

ABSTRAK

MODEL PREDIKSI KONSUMSI ENERGI PADA SMART HOME MENGUNAKAN ALGORITMA *XGBOOST* DENGAN IMPLEMENTASI WEB DASHBOARD INTERAKTIF

Ridho Chaerullah, 202231122

Di bawah bimbingan Ibu Rosida Nur Aziza, S.T., M.Eng.Stud.

Peningkatan penggunaan perangkat elektronik pada lingkungan *smart home* menyebabkan konsumsi energi listrik menjadi semakin dinamis dan sulit diprediksi. Kondisi ini memerlukan sistem yang mampu menghasilkan prediksi konsumsi energi secara akurat sekaligus menyajikannya dalam bentuk visual yang mudah dipahami pengguna. Penelitian ini bertujuan membangun model prediksi konsumsi energi *smart home* menggunakan algoritma *XGBoost* (*XGBoost*) serta mengimplementasikannya ke dalam web *dashboard* interaktif. Metode penelitian mengacu pada *framework* Cross Industry Standard Process for Data Mining (CRISP-DM) yang meliputi Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, dan Deployment. Dataset yang digunakan adalah Smart Home Energy Usage Dataset dari Kaggle yang terdiri atas 500 data. Tahap data preparation meliputi fitur engineering, label encoding, fitur selection menggunakan SelectKBest, serta pembagian data secara temporal dengan rasio 80% data latih dan 20% data uji. Model *XGBoost* dioptimasi menggunakan RandomizedSearchCV dan TimeSeriesSplit, kemudian diintegrasikan dengan Laravel, Livewire, dan FastAPI untuk membangun *dashboard* interaktif. Hasil penelitian menunjukkan bahwa skenario penggunaan seluruh fitur menghasilkan performa terbaik dengan nilai RMSE 0,4098, MAE 0,3182, MAPE 4,04%, dan R^2 98,74% pada data uji. Selisih nilai R^2 antara data latih dan data uji yang kecil menunjukkan model memiliki kemampuan generalisasi yang baik tanpa mengalami overfitting. Selain itu, seluruh fitur aplikasi berhasil diimplementasikan dan berfungsi sesuai hasil pengujian. Dengan demikian, *XGBoost* mampu menghasilkan prediksi konsumsi energi yang akurat, sedangkan web *dashboard* yang dibangun mampu menyajikan hasil prediksi secara informatif untuk membantu pemantauan konsumsi energi.

Kata Kunci: *Smart Home, Prediksi Konsumsi Energi, XGBoost, Machine Learning, Web Dashboard, CRISP-DM.*

ABSTRACT

ENERGY CONSUMPTION PREDICTION MODEL IN SMART HOMES USING THE XGBOOST ALGORITHM WITH INTERACTIVE WEB DASHBOARD IMPLEMENTATION

Ridho Chaerullah, 202231122

Under the guidance of Ms. Rosida Nur Aziza, S.T., M.Eng.Stud.

The increasing use of electronic devices in smart home environments causes electrical energy consumption to become increasingly dynamic and difficult to predict. This condition requires a system capable of generating accurate energy consumption predictions while presenting them in a visual form that is easy for users to understand. This study aims to build a smart home energy consumption prediction model using the XGBoost (XGBoost) algorithm and implement it into an interactive web dashboard. The research method refers to the Cross Industry Standard Process for Data Mining (CRISP-DM) framework which includes Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, and Deployment. The dataset used is the Smart Home Energy Usage Dataset from Kaggle which consists of 500 data. The data preparation stage includes feature engineering, label encoding, feature selection using SelectKBest, and temporal data division with a ratio of 80% training data and 20% test data. The XGBoost model is optimized using RandomizedSearchCV and TimeSeriesSplit, then integrated with Laravel, Livewire, and FastAPI to build an interactive dashboard. The results showed that the scenario of using all features produced the best performance with an RMSE of 0.4098, MAE of 0.3182, MAPE of 4.04%, and R^2 of 98.74% on the test data. The small difference in R^2 values between the training and test data indicates that the model has good generalization capabilities without experiencing overfitting. In addition, all application features were successfully implemented and functioned according to the test results. Thus, XGBoost is able to produce accurate energy consumption predictions, while the web dashboard that was built is able to present prediction results informatively to help monitor energy consumption.

Keywords: Smart Home, Energy Consumption Prediction, XGBoost, Machine Learning, Web Dashboard, CRISP-DM.