Functional Design Specification (FDS)

# Project: TrafficTelligence - Advanced Traffic Volume Estimation with Machine Learning

## 1. Purpose

This document outlines the functional design specifications for the TrafficTelligence system. It defines the system's modules, data flow, user interactions, and performance requirements to ensure consistent development and deployment.

## 2. Scope

TrafficTelligence is designed to provide accurate real-time traffic volume estimates using ML models. The system processes video input or sensor data, performs vehicle detection, and visualizes results via a web interface.

## 3. System Architecture

- Data Input Module: Handles video feeds or sensor inputs  
- Preprocessing Module: Cleans and formats input data  
- ML Engine: Detects and estimates vehicle counts  
- Dashboard: Visualizes traffic stats and insights  
- API Layer: Enables interaction with external systems

## 4. Functional Modules

4.1 Video Capture & Preprocessing  
- Ingests video feeds  
- Converts to frames  
- Applies filters and bounding boxes  
  
4.2 ML Model Inference  
- Predicts vehicle count using CNN or regression  
  
4.3 Dashboard Visualization  
- Displays counts, congestion levels, trends  
  
4.4 Admin Panel  
- Configure camera sources, thresholds, and user management

## 5. Data Flow Diagram (DFD)

Level 0 and Level 1 DFDs will illustrate the flow from raw input to final display and analytics.

## 6. Input/Output Specifications

Inputs:  
- Live camera feed or video file  
- Sensor logs (optional)  
  
Outputs:  
- Real-time vehicle count  
- Daily/hourly traffic reports  
- Alerts for congestion

## 7. API Endpoints

- POST /upload\_video  
- GET /traffic\_volume?location=xyz  
- GET /dashboard\_stats  
- POST /configure\_system

## 8. User Roles & Access

- Admin: Full access to configuration, dashboard, and user control  
- Analyst: View dashboards and download reports  
- Guest: Real-time view only

## 9. Error Handling

- Input video corruption detection  
- Inference model fallback  
- Notification for failed data pipelines

## 10. Performance Requirements

- Inference latency < 2 seconds per frame  
- Accuracy ≥ 90% vehicle count  
- System uptime ≥ 99.5%

## 11. Future Enhancements

- Cloud deployment for multi-junction scalability  
- Integration with traffic signal systems  
- AI route recommendations