International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 07 | July - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Prototype of Aquaculture Using IOT Technologies

DR. Rajalakshmi MC[1], Aishwarya TR[2], Arpitha MK[3], Impana HD[4]

[1]*DR. Rajalakshmi MC, Professor, Dept of Electronics and Communications, Vidya Vikas Institute of Engineering and Technology, Mysuru, Karnataka, India*

[2]*Aishwarya TR, Dept of Electronics and Communications, Vidya Vikas Institute of Engineering and Technology, Mysuru, Karnataka, India*

[3]*Arpitha MK, Dept of Electronics and Communications, Vidya Vikas Institute of Engineering and Technology, Mysuru, Karnataka, India*

[4]*Impana HD, Dept of Electronics and Communications, Vidya Vikas Institute of Engineering and Technology, Mysuru, Karnataka, India*

---***---

Abstract - The creation and deployment of an aquaculture monitoring prototype utilising Internet of Things (IoT) technology is presented in this study. By offering real-time monitoring and management of important water quality factors including temperature, pH, and dissolved oxygen levels, the system is intended to increase the efficiency of fish farming. Using sensors and a microcontroller unit, the suggested prototype wirelessly sends data to a cloud-based platform for analysis, visualisation, and storage. Users can access real-time data, get warnings, and make well-informed decisions from a distance using a web interface or mobile application. The system showed dependable performance in data collecting and communication throughout testing in a controlled aquaculture environment. The findings show increased monitoring precision and prompt intervention skills, which promote healthier aquatic life and better farm management.

Key Words: Internet of Things, fish farming, wireless sensor networks, real-time data, aquaculture, and water quality monitoring.

1. INTRODUCTION

Around the world, aquaculture is an essential source of food and revenue, particularly in areas where fish farming is prevalent. However, aquatic life's growth and well-being depend on maintaining appropriate water quality. Fish death and delayed action are frequent outcomes of laborious, time-consuming traditional monitoring techniques. This project suggests an automated water quality monitoring system that makes use of Arduino and Internet of Things technologies in order to tackle this problem. The system measures important characteristics like temperature, turbidity, pH level, and water level using a variety of sensors. For real-time monitoring and visualisation, these values are continuously gathered and transmitted to the ThingSpeak cloud platform. When the water quality gets dangerous, a bell instantly informs users.

Additionally, the system has an automated water valve to regulate water levels and cooling tubes to regulate temperature. This IoT-based method is a workable answer for contemporary fish farming since it increases productivity, decreases manual labour, and guarantees a safer aquatic environment. The design and development of a smart aquaculture monitoring system prototype based on the Internet of Things is presented in this project. Temperature, pH, turbidity, and water level sensors are among the many sensors that are interfaced with an Arduino Uno microcontroller in this system. Data from the aquaculture environment is continuously gathered by these sensors and sent to the Arduino for processing. Through a Wi-Fi module (ESP8266), the Arduino then transmits the data to the ThingSpeak cloud platform, enabling remote access and real-time visualisation from any device with an internet connection.

1.1 PROBLEM STATEMENT

Conventional aquaculture methods are time-consuming, labour-intensive, and prone to human error because they mainly rely on manual monitoring and intervention. Fish mortality, decreased yield, and higher operating expenses are frequently the results of inconsistent water quality management. Additionally, farmers do not have real-time knowledge of vital environmental factors that are necessary for sustaining aquatic life, such as temperature, pH, dissolved oxygen, and water depth. Fish farming operations are inefficient and have limited scalability due to the lack of automated systems and remote monitoring technologies. Therefore, in order to support sustainable and effective aquaculture management, a low-cost, Internet of Things (IoT)-based smart monitoring solution is required that can provide continuous, real-time data, enable remote access, and automate important activities.

1.2 LITERATURE REVIEW

1) Monitoring System for Smart Fish Farming Making use of IoT An Internet of Things (IoT)-based smart aquaculture system that tracks vital indicators including water temperature, pH, and ammonia levels was proposed by P. Singh et al. The system transmits data to a cloud platform for real-time monitoring through sensors that are coupled to a microcontroller. This method helps to improve fish health and productivity while guaranteeing farmers receive timely information. Benefit: Offers alert notifications and real-time monitoring. A disadvantage is the lack of automation in the water quality control systems and the restricted control features.

2) Aquaponics System with Automation Using IoT and Arduino

In order to monitor water quality and plant development circumstances, M. Kumar and his colleagues created a completely automated aquaponics system that integrates Arduino, Wi-Fi modules, and sensors. It maximises resource efficiency by enabling data-driven control of the aquatic and plant environment. Benefit: Integrates agriculture with aquaculture to promote sustainable farming. Cons: May not scale well in open water systems and needs to be calibrated frequently.

3) IoT-Powered Aquaculture Water Quality Monitoring

A sensor network system was presented by R. Das et al. for the ongoing monitoring of temperature, turbidity, and dissolved oxygen in fish ponds. For the convenience of farmers in remote locations, the data is shown via a mobile application. A low-cost solution that can be adopted in rural areas is an advantage. The accuracy of the data may be impacted by sensor drift and ambient noise.

4) Wireless Sensor Network for Managing Aquaculture Ponds

For remote pond monitoring, K. Sharma et al. suggested a wireless sensor network with GSM integration. Farmers can receive regular SMS updates regarding significant changes in water quality thanks to the technology. Benefit: Suitable for places with poor connectivity, it doesn't require internet access. Limitations in analytics and data visualisation are a drawback.

2. PROPOSED SYSTEM

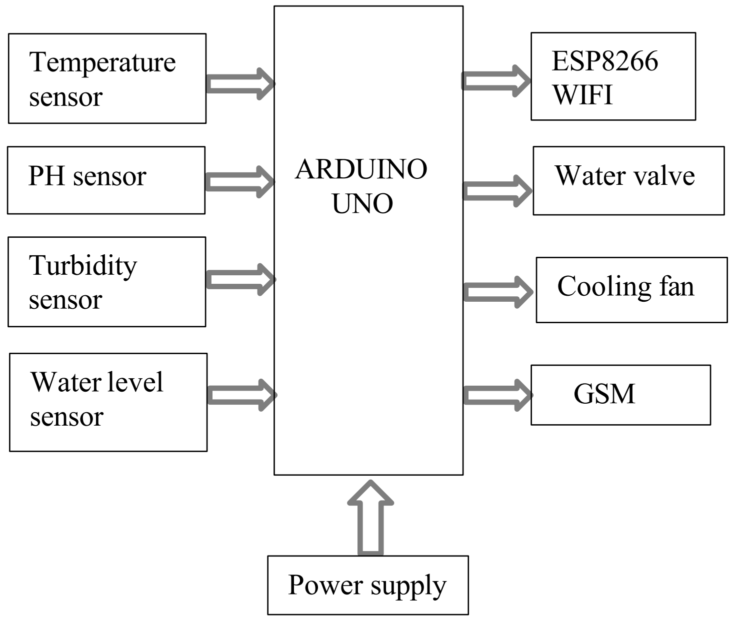

Figure 1: Block diagram of the proposed system

The above figure1 shows our suggested system uses Internet of Things (IoT) technology to provide an intelligent and economical aquaculture monitoring solution. Automating fish pond management and water quality monitoring is the main goal in order to maintain healthy aquatic life and maximise operational effectiveness. The system is made up of an Arduino Uno microcontroller that is connected to a number of sensors, such as those that measure water temperature, pH, and dissolved oxygen, as well as an ultrasonic sensor (JSN-SR04T) that measures water level or depth. These sensors gather data, which is then analysed and wirelessly sent to a local monitoring system or mobile application via a Bluetooth module.

Study	Parameters Monitored	Automation	Cloud Access	Estimated Cos
Islam et al. (2018)	Temperature, pH	No	Yes (ThingSpeak)	Low
Rahman et al. (2016)	Temperature, pH	No	No	Low
Kumar & Rajesh (2020)	Dissolved Oxygen	Yes	No	Medium
Proposed System (This Work)	Temp, pH, Turbidity, Water Level	Yes	Yes (ThingSpeak)	Low

Table 1: Monitoring system comparison

The prototype uses a rechargeable lithium battery to increase system autonomy, which makes it appropriate for remote pond settings. Based on real-time sensor readings, motors are integrated to enable autonomous garbage cleaning or aeration systems. A user-friendly dashboard or app provides access to alerts and statistics, enabling fish producers to act promptly. This technology guarantees ideal water conditions, minimises manual involvement, and supports sustainable aquaculture methods. It is made to be scalable, modular, and flexible enough to work in a variety of fish farming settings.

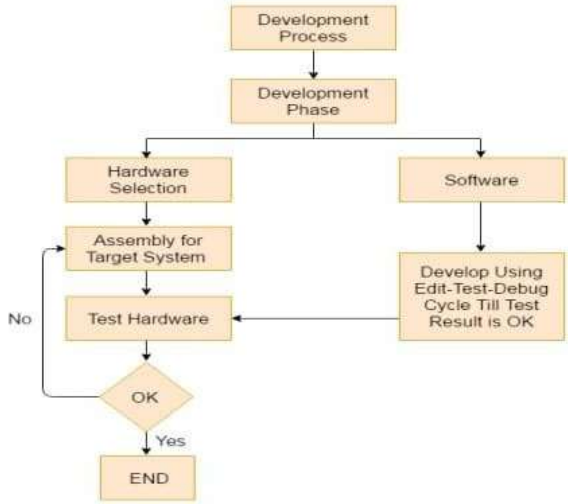

Figure 2: Flow Chart

1. Begin

The development process starts and enters the development phase.

2. Hardware and Software Branch

The development phase is divided into two parts: Hardware and Software.

3. Hardware Selection

The system selects appropriate hardware components required for the project.

4. Assembly for Target System

The selected hardware components are assembled to form the intended system.

5. Software Development

At the same time, the software is developed using the Edit → Test → Debug method.

The developer continues testing and debugging until the software runs properly.

6. Test Hardware

Once both hardware and software are ready, the hardware is tested to ensure it functions correctly with the software.

7. Is It OK?

If everything works correctly, the process moves to the end.

If not, it goes back to the previous steps to correct any issues and then re-test.

8. End

The development process ends once the hardware and software pass all tests successfully.

3. CONCLUSIONS

This project offers a working prototype of an Internet of Things-based smart aquaculture monitoring system. The system allows for real-time monitoring of important factors including temperature, pH, and dissolved oxygen by combining wireless connection, an Arduino Uno, and water quality sensors. Fish health is improved, manual labour is decreased, and sustainable aquaculture methods are supported by the motorised response mechanisms and automated data collection. All things considered, the prototype provides an affordable, scalable, and effective answer for contemporary fish farming applications.

4. Future scope

By including cloud connectivity for long-term analytics and remote data access, the suggested system can be further improved. In off-grid areas, adding solar power can increase system sustainability and energy efficiency. Decision-making and operational efficiency can be greatly enhanced by cutting-edge features like automated feeding, AI-based disease prediction, and integration with voice assistants or mobile alerts. Developing fully automated, intelligent aquaculture ecosystems can be facilitated by expanding the system to accommodate large-scale fish farms or multi-pond settings.

ACKNOWLEDGEMENT

The authors would like to sincerely thank Dr. Rajalakshmi M C for her essential advice, inspiration, and unwavering support during the project's development. We also express our gratitude to the Department of Electronics and Communication Engineering's faculty and staff for supplying the required materials and technical support. We would especially want to thank our peers and well-wishers whose helpful criticism improved the study work's prototype and documentation.

REFERENCES

[1] In 2020, P. Singh, R. Sharma, and A. Verma published "Smart Fish Farming Monitoring System Using IoT" in the International Journal of Engineering Research & Technology (IJERT), volume 9, issue 6, pages 102–106.

[2] "Automated Aquaponics System Using Arduino and IoT," International Journal of Scientific & Technology Research (IJSTR), vol. 9, no. 4, pp. 250–254, 2020; M. Kumar, A. Singh, and S. Bansal.

[3] "IoT-Based Water Quality Monitoring System for Aquaculture," Procedia Computer Science, vol. 167, pp. 515–524, 2020, R. Das, P. Roy, and S. Mondal.

[4] K. Sharma, M. Gupta, and T. Saxena, "Developing a Wireless Sensor Network for Intelligent Aquaculture Monitoring," International Journal of Advanced Research in Computer Science and Software Engineering, 2018; vol. 8, no. 11, pp. 44–49.

[5] In 2019, A. Verma and N. Patel published "IoT Enabled Decision Support System for Aquaculture Management" in the International Journal of Innovative Research in Science, Engineering, and Technology (IJIRSET), volume 7, issue 3, pages 456–462.

[6] In 2021, S. Ahmed and M. Alam published "A Low-Cost IoT Based Smart Aquaculture Monitoring System" in the Journal of Marine Science and Technology, vol. 26, no. 1, pp. 34–41.

7] S. Bhoi, P. Mishra, and S. Swain, “IoT Based Smart Aquaculture Monitoring System,” International Journal of Engineering and Advanced Technology (IJEAT), vol. 9, no. 3, pp. 398–402, Feb. 2020.

[8] B. Ramesh, K. Gopinath, and M. Venkatesh, “Design and Implementation of IoT Based Water Quality Monitoring System,” International Journal of Pure and Applied Mathematics, vol. 119, no. 16, pp. 3199–3205, 2018.

[9] "Smart IoT Based System for Real-Time Aquaculture Monitoring," International Journal of Computer Applications, vol. 182, no. 44, pp. 23–27, 2019, by S. Kundu and D. Ghosh.

[10] "Fish Farm Monitoring Using IoT," Materials Today: Proceedings, vol. 45, pp. 4672–4676, 2021, by A. T. Dinesh and V. J. Hemanth.

[11] "IoT-Based Real-Time Water Quality Monitoring," International Journal of Scientific & Engineering Research (IJSER), vol. 9, no. 4, pp. 98–103, April 2018. D. Manjula and R. Jayaprakash.