edunet foundation

Name of Project: EV Vehicle/Charging Demand Prediction

Name: Ujjwal Gupta

AICTE Student ID: STU68374882bc9891748453506

AICTE Internship ID: INTERNSHIP_1748923002683e727a876ea

Learning Objectives

Analyze real-world EV adoption data to forecast charging demand using a full ML pipeline.

- Apply time series forecasting techniques.
- Perform data cleaning, transformation, and visualization.
- Engineer features (lags, trends, rolling averages).
- Build and evaluate regression-based prediction models.
- Interpret results using forecasting metrics.
- Deploy an interactive dashboard with Streamlit.
- Compare EV trends across regions.
- Gain end-to-end AI/ML project experience.

Source : www.freepik.com/

Tools and Technology used

Languages & Libraries

- **Python** – Core programming language
- **pandas, numpy** – Data manipulation & processing
- **scikit-learn** – Machine learning models
- **matplotlib, statsmodels** – Visualization & statistical analysis
- **joblib, tensorflow** – Model saving & support

Development & Deployment

- **Jupyter Notebook** – Model development & experimentation
- **Streamlit** – Interactive dashboard deployment
- **VS Code** – Code editing & debugging

Environment

- **Virtual environment** managed via requirements.txt

Data Source

- EV registration data from **Washington State, USA**

Methodology

1. **Data Collection**
   Collected county-wise EV registration data from Washington State.

2. **Data Preprocessing**
   Handled missing values, parsed dates, and encoded categorical features.

3. **Feature Engineering**
   Generated lag features, rolling averages, growth rates, and trend indicators.

4. **Model Building**
   Trained a **Random Forest** model using the engineered features.

5. **Forecasting**
   Predicted monthly EV adoption for the next 3 years.

6. **Visualization**
   Plotted EV adoption trends for individual and multiple counties.

7. **Deployment**
   Created an interactive dashboard using **Streamlit** for real-time insights.

Problem Statement:

Despite rising interest in electric vehicles, government planners and stakeholders lack effective tools to:

- Understand current EV adoption trends at the regional (county) level
- Predict future EV growth for infrastructure and policy planning
- Visualize adoption patterns across different counties

To address this, we built a machine learning model that forecasts EV adoption for the next 3 years and displays the results through an **interactive, user-friendly dashboard**.

Solution:

- Developed a machine learning model using historical EV registration data.
- Engineered time-based features to capture trends, seasonality, and growth patterns.
- Applied **Random Forest Regression** to forecast EV adoption at the county level.
- Built an interactive **Streamlit web app** for easy visualization and analysis.

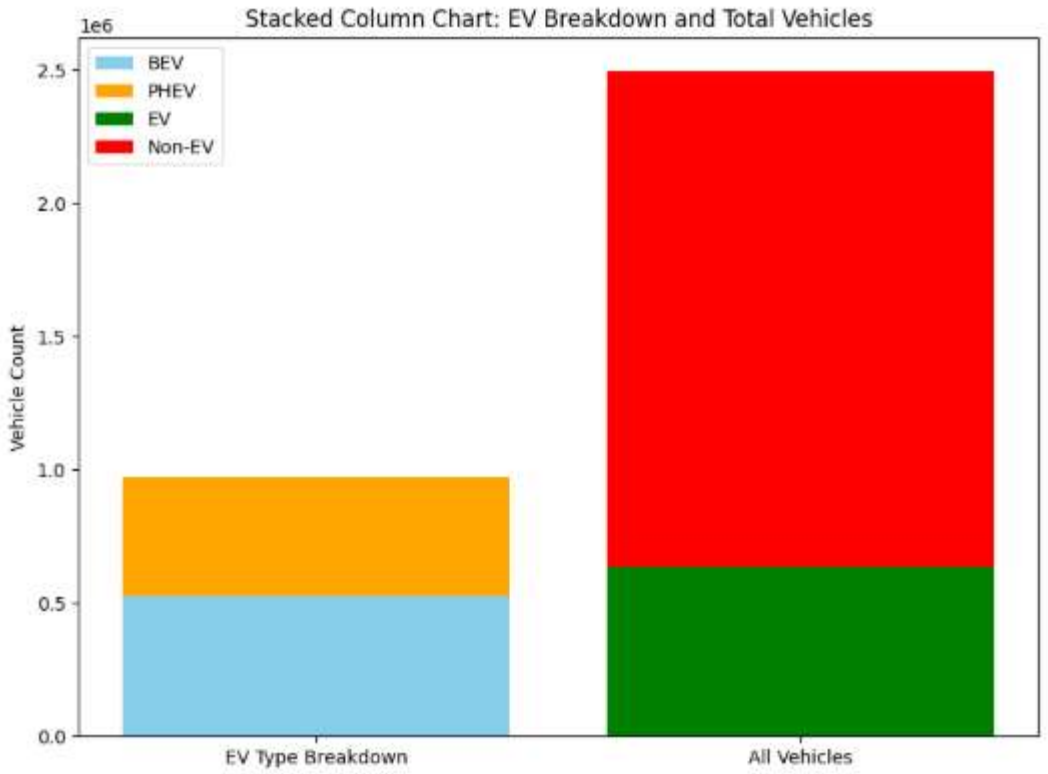
Dashboard Features

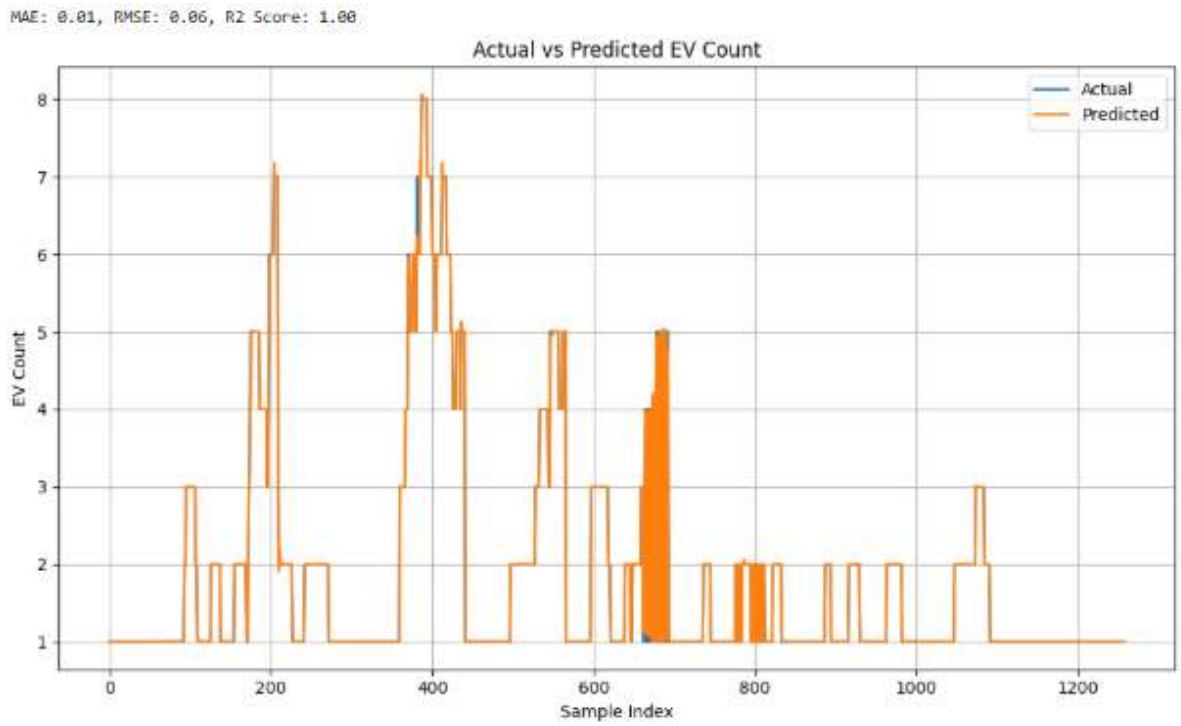
- Select a county to view its EV growth forecast
- Compare adoption trends across up to **three counties**
- Analyze projected EV growth over a **3-year period**

GitHub Repository Link:
https://github.com/ujjwalgupta2021/EV_Vehicle_Charge_Demand

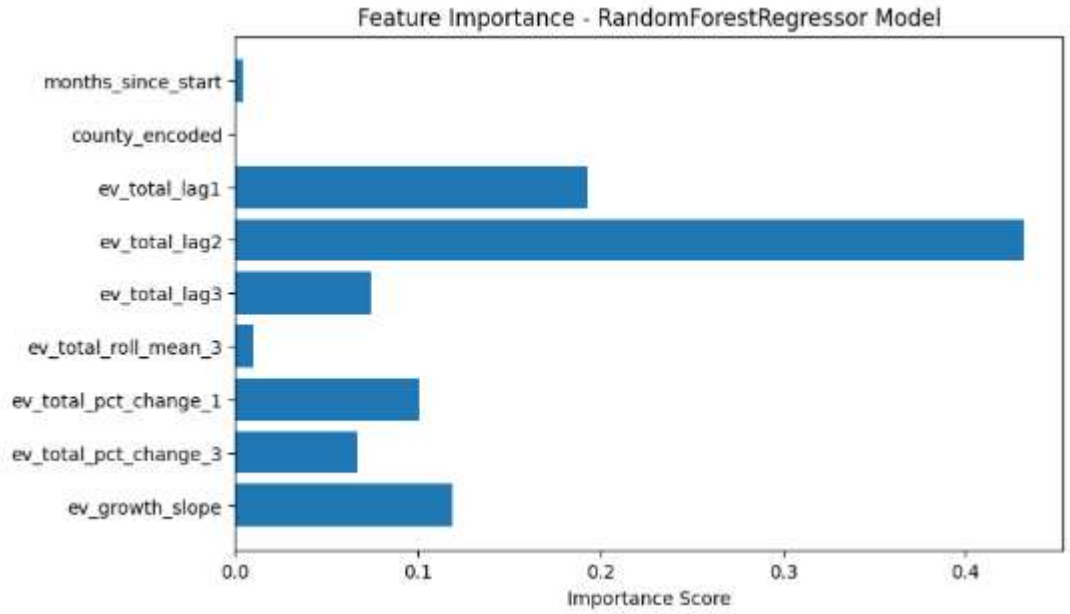
Streamlit Deployment Link:
https://ev-demand.streamlit.app/

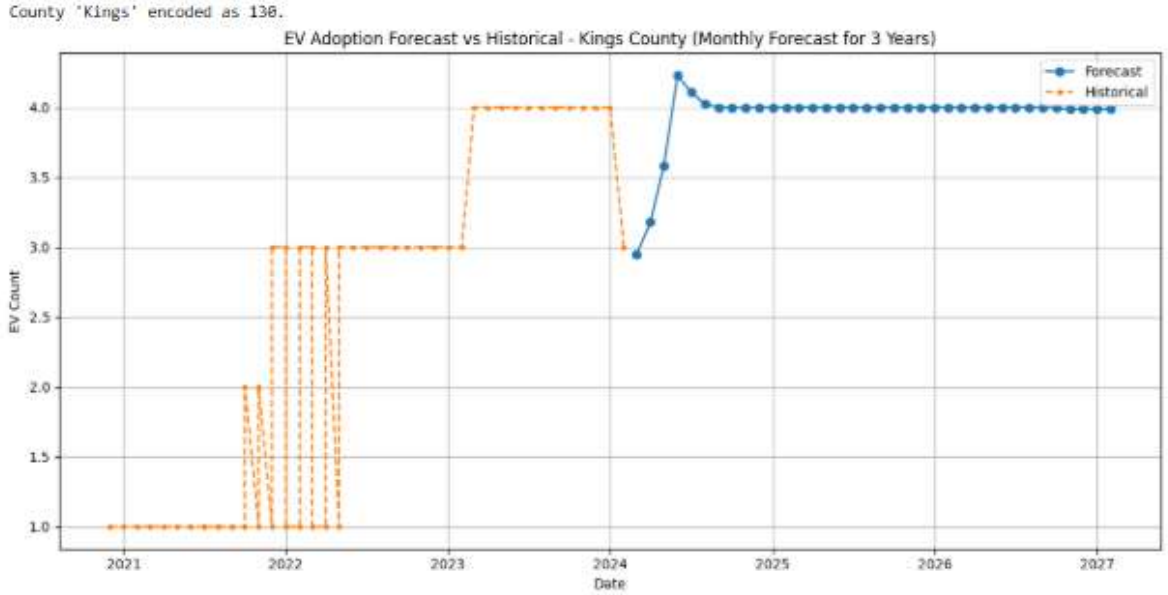
Screenshot of Output:



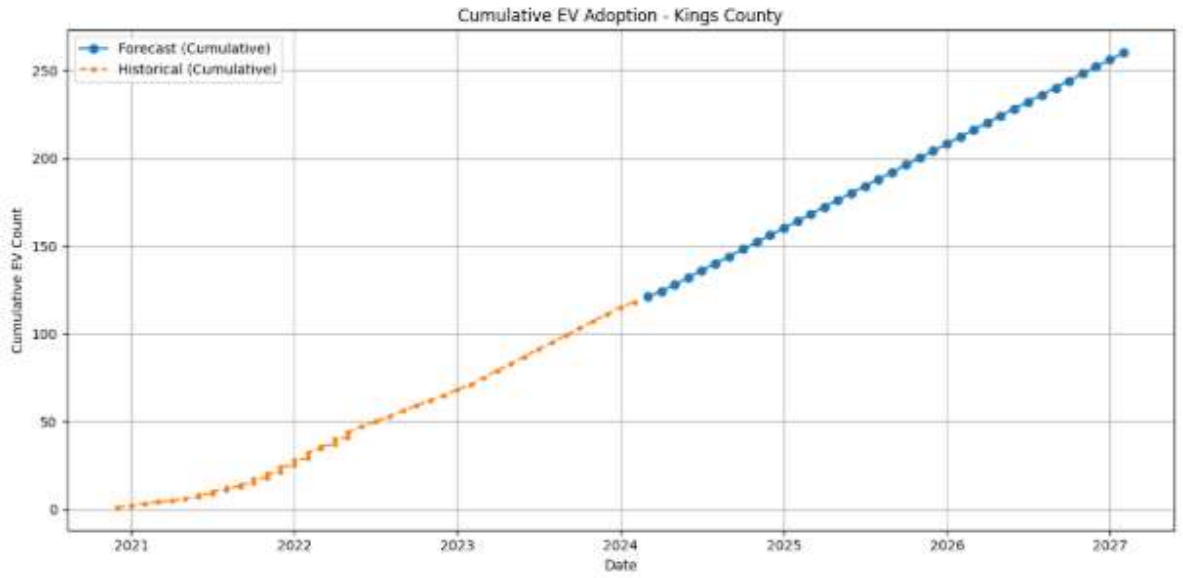


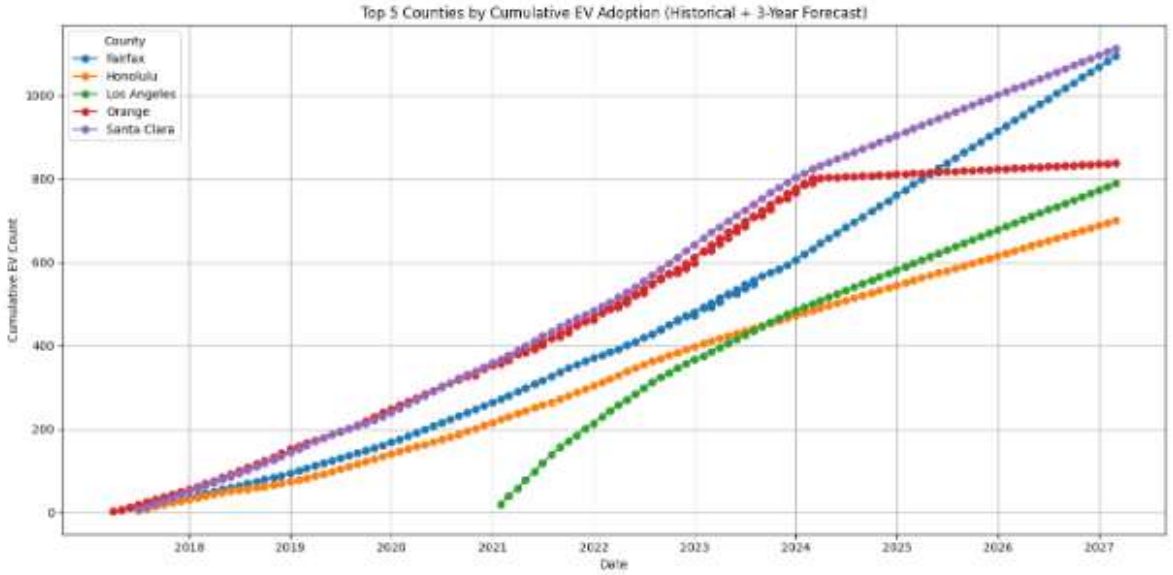
Screenshot of Output:



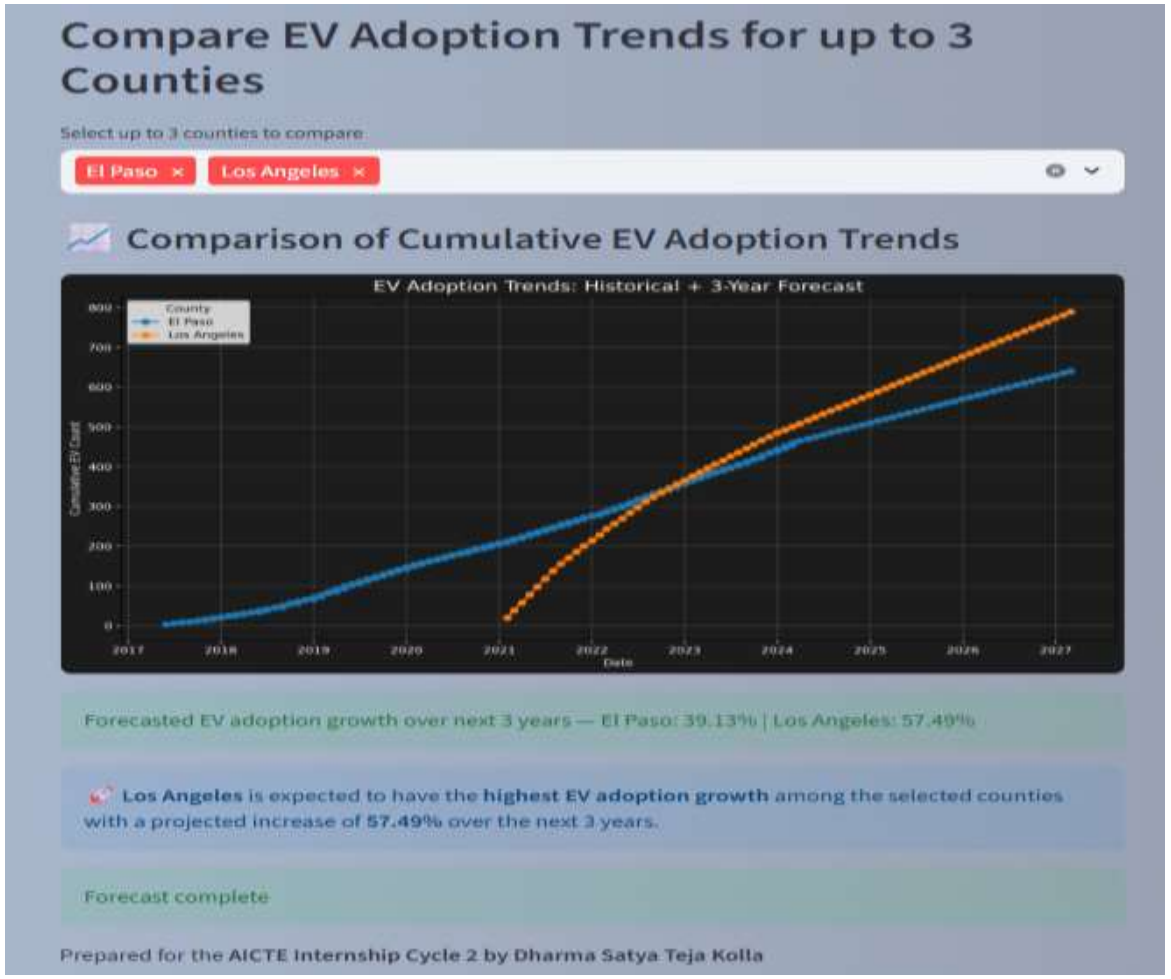


Screenshot of Output:





Screenshot of Output:



Conclusion:

- Successfully developed a machine learning model to forecast EV adoption using real-world data.
- Applied essential ML techniques including preprocessing, feature engineering, and regression modeling.
- Deployed an interactive **Streamlit dashboard** to visualize and explore predictions.
- Enabled data-driven insights to support regional planning and policy decisions.
- Demonstrated the practical value of AI/ML in addressing environmental and policy challenges.