ABSTRAK

ANALISIS PERBANDINGAN ALGORITMA DECISION TREE DAN XGBOOST UNTUK PREDIKSI DURASI FAST CHARGING BATERAI LITHIUM POLYMER

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Analisis Perbandingan Algoritma Decision Tree dan XGBoost untuk Prediksi Durasi Fast Charging Baterai Lithium Polymer

(2026: 99 halaman + 26 tabel + 42 gambar + xx lampiran)

Perkembangan kendaraan listrik mendorong kebutuhan akan sistem fast charging yang mampu mengisi baterai secara cepat tanpa mengurangi keamanan dan umur pakai baterai. Selama proses pengisian, perubahan parameter seperti tegangan, arus, suhu, dan State of Charge (SoC) sangat memengaruhi durasi pengisian serta kondisi baterai. Oleh karena itu, penelitian ini bertujuan merancang sistem monitoring berbasis ESP32 yang mampu memantau parameter baterai secara real-time melalui Telegram serta membandingkan kinerja algoritma Decision Tree dan XGBoost dalam memprediksi durasi pengisian baterai Lithium Polymer. Data diperoleh secara langsung menggunakan sensor PZEM-017, ACS758, dan GY-906 selama proses fast charging, kemudian dilakukan tahap *preprocessing*, pelatihan model, serta evaluasi menggunakan metrik Mean Absolute Error (MAE), Root Mean Square Error (RMSE), Mean Absolute Percentage Error (MAPE), dan koefisien determinasi (R^2). Hasil penelitian menunjukkan bahwa algoritma XGBoost memberikan performa prediksi yang lebih baik dibandingkan Decision Tree, dengan nilai RMSE sebesar 66,62 detik, MAE sebesar 37,46 detik, MAPE sebesar 1,79%, dan R^2 sebesar 0,9983, sedangkan Decision Tree memperoleh RMSE sebesar 81,48 detik, MAE sebesar 45,31 detik, MAPE sebesar 2,77%, dan R^2 sebesar 0,9973. Hasil tersebut menunjukkan bahwa XGBoost lebih akurat dalam memprediksi durasi pengisian baterai Lithium Polymer, sehingga berpotensi meningkatkan efektivitas sistem monitoring dan membantu pengguna dalam memperkirakan waktu pengisian secara lebih tepat.

Kata Kunci: *Fast Charging*, Decision Tree, XGBoost, Lithium Polymer, Prediksi Durasi Pengisian, State of Charge (SoC).

ABSTRACT

COMPARATIVE ANALYSIS OF DECISION TREE AND XGBOOST ALGORITHMS FOR PREDICTING FAST CHARGING DURATION OF LITHIUM POLYMER BATTERIES

Scientific paper in the form of a Final Project, June 2026

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Comparative Analysis of Decision Tree and XGBoost Algorithms for Predicting Fast Charging Duration of Lithium Polymer Batteries

(2026: 99 pages + 26 tables + 42 figures + xx appendices)

The rapid development of electric vehicles has increased the demand for fast charging systems capable of charging batteries efficiently while maintaining safety and battery lifespan. During the charging process, battery parameters such as voltage, current, temperature, and State of Charge (SoC) significantly influence the charging duration and battery performance. Therefore, this study aims to develop an ESP32-based real-time monitoring system integrated with Telegram and to compare the performance of the Decision Tree and XGBoost algorithms in predicting the charging duration of Lithium Polymer batteries. Data were collected directly using PZEM-017, ACS758, and GY-906 sensors during the fast charging process. The collected data were then preprocessed, followed by model training and evaluation using Mean Absolute Error (MAE), Root Mean Square Error (RMSE), Mean Absolute Percentage Error (MAPE), and the Coefficient of Determination (R^2). The experimental results show that the XGBoost algorithm achieved better prediction performance than the Decision Tree algorithm, with an RMSE of 66.62 seconds, MAE of 37.46 seconds, MAPE of 1.79%, and R^2 of 0.9983. In comparison, the Decision Tree model obtained an RMSE of 81.48 seconds, MAE of 45.31 seconds, MAPE of 2.77%, and R^2 of 0.9973. These results indicate that XGBoost provides higher prediction accuracy for estimating the fast charging duration of Lithium Polymer batteries. Furthermore, the proposed monitoring system can provide real-time charging information and assist users in estimating the remaining charging time more accurately and efficiently.

Keywords: *Fast Charging, Decision Tree, XGBoost, Lithium Polymer Battery, Charging Duration Prediction, State of Charge (SoC).*