E-Challan System - Project Report

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1. Project Overview

The E-Challan System is a comprehensive solution designed to automate traffic violation detection and management. It consists of a robust Backend API, a dynamic Web Frontend for monitoring and analytics, and an Android Application for mobile access.

2. Backend (FastAPI)

The backend is built using FastAPI and SQLModel, providing a high-performance REST API.

Key Features:

- Core API: Camera management, Challan issuance, and Image Prediction.
- Authentication: User Registration and Login with secure password hashing.
- Database: SQLite database with SQLModel ORM for efficient data handling.
- Analytics: Endpoints for violation stats, revenue, and camera performance.
- User Management: Profile viewing and updating.
- Challan Management: Detailed history, filtering, and vehicle lookup.
- Payments: Payment processing simulation and history tracking.
- Appeals System: Users can submit appeals; Admins can review them.
- Search: Universal search across vehicles, challans, and cameras.
- Camera Health: Monitoring system for camera status and maintenance.
- Notifications: Integration with FCM (Push), Email (Gmail), and WhatsApp (Twilio).
- Testing Infrastructure: Automated Python script to verify API health, analytics, and prediction endpoints.

3. Frontend (Web)

The web interface is built with HTML, CSS, and Vanilla JavaScript, utilizing Leaflet for mapping.

Key Features:

- Interactive Map: Real-time camera visualization using Leaflet.js.
- Live Monitoring: Simulated activity feed and real-time statistics.
- Violation Detection: 'Over Speed' and 'Slow Speed' alerts with visual warnings.
- Dashboard: Analytics charts for violation trends and camera performance.
- Vehicle Lookup: Search tool for vehicle history and fines.
- Theme Support: Toggle between Light and Dark modes.
- Voice Alerts: Text-to-speech notifications for critical events.
- Image Upload: Interface to upload evidence and get AI predictions.

4. Android Application

The Android app is developed using Kotlin and Jetpack Compose.

Key Features:

- Modern UI: Built with Jetpack Compose for a responsive interface.
- Google Maps Integration: Displays traffic cameras on a native map.
- Real-time Data: Fetches camera data directly from the Backend API.
- Marker System: Visual markers for camera locations.

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5. Conclusion

The project has successfully implemented the core pillars of a modern traffic management system. The integration between the Backend, Web Frontend, and Android App ensures a seamless flow of data and real-time responsiveness.