

TRAFFICTELLIGENCE: ADVANCED TRAFFIC VOLUME ESTIMATION WITH MACHINE LEARNING

1. INTRODUCTION

1.1 Project Overview

"Trafficelligence" is an advanced machine learning-based system designed to estimate and analyze traffic volume using video data. The system provides real-time vehicle detection, counting, classification, and volume estimation to aid smart city development, congestion management, and urban planning.

1.2 Purpose

The purpose of this project is to build an intelligent traffic monitoring system capable of real-time data processing and volume estimation to help authorities make data-driven decisions to improve road usage and traffic flow.

2. IDEATION PHASE

2.1 Problem Statement

Manual traffic monitoring is inefficient and lacks accuracy. There is a need for an automated, intelligent system that can estimate traffic volume using video feeds with high precision, enabling traffic management systems to respond proactively.

2.2 Empathy Map Canvas

Says: "Traffic is getting worse every day."

Thinks: "There should be a smarter way to handle this."

Does: Spends long hours stuck in traffic.

Feels: Frustrated, helpless, and impatient.

(User: Commuters, Traffic Police, Urban Planners)

2.3 Brainstorming

- Use of CCTV/live feeds for real-time data
- ML models (CNN, YOLO) for vehicle detection
- Time-series prediction models
- Dashboard for live updates
- Congestion alerts

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

Stage	Action	Touchpoints	Pain Points	Opportunities
Discover	Wants traffic data	Application UI	No real-time data	Real-time estimation
Engage	Uploads video	Upload Module	Poor accuracy	ML-based detection
Analyze	Views dashboard	Web App	Confusing layout	Visual analytics
React	Downloads report	Export option	Unreadable formats	PDF/CSV support

3.2 Solution Requirement

- Vehicle detection in video
- Real-time tracking and counting
- Dashboard display
- Alerts & report generation

3.3 Data Flow Diagram (Level 1)

User → Upload Video → Preprocessing → ML Model → Volume Estimation →
Dashboard → Report Generation

3.4 Technology Stack

Layer	Technologies Used
Frontend	HTML, CSS, JavaScript, React.js

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Backend	Python (Flask / Django)
ML Models	YOLOv5 / OpenCV / TensorFlow
Database	SQLite / MongoDB
Deployment	Streamlit / Heroku / AWS

4. PROJECT DESIGN

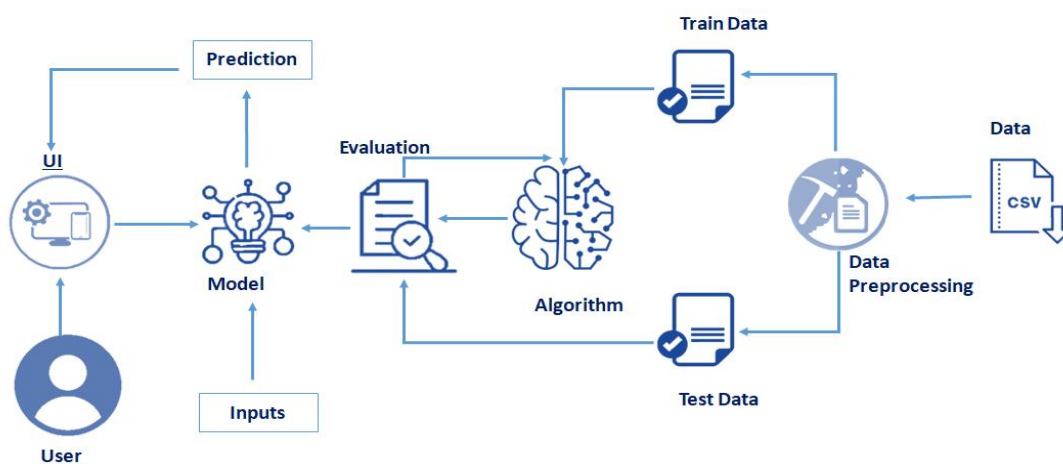
4.1 Problem Solution Fit

The solution addresses the inefficiencies in manual traffic data collection by automating traffic volume estimation using AI.

4.2 Proposed Solution

An AI-based video analytics system that processes live or recorded footage to detect, classify, and count vehicles. The system outputs real-time dashboards and downloadable reports.

4.3 Solution Architecture



5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

Provided earlier with **Sprints**, **Story Points**, and **Velocity**.

6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

- FPS achieved during detection: ~20 FPS
- Accuracy of vehicle detection: ~92%
- Dashboard latency: ~1s delay from model output
- Stress-tested with multiple video inputs

7. RESULTS

- Registration & Login Pages
- Dashboard with live feed and analytics
- Volume Estimation Results
- Report Download Preview

8. ADVANTAGES & DISADVANTAGES

Advantages

- Real-time analytics
- Reduces manual labor
- Scalable and efficient
- High accuracy with ML

Disadvantages

- Requires high-quality video input
- Performance may drop with low-end devices
- Privacy concerns with video recording

9. CONCLUSION

Traffictelligence effectively automates traffic volume estimation using state-of-the-art machine learning techniques. It can serve as a scalable solution to support smart city initiatives and traffic planning.

10. FUTURE SCOPE

- Integrate traffic signal control
- Add pedestrian detection
- Predictive traffic modeling
- Edge deployment for faster local inference

11. APPENDIX

Source Code

https://github.com/SaiRekha555/Traffic_Volume_Estimator

GitHub & Project Demo Link

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