

WATER QUALITY CLASSIFICATION IN MOBILE-BASED AQUAPONICS USING A MACHINE LEARNING APPROACH

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ABSTRACT

The success of an aquaponic ecosystem highly depends on maintaining stable water quality; however, conventional manual monitoring tends to be reactive and fails to address rapid fluctuations in Temperature, pH, DO, and TDS parameters, often leading to crop failure. Based on these problems, this study proposes a research project titled "Mobile-Based Water Quality Classification in Aquaponics Using a Machine Learning Approach". The system is designed by integrating IoT technology for real-time sensor data acquisition, the K-Nearest Neighbor (K-NN) algorithm as artificial intelligence to predict water quality status into Ideal, Normal, and Hazardous categories, and a mobile interface using the Flutter framework. The data pre-processing stage is optimized through automatic labeling using Mamdani Fuzzy Logic and data balancing using the hybrid SMOTE-RUS method. Testing was conducted through classification model performance evaluation using a confusion matrix, Flask backend REST API integration testing, mobile application interface functionality testing, and early warning system (push notification) testing. From the testing results, the K-NN model successfully classified water quality with an accuracy rate 92.60%. Furthermore, the end-to-end system testing proved a high success rate, with all API functions, real-time chart visualizations, and push notifications executing successfully with a response latency of under 1 second, making it a viable and practical decision-making tool for farmers.

Keywords: *Aquaponics, Water Quality, Machine Learning, Mobile*