E-Challan System

Comprehensive Project Report

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Section 1 : Project Overview

The E-Challan System is a comprehensive solution designed to automate traffic violation detection, management, and penalty enforcement. It leverages modern web technologies and machine learning to create a robust infrastructure for traffic monitoring.

The system consists of a high-performance FastAPI backend and a responsive, interactive frontend built with HTML, CSS, and JavaScript.

Section 2 : Backend Architecture

Technology Stack: Python, FastAPI, SQLModel (SQLite), TensorFlow Lite.

Key Features:

- RESTful API Design: Structured endpoints for scalability.

- Database Management: SQLite database handling Cameras, Users, Challans, Payments, and Appeals.

- Machine Learning Integration: TFLite model integration for processing vehicle images and detecting violations (e.g., no helmet, speeding).

- Notification System: Multi-channel alerts using FCM (Push), Email, and WhatsApp.

- Analytics Engine: Dedicated endpoints for aggregating violation stats, revenue data, and camera health metrics.

Section 3 : Frontend Features

Technology Stack: HTML5, CSS3, JavaScript (ES6+), Leaflet.js, Chart.js.

Key Features:

- Interactive Map: Real-time visualization of camera locations with status indicators (Active/Inactive).

- Dashboard: Live statistics showing total violations, revenue generated, and system health.

- Voice Alerts: Integrated text-to-speech engine for audible notifications of system events.

- Vehicle Lookup: Public portal for users to check violation history by vehicle number.

- Evidence Upload: Interface for uploading images to test the violation detection model.

- Dark/Light Mode: User-customizable interface theme.

- Routing: Integrated navigation to find directions to specific camera locations.

Section 4 : Database Schema

The system uses a relational database with the following core entities:

1. Camera: Stores location (lat/lng), address, status, and health score.

2. User: Manages authentication, roles (admin/user), and contact info.

3. Challan: Records violation details, vehicle info, amount, and payment status.

4. Payment: Tracks payment transactions and methods.

5. Appeal: Manages user disputes against issued challans.

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Section 5 : Recent Updates & Achievements

- Implemented Voice Alert system for real-time auditory feedback.
- Added comprehensive Analytics Dashboard with visual charts.
- Integrated Payment and Appeals processing workflows.
- Enhanced Map interface with routing and clustering capabilities.
- Finalized User Authentication and Profile management.