ABSTRAK

SISTEM MONITORING TANAMAN HIAS SUCCULENT MENGGUNAKAN ALGORITMA FUZZY LOGIC

(2025: vii + 116 Halaman + 80 Gambar + 6 Tabel + Daftar Pustaka + Lampiran)

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Tanaman hias jenis succulent tergolong tanaman yang peka terhadap tingkat kelembapan tanah dan intensitas pencahayaan. Oleh karena itu, dibutuhkan suatu sistem pemantauan otomatis yang mampu beradaptasi terhadap dinamika kondisi lingkungan. Penelitian ini merancang dan membangun sistem monitoring tanaman succulent berbasis mikrokontroler ESP32 dengan pendekatan algoritma logika fuzzy sebagai metode penentu keputusan. Sistem memperoleh data input dari tiga sensor kelembapan tanah, sensor suhu dan kelembapan udara (DHT22), serta sensor pencahayaan (BH1750). Informasi ini diolah untuk menentukan kondisi penyiraman melalui pengaktifan tiga pompa air serta pengendalian lampu grow light secara otomatis. Fungsi keanggotaan dan aturan fuzzy dirumuskan untuk memetakan kondisi lingkungan ke dalam kategori linguistik seperti “kering”, “sedang”, dan “basah”, yang kemudian menghasilkan luaran terkontrol melalui proses defuzzifikasi. Hasil pengujian membuktikan bahwa sistem mampu merespons secara waktu nyata terhadap perubahan lingkungan dan mengatur penyiraman serta pencahayaan secara optimal sesuai kebutuhan tanaman. Sistem juga tetap berfungsi secara otonom meskipun terdapat kegagalan sebagian sensor, selama data utama masih tersedia dan valid. Dengan demikian, penerapan logika fuzzy dalam sistem ini terbukti efektif dalam meningkatkan efisiensi dan kemandirian perawatan tanaman hias secara otomatis.

Kata kunci: fuzzy logic, succulent, sensor tanah, ESP32, monitoring tanaman otomatis

ABSTRACT

SUCCULENT ORNAMENTAL PLANT MONITORING SYSTEM USING FUZZY LOGIC ALGORITHM

(2025: vii + 116 Pages + 80 Picture + 6 Table + Reference + Attachments)

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Succulent ornamental plants are sensitive to soil moisture levels and light intensity. Therefore, an automatic monitoring system is needed that can adapt to changing environmental conditions. This study designs and develops a succulent plant monitoring system based on the ESP32 microcontroller using a fuzzy logic algorithm as the decision-making method. The system receives input data from three soil moisture sensors, an air temperature and humidity sensor (DHT22), and a light intensity sensor (BH1750). This information is processed to determine the watering conditions by activating three water pumps and controlling a grow light automatically. Fuzzy membership functions and rules are formulated to map environmental conditions into linguistic categories such as "dry," "moderate," and "wet," which then produce a controlled output through a defuzzification process. Test results demonstrate that the system can respond in real-time to environmental changes and regulate watering and lighting optimally according to the plant's needs. The system also continues to operate autonomously even in the event of partial sensor failure, as long as the main data remains available and valid. Thus, the application of fuzzy logic in this system proves effective in enhancing the efficiency and autonomy of ornamental plant care automatically.

Kata kunci: fuzzy logic, succulent, Soil Moisture Sensors, ESP32, Automation Succulent Monitoring