PREDICTIVE ENERGY ANALYTICS: LEVERAGING MACHINE LEARNING AND WEATHER DATA INTEGRATION FOR SMART CONSUMPTION FORECASTING AND OPTIMIZATION

A MINI PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this Report titled "**PREDICTIVE ENERGY ANALYTICS: LEVERAGING MACHINE LEARNING AND WEATHER DATA INTEGRATION FOR SMART CONSUMPTION FORECASTING AND OPTIMIZATION**" is the bonafide work of **PRIADHARSHNI P (221801039) , PRIYADARSHINI S (221801040)** who carried out the work under my supervision.

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ABSTRACT

“Predictive Energy Analytics: Leveraging Machine Learning and Weather Data Integration for Smart Consumption Forecasting and Optimization” project presents a forecasting model to predict energy consumption in residential and commercial buildings, using historical data, weather forecasts, and occupancy information. By analyzing features such as temperature, humidity, and temporal factors (hour, day, and month), the model provides insights into energy usage patterns and identifies factors influencing consumption. Data preprocessing involved handling missing values, transforming timestamps, and creating lagged features for short-term energy consumption patterns. Visualization techniques, including time series plots and correlation heatmaps, offer a comprehensive view of energy usage trends and feature relationships. An XGBoost regression model was implemented to predict energy consumption based on identified features, evaluated by Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE). The model achieved robust accuracy in predicting energy usage, with visual comparisons of actual vs. predicted values to assess performance. Additionally, feature importance analysis highlighted influential factors. The model also provides a predictive alert for high energy consumption events, guiding users to conserve energy during peak usage periods. Forecasting extends predictions for upcoming time periods, presenting a scalable solution to optimize energy management in diverse building environments.