Development Of IoT Based Fish Monitoring System For Aquaculture

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Abstract

Aquaculture, which involves cultivating aquatic organisms for commercial, recreational, and public purposes, plays a vital role in Bangladesh's economy. This paper proposes an Internet of Things (IoT) based system designed to enhance fish production and maintain a healthy aquatic environment.. The system utilizes devices equipped with sensors to monitor crucial water parameters, including pH levels, water temperature, dissolved oxygen levels, and ammonia levels. An android- based mobile application has been developed to notify farmers, fishermen, and aquaculture professionals about these parameters, enabling them to take necessary steps to prevent disturbances in the aquatic environment. By leveraging this technology, fish farmers in Bangladesh can improve their practices, increase productivity, and contribute to the country's economy. Currently, many fisheries in Bangladesh lack the expertise to provide optimal conditions for fish growth, but this system can help bridge that gap by providing valuable insights and guidance.

Keywords: *Aquaculture; android application; IoT; sensors; dissolved oxygen; pH level; temperature; water pollution; fish health; fish farmers.*

Software:- Arduino IDE

1. Introduction

Aquaculture plays a vital role in Bangladesh's economy and food security. In this system, fish are raised in confined artificial water bodies, such as tanks, where water quality can quickly decline, affecting fish growth and health. Maintaining optimal water quality is crucial for successful aquaculture. An innovative approach to enhancing fish production and economic value is presented in this paper, which proposes a cutting-edge Internet of Things (IoT) based system. This system is designed to monitor and maintain optimal water quality, thereby promoting healthy fish growth and reducing losses. By leveraging IoT technology, fish farmers can improve productivity, increase economic returns, and contribute to sustainable aquaculture practices. The system utilizes sensors to track key water parameters, including pH levels, water temperature, dissolved oxygen levels, and ammonia levels. An Android-based mobile application has been developed to notify farmers, fishermen, and aquaculture professionals about these parameters, enabling them to take necessary steps to prevent disturbances in the aquatic environment.

By leveraging this technology, fish farmers in Bangladesh can improve their practices, increase productivity, and contribute to the country's economy. Despite being a riverine country with significant fish farming potential, Bangladesh's fisheries often lack expertise in providing optimal conditions for fish growth. This system can help

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bridge that gap, supporting the growth of a sustainable and thriving aquaculture industry.

2. Material

2.1 Ph Sensor:

Fig1: Ph Sensor

Ph sensors are crucial tools for ensuring the safety and quality of products and processes in various industries, including wastewater treatment and manufacturing plants. These sensors measure the acidity or alkalinity of water and other solutions, making them essential for water quality monitoring. The use of pH sensors is instrumental in preventing potential issues and maintaining optimal conditions in aquatic environments. By providing accurate pH readings, these sensors enable prompt action to address any imbalances, thereby supporting healthy aquatic ecosystems and promoting optimal water quality.

2.2 Temperature Sensor

Fig2: Temperature Sensor

Temperature sensors, such as thermocouples or resistance temperature detectors, provide temperature measurements in a readable form through electrical signals. Thermometers, the most basic form of temperature meters, measure the degree of hotness and coolness. These devices are widely used in the geotechnical field to monitor concrete, structures, soil, water, bridges, and other infrastructure for structural changes caused by seasonal variations.

2.3 Turbidity Sensor

Fig3: Turbidity Sensor

Turbidity sensors measure the cloudiness or haziness of a liquid, typically to determine water quality, by detecting the amount of light scattered by suspended solids. The measurement technique used depends on the sample's characteristics: light transmission is suitable for samples with high amounts of total suspended solids (TSS) and total dissolved solids (TDS), while light scattering is better for samples with low amounts. To ensure accurate measurements, it's essential to minimize external light interference, as turbidity sensors rely on light to detect turbidity levels.

2.4 Circuit Diagram :

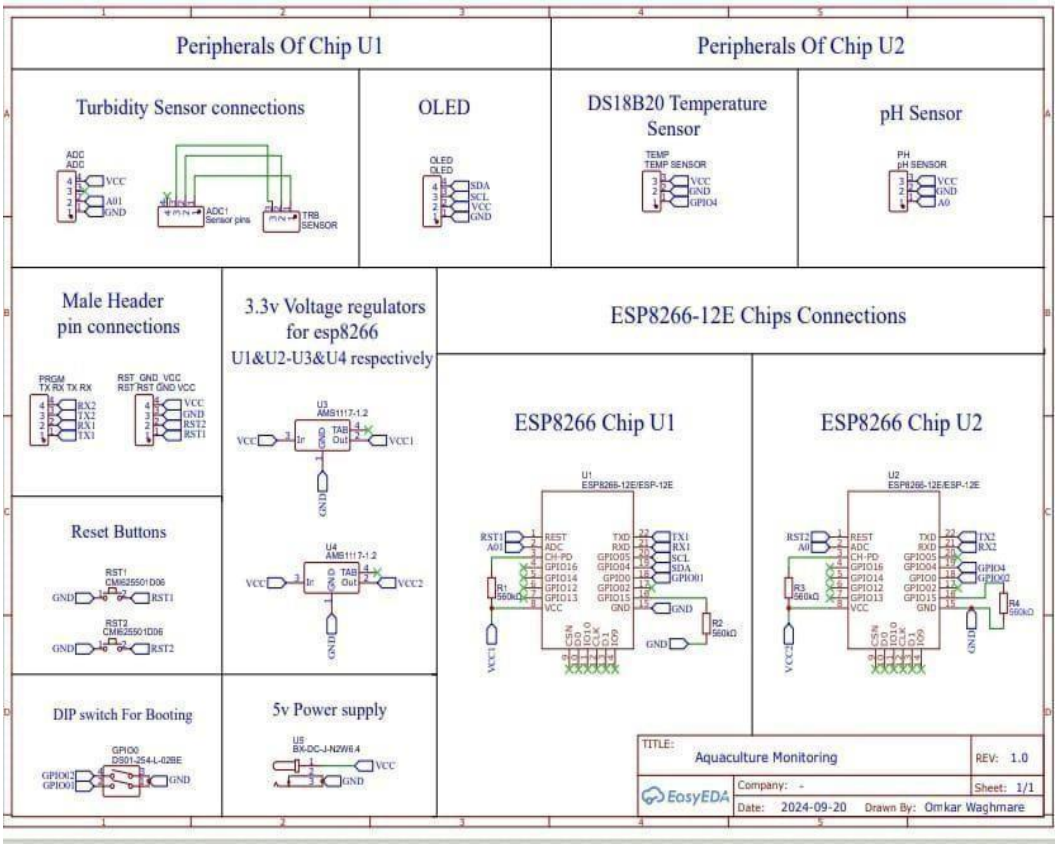

Fig 4:Circuit Diagram

Sensors are connected to the microcontroller's analog input pins to measure water temperature, pH, dissolved oxygen, turbidity, and fish detection. The microcontroller processes the sensor data and sends it to the communication module. The communication module transmits the data to the cloud or a remote server via Wi-Fi or Bluetooth. The power supply provides power to the system. The breadboard or PCB connects the components together.

3. Methodology

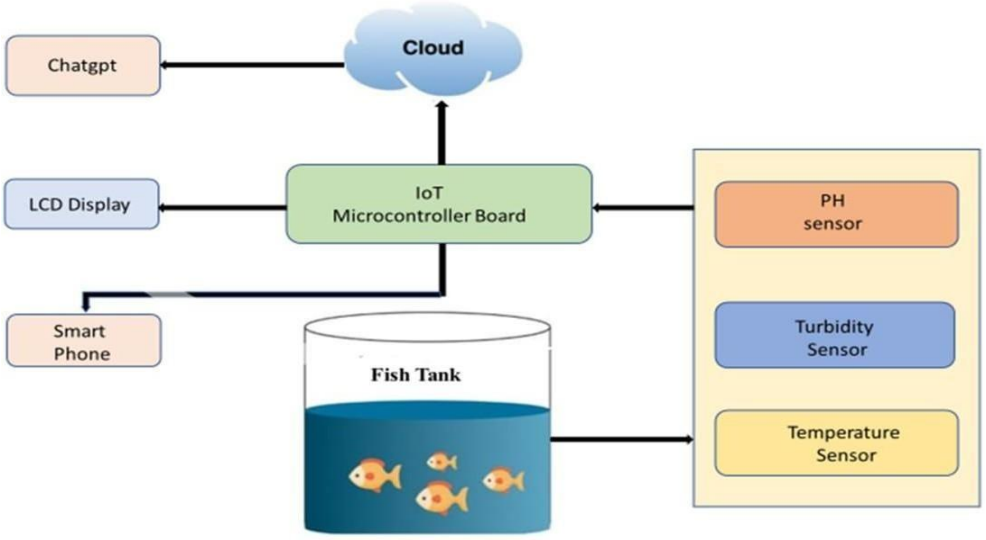

Fig 5: Block Diagram Of Development Of IoT Based Fish Monitoring System For Aquaculture.

In the context of the IoT-based fish monitoring system, a block diagram provides a visual representation of the various components and their connections. The diagram consists of several key blocks, including Sensors, Microcontroller, Communication Modules, and Cloud Services. The Sensors block represents the devices that collect data on water quality and fish behavior. The Microcontroller block is the brain of the system, processing sensor data and controlling communication. The Communication Modules block transmits data to the cloud or other remote locations, while the Cloud Services block stores, analyzes, and provides insights on the collected data. The block diagram plays a crucial role in understanding the system's functionality by illustrating the relationships between its various components. By visually representing the interactions and interconnections between these components, the diagram provides a clear and concise overview of the system's architecture and workflow.

4. Hardware Implementation & Result

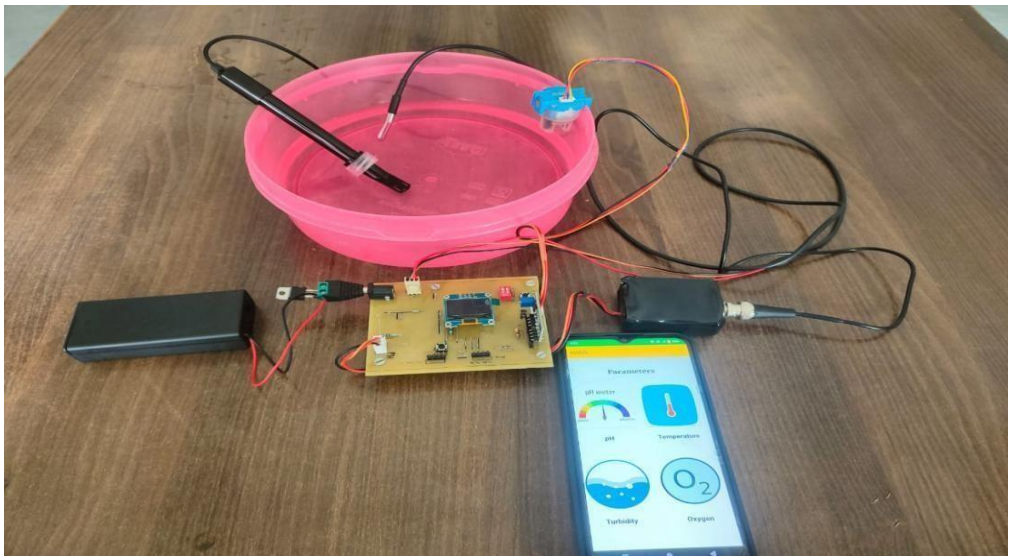

Fig 6: Hardware Design

4.1 Result:

4.1.1 Ph Sensor:

Fig 7: Output Of Ph Sensor

To measure the pH value of water, a pH sensor is submerged in the water, collecting data and transmitting it to a mobile application via a Wi-Fi module. In the pH section of the application's interface, the measured pH level of the pond water is displayed in real-time. For example, a current reading shows a pH value of 7.03.

4.1.2 Temperature Sensor:

Fig 8: Output Of Temperature

To measure the water temperature, a temperature sensor is submerged in the water, The temperature value is transmitted to the application via a Wi-Fi module, where it is displayed in the temperature section. This real-time data transmission enables users to monitor temperature fluctuations and make informed decisions. This setup allows for real-time monitoring of water temperature, which is crucial for maintaining optimal conditions for fish health and growth.

4.1.3 Turbidity Sensor

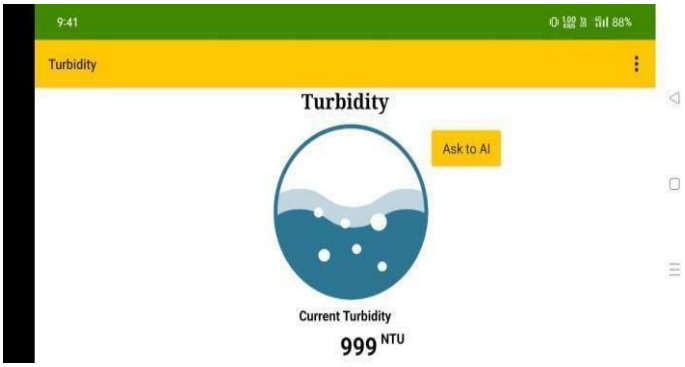

Fig 9: Output Of Turbidity Sensor

A turbidity sensor measures the cloudiness or opacity of a fluid, typically water, by detecting the amount of light scattered by particles in the water. This scattered light measurement indicates the level of turbidity, providing a quantitative assessment of water clarity.

5. Conclusion

This research proposes an innovative IoT-based aquaculture system designed to enhance water quality monitoring for the fishing industry. Key parameters such as temperature, pH levels, oxygen supply, and dissolved ammonia levels are closely tracked to ensure optimal conditions for aquatic life. By leveraging this technology, the system aims to boost profitability, productivity, and sustainability in aquaculture, ultimately benefiting both public health and the economy in Bangladesh. To further support this sector, government intervention is crucial, including strategic investments, stringent environmental regulations, and effective communication channels between farmers, fishermen, and stakeholders. By adopting these measures, Bangladesh can effectively address the rising demand for fish and promote a thriving aquaculture industry.

6. Conflict of Interest

The authors declare that they have no conflict of interest.

7. Funding Declaration

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Ms.Pratiksha Lingadev Babar is currently pursuing a Bachelor of Engineering degree in Electronics and Telecommunication Engineering at Dr. Babasaheb Ambedkar Technological University, Lonere, Maharashtra, India. Her core academic interests lie in the fields of embedded systems, Internet of Things (IoT)-based applications, and smart automation technologies. With a solid foundation in programming, particularly in C and Java, she is passionate about applying technical knowledge to develop practical, real-world solutions that address current challenges in sustainability and automation.