

ABSTRAK

RANCANG BANGUN SISTEM *MONITORING* DAN KONTROL PENYIRAMAN TANAMAN CABAI OTOMATIS DENGAN PENDEKATAN *FUZZY LOGIC* DAN ANTARMUKA *WEBSITE*

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Cabai merupakan komoditas hortikultura bernilai ekonomi tinggi yang produktivitasnya sangat dipengaruhi oleh kondisi lingkungan. Perkembangan teknologi dalam penyiraman otomatis berbasis *Internet of Things* (IoT) mulai terimplementasikan untuk meningkatkan efisiensi penggunaan air dan mendukung kualitas hasil panen. Berdasarkan data Badan Pusat Statistik (BPS), produksi cabai nasional pada tahun 2024 mencapai 15.687.569,77 kuintal, namun produksi cabai merah besar mengalami penurunan sekitar 5,48% dibandingkan tahun sebelumnya akibat faktor iklim dan efisiensi penggunaan input produksi. Selain itu, lokasi kebun cabai di Desa Tirta Kencana yang relatif jauh dari permukiman menyebabkan pemantauan tanaman dan penyiraman masih dilakukan secara manual. Penelitian bertujuan merancang dan mengimplementasikan sistem *monitoring* serta kontrol penyiraman tanaman cabai otomatis berbasis IoT yang mampu melakukan pemantauan jarak jauh dan menentukan durasi penyiraman secara adaptif sebagai solusi penyiraman manual. Sistem dikembangkan menggunakan ESP32 dan ESP32-CAM yang terintegrasi dengan *website*, serta memanfaatkan sensor DHT22, *Capacitive Soil Moisture Sensor v1.2*, dan BH1750 untuk memperoleh data suhu, kelembapan tanah, dan intensitas cahaya. Data sensor diproses menggunakan metode *Fuzzy Logic* Sugeno tiga input, sedangkan mekanisme *deep sleep* diterapkan untuk mengurangi konsumsi daya alat. Hasil pengujian lapangan pada 17–18 Juni 2026 menunjukkan sistem mampu melakukan *monitoring* kondisi lingkungan secara *real-time* dalam mengirimkan data sensor dan citra tanaman ke *website*, serta menjalankan penyiraman otomatis sebanyak tiga kali dengan durasi 17 detik, 65 detik, dan 215 detik berdasarkan hasil inferensi *Fuzzy Logic* Sugeno. Berdasarkan hasil tersebut, sistem mampu mendukung pemantauan tanaman cabai dari jarak jauh, mengotomatisasi penyiraman sesuai kondisi kelembapan tanah, suhu, dan intensitas cahaya, serta dapat mengurangi konsumsi daya alat melalui penerapan mode *deep sleep*.

Kata kunci: IoT, *fuzzy logic*, *monitoring*, penyiraman otomatis, tanaman cabai

ABSTRACT

DESIGN AND DEVELOPMENT OF AN AUTOMATIC MONITORING AND CONTROL SYSTEM FOR CHILI PLANT WATERING USING A FUZZY LOGIC APPROACH AND WEBSITE INTERFACE

(2026 : XIV + 105 Pages + 32 Figures + 14 Table + 42 Appendix)

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Chili is a high-economic-value horticultural commodity whose productivity is strongly influenced by environmental conditions. Technological advances in Internet of Things (IoT)-based automatic watering systems have begun to be implemented to improve water use efficiency and support crop quality. According to data from the Central Bureau of Statistics (BPS), national chili production in 2024 reached 15,687,569.77 quintals; however, production of large red chili decreased by approximately 5.48% compared to the previous year due to climatic factors and inefficiencies in production input usage. Furthermore, the location of chili farms in Tirta Kencana Village, which is relatively far from residential areas, means that crop monitoring and watering are still carried out manually. This study aims to design and implement an IoT-based automatic monitoring and control system for chili plant watering that is capable of remote monitoring and adaptively determining watering duration as a solution to manual watering. The system was developed using ESP32 and ESP32-CAM integrated with a website, utilizing DHT22, Capacitive Soil Moisture Sensor v1.2, and BH1750 sensors to obtain temperature, soil moisture, and light intensity data. Sensor data were processed using a three-input Sugeno Fuzzy Logic method, while a deep sleep mechanism was applied to reduce device power consumption. Field test results on 17–18 June 2026 showed that the system was able to perform real-time environmental condition monitoring by transmitting sensor data and plant images to the website, as well as carrying out automatic watering three times with durations of 17 seconds, 65 seconds, and 215 seconds based on the Sugeno Fuzzy Logic inference results. Based on these results, the system is capable of supporting remote monitoring of chili plants, automating watering according to soil moisture, temperature, and light intensity conditions, and reducing device power consumption through the implementation of deep sleep mode.

Keywords: IoT, fuzzy logic, monitoring, automatic irrigation, chili plants