ABSTRAK

IMPLEMENTASI SISTEM *MONITORING* KUALITAS AIR MINUM BERBASIS *INTERNET OF THINGS* DENGAN METODE *SUPPORT VECTOR MACHINE* DAN *SUPPORT VECTOR REGRESSION*

(2026 : xiv + 76 halaman + 32 gambar + 7 tabel + 12 lampiran)

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Penelitian ini bertujuan merancang sistem *monitoring* kualitas air minum berbasis *Internet of Things* (IoT) yang terintegrasi dengan *machine learning*. Permasalahan pada depot air minum isi ulang adalah pemantauan kualitas air yang masih visualisasi manual, sehingga berpotensi menurunkan kualitas air tanpa terdeteksi serta menyebabkan keterlambatan penggantian filter. Penelitian ini mengimplementasikan sistem monitoring kualitas air minum berbasis *Internet of Things* (IoT) menggunakan sensor pH, *turbidity*, dan *Total Dissolved Solids* (TDS) yang dikendalikan oleh mikrokontroler ESP32. Data hasil pembacaan sensor dikirim menggunakan protokol MQTT, disimpan pada *database* MySQL, dan ditampilkan secara *real time* melalui *website monitoring*. Selanjutnya, metode *Support Vector Machine* (SVM) digunakan untuk mengklasifikasikan kelayakan air minum, sedangkan *Support Vector Regression* (SVR) digunakan untuk memprediksi sisa umur filter. Sebelum proses pelatihan model, dilakukan preprocessing data berupa pembersihan data, penyeimbangan kelas menggunakan *Synthetic Minority Oversampling Technique* (SMOTE), standardisasi menggunakan *Standard Scaler*, serta optimasi *hyperparameter* menggunakan *Grid Search*. Hasil pengujian menunjukkan bahwa model SVM memperoleh *accuracy* sebesar 94,85%, *precision* 77,30%, *recall* 99,71%, dan F1-*score* 87,00%. Sementara itu, model SVR menghasilkan nilai MAE sebesar 0,0836 hari, MSE sebesar 0,0342, dan R^2 sebesar 0,9977, yang menunjukkan kemampuan prediksi sisa umur filter dengan tingkat kesalahan yang rendah. Hasil penelitian menunjukkan bahwa integrasi teknologi IoT dengan metode SVM dan SVR mampu menghasilkan sistem monitoring kualitas air minum secara *real time* serta mendukung pengambilan keputusan dalam menentukan kelayakan air dan estimasi waktu penggantian filter.

Kata Kunci: *Internet of Things* (IoT), pH, *Turbidity*, TDS, *Support Vector Machine, Support Vector Regression*

ABSTRACT

IMPLEMENTATION OF AN INTERNET OF THINGS-BASED DRINKING WATER QUALITY MONITORING SYSTEM USING SUPPORT VECTOR MACHINE AND SUPPORT VECTOR REGRESSION

(2026 : xiv + 76 halaman + 32 gambar + 7 tabel + 12 lampiran)

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This study aims to develop an Internet of Things (IoT)-based drinking water quality monitoring system integrated with machine learning. One of the main challenges in refill drinking water depots is that water quality monitoring is still performed through manual visual inspection, which may allow water quality deterioration to go undetected and delay filter replacement. The proposed system employs pH, turbidity, and Total Dissolved Solids (TDS) sensors controlled by an ESP32 microcontroller. Sensor data are transmitted using the MQTT protocol, stored in a MySQL database, and displayed in real time through a web-based monitoring platform. Furthermore, the Support Vector Machine (SVM) algorithm is applied to classify drinking water quality, while Support Vector Regression (SVR) is used to predict the remaining useful life of the water filter. Before model training, the dataset underwent preprocessing, including data cleaning, class balancing using the Synthetic Minority Oversampling Technique (SMOTE), feature standardization using Standard Scaler, and hyperparameter optimization using Grid Search. Experimental results show that the SVM model achieved an accuracy of 94.85%, a precision of 77.30%, a recall of 99.71%, and an F1-score of 87.00%. Meanwhile, the SVR model obtained a Mean Absolute Error (MAE) of 0.0836 days, a Mean Squared Error (MSE) of 0.0342, and a coefficient of determination (R^2) of 0.9977, indicating high prediction accuracy with minimal error. These results demonstrate that integrating IoT technology with SVM and SVR provides an effective real-time drinking water quality monitoring system while supporting decision-making for water quality assessment and filter replacement scheduling.

Keywords: *Internet of Things* (IoT), pH, *Turbidity*, TDS, *Support Vector Machine, Support Vector Regression*