ABSTRAK

KLASIFIKASI TINGKAT KEBERSIHAN UDARA MENGGUNAKAN K-MEANS DAN SVM PADA *SMART INDOOR AIR SYSTEM* BERBASIS IOT

(2025: xxxiv+145 Halaman+92 Gambar +35 Tabel+Daftar Pustaka+Lampiran)

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Kualitas udara dalam ruangan sangat memengaruhi kesehatan dan kenyamanan penghuni. Penelitian ini mengembangkan sistem klasifikasi kebersihan udara berbasis IoT menggunakan metode K-Means dan Support Vector Machine (SVM). Klasterisasi dilakukan terhadap enam parameter utama (CO, asap, HC, PM_{10}, TVOC, dan eCO_2) dan menghasilkan empat kelas, yaitu Aman, Sedang I, Sedang II, dan Bahaya, dengan nilai *silhouette score* >0.85 yang menunjukkan kualitas klasterisasi baik dan konsisten. Model SVM dilatih menggunakan data hasil klasterisasi dan dioptimasi dengan Optuna serta teknik SMOTE, menghasilkan akurasi pelatihan 97.34%, validasi 98.16% dan pengujian 95.97%, selisih kecil menunjukkan performa stabil tanpa indikasi *overfitting*. Evaluasi prediksi juga menunjukkan nilai error (MAE, RMSE, MAPE) sangat kecil, memperkuat kemampuan prediksi model. Implementasi *real-time* dilakukan melalui konversi model ke format JSON untuk digunakan di Google Apps Script, dan diuji selama lima hari terhadap 5.781 data sensor. Hasilnya, sebanyak 99.91% data berhasil diklasifikasikan dengan benar. Sistem ini terbukti akurat, efisien, dan baik untuk diterapkan dalam *smart indoor air system.*

Kata kunci: Klasifikasi Udara, SVM, K-Means, Metrik Evaluasi, IoT

ABSTRACT

AIR QUALITY LEVEL CLASSIFICATION USING K-MEANS AND SVM ON SMART INDOOR AIR SYSTEM BASED ON IOT
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Indoor air quality greatly affects occupants' health and comfort. This research develops an IoT-based air cleanliness classification system using K-Means and Support Vector Machine (SVM) methods. Clustering was performed on six main parameters (CO, smoke, HC, PM_{10}, TVOC, and eCO_2) and resulted in four classes, namely Safe, Moderate I, Moderate II, and Hazard, with a silhouette score value >0.85 which indicates the quality of clustering is good and consistent. The SVM model was trained using clustering data and optimized with Optuna and SMOTE techniques, resulting in training accuracy of 97.34%, validation of 98.16% and testing of 95.97%, a small difference indicating stable performance with no indication of overfitting. Prediction evaluation also shows that the error values (MAE, RMSE, MAPE) are very small, strengthening the model's predictive ability. Real-time implementation was done through converting the model to JSON format for use in Google Apps Script, and tested for five days against 5,781 sensor data. As a result, 99.91% of the data was classified correctly. This system is proven to be accurate, efficient, and good to be applied in smart indoor air systems.

Keywords: *Air Classification, SVM, K-Means, Evaluation Metrics, IoT*