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SMART ACQUAFARMING: REVOLUTING FISH FARMING WITH IOT AND AI

Capstone project proposal report

Supervised by:

Dr. Md. Ashraful Islam

Professor

Department of Computer Science and Engineering (CSE)

Deen, Faculty of science and engineering

University of Information Technology and Sciences

Submitted by:

Name	Student Id
Md. Shakibul Islam Ramim	2125051063
Md. Nahian Islam Emon	2125051114
Fazlay Rabbi	2125051070
Sumi Akter	2125051037

Department of Computer Science and Engineering

University of Information technology and Sciences

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INDEX

1. Introduction

Smart aquafarming represents a significant leap in the evolution of fish farming. By integrating IoT and AI technologies, fish farms can now operate with greater efficiency and precision. This project aims to modernize traditional fish farming practices through the deployment of sensors and automated systems to monitor water quality, optimize feeding, and improve fish health.

2. Problem Statement

The traditional fish farming industry faces a number of challenges that hinder optimal production and sustainability. Some of these challenges include:

- Limited water quality control
- Inefficient feed utilization
- High disease prevalence
- Environmental impacts and inconsistent fish quality
- Lack of integrated monitoring, energy loss, and excessive costs
- High labor costs

3. Objectives

The main objectives of the Smart Aquafarming project are:

- Optimize water quality management using IoT sensors.
- Maximize feed efficiency through automation.
- Enhance disease detection using AI-driven algorithms.
- Enable continuous monitoring and predictive reporting.
- Increase productivity and reduce costs.

4. Literature Review

- The potential benefits of IoT sensors in smart aquafarming are well documented. Studies have shown that real-time water quality monitoring can reduce fish mortality by up to 30% [1].
- Optimized feeding schedules powered by IoT systems can reduce feed waste by 15-20%.
- Automated water and oxygen control mechanisms can reduce energy use by 25%, promoting more sustainable practices [2].
- Furthermore, predictive analytics allow farmers to optimize growth and harvesting, reducing operational costs by 10-15% [2].

5. Methodology

The methodology for this project is broken down into several key steps:

- Project Planning: Define objectives, conduct research, and estimate the budget.
- -Selection of IoT Components: Sensors for monitoring water parameters (O2, pH, temperature), smart valves for feeding, air pumps
- System Design and Architecture: Network infrastructure, cloud-based data storage, and control system development
- Installation of Sensors: Deploying sensors in fishponds/tanks and connecting them to controllers (e.g., Raspberry Pi)
- Software Development: Building the interface (mobile/web app), firmware for real-time data visualization, and alert systems.
- Testing and Calibration: Sensor calibration and system testing before full deployment.
- Deployment and Monitoring: Continuous system monitoring and performance evaluation

6. Results Framework

Inputs	Activities	Output	Impacts
Hardware: IoT sensor: water quality senors, temperature, pH, dissolved oxygen, Light sensor, smart valves for feeding control, air pumps, WiFi module and internet access **Software components:** AWS IoT, Mobile Application development	• Install IoT sensors in the fish tanks to monitor water quality • Integrate an automatic feeding system controller by sensors and a microelectronic. • Set up an oxygen pump system to maintain optimal oxygen levels, activated automatically. • Develop a control system to collect and analyze sensor data and trigger actions. • Create a mobile app for remote monitoring and control.	• A functioning smart fish farming system with real-time water quality monitoring. • Automated feeding based on fish's growth stage and consumption patterns. • automated oxygen pump that activates based on dissolved oxygen levels. • A centralized dashboard for users to monitor and control the fish farm remotely. • Alerts for abnormal water conditions or equipment malfunctions.	• Higher fish yields and improved profitability for the fish farm. • Sustainable and Eco-friendly fish farming practices. • Better quality of fish, leading to improved market value. • Contribution to the global push for smart agriculture and aquaculture. • Enhanced food security through increased fih production.

7. Logical Device

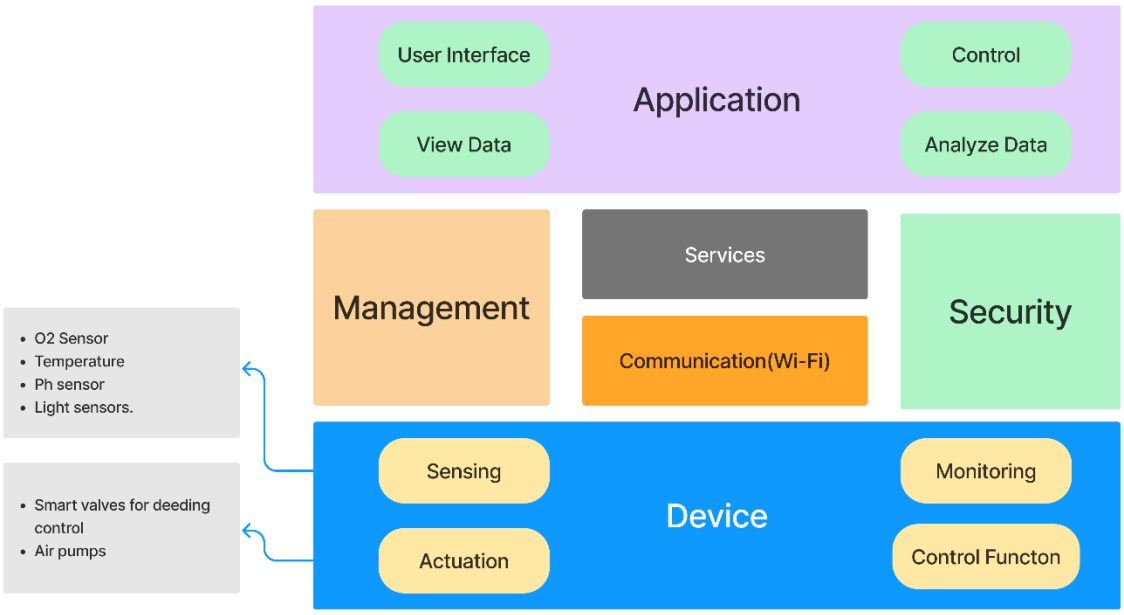
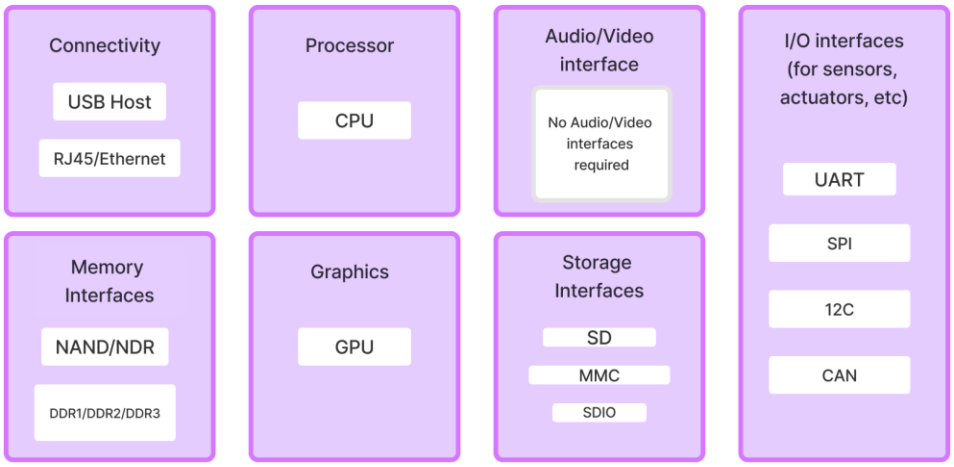


Figure: Logical diagram of Smart Fish farming

8. Physical Diagram



General block Diagram of our project

9. Expected Outcomes

Upon successful completion of the project, the following outcomes are expected:

- Development of a functional smart fishery prototype
- Early disease detection through AI models and predictive analysis
- Improved fish health and growth rates
- Reduced feed waste, lowering overall feeding costs.
- Performance evaluation report and a marketplace website for buying/selling fish.

10. Budget Estimation

No	Item Name		Price per unit	Quantity	Total amount BDT
1	Bread Board		420	1	420
2	Sensors		1000	4	4000
3	Wi-Fi module		530	1	530
4	Electrical Components		1050	1	1050
5	Micro Controllers		1500	2	3000
6	Others		2270	1	2500
				Total=	12,500

11. Timeline

The project is expected to follow the below timeline:

- Project planning: 1 month
- System design: 1 month
- Development: 1 month
- Testing: 1 month
- Deployment and monitoring: 1 month
- Training and optimization: 2 months

12. Conclusion

The Smart Aquafarming project seeks to revolutionize fish farming by integrating IoT and AI technologies. This project will empower fish farmers with real-time monitoring capabilities, automation for feeding and oxygen control, and data-driven insights to optimize fish health and productivity. With sustain-

able practices at its core, this project has the potential to significantly enhance the profitability and environmental friendliness of fish farms.

13. References

- [1]Kiruthika, S. Usha, S. R. Kanaga, and R. Jaichandran. "IOT based automation of fish farming." *J. of Adv. Res. in Dynam. Control Syst* 9.1 (2017).
- [2]Chen, Chiung-Hsing, et al. "IoT-based fish farm water quality monitoring system." *Sensors* 22.17 (2022): 6700.
- [3]Nocheski, S., and Andreja Naumoski. "Water monitoring IoT system for fish farming ponds." *Industry 4.0* (2018).

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