

FISH VISTA: Comprehensive intelligent Fish Farming Assistant And Automation

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ABSTRACT: Aquaculture plays a significant role in global food production, but traditional fish farming relies on manual monitoring and fixed feeding schedules, which often lead to poor water quality, fish diseases, and economic losses. This paper proposes FISH VISTA, an intelligent fish farming system that integrates Internet of Things (IoT), automation, and cloud-based analytics. The system continuously monitors key water parameters such as temperature, pH, dissolved oxygen, and turbidity using sensors. The collected data is processed through a microcontroller and transmitted to a cloud platform for real-time monitoring and alerts. Additionally, an automated feeding mechanism ensures optimal feed distribution. The proposed system reduces manual effort, improves monitoring accuracy, and enables timely decision-making. Experimental results indicate improved fish survival rate, reduced feed wastage, and increased overall productivity, making the system suitable for sustainable aquaculture practices.

KEYWORDS: Aquaculture, IoT, Smart Fish Farming, Water Quality Monitoring, Automated Feeding, Cloud Computing

I. INTRODUCTION

Fish farming is an important sector for food production, but traditional methods rely on manual observation, making them inefficient and error-prone. This creates a need for automation and real-time monitoring to improve fish health and productivity. The main problem is the lack of continuous monitoring, which can lead to poor water quality, fish diseases, and financial losses. To address this, the system aims to monitor water quality in real time, automate the feeding process, provide alerts for abnormal conditions, and improve productivity while reducing losses. It is designed for small to medium-scale fish farms, but its performance depends on sensor accuracy and stable internet connectivity. This paper includes a literature review, system design, implementation, testing, experimental results, and conclusion.

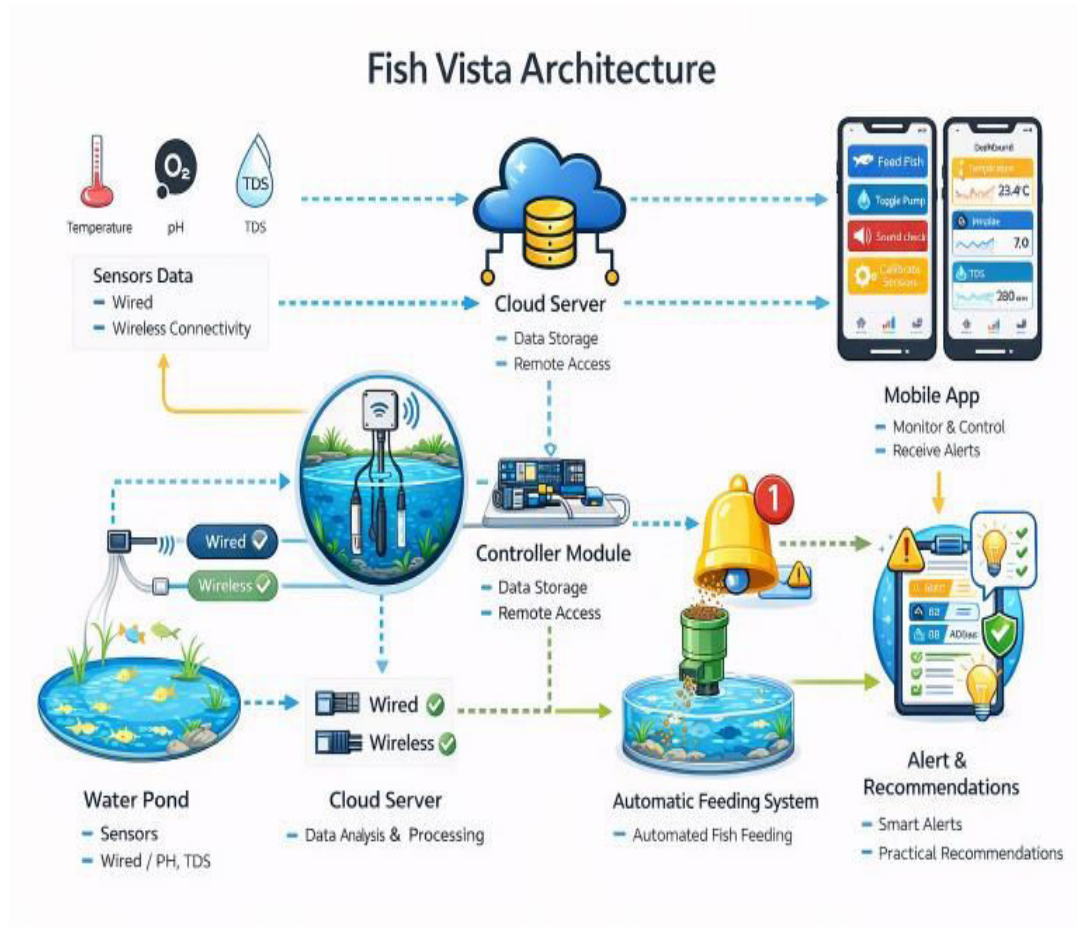
II. LITERATURE REVIEW

Literature Review

Sr.No.	Authors & Year	Title of paper	Description
1	Narayana Darapaneni, S. Sreekanth, et al. (2022)	AI-Based Farm Fish Disease Detection System to Help Micro and Small Fish Farmers	his study presents a mobile-optimized Convolutional Neural Network (CNN) integrated with IoT sensors to detect fish diseases. The system provides real-time alerts and treatment recommendations via a cloud based interface, aiding small-scale fish farmers in disease management.
2	Yang et al.(2024)	Precision Aquaculture: Empowering Fish Farming with AI and IoT	The paper discusses the integration of AI's data analysis capabilities with IoT's realtime monitoring tools, such as bionic robots and remote cameras, to enhance automation in aquaculture. This approach aims to significantly reduce or eliminate risks associated with fish diseases.

3.	A.W. Al-Mutairi (2023)	IoT-based Smart Monitoring and Management System for Fish Farming	This research focuses on the design and implementation of an IoT -based system for real-time monitoring, control, and management of fish farming. The system aims to transition from traditional manual methods to automated solutions for better disease prevention.
4.	H. Rastegari (2023)	Internet of Things in Aquaculture: A Review of the Challenges and Potential Solutions	This review categorizes the challenges associated with implementing IoT systems in aquaculture and provides potential solutions based on current and future trends, highlighting the role of IoT in disease prevention
5.	S. Zhao (2021)	Application of Machine Learning in Intelligent Fish Aquaculture	The paper explores the application of machine learning techniques in intelligent fish aquaculture, focusing on feature extraction in underwater images and the selection of appropriate algorithms for disease detection.

III .SYSTEM ARCHITECTURE



The FISH VISTA system is designed as an integrated smart fish farming solution that combines sensors, a processing unit, cloud technology, and a user interface. It consists of multiple modules, including a sensor module that measures water parameters such as temperature, pH, and dissolved oxygen, a processing unit like Arduino Uno or Raspberry Pi for data handling, cloud storage for data management, a mobile or web application for user access, and an automated feeder for controlled feeding.

The system requires essential hardware components such as sensors, a microcontroller, and a Wi-Fi module, along with software components like a cloud platform and a mobile application for monitoring and control. In terms of methodology, the system uses IoT-based sensors to continuously monitor water quality parameters. The collected data is processed by the microcontroller and transmitted to the cloud for real-time tracking and alert generation. The automated feeding system ensures timely and accurate feed distribution, reducing manual effort and improving overall farm efficiency and productivity.

IV. IMPLEMENTATION

The implementation of the FISH VISTA system is carried out using a combination of hardware and software technologies. It uses platforms like Arduino Uno or Raspberry Pi, along with IoT sensors to collect water quality data. Cloud platforms such as Firebase or ThingSpeak are used for storing and analyzing data. Programming is done using languages like C and Python to control system operations.

The system applies key techniques such as sensor data collection, real-time data transmission to the cloud, and automation logic for managing the feeding process. These techniques ensure continuous monitoring and quick response to changing conditions.

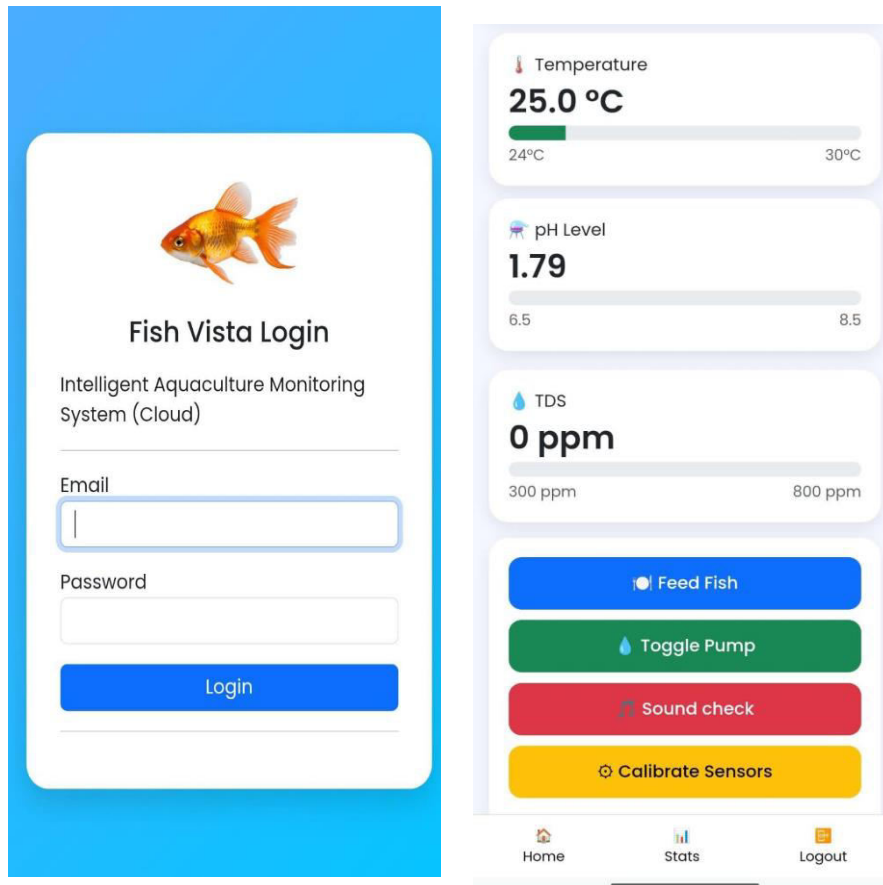
The overall process begins with sensor setup in the fish tank, followed by continuous data collection. This data is then integrated with the cloud platform for remote monitoring. A mobile or web application is developed for user interaction, and finally, the system undergoes testing to ensure accurate performance and reliability.

V. TESTING AND EVALUATION

The system is tested and evaluated using different methods to ensure reliability and performance. Unit testing is carried out to check individual components such as sensors, processing units, and the feeder. Integration testing is performed to verify proper communication between modules like sensors, cloud, and application. Finally, system testing evaluates the complete working of the FISH VISTA system in real-time conditions.

Several test cases are conducted, including sensor accuracy tests to ensure correct readings of temperature, pH, and oxygen levels, feeding system tests to verify proper and timely feed distribution, and alert system tests to confirm instant notifications during abnormal conditions.

The system shows improved performance by providing more accurate monitoring, reducing manual work, and enabling faster response to issues. However, some challenges remain, such as the need for proper sensor calibration and dependence on stable network connectivity for real-time data transmission.



VI. RESULTS AND DISCUSSION

The results and discussion show that the FISH VISTA system provides accurate real-time monitoring of water parameters, which helps in maintaining a healthy environment for fish. This leads to reduced fish mortality and more efficient feed management.

The interpretation of these results indicates that automation significantly improves efficiency and minimizes human errors in fish farming operations.

In comparison to traditional methods and partial solutions, the system performs better by offering an integrated approach, ensuring continuous monitoring, timely feeding, and faster response to issues.

VII. CONCLUSION AND FUTURE WORK

The conclusion of this work shows that FISH VISTA provides a smart and efficient solution for fish farming by using IoT and automation. It enables real-time monitoring, improves productivity, reduces losses, and supports sustainable aquaculture practices.

For future work, the system can be enhanced by adding AI-based disease prediction for early detection of fish health issues, improving the mobile application for better user experience and control, and integrating weather forecasting to make more informed farming decisions.

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