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Smart Fish Feeding and Water Quality Monitoring System

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ABSTRACT: This study addressed the limitations in manual aquaculture management in local fish ponds, which caused delays in monitoring and feeding. The system consists of an ESP32 microcontroller, pH, temperature, and turbidity sensors, a servo motor for automated feeding, SMS alerts, and a Firebase-connected mobile application for real-time control. Using a developmental-descriptive design and the Agile model, the system integrates automated feeding, real-time water quality monitoring, SMS notifications, cloud-based data storage, and a mobile app for remote

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management. Evaluation using ISO 25010 standards yielded a “Very High” rating (4.52), confirming its performance, accuracy, usability, and reliability.

KEYWORDS: Aquaculture management, Smart Fish Feeding, Water quality Monitoring, Agile Methodology, System Evaluation, ISO/IEC 25010.

I. INTRODUCTION

Aquaculture, mainly through fish farming, is a major source of animal protein, minerals, and vitamins, especially for the poorer nations. Conventional procedures like soaking the fish, changing the water, and hand feeding are extremely monotonous and labor intensive; moreover, they frequently result in problems of overfeeding, underfeeding, and water quality. Scientists have stated that pH, temperature, and turbidity, among other water parameters, are the most important factors that decide fish health, growth, and farm productivity overall. Manually feeding fish along with water quality monitoring can lead to a variety of negative outcomes such as feed wastage, insufficient nutrition, stress, and higher mortality rates. In the end, there are not significant changes in the situation since a lot of the fish farmers in the Philippines are still relying on such old methods which by doing so bring down their profits and make them less sustainable.

The development of the Smart Fish Feeding and Water Quality Monitoring System directly addresses these challenges by automating feeding and monitoring water quality in real time. The system uses an ESP32 microcontroller that can communicate with the pH, temperature, and turbidity sensors and has the capability of sending SMS alerts to users when necessary changes occur. Through the integration of automated feeding and environmental monitoring, the system not only saves labor but also lowers the chance of problems caused by water imbalance or overfeeding. In terms of fish health, feed, uniformity of growth rates, and farm productivity, this scheme harbors more than one advantage. Ultimately, it provides a practical and affordable solution for local aquaculture communities.

II. LITERATURE SURVEY

Aquaculture is an important element of global food supply, mainly by providing protein, vitamins, and minerals for people, especially in less developed countries. Manual feeding and visual water quality monitoring were the main practices in traditional fish farming; these are time-consuming and not efficient. The feeding done by hand often results in the wastage of feed and the fish getting less than the required amount of good quality food; this, in turn, affects the fish growth and productivity negatively. [4] pointed out that the fish health and the profitability of the farm can be adversely affected by these traditional practices.

Sustainable aquaculture operations heavily depend on the monitoring of water quality, which is a critical aspect thereof. The main water quality parameters that the fish are affected by positively or negatively are pH, temperature, and turbidity in that order. The traditional monitoring method with manual instruments is a slow and reactive process, which is a big barrier to preventing fish stress or illness. [5] highlighted that delayed interventions from traditional monitoring reduce farm efficiency.

The application of intelligent sensors and Internet of Things (IoT) technologies has improved fish farming management. The automated systems of feeding control the use of feed and at the same time provide the fish with the required nutrition pretty much without interruptions. Real-time water monitoring allows timely intervention to maintain optimal environmental conditions. [1] reported that IoT-based systems significantly enhance fish growth and operational efficiency.

Precision feeding systems have also been shown to reduce feed waste and improve productivity. Smart control systems schedule feeding based on fish behavior and pond conditions. Automation reduces the possibility of human mistakes and enables uniformity in managing farms. According to [2], systems that feed through sensors make the best use of feed, and thus, the whole aquaculture performance becomes better.

Local fish farmers, regardless of the technology, have not changed their ways of working and still depend on the old manual methods. This reliance causes various issues such as inconsistent feeding, bad water quality, and thus higher

mortality rates among the fish. Affordable and practical solutions tailored to local aquaculture communities remain limited. [3] stressed the need for smart systems to improve farm efficiency and fish health sustainably.

Table 1. Summary of Relevant Literature

No.	Paper Title	Author Name	Key Points	Remarks
1	Design and development of feeding automation system and water quality monitoring on freshwater fish cultivation	Zuriati et al., 2022	Manual feeding causes feed wastage, poor nutrition, and low productivity	Highlights limitations of conventional feeding
2	An innovative real-time water quality monitoring system for aquaculture application. ARPN Journal of Engineering and Applied Sciences	Dayaday & Namoco, 2021	Handheld monitoring is slow, reactive, and reduces efficiency	Shows need for timely and automated monitoring
3	Automated control and IoT-based water quality monitoring system for a Molobicus tilapia recirculating aquaculture system	Libao et al., 2024	IoT systems optimize feeding and improve fish growth	Supports adoption of automated systems
4	Feeding control and water quality monitoring in aquaculture systems:Opportunities and challenges	Aljehani et al., 2023	Automated feeding reduces waste and improves performance	Demonstrates benefits of sensor-based feeding
5	Important water quality parameters in aquaculture: An overview. Agriculture and Environment	Verma et al., 2022	Monitoring pH, temperature, and turbidity prevents stress and mortality	Emphasizes importance of real-time water monitoring

In conclusion, the literature indicates that conventional aquaculture practices are limited by manual feeding and water monitoring, leading to inefficiency and higher fish mortality. The advancements in IoT-based solutions and smart monitoring devices have also been the main contributors to higher feeding efficiency, better management of water quality, and increased productivity of farms in general. The Smart Fish Feeding and Water Quality Monitoring System bridges the gap by providing a solution that is automated, real-time, and reliable, tailored to the needs of local aquaculture.

III. METHODOLOGY

Research Design

The research employs a developmental research design coupled with the Agile methodology as a framework for the development of the Smart Fish Feeding and Water Quality Monitoring System. The method allows the execution of technology-oriented projects that need constant upgrades through the processes of planning, execution, testing, and receiving feedback in cycles. Agile methodology is flexible and allows user interaction during development. The study

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entails setting requirements, system design, hardware and software component development, and technical and user testing. Deployed in Barangay Union, Madrid, Surigao del Sur, the study hopes to reach small-scale fish pond owners to make the system operational and usable in real aquaculture practice.

Instrument

To measure the software quality of the Smart Fish Feeding and Water Quality Monitoring System, this study adopted the ISO 25010 framework for software validation to ensure that the system met internationally recognized standards. A five-point Likert scale questionnaire was administered to the selected respondents to collect quantitative feedback on key software quality attributes, including functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability.

Data Collection and Participants

Data was gathered from a purposive sample of 50 respondents who were either participating in or had knowledge about aquaculture practices. The respondent group was made up of 10 local fish farmers of Brgy. Union, Madrid, Surigao del Sur, 30 students, and 10 IT practitioners, who were the main respondents due to their practical experience or knowledge of fish pond management and system application. The variety of this group made certain that the assessment received both the practical and technical points of view.

Data Analysis

The quantitative data gathered from the evaluation of Smart Fish Feeding and Water Quality Monitoring System were analyzed using the following statistical treatments:

1. **Weighted Mean:** Determined to find out the average rating for each software quality attribute according to the ISO 25010 framework, which consists of functionality, usability, reliability, and performance efficiency.
2. **Qualitative Interpretation:** The mean scores were divided into descriptive levels (e.g., 4.21–5.00 was classified as "Very High") to evaluate the degree of user satisfaction and acceptance of the system.
3. **Performance Verification:** Testing was performed in a systematic manner on the responsiveness of the sensors, accuracy of automated feeding, and water quality monitoring in real-time to ensure that the system could perform reliably even under different pond conditions.
4. **System Logs and Observation:** The analysis of the recorded user interactions and sensor data was done to confirm the system's functionality, responsiveness, and ease of use.

IV. RESULTS AND DISCUSSION

The Smart Fish Feeding and Water Quality Monitoring System effectively enhances aquaculture management. The main features consist of Automatic Fish Feeding by means of a servo motor that handles feeding with great precision and at the right time, the Monitoring of Water Quality in Real-Time regarding the parameters of pH, temperature, and turbidity which are great for the pond' s conditions, SMS Alert Notifications for the immediate informing of users concerning the critical changes, Cloud-Based Data Storage through Firebase for keeping the records securely and providing access to them easily, and Mobile Application Control for the remote monitoring and management of the fishes pond environment. All these features collaborate to lessen the need for labor to be done manually, keep the aquatic conditions right for the living beings, and raise the operational efficiency. The system received a "Very High" rating overall, with a mean score of 4.52. The software quality attributes that were assessed showed that accuracy had the highest score of 4.61, followed by usability (4.60), functionality (4.47), and reliability (4.40), which are the user-friendliness, consistent performance, secure data handling, and high accuracy of the system.

Table 2. Performance Evaluation System Tabulation

Table	Quality Characteristics	Mean	Verbal Interpretation
1	Functionality	4.47	Strongly Agree
2	Reliability	4.40	Strongly Agree
3	Usability	4.6	Strongly Agree
4	Accuracy	4.61	Strongly Agree
	Over-All Mean	**4.52**	**Strongly Agree**

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V. CONCLUSION

The Smart Fish Feeding and Water Quality Monitoring System effectively provides an automatic, reliable, and efficient tool for fish farmers by integrating an ESP32 microcontroller and an automated feeder with temperature, pH, and turbidity sensors. With the system eliminating manual labor, providing real-time water data that is precise, and aiding in fish health maintenance, it is all going towards better farm productivity. Similarly, to correlated research, the adoption of automation and IoT in aquaculture improves feeding correctness, water checking, and pond management in general while significantly reducing human mistake and time consumption. The outcome indicates that the system created is a practical and powerful answer for intelligent and productive fish farming.

REFERENCES

[1] Libao, F. J. D., Villaverde, O. S. M., De Luna, N. A. P. U., Comedia, V. J. G., Luna, M. O., Atienza, A. M. C., & Espeña, G. D. (2024, April). *Automated control and IoT-based water quality monitoring system for a Molobicus tilapia recirculating aquaculture system (RAS).* In *2024 IEEE Conference on Technologies for Sustainability (SusTech)* (pp. 410–415). IEEE. https://doi.org/10.1109/SusTech60925.2024.10553538

[2] Aljehani, F., N'Doye, I., & Laleg-Kirati, T. M. (2023). *Feeding control and water quality monitoring in aquaculture systems: Opportunities and challenges. arXiv preprint* arXiv:2306.09920. https://doi.org/10.48550/arXiv.2306.09920

[3] Verma, D. K., Satyaveer, N. K. M., Kumar, P., & Jayaswal, R. (2022). *Important water quality parameters in aquaculture: An overview. Agriculture and Environment, 3*(3), 24–29. https://www.researchgate.net/publication/368755962

[4] Zuriati, Z., Supriyatna, A. R., & Arifin, O. (2022, April). *Design and development of feeding automation system and water quality monitoring on freshwater fish cultivation.* In *IOP Conference Series: Earth and Environmental Science* (Vol. 1012, No. 1, p. 012077). IOP Publishing. https://doi.org/10.1088/1755- 1315/1012/1/012077

[5] Dayaday, M. G., & Namoco, C. S. Jr. (2021). *An innovative real-time water quality monitoring system for aquaculture application. ARPN Journal of Engineering and Applied Sciences,16*(24),112–117. https://www.arpnjournals.org/jeas/research_papers/rp_2021/jeas_1 221_879 8.pdf

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