float switch. The controller receives the data and can then trigger a pump to provide additional water or a drain valve to remove extra water. For optimum plant growth and fish health, the water level must be maintained.

Nitrate Sensor: A nitrate sensor measures the amount of nitrate in water by using either a colorimetric technique or an ion-selective electrode. It transmits the information to a controller, which may change the amount of nitrate by adding or removing plants, altering the pace of feeding, or utilising a denitrification system.

Ammonia Sensor: An ammonia sensor monitors the amount of ammonia in the water using either a colorimetric technique or an ion-selective electrode. It transmits the information to a controller, which may change the feeding rate, increase aeration, or use a biological or chemical filter to lower the ammonia level.

Chlorine Sensor: A chlorine sensor measures the amount of chlorine in the water using either a colorimetric technique or an ion-selective electrode. It transmits the information to a controller, which may change the water source, provide extra water, use a de chlorination system, or alter the chlorine level.

Grow bed Wetness sensor: Aquaponics uses a grow bed wet sensor to measure the moisture content of the grow bed. It operates by determining how electrically conductive the water in the grow bed is. The electrical conductivity of the water in the grow bed diminishes as it evaporates and the moisture content rises.

IV. RESULTS AND ANALYSIS

An Android smartphone application has been developed to help farmers. The farmer may evaluate water quality, update data, observe how the grow bed is performing right now, and monitor the system's overall performance. When new water has to be added, the app also gives the farmer advice. Additionally, if water quality falls more quickly than expected, the AWSM algorithm predicts fish health, indicating that ill fish could be the cause of unexpected water pollution. The App runs in the background to notify the farmer via push notifications while the phone is in use and connected to the internet.

The performance and efficiency of the system have improved significantly as a consequence of the results and analysis of aquaponics utilizing IoT. Growers can monitor and adjust a number of factors, including temperature, pH, water level, and fertilizer levels in real-time with the integration of IoT sensors, resulting in improved plant development and greater production. IoT-enabled aquaponics systems have been demonstrated in studies to dramatically increase the

yield of various crops. For instance, a research done in Spain found that using IoT sensors in aquaponics increased tomato productivity by 30% when compared to conventional hydroponic systems. Additionally, the integration of IoT sensors in aquaponics can assist decrease wastage of water and nutrients, resulting in more environmentally friendly and sustainable agricultural practices. The sensors are capable of identifying any imbalances or anomalies in the system and may notify farmers so they can make necessary adjustments before any harm is done.

Although there are certain difficulties with IoT integration in aquaponics. For farmers who are unfamiliar with the technology, there may be a learning curve and significant implementation costs for IoT sensors and control systems. To guarantee constant functioning, the sensors' dependability and accuracy must also be frequently tested and calibrated.

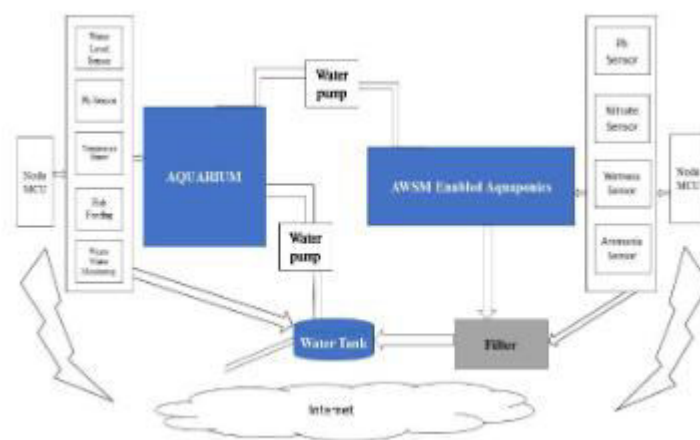


Figure 4: Block diagram of the system

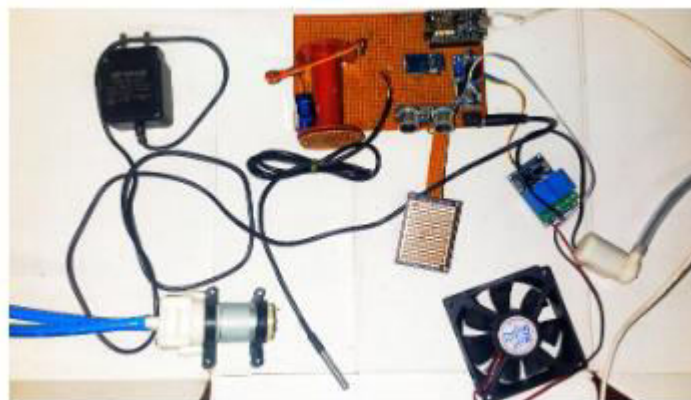


Figure 5: Hardware setup

V. CONCLUSION

The use of IoT in aquaponics has the potential to increase the system's production and efficiency, resulting in improved agricultural yields and more environmentally friendly farming methods. Growers can monitor and regulate many factors in real-time with the use of IoT sensors, allowing for more accurate and precise system modifications. As a result, there may be less water and fertilizer waste and increased plant development. The high cost of the sensors and control systems, as well as the requirement for routine calibration to assure correct readings, provide some hurdles for the application of IoT in aquaponics. Nevertheless, there are a lot of potential advantages for IoT in aquaponics, and the technology is probably going to become more crucial for sustainable agriculture.

The use of IoT in aquaponics provides a viable approach that can help address these difficulties as the globe faces increasing challenges in food production and resource management. We can develop farming systems that are more effective, sustainable, and good for both the environment and society as a whole by utilizing the power of technology.



REFERENCES

1. G. Eason, B. Noble, and I. N. Sneddon, "On Changhui Deng, yanpinggao, Jun Gu, Xinying Miao, "Research on the Growth Model of Aquaculture Organisms Based on Neural Network Expert System," Sixth International Conference on Natural Computation (ICNC 2010); pg.no 1812-1815, SEPTEMBER 2010
2. Sheetal Israni, Harshal Meharkure, Parag Yelore, "Application of iot based System for Advance Agriculture in India, "International Journal of Innovative research in Computer and Communication Engineering Vol. 3, Issue. 11, November 2015.
3. Nikesh Gondchawar, Prof. Dr. R. S. Kawitkar, "iot based smart Agriculture," International Journal of advanced research in Computer and Communication Engineering, Vol.5, Issue. 6, June 2016.
4. Daudi S. Simbeye and Shi Feng Yang, "Water Quality Monitoring and Control for Aquaculture Based on Wireless Sensor Networks," JOURNAL OF NETWORKS, VOL. 9, NO. 4, APRIL 2014.
5. Mr. Kiran Patil, Mr. Sachin Patil, Mr. Sachin Patil and Mr. Vikas Patil, "Monitoring of Turbidity, ph & Temperature of Water Based on GSM, "International Journal for Research in Emerging Science and Technology, Volume-2, Issue-3, March-2015.
6. S.Kayalvizhi, Koushik Reddy G, Vivek Kumar P, venkataprasanth N, "Cyber Aqua Culture Monitoring System Using Arduinio and Raspberry Pi," International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering. Vol. 4, Issue 5, Pg.2320-3765; May 2015



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.423



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

9940 572 462 6381 907 438 ijirset@gmail.com



www.ijirset.com

Scan to save the contact details