

RANCANG BANGUN SISTEM MONITORING DAN PENYIRAMAN OTOMATIS TANAMAN VANILI BERBASIS *INTERNET OF THINGS* MENGUNAKAN METODE *FUZZY LOGIC*

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ABSTRAK

Penelitian ini berfokus pada perancangan dan pembangunan sistem berbasis Internet of Things (IoT) untuk memantau kondisi lingkungan serta mengatur penyiraman tanaman vanili secara otomatis. Sistem dirancang dengan mengintegrasikan metode Fuzzy Mamdani untuk menentukan durasi penyiraman berdasarkan kondisi lingkungan yang terukur. Pengembangan sistem dilakukan melalui tahapan analisis kebutuhan, perancangan, implementasi, pengujian, dan evaluasi dengan menggunakan pendekatan pengembangan Prototype. Pengumpulan data dilakukan melalui observasi dan wawancara dengan pengelola kebun vanili di Desa Sambangan, studi literatur, serta pengujian langsung terhadap prototipe yang telah dibuat. Perangkat keras sistem terdiri atas tiga Node ESP32 yang bertukar data melalui protokol Message Queuing Telemetry Transport (MQTT). Parameter yang dipantau meliputi kelembapan tanah menggunakan Capacitive Soil Moisture Sensor, suhu dan kelembapan udara menggunakan DHT22, intensitas cahaya menggunakan BH1750, serta kondisi hujan melalui sensor YL-83 dan data cuaca dari OpenWeatherMap API. Nilai kelembapan tanah, suhu, dan kelembapan udara digunakan sebagai masukan bagi metode Fuzzy Mamdani untuk menghasilkan keputusan durasi penyiraman. Hasil pengujian menunjukkan bahwa komponen sistem dapat diintegrasikan untuk mendukung fungsi pemantauan dan pengendalian penyiraman, meliputi sensor, komunikasi MQTT, Firebase Realtime Database, Telegram Bot, relay, pompa air DC, dan solenoid valve. Sistem juga menyediakan fitur penjadwalan penyiraman, yaitu Scheduled Watering, Emergency Watering, dan Critical Watering, serta mendukung pemantauan kondisi lingkungan dan pengendalian penyiraman tanaman vanili secara real-time melalui data sensor dan kondisi sistem yang tercatat.

Kata kunci: *Internet of Things* (IoT), Fuzzy Mamdani, tanaman vanili, penyiraman otomatis, *monitoring*.

DESIGN AND IMPLEMENTATION OF AN INTERNET OF THINGS (IOT)-BASED MONITORING AND AUTOMATIC IRRIGATION SYSTEM FOR VANILLA PLANTS USING THE FUZZY LOGIC METHOD

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ABSTRACT

This research focuses on developing an Internet of Things (IoT) application for environmental monitoring and automated irrigation in vanilla cultivation. The proposed system incorporates the Mamdani Fuzzy method to establish watering durations according to measured environmental parameters. System development followed the Prototype model, encompassing requirements analysis, system design, implementation, testing, and evaluation. Data were obtained through field observations, interviews with vanilla farmers in Sambangan Village, a literature review, and direct testing of the developed prototype. The hardware architecture comprises three ESP32 nodes that exchange information using the Message Queuing Telemetry Transport (MQTT) protocol. Environmental parameters are acquired using a Capacitive Soil Moisture Sensor for soil moisture, a DHT22 for air temperature and humidity, a BH1750 for light intensity, and a YL-83 rain sensor, complemented by weather information from the OpenWeatherMap API. Soil moisture, air temperature, and air humidity serve as inputs to the Mamdani Fuzzy method to determine the watering duration. Test results demonstrate that the system components can be integrated to support environmental monitoring and irrigation control. These components include sensors, MQTT communication, Firebase Realtime Database, Telegram Bot, relays, a DC water pump, and solenoid valves. The system also incorporates Scheduled Watering, Emergency Watering, and Critical Watering features, enabling real-time monitoring of environmental conditions and irrigation control based on sensor readings and recorded system conditions.

Keywords: *Internet of Things (IoT), Fuzzy Mamdani, vanilla plants, automatic irrigation, monitoring.*