🛣️ Sahchaari - Smart Traffic Control Assistant

Comprehensive Project Documentation

Problem Statement

Modern cities face a growing burden of traffic congestion, inefficient signal management, uncoordinated emergency movement, and unreported infrastructure issues like potholes or illegal parking. This project presents an AI-powered web dashboard that supports traffic police in making data-driven decisions, integrates emergency routing alerts, and enables citizens to report real-world issues, leading to a holistic and responsive traffic management system.

📘 1. Project Overview

The **Smart Traffic Control Assistant** is an intelligent, modular traffic management web platform designed to support urban traffic authorities, emergency services, and citizens. The system combines AI-based traffic analytics, user reporting, and map-based insights to offer smarter, real-time decision-making in metropolitan areas.

🧠 2. Core Features & Modules

🧠 A. AI-Based Manual Traffic Control Assistant

✅ Problem:

Traffic officers at junctions manually control vehicle flow without real-time data about traffic density on each road.

💡 Solution:

A web dashboard powered by AI (OpenCV or YOLO) that counts vehicles per side and recommends traffic light switching priorities.

🔧 Functional Flow:

1. **Input**: Live camera feed (via CCTV, IP camera, or video simulation)
2. **Processing**:

    - Frame-by-frame vehicle detection using YOLO/OpenCV
    - Count vehicles in each lane/direction
    - Estimate wait times
3. **Output**:
    - Visual indicators of congestion on each direction
    - Recommended action (e.g., "Release Northbound vehicles")
    - Wait time stats

🧰 **Tech Stack:**

- **Frontend**: React + TypeScript + Tailwind CSS
- **Backend**: Django (Python)
- **AI**: YOLOv8/OpenCV with Python
- **Video Input**: YouTube live stream or uploaded video (for simulation)
- **Dashboard**: Charts for vehicle count, recommendations, history

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🚑 B. Emergency Route Clearance Assistant

✅ **Problem:**

Ambulances face delays due to congested routes, especially during peak hours.

💡 **Solution:**

Allow ambulances/hospitals to send a live alert specifying their route, so admins and traffic officers can take immediate action.

🔧 **Functional Flow:**

1. Hospital/driver sends alert via web form or mobile input
2. Route is marked on the admin map interface
3. Traffic admins are alerted with the ETA and direction

4. Manual or AI-based clearance is initiated (e.g., pause signal, send alert to public dashboard)

🧰 **Implementation Notes:**

- Notification system via backend + Firebase (optional)
- Routes highlighted using Leaflet or Google Maps API

📢 C. Public Incident Reporter (User Submission Panel)

✅ **Purpose:**

Enable citizens to report traffic-related issues in real time.

🧩 **Supported Report Types:**

- 🚧 Accidents
- 🕳️ Potholes
- 🌊 Waterlogging
- 🚦 Traffic jams or blockages

🔧 **Functional Flow:**

1. User selects type of issue
2. Inputs optional description, location, and uploads an image
3. Submits to backend via authenticated or anonymous form
4. Admin receives notification and incident appears on the map

🧰 **Tech Highlights:**

- React form + Google Maps location picker
- Django REST API for submission
- Firestore or PostgreSQL for storing report logs

🅿️ D. Public Parking Area Viewer (NEW FEATURE)

✅ **Purpose:**

Let users view static public parking areas within a city (no slot availability shown).

🔧 **Features:**

- "🚗 Parking" tab in navigation bar
- Map view with markers of all known parking zones
- Marker popup includes: name, type (public/private), capacity (optional)

🧰 **Stack:**

- Leaflet.js + React-Leaflet
- Parking data fetched from Django API or local JSON

🔧 3. Technology Stack Summary

Layer	Stack
Frontend	React, TypeScript, Tailwind CSS
Backend	Django + Django REST Framework
AI Module	Python, OpenCV, YOLOv8
Map API	Leaflet.js or Google Maps API
Database	mysqlite
Deployment	Vercel (Frontend), Heroku/AWS (Backend)

🧪 4. Future Add-Ons

✅ Smart Signal Scheduling (Peak Time AI Control)

- Use traffic data at peak hours (8–10 AM, 4–10 PM)
- Adjust signal duration based on vehicle count
- Generate a traffic flow timetable for officers

✅ Parking Slot Availability (Future IoT Integration)

- Show **real-time available slots**
- Use sensors or 3rd-party API to update availability on map

✅ Automatic Illegal Parking Detection

- Detect vehicles parked illegally on public roads
- Use object detection + OCR for number plate
- Compare against road rules (no parking zones, timing)
- Auto-generate alerts or fines

👩‍💼 5. Admin Panel Capabilities

- 👮 View live traffic feeds and AI recommendations
- 📢 Receive user-submitted incident alerts
- 🚑 Get emergency route alerts in real time
- 🅿️ Manage and update parking location database
- 📊 View analytics (vehicle count history, reports, emergency alerts)

🔚 6. Conclusion

The **Smart Traffic Control Assistant** aims to revolutionize urban traffic management by merging artificial intelligence, real-time reporting, and public utility services. With a scalable and modular design, the system can be extended into full-fledged smart city infrastructure management.