INTISARI

RANCANG BANGUN AKUARIUM BERBASIS *INTERNET OF THINGS* (IoT) DENGAN SISTEM PEMELIHARAAN TERINTEGRASI

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Akuarium ikan memerlukan pemeliharaan yang konsisten terhadap suhu, kualitas air, dan ketersediaan pakan. Untuk mengatasi kendala tersebut, dikembangkan sistem akuarium berbasis *internet of things* (IoT) yang terintegrasi, mencakup fitur otomatisasi pengaturan suhu, pemberian pakan, dan filtrasi air. Sistem ini dikendalikan oleh mikrokontroler ESP32 dan dilengkapi dengan sensor suhu DS18B20, sensor turbidity sn8009, dan sensor ultrasonik HC-SR04, dengan antarmuka pemantauan melalui *Home Assistant* berbasis MQTT dan LCD I2C secara *real-time*.

Hasil pengujian menunjukkan bahwa sensor suhu memiliki persentase error rata-rata 0.521% dan simpangan baku 0.0487°C. Sensor *turbidity* mencatat persentase *error* rata-rata 9.73%, dan menunjukkan tren pengukuran yang konsisten. Sensor ultrasonik menunjukkan rata-rata total simpangan baku 0.062 dan ketidakpastian tipe A 0.028. Proses pengurasan air otomatis berhasil diselesaikan dalam waktu 58 menit dari kekeruhan 52 NTU hingga mencapai kualitas air standar. Fitur pemberian pakan otomatis berjalan sesuai jadwal dan takaran yang ditentukan, Konsumsi energi harian tercatat 0.113 kWh, lebih hemat dibandingkan sistem manual sebesar 0.269 kWh dengan efisiensi 58%. Sistem ini terbukti mampu meningkatkan efisiensi, presisi, dan kepraktisan dalam pemeliharaan akuarium, serta dapat menjadi solusi otomatisasi yang efektif dan hemat energi.

Kata Kunci: *Internet of Things* (IoT), ESP32, otomatisasi akuarium, MQTT, *Home Assistant*

ABSTRACT

DESIGN AND DEVELOPMENT OF AN INTERNET OF THINGS (IoT)-BASED AKUARIUMWITH INTEG53RATED MAINTENANCE SYSTEM

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Fish aquariums require consistent maintenance of temperature, water quality, and feed availability. To address these challenges, an integrated Internet of Things (IoT)-based aquarium system was developed, featuring automated temperature control, feeding, and water filtration. The system is powered by an ESP32 microcontroller and equipped with a DS18B20 temperature sensor, SEN0189 turbidity sensor, and HC-SR04 ultrasonic sensor. Real-time monitoring is provided through the Home Assistant platform via MQTT and an I2C LCD interface.

The test results indicate that the temperature sensor has an average error percentage of 0.521% and a standard deviation of 0.0487°C. The turbidity sensor recorded an average error of 9.73% and exhibited a consistent measurement trend. The ultrasonic sensor showed an overall average standard deviation of 0.062 and a type A uncertainty of 0.028. The automatic water drainage process was successfully completed within 58 minutes, reducing turbidity from 52 NTU to the standard water quality level. The automatic feeding feature operated according to the scheduled time and predetermined portions. Daily energy consumption was recorded at 0.113 kWh, which is more efficient compared to the manual system's 0.269 kWh, achieving an energy efficiency of 58%. This system has proven to improve the efficiency, accuracy, and convenience of aquarium maintenance and serves as an effective and energy-saving automation solution.

Keywords: Internet of Things (IoT), ESP32, aquarium automation, MQTT, Home Assistant