ABSTRAK

ANALISIS KOMPARATIF PERTUMBUHAN TANAMAN PADA SISTEM AEROPONIK DAN SISTEM KONVENSIONAL MENGGUNAKAN SISTEM *MONITORING* TERINTEGRASI BERBASIS SENSOR DAN *COMPUTER VISION* DENGAN PENDEKATAN KECERDASAN BUATAN

(2026: xv + 85 Halaman + 43 Gambar + 18 Tabel + Daftar Pustaka + Lampiran)

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Tujuan dari penelitian ini adalah untuk melihat bagaimana pertumbuhan tanaman stroberi (Fragaria × ananassa) dilakukan pada sistem aeroponik dan sistem konvensional dengan menggunakan sistem monitoring terintegrasi berbasis sensor, *computer vision*, dan kecerdasan buatan. Untuk memastikan kondisi lingkungan tetap optimal, sistem aeroponik dilengkapi dengan sensor. Hasil penelitian menunjukkan bahwa pertumbuhan tanaman stroberi pada sistem konvensional memiliki tinggi tanaman yang lebih baik daripada sistem aeroponik. Hal ini mengindikasikan bahwa sistem aeroponik dipengaruhi oleh proses adaptasi, pengaturan lingkungan dan lama pengamatan. Di sisi lain, model YOLOv10 digunakan untuk mengestimasi umur tanaman dan metode *Quadratic Regression*, *Random Forest*, serta *Multi-Layer Perceptron* (MLP) digunakan untuk memprediksi tinggi tanaman. Dengan nilai *precision* dan *recall* mendekati 1,00, mAP@50 sebesar 0,99, dan mAP@50–95 sebesar 0,87, hasil pelatihan YOLOv10 menunjukkan kinerja yang sangat baik. Hasil evaluasi model prediksi menunjukkan bahwa *Quadratic Regression* memberikan performa terbaik pada sistem aeroponik dengan nilai R^2 0,971366 dan sistem konvensional dengan nilai R^2 0,997846, sedangkan *Random Forest* memiliki nilai R^2 sebesar 0,945181 dan sistem konvensional dengan nilai R^2 0,975002, masing-masing. MLP memberikan performa terendah dengan nilai R^2 0,454714 dan 0,247551. Hasil penelitian menunjukkan bahwa sistem monitoring berbasis sensor, visi komputer, dan AI dapat secara efektif mendukung analisis pertumbuhan tanaman.

Kata Kunci: Aeroponik, Sistem Konvensional, Pertumbuhan Tanaman, YOLOv10, *Internet of Things*, Kecerdasan Buatan

ABSTRACT

Comparative Analysis of Plant Growth in Aeroponic and Conventional Cultivation Systems Using an Integrated Sensor-Based Monitoring System and Computer Vision with an Artificial Intelligence Approach

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This study uses an integrated monitoring system based on sensors, computer vision, and artificial intelligence to compare the growth of strawberries (Fragaria × ananassa) grown under aeroponic and conventional systems. The aeroponic system was outfitted with environmental monitoring sensors in order to preserve ideal environmental conditions. According to the findings, strawberry plants produced in an aeroponic system were shorter than those grown in a standard farming system. These results imply that the aeroponic system's performance was impacted by environmental control, plant adaptability, and the comparatively brief observation period. Additionally, plant age was estimated using the YOLOv10 model, and plant height was predicted using Quadratic Regression, Random Forest, and Multi-Layer Perceptron (MLP). The YOLOv10 model performed exceptionally well, with recall and precision values close to 1.00, a mAP@50 of 0.99, and a mAP@50–95 of 0.87. The prediction results showed that Quadratic Regression performed the best, with an R2 value of 0.997846 for the conventional system and 0.971366 for the aeroponic system. For the aeroponic and conventional systems, Random Forest came in second with R2 values of 0.945181 and 0.975002, respectively. On the other hand, with R^2 values of 0.454714 for the aeroponic system and 0.247551 for the conventional system, the Multi-Layer Perceptron (MLP) generated the lowest prediction performance. Overall, the results show that the analysis of plant growth under various cultivation techniques may be successfully supported by an integrated monitoring system that combines sensors, computer vision, and artificial intelligence.

***Keywords**: Aeroponics, Conventional Cultivation System, Computer Vision, YOLOv10, Plant Growth Prediction, Artificial Intelligence.*