ABSTRACT

Mangrove crab aquaculture faces persistent challenges such as maintaining optimal water quality, labor-intensive monitoring, and supply chain inefficiencies. This capstone project presents an Internet of Things (IoT)-based precision aquaculture system designed to tackle these issues through real-time environmental monitoring and automated control.

The system employs an ESP32 microcontroller integrated with five critical sensors: DS18B20 (temperature), PH4502C (pH), SEN0237 (dissolved oxygen), SEN0244 (salinity/TDS), and MQ137 (ammonia). Data from these sensors is transmitted to the cloud via Supabase, enabling remote access, automated interventions, and threshold-triggered alerts. A comprehensive web and mobile dashboard visualize water quality trends, facilitates crab inventory management, and delivers AI-driven recommendations. Moreover, the system tracks crab growth performance and ensures end-to-end supply chain traceability.

Validation tests demonstrated high system accuracy and reliability. Data transmission exhibited low latency and robust stability. Challenges such as sensor biofouling and Wi-Fi dependency were effectively mitigated through regular calibration and optimized system design.

This solution offers a scalable, cost-effective, and sustainable approach for advancing smart mangrove crab aquaculture. Planned future enhancements include solar power integration, LPWAN communication redundancy, and open-source platform adoption to maximize community engagement and impact.

Keywords: *Mangrove Crab, Water Quality Monitoring, Precision Aquaculture, IoT, ESP32, Sensors.*