Smart City Traffic Forecasting – Project Report

# 1. Introduction

This project focuses on forecasting traffic patterns in a smart city using historical traffic data collected from four major junctions. The goal is to analyze traffic volume trends and use predictive models to forecast future traffic for effective city planning and congestion management.

# 2. Dataset Description

The dataset contains hourly traffic volume for four city junctions over a continuous time period. Each record includes the timestamp, junction ID, and the number of vehicles.

Key columns:

* - DateTime: Timestamp of the traffic record
* - Junction: ID of the junction (1 to 4)
* - Vehicles: Number of vehicles at the given time

# 3. Data Preprocessing & Feature Engineering

The following features were engineered to enhance model performance:  
- Time-based features: hour, day, month, weekday, is\_weekend  
- Lag features: 1-hour, 3-hour, and 6-hour lag of traffic volume  
- Rolling averages: 3-hour and 6-hour moving averages

# 4. Exploratory Data Analysis (EDA)

Various plots were created to analyze traffic patterns:  
- Boxplots of traffic volume by junction  
- Line plots showing average traffic by hour  
- Heatmaps of traffic across weekdays and hours

# 5. Forecasting Models Used

We implemented three forecasting techniques:  
- Prophet: Captures trends and seasonality for long-term hourly predictions  
- ARIMA: Classical statistical model for short-term forecasting  
- XGBoost: Tree-based regression model using lag/rolling features for prediction

# 6. Evaluation

The models were evaluated using the following metrics:  
- MAE (Mean Absolute Error)  
- R² Score (Coefficient of Determination)  
Results indicated that XGBoost achieved competitive accuracy due to engineered features, while Prophet captured long-term trends effectively.

# 7. Conclusion

Traffic forecasting can help smart cities manage congestion, optimize infrastructure usage, and improve transportation systems. This project demonstrates a hybrid approach combining statistical, machine learning, and time series forecasting techniques.

# 8. Future Scope

- Incorporate external data: holidays, weather, and road events  
- Deploy a live dashboard for city officials using Streamlit  
- Use LSTM deep learning models for improved long-range forecasts