ABSTRACT

The decline in catfish aquaculture production has become one of the significant issues faced by the aquaculture sector, particularly in Bandung Regency. One of the primary causes of this problem is unstable water quality, which directly impacts the growth rate and productivity of catfish. To address this issue, this study developed a prediction system based on the Internet of Things (IoT) and machine learning to analyze the influence of water quality parameters on catfish growth. The system is designed to provide data-driven recommendations, supporting more efficient and effective aquaculture management.

Water quality data were collected using IoT devices equipped with temperature, turbidity, and pH sensors connected to an ESP32 module for real-time data transmission to Firebase. The dataset used was derived from observations conducted over 30 days, with measurements taken at one-minute intervals. After preprocessing the data to remove anomalies and outliers, the data were analyzed using an unsupervised clustering method. The chosen model was KMeans, which showed better evaluation results with a Silhouette Score of 0.670 and a Davies-Bouldin Score of 0.407 compared to Agglomerative Clustering, which had a Silhouette Score of 0.591 and a Davies-Bouldin Score of 0.410. The clustering process produced three groups: most optimal, optimal, and moderately optimal, based on the observed parameter distribution patterns.

An analysis of the impact of water quality revealed that the distribution of clusters 0 and 2 was found in Pond 1, while clusters 0, 1, and 2 were present in Pond 2. The cluster distribution in Pond 1 was considered more favorable based on the growth rate of the catfish, which was better compared to Pond 2. Cluster 0 was deemed the most optimal due to its widespread presence in Pond 1. Cluster 1 was considered moderately optimal since it was not distributed in Pond 1, while Cluster 2 was categorized as optimal as its data distribution was present in both ponds.

This study provides a significant contribution by leveraging IoT and machine learning technologies to support data-driven water quality management, thereby enhancing the sustainable productivity of catfish aquaculture.

Keywords: Aquaculture, Catfish Farming, Clustering, KMeans, IoT (Internet of Things), Machine Learning, Water Quality