**Purpose**

The AI-Powered Smart Traffic Management System aims to optimize traffic flow, reduce congestion, and enhance road safety using artificial intelligence. The system will leverage real-time data from cameras, sensors, and historical traffic patterns to make intelligent traffic control decisions.

**User Roles & Hierarchies**

**City Traffic Control Authorities (Admin)**

Full access to control the traffic system.

Manage AI rules and policies.

Monitor traffic patterns and congestion levels.

Oversee system analytics and reports.

Override AI decisions in emergencies.

**Traffic Police Officers (Moderator)**

Access live traffic data and reports.

Adjust signals manually in case of system failure.

Issue real-time alerts (e.g., accidents, emergencies).

Use AI-driven insights for road safety enforcement.

**General Public (Driver/Citizen)**

Receive real-time traffic updates.

Get route optimization and alternative path suggestions.

View congestion reports and accident alerts.

**System Administrator (Technical Role)**

Maintain and update the AI system.

Manage database and sensor connectivity.

Ensure cybersecurity and data integrity.

**Use Case Diagram**

**Admin:**

Configures AI algorithms.

Monitors and overrides traffic signals.

Reviews analytics and reports.

**Traffic Police**:

Views real-time traffic conditions.

Issues alerts for accidents.

Adjusts signals in case of AI failure.

**Drivers/Public:**

Receives optimized routes.

Checks traffic congestion.

Gets accident alerts.

**Functional Requirements**

**Core Functionalities**

Traffic Signal Optimization – AI will analyze traffic density and adjust signal durations accordingly.

Real-Time Traffic Monitoring – The system will use camera feeds and sensors to monitor congestion.

Route Optimization & Navigation – Drivers will get the best possible routes based on AI predictions.

Incident Detection & Alert System – AI will detect accidents or anomalies and notify relevant authorities.

Emergency Vehicle Priority System – The system will recognize emergency vehicles and adjust signals to provide them a green corridor.

Historical Data Analysis – AI will analyze past traffic patterns to predict and prevent congestion.

Manual Override – Authorities can manually override AI decisions in case of failures or special events.

**Non-Functional Requirements**

High System Availability – The system should operate 24/7 with minimal downtime.

Scalability – The architecture should support an increasing number of users and data sources.

Data Security & Privacy – Protect personal and vehicle data from unauthorized access.

User-Friendly Interface – The system should have an intuitive UI for authorities and citizens.

**Example Scenarios**

**Scenario 1: AI-Driven Traffic Signal Control**

A busy intersection is monitored by AI.

AI detects that one road has significantly more traffic than the other.

It adjusts the green light duration to ease congestion.

**Scenario 2: Emergency Vehicle Priority**

A fire truck is detected by the system.

AI creates a green corridor by adjusting traffic signals along its route.

The vehicle reaches the destination faster.

**Scenario 3: Accident Detection & Alert**

AI identifies a sudden stop of multiple vehicles.

The system flags it as a possible accident.

Traffic police receive an alert and dispatch assistance.