

**Title:** Internet of Things-Driven Precision in Fish Farming: A Deep Dive into Automated Temperature, Oxygen, and pH Regulation

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**Abstract:** The research introduces a revolutionary Internet of Things (IoT)-based system for fish farming, designed to significantly enhance efficiency and cost-effectiveness. By integrating the NodeMcu12E ESP8266 microcontroller, this system automates the management of critical water quality parameters such as pH, temperature, and oxygen levels, essential for fostering optimal fish growth conditions and minimizing mortality rates. The core of this innovation lies in its intelligent monitoring and control mechanism, which not only supports accelerated fish development but also ensures the robustness of the farming process through automated adjustments whenever the monitored parameters deviate from desired thresholds. This smart fish farming solution features an Arduino IoT cloud-based framework, offering a user-friendly web interface that enables fish farmers to remotely monitor and manage their operations from any global location. This aspect of the system emphasizes the importance of efficient information management and the transformation of sensor data into actionable insights, thereby reducing the need for constant human oversight and significantly increasing operational reliability. The autonomous functionality of the system is a key highlight, designed to persist in adjusting the environmental conditions within the fish farm until the optimal parameters are restored. This capability greatly diminishes the risks associated with manual monitoring and adjustments, allowing even those with limited expertise in aquaculture to achieve high levels of production efficiency and sustainability. By leveraging data-driven technologies and IoT innovations, this study not only addresses the immediate needs of the fish farming industry but also contributes to solving the broader global challenge of protein production. It presents a scalable and accessible approach to modern aquaculture, empowering stakeholders to maximize output and minimize risks associated with fish farming, thereby paving the way for a more sustainable and efficient future in the global food supply.

**Keywords:** Smart fish farm; PH sensor; Internet of Things (IoT); Temperature sensor; Cloud monitoring; Automatic controlling

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