ABSTRAK

Raden Muhammad Asyam Rafi. RANCANG BANGUN SISTEM INSTRUMENTASI AKUISISI DATA KUALITAS AIR TANDON MENGGUNAKAN SENSOR MULTI-PARAMETER BERBASIS ESP32 DENGAN APLIKASI THINGSPEAK.

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Kualitas air pada tandon perlu dipantau secara berkala untuk mengetahui kondisi air berdasarkan beberapa parameter kualitas. Penelitian ini bertujuan merancang dan menguji sistem instrumentasi akuisisi data kualitas air tandon berbasis Internet of Things (IoT) menggunakan ESP32 dengan parameter pH, Total Dissolved Solids (TDS), turbidity, dan suhu. Sistem dirancang untuk melakukan pembacaan sensor secara terintegrasi, mengirimkan data ke platform ThingSpeak, serta memberikan notifikasi melalui WhatsApp apabila nilai parameter melewati batas yang telah ditentukan. Pengujian dilakukan melalui tahap kalibrasi, verifikasi, dan pengujian respons sensor, kemudian dilanjutkan dengan penerapan sistem pada sampel air PDAM dan air tanah. Hasil pengujian menunjukkan bahwa sensor pH memiliki nilai MAE sebesar 0,1200, RMSE sebesar 0,1414, MAPE sebesar 1,7451%, dan R^2 sebesar 0,9983. Sensor TDS menghasilkan MAE sebesar 6,1667 ppm, RMSE sebesar 7,6048 ppm, MAPE sebesar 1,7327%, dan R^2 sebesar 0,9998. Sensor suhu DS18B20 menghasilkan MAE sebesar 0,1967 °C, RMSE sebesar 0,2714 °C, MAPE sebesar 0,7876%, dan R^2 sebesar 0,9995. Sementara itu, sensor turbidity diuji berdasarkan respons relatif terhadap variasi kondisi sampel karena tidak menggunakan alat pembanding dalam satuan NTU. Hasil pengujian turbidity menunjukkan perubahan rata-rata pembacaan dari 0,08 hingga 119,20 pada enam kondisi sampel. Pada penerapan sistem pada air tandon, seluruh sensor mampu melakukan pembacaan secara berulang pada air PDAM dan air tanah. Hasil penelitian menunjukkan bahwa sistem yang dikembangkan mampu melakukan akuisisi dan pemantauan empat parameter kualitas air secara terintegrasi serta menyediakan data hasil pengukuran melalui platform IoT dan notifikasi sebagai pendukung pemantauan kondisi air tandon.

Kata kunci: kualitas air, ESP32, Internet of Things, pH, TDS, turbidity, suhu.

ABSTRACT

Raden Muhammad Asyam Rafi. *DESIGN OF AN ESP32-BASED INSTRUMENTATION SYSTEM FOR WATER QUALITY DATA ACQUISITION IN WATER STORAGE TANKS USING MULTI-PARAMETER SENSORS AND THE THINGSPEAK PLATFORM.*

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Water quality in storage tanks needs to be monitored periodically to determine water conditions based on several quality parameters. This study aims to design and evaluate an Internet of Things (IoT)-based water quality data acquisition instrumentation system using an ESP32, with pH, Total Dissolved Solids (TDS), turbidity, and temperature as the monitored parameters. The system is designed to integrate sensor measurements, transmit data to the ThingSpeak platform, and provide WhatsApp notifications when parameter values exceed predetermined thresholds. Sensor testing was conducted through calibration, verification, and response testing, followed by system implementation using tap water and groundwater samples. The results showed that the pH sensor achieved an MAE of 0.1200, RMSE of 0.1414, MAPE of 1.7451%, and R^2 of 0.9983. The TDS sensor achieved an MAE of 6.1667 ppm, RMSE of 7.6048 ppm, MAPE of 1.7327%, and R^2 of 0.9998. The DS18B20 temperature sensor achieved an MAE of 0.1967 °C, RMSE of 0.2714 °C, MAPE of 0.7876%, and R^2 of 0.9995. Meanwhile, the turbidity sensor was evaluated based on its relative response to variations in sample conditions because no reference instrument in NTU was used. The turbidity test showed changes in the average sensor readings ranging from 0.08 to 119.20 across six sample conditions. In the implementation on water tank samples, all sensors were able to perform repeated measurements on tap water and groundwater. The results indicate that the developed system is capable of simultaneously acquiring and monitoring four water quality parameters and providing measurement data through an IoT platform and notifications to support water tank condition monitoring.

Keywords: *water quality, ESP32, Internet of Things, pH, TDS, turbidity, temperature, ThingSpeak.*