

ABSTRACT

The rapid growth of urban populations has led to limited residential land and increased air temperatures due to the scarcity of oxygen-producing plants. To address this issue, various agricultural methods have been developed, one of which is the aquaponic system. Aquaponics combines hydroponics and aquaculture, optimizing the use of limited space by integrating fish farming and plant cultivation. However, aquaponic systems face several challenges, such as nocturnal fish feeding, temperature and pH management, and the need for continuous monitoring of water quality to support the sustainability of both fish and plants.

As a solution to address the weaknesses in aquaponic systems, Internet of Things (IoT) technology is applied to enhance the efficiency and effectiveness of fish and plant farming management. With IoT, real-time monitoring and automatic control of water quality and fish feeding can be implemented, helping farmers maintain the stability of the aquaponic ecosystem. This system is expected to improve the productivity of catfish and pakcoy, while preventing issues that could lead to crop failure.

This research aims to test an aquaponic system equipped with various sensors (pH, turbidity, TDS, LDR, and ultrasonic) to monitor water quality and the environment for plants and fish. The system uses an ESP32 microcontroller that sends and receives data via API and Firebase Realtime Database. Hardware testing demonstrated that all sensors functioned properly, with low average error for each sensor. Sensor data was collected over seven days to monitor system conditions, showing a gradual increase in TDS, stable pH levels, dark lighting conditions in line with the time, and clean water thanks to the filtration system. The system was also tested for automated feeding and QoS testing, which recorded an average delay of 0.0054 ms and a throughput of 2.42 kbps, indicating good performance in transmitting data to the database.

Keyword : *Aquaponics, Internet of Things (IoT), Catfish, Pakcoy*