EV Charging Demand Forecasting — Project Report

1. Introduction

Electric Vehicle (EV) adoption is rapidly increasing, creating new challenges in managing charging station demand. This project aims to forecast daily energy demand at EV charging stations using time-series models based on historical usage, weather, and traffic data. Accurate forecasting helps optimize infrastructure and ensure sustainable charging availability.

2. Abstract

The project integrates three datasets: EV usage (Battery Capacity in kWh), weather data, and traffic data. By merging them on timestamp and resampling to daily values, we applied a forecasting model (Prophet) to project future demand. Visualizations were built in Tableau to compare actual and predicted values. The final dashboard includes forecast trends and a demand heatmap, allowing stakeholders to make data-driven planning decisions.

3. Tools Used

- Python (Pandas, Prophet, Matplotlib)

- Excel (data cleaning & validation)

- Tableau (dashboard visualization)

4. Steps Involved in Building the Project

Step 1: Data Collection & Preprocessing

• Loaded ev_usage.csv, weather_data.csv, traffic.csv

• Converted datetime columns, merged datasets using pd.merge_asof()

• Resampled data daily (.resample('D').sum())

Forecasting with Prophet:-

• Created time series with ds (date) and y (daily kWh usage)

• Trained Prophet model, generated 30-day future forecast

• Exported forecast to ev_demand_forecast.csv

Tableau Visualization:-

• Imported both ev_actual_demand.csv and ev_demand_forecast.csv

• Joined on date (ds = timestamp)

• Created dual-axis line chart to compare actual vs forecast

• Added filters and titles in dashboard layout

5. Conclusion

The model accurately forecasted energy demand trends for EV charging stations, showing peak demand periods in future dates. This enables better planning for station capacity, electricity allocation, and smart pricing during high-demand hours. The dashboard offers a quick visual insight into both historical and future patterns, supporting data-driven infrastructure planning.

Note: The project is limited to short-term daily forecasts. Future enhancements could include hourly prediction granularity and external factors like holiday schedules.

Tableau Dashboard Screenshot:-