Final Report

1. INTRODUCTION

1.1 Project Overview

Traffic Telligence is a machine learning-based project developed to estimate traffic volume using features such as date, time, weather, holidays, and road conditions. This project applies regression models to predict traffic load and support traffic management systems with data-driven decisions.

1.2 Purpose

The purpose of this project is to provide an accurate and automated approach to predict traffic volume using machine learning, helping city authorities, planners, and commuters make informed decisions to reduce congestion and improve road safety.

2. IDEATION PHASE

2.1 Problem Statement

Urban areas suffer from unpredictable traffic congestion, causing delays and environmental concerns. Traditional prediction systems lack accuracy and scalability. The project aims to solve this by using machine learning models for advanced traffic volume estimation.

2.2 Empathy Map Canvas

Think & Feel: Users want smoother commutes and less waiting time.

Hear: Complaints about long traffic jams and unpredictable delays.

See: Constant congestion on roads, especially during peak hours.

Say & Do: Depend on traffic apps, try alternate routes.

Pain: Wasted time, fuel, increased stress.

Gain: Efficient travel, reliable traffic insights, better planning.

2.3 Brainstorming

Use historical traffic and weather data

Apply machine learning regression models

Visualize hourly, daily, and seasonal traffic patterns

Provide actionable insights through predictions

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

User Need: Real-time, reliable traffic forecasts

Interaction: Check traffic conditions or plan travel

Pain Point: Unplanned delays due to congestion

Solution: Predictive traffic model for route and volume awareness

3.2 Solution Requirement

Clean and labeled dataset

Time and weather feature extraction

Visualization libraries (matplotlib, seaborn)

ML models like Random Forest and Linear Regression

3.3 Data Flow Diagram

Raw Data → Preprocessing → Feature Engineering → Model Training → Evaluation → Prediction → Visualization

3.4 Technology Stack

Language: Python

IDE: Jupyter Notebook

Libraries: pandas, numpy, matplotlib, seaborn, scikit-learn

Version Control: Git, GitHub

4. PROJECT DESIGN

4.1 Problem Solution Fit

The system uses ML to fill the gap in accurate traffic volume prediction, helping in traffic management and planning.

4.2 Proposed Solution

Random Forest Regressor model outperforms other models in prediction accuracy. Extracted features like hour, holiday status, and weather conditions improved predictions.

4.3 Solution Architecture

Data Collection

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Preprocessing & Feature Engineering

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Model Building (Linear, Decision Tree, Random Forest)

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Evaluation & Visualization

5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

Week	Tasks
1	Dataset collection and understanding
2	Data preprocessing and cleaning
3	Feature engineering and visualization
4	Model training and testing
5	Evaluation, result interpretation, and documentation

6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

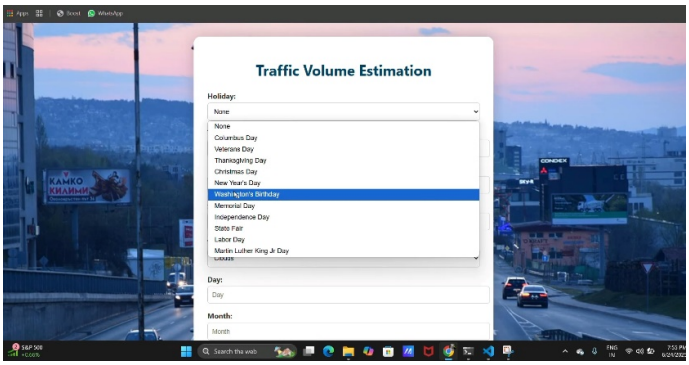
Evaluation Metric: R^2 Score

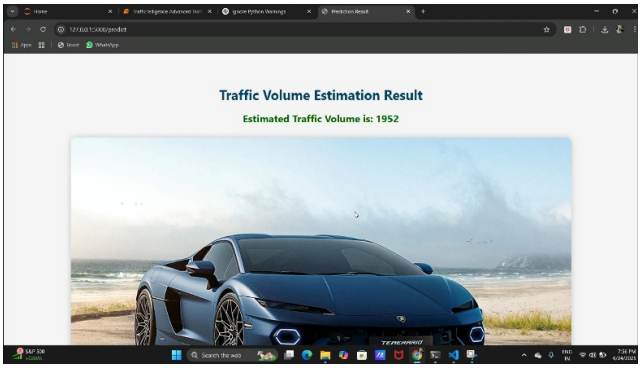
Model	R^2 Score
Linear Regression	~0.36
Decision Tree Regressor	~0.65
Random Forest Regressor	~0.84

Random Forest showed the best performance with the highest accuracy

7. RESULTS

7.1 Output Screenshots





8. ADVANTAGES & DISADVANTAGES

Advantages

- Accurate prediction of traffic volume
- Easily extendable to live systems
- Visual and analytical insight generation

Disadvantages

- Depends on dataset quality
- May need frequent retraining for new cities or trends
- Doesn’t include live sensor data

9. CONCLUSION

The Traffic Intelligence project successfully demonstrates how machine learning can predict traffic volume with considerable accuracy. It simplifies traffic forecasting and supports better decision-making in traffic management and urban planning.

10. FUTURE SCOPE

Integrate real-time data streams (e.g., IoT, GPS)

Web app/dashboard deployment

Include deep learning for time series forecasting

Use location-based clustering for city-specific models

11. APPENDIX

Source Code

Included in the GitHub repository.

GitHub & Project Demo Link: https://drive.google.com/file/d/1LGR9F0E9AW-5AiwWfh4uVEPm7yZilipm/view?usp=sharing

GitHub Repository: - TrafficTelligence-Advanced-Traffic-Volume-Estimation-with-Machine-Learning