

# Abstract

The modernization of fish farming introduces significant financial and operational challenges, particularly in managing daily tasks such as monitoring pH, temperature, and water quality fluctuations. As the global population approaches 7.7 billion, the demand for seafood continues to rise, making aquaculture a critical method for bridging the gap between supply and demand. Traditional methods rely heavily on manual monitoring of water quality, oxygen levels, and fish health, which are often labor-intensive and inefficient.

This research proposes an innovative solution utilizing advanced IoT-enabled underwater sensors—including temperature, turbidity, and dissolved oxygen sensors—strategically deployed within the aquaculture environment. These sensors continuously gather precise data on vital parameters, which is transmitted in real-time to a centralized control system via Wi-Fi modules. This system offers seamless access through smartphones and computers, enabling remote monitoring and proactive alerts in case of anomalies or threshold breaches.

The overarching goal is to support healthier fish cultivation, reduce operational costs, and strengthen environmental stewardship. This study contributes to the evolving landscape of smart aquaculture by presenting a comprehensive, scalable, and sustainable solution tailored to modern challenges. By integrating IoT technologies, the proposed system enhances decision-making, promotes efficiency, and aligns with the global push for sustainable and environmentally responsible agricultural practices.