

Title: Smart aquaculture analytics: Enhancing shrimp farming in Bangladesh through real-time IoT monitoring and predictive machine learning analysis

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Abstract: Water quality is a critical factor in [shrimp](#) farming, and the success of shrimp production is closely tied to the overall condition of the water. Challenges such as rapid population growth, [environmental pollution](#), and [global warming](#) have led to a decline in [fisheries production](#), particularly in the freshwater shrimp sector. This study addresses these challenges by monitoring multiple water parameters in shrimp farms, including pH, temperature, TDS, EC, and [salinity](#). Traditional manual monitoring systems are known to be cumbersome, time-consuming, and lacking real-time capabilities. Consequently, a continuous and automated monitoring system becomes imperative for efficient and real-time metrics handling. This study introduces a real-time freshwater shrimp (locally named Galda, i.e., *Macrobrachium Rosenbergii*) farm monitoring system. The proposed system incorporates technologies such as microcontroller-based physical devices, IoT, cloud storage with service, machine learning models, and web applications. This integrated system enables users to remotely monitor shrimp farms and receive alerts when water parameters fall outside the optimal range. The physical implementation involves a set of sensors for collecting data on water metrics in shrimp farms. Regression analysis is employed for predicting next-day values, and a newly developed decision-based algorithm classifies shrimp production levels into low, medium, and maximum categories using six well-known classification algorithms. The system demonstrates a high success rate for next-day predictions (r^2 of 0.94) by multiple linear regression, and the accuracy in classifying shrimp production is 97.84 % by Random Forest. Additionally, a ‘Smart Aquaculture Analytics’ web application has been developed, offering features such as real-time dashboards, historical data visualization, prediction and classification tools, and automated notifications to farmers in Bangladesh.

Keywords: Shrimp farm Real-time monitoring Smart aquaculture Internet of things Machine learning Bangladesh

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