

ABSTRAK

**SISTEM KLASIFIKASI KUALITAS AIR AQUARIUM IKAN HIAS
MENGUNAKAN ALGORITMA LIGHTGBM BERBASIS IOT DAN
OTOMATISASI PEMBERIAN PROBIOTIK EM4
(2026:xv + 89 halaman + 31 gambar + 14 tabel + 13 lampiran)**

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Fluktuasi parameter kualitas air seperti suhu, pH, amonia, dan *Total Dissolved Solids* (TDS) sering kali memicu stres hingga kematian pada ikan hias. Untuk mengatasi permasalahan tersebut, penelitian ini merancang sistem pemantauan kualitas air berbasis *Internet of Things* (IoT) yang dilengkapi dengan algoritma LightGBM serta sistem penakar probiotik EM4 otomatis. Parameter air dipantau secara *real-time* dan diklasifikasikan oleh model *machine learning* menjadi tiga kondisi, yaitu BAIK, WASPADA, dan BURUK. Informasi ini ditampilkan pada *website monitoring* sekaligus mengirimkan notifikasi peringatan dini via WhatsApp jika kualitas air menurun. Saat sistem mendeteksi status WASPADA, aktuator akan langsung menuangkan cairan probiotik EM4 sesuai takaran untuk menetralkan polutan. Berdasarkan hasil pengujian, sistem ini menunjukkan performa yang sangat andal dengan akurasi pembacaan seluruh sensor di atas 95% dan tingkat akurasi klasifikasi LightGBM mencapai 99,30%. Selain itu, proses pengiriman data menggunakan protokol MQTT berjalan lancar dengan tingkat keberhasilan 100% (*packet loss* 0%). Integrasi teknologi ini diharapkan mampu menjaga stabilitas ekosistem akuarium dan meminimalisir kerugian ekonomi bagi pelaku usaha ikan hias.

Kata Kunci: Kualitas Air, IoT, LightGBM, *Machine Learning*, EM4, *Monitoring System*

ABSTRACT

WATER QUALITY CLASSIFICATION SYSTEM FOR ORNAMENTAL FISHAQUIRIUM USING LIGHTGBM ALGORITHM BASED ON IOT AUTOMATED EM4 PROBIOTIC DISPENSING
(2026:xii + 89 pages + 31 pictures + 14 tables + 12 appendixes)

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Fluctuations in water quality parameters, such as temperature, pH, ammonia, and Total Dissolved Solids (TDS), often trigger stress and even mortality in ornamental fish. To address this issue, this research proposes an Internet of Things (IoT)-based water quality monitoring system utilizing the LightGBM algorithm and an automated EM4 probiotic dosing mechanism. Water parameters are monitored in real-time and classified by the machine learning model into three conditions: GOOD, WARNING, and POOR. This information is displayed on a monitoring website and triggers WhatsApp early warning notifications if the water quality degrades. When a WARNING status is detected, the actuator automatically dispenses a measured dose of EM4 probiotics to neutralize pollutants. Testing results demonstrate high reliability, with the overall sensor reading accuracy exceeding 95% and the LightGBM classification accuracy reaching 99.30%. Furthermore, data transmission via the MQTT protocol was perfectly stable with a 100% success rate (0% packet loss). This technological integration is expected to maintain aquarium ecosystem stability and minimize economic losses for ornamental fish businesses.

Keywords: Water Quality, IoT, LightGBM, Machine Learning, EM4, Monitoring System