Chapter 16
Emerging Engineering Technologies:
Design, Development, and Industrial Applications of IoT-Based Aquaculture Monitoring System

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ABSTRACT

India is the third-largest fish producer in the world and the second-largest aquaculture country after China. The Indian Blue Revolution highlighted the significance of the aquaculture and fishing industries. This industry is viewed as one that is growing and has the potential to have a significant impact on India. For aquatic life to remain healthy, water quality monitoring is essential. Traditional methods for water quality monitoring involve manual sample collection and complex procedures. They are ineffective, expensive, lack real-time monitoring, and require laboratory testing. To address these issues, the proposed method for monitoring the water quality in aquaculture uses IoT to determine the pH value of the water, which can identify poor water quality that may result in disease or negatively impact living things. Similar to early water quality detection, which prompts the owner to take the proper action, this strategy alerts the owner.

INTRODUCTION

Fresh water management is essential due to India's rapidly expanding population, which is driving up agricultural, industrial, and other demands. Fresh water's "chemical, physical, and biological" composition dictates its quality. Monitoring the quality of the water helps identify contaminants, dangerous chemicals, and pollution. The traditional method, which is still used today, entails gathering water samples,

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analyzing them in a lab, and making suggestions for water treatment, among other things. The current method for monitoring water pollution consists of three basic steps: -

1. Water sampling
2. Sample testing
3. Investigational analysis

All three steps are ineffective, extremely expensive, difficult, and time-consuming. They also demand expert advice. Because of this, rather than relying on a manual process, automation may now be used to monitor water quality and take appropriate action. This has led to some technological advancement in water quality monitoring, which will help to monitor water quality rather than relying on human processes. A small amount of research has been done on the use of machine learning techniques in water standard monitoring in addition to the use of technology to monitor water quality. A subset of artificial intelligence (AI) called machine learning enables machines to learn without having to be logically organized. In one of the studies that used machine learning to track the water quality in rivers, Least Squares Vector Machine was employed. As a result, we have developed an intelligent Internet of Things-based water quality monitoring system that uses a PH sensor and a TDS meter to regularly collect water parameters from different types of water. This is due to the development of machine-to-machine interaction, which leads to the Internet of Things with devices that interact with each other without human intervention.

Through serial communication with the Raspberry Pi 3, these water characteristics are gathered and supplied to the microcontroller. The Pi3 CPU was used to run the K-Means clustering algorithm, which divided the water frameworks into various groups based on pH and TDS. The data set was then trained to determine whether the water quality was good or bad. In order for water authorities to take action, this information is posted on the cloud's website. This was developed as a prototype using the Raspberry Pi 3 and Arduino. It is becoming more and more important to monitor water qualities and characteristics like pH, temperature, and turbidity as the aquaculture industry expands. Water temperature affects when fish eat and how much they grow. In comparison to frozen water, warm water has less dissolved oxygen. Aquatic animals and plants in stationary aquariums require particular care. Their lives could be cut short because there is a smaller amount water in the tank. The right amounts of daylight and carbon dioxide are necessary for the growth of fish and plants. It's essential to constantly monitor the state of the water as a result.

A. The Traditional Approach's Drawbacks
   - Manually collect the sample.
   - Difficult methodology
   - It takes a long time.
   - Measurement precision is poor.
   - Expensive.
   - There is no live tracking.

B. Benefits of the Proposed System
   - There is no requirement for manual collecting.
   - It is simple to use.
   - It is a low-cost and fast process.