# EV Charging Demand Forecasting in India

## Introduction

Electric Vehicles (EVs) are rapidly gaining popularity in India due to the push for clean energy. Accurately forecasting EV charging demand is crucial for efficient energy distribution and infrastructure planning. This project focuses on predicting EV charging station usage using environmental, temporal, and historical patterns.

## Abstract

This project aims to develop a predictive model for EV charging demand in India. Using simulated data that includes temperature, rainfall, day of the week, station type, and weather conditions, the model forecasts expected EV usage count. The forecasting pipeline begins with a **Random Forest Regressor** for pattern learning, and then transitions into a **Time Series Forecasting** model (**ARIMA**) to capture trends and temporal dependencies. The final solution is deployed using Streamlit for interactive real-time usage prediction.

## Tools Used

- Python
- Pandas & NumPy for data processing
- **Scikit-learn for Random Forest modeling**
- **Statsmodels for Time Series Modeling (ARIMA)**
- Streamlit for web-based deployment
- FPDF for report generation

## Steps Involved in Building the Project

1. Define the region of interest (India)
2. Simulate EV usage dataset with environmental and temporal variables
3. Preprocess the data (cleaning, encoding, and feature selection)
4. Build a **Random Forest Regressor** for initial forecasting
5. Transition to **ARIMA-based Time Series Model** for trend-based forecasting
6. Evaluate forecasting performance and visualize future usage
7. Develop a **Streamlit app** for real-time prediction interface
8. Package the model and app for local or cloud deployment

## Conclusion

The EV Charging Demand Forecasting project presents a powerful approach for smart infrastructure planning in India. By combining ensemble machine learning with ARIMA time series forecasting, the system captures both structured environmental inputs and evolving usage trends. Although built with simulated data, the architecture is ready for integration with real-time APIs, making it highly applicable for smart cities and energy distribution planning.