

ABSTAK

Pengembangan Sistem Monitoring dan Kontrol Hidroponik Berbasis IOT

(2026: xiv + 61 halaman + 28 gambar + 1 tabel + Daftar pustaka + lampiran)

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Sistem hidroponik merupakan metode budidaya tanaman tanpa menggunakan media tanah yang memerlukan pemantauan terhadap beberapa parameter penting, seperti suhu larutan nutrisi, konsentrasi nutrisi, dan ketinggian air. Pemantauan yang masih dilakukan secara manual dinilai kurang praktis serta berpotensi menyebabkan keterlambatan dalam mendeteksi perubahan kondisi sistem, sehingga dapat memengaruhi pertumbuhan tanaman. Oleh karena itu, penelitian ini bertujuan merancang dan membangun sistem monitoring dan kontrol hidroponik berbasis Internet of Things (IoT) yang mampu melakukan pemantauan serta pengendalian secara real-time melalui jaringan internet. Sistem dikembangkan menggunakan mikrokontroler ESP32 sebagai pusat kendali yang terintegrasi dengan sensor TDS untuk mengukur konsentrasi nutrisi, sensor DS18B20 untuk mengukur suhu larutan nutrisi, dan sensor ultrasonik HC-SR04 untuk mengukur ketinggian air pada tangki nutrisi. Data hasil pembacaan sensor dikirim menggunakan protokol MQTT menuju dashboard Node-RED sehingga dapat dipantau secara daring. Selain fungsi monitoring, sistem juga dilengkapi dengan fitur kontrol pompa air berbasis relay yang dapat dioperasikan secara manual maupun otomatis melalui dashboard sesuai kondisi sistem. Hasil pengujian menunjukkan bahwa sistem mampu melakukan monitoring suhu larutan nutrisi, nilai TDS, dan ketinggian air secara real-time. Dashboard Node-RED berhasil menampilkan data hasil pemantauan serta status pompa secara langsung, sedangkan sistem kontrol pompa dapat beroperasi sesuai perintah yang dikirim melalui protokol MQTT. Dengan demikian, sistem yang dikembangkan mampu mendukung proses monitoring dan pengendalian hidroponik berbasis IoT sehingga memudahkan pengguna dalam memantau kondisi sistem, mengoperasikan pompa air dari jarak jauh, serta mendukung penerapan konsep smart farming secara lebih efektif.

Kata kunci: Hidroponik, Internet of Things (IoT), ESP32, MQTT, Node-RED, Monitoring, Kontrol Pompa.

ABSTACT

Development of an IoT-Based Hydroponic Monitoring and Control System

(2026: xiv + 61 pages + 28 images + 1 tables + bibliography + attachment)

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Hydroponic systems are a method of cultivating plants without using soil media and require monitoring of several important parameters such as water temperature, nutrient concentration, and water level. Monitoring processes that are still carried out manually are considered inefficient and may cause delays in handling changes in hydroponic system conditions. Therefore, this study developed an Internet of Things (IoT)-based hydroponic monitoring and control system capable of performing real-time monitoring and control. The system was designed using an ESP32 microcontroller as the main controller connected to a TDS sensor to measure nutrient concentration, a DS18B20 temperature sensor to measure nutrient solution temperature, and an HC-SR04 ultrasonic sensor to detect water level in the nutrient reservoir. Sensor data were transmitted using the MQTT protocol to a Node-RED dashboard so that the system could be monitored through the internet network. In addition to the monitoring function, the system was also equipped with a water pump control feature using a relay that could be operated manually or automatically through the monitoring dashboard. The test results showed that the system was capable of monitoring temperature, TDS value, and water level in real-time properly. The Node-RED dashboard was able to display monitoring data and pump status directly. The pump control system also functioned according to commands sent through MQTT. With this system, the hydroponic monitoring and control process becomes more effective and efficient, while also supporting the implementation of IoT-based smart farming concepts.

Keywords: *Hydroponics, Internet of Things (IoT), ESP32, MQTT, Node-RED, Monitoring, Pump Control.*