🚦 Traffic Volume Estimation - Final Project Report

1. INTRODUCTION

1.1 Project Overview

This project aims to develop a machine learning-based solution to estimate traffic volume based on historical and real-time data. The system analyzes patterns in traffic data to help city planners, commuters, and authorities make informed decisions for managing congestion.

1.2 Purpose

The purpose is to automate traffic volume estimation using data science techniques, improving prediction accuracy over manual or static models, and supporting smart city initiatives.

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2. IDEATION PHASE

2.1 Problem Statement

Increasing traffic congestion in urban areas leads to delays, pollution, and inefficiency. Accurately estimating traffic volume can help manage and plan road usage effectively.

2.2 Empathy Map Canvas

- **Who are we helping?** Commuters, traffic authorities, city planners
- **What do they see?** Traffic jams, unexpected delays
- **What do they feel?** Frustration, stress
- **What do they say?** Need better traffic management
- **What do they do?** Use apps, follow traffic signals

2.3 Brainstorming

Ideas considered:

- Use of real-time sensors
- Integration with weather data
- Time-series modeling

- Flask API for deployment

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3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

Commuter → Starts journey → Uses app for volume estimate → Chooses optimal route → Reaches destination

3.2 Solution Requirement

- Historical traffic dataset (`traffic_volume.csv`)
- Preprocessing and feature engineering
- ML model (e.g., Linear Regression, Random Forest)
- Web interface (Flask app)

3.3 Data Flow Diagram

1 Input data → 2 Preprocessing → 3 Model Prediction → 4 Output

3.4 Technology Stack

- Python, Pandas, Scikit-Learn
- Jupyter Notebook
- Flask (for API)
- IBM Cloud / Heroku (deployment)

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4. PROJECT DESIGN

4.1 Problem Solution Fit

The proposed solution directly addresses the need for dynamic traffic volume predictions.

4.2 Proposed Solution

A machine learning model trained on traffic volume data, exposed via a Flask API for real-time use.

4.3 Solution Architecture

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- CopyEdit
- User → API request → Flask → ML Model → Response with prediction
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- ## 5. PROJECT PLANNING & SCHEDULING
- ### 5.1 Project Planning

Phase	Timeline
Data collection & cleaning	Week 1
Model development	Week 2-3
API integration	Week 4
Testing & Deployment	Week 5

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- ## 6. FUNCTIONAL AND PERFORMANCE TESTING
- ### 6.1 Performance Testing
- ● MSE / RMSE computed on test data
- ● Model tested with unseen data
- ● API tested for response time
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- ## 7. RESULTS
- ### 7.1 Output Screenshots
- ✅ Model predictions plotted (from `traffic_volume.ipynb`)
  ✅ API responses (Flask app screenshot)
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- ## 8. ADVANTAGES & DISADVANTAGES
- ✅ Accurate, data-driven predictions
  ✅ Scalable and can integrate additional features (weather, holidays)

⚠️ Dependent on data quality
⚠️ Requires regular model retraining

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9. CONCLUSION

The traffic volume estimation project successfully demonstrates how machine learning can be applied to real-world urban challenges.

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10. FUTURE SCOPE

- Incorporate live sensor data
- Use deep learning for higher accuracy
- Predict congestion zones on maps

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11. APPENDIX

- **Source Code:** Included in `train_model.ipynb`, `traffic_volume.ipynb`
- **Dataset Link:** Local file `traffic_volume.csv`
- **GitHub & Project Demo Link:**
  [https://github.com/Venkatesh7981/TrafficVolumeProject]