Project Title: UrbanFlow - Smart Traffic Light System with Dynamic Priority Management

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Project Overview:

Objective:
To develop UrbanFlow, a smart traffic light system that prioritizes emergency vehicles and optimizes traffic flow using innovative Priority Management and a user-friendly Android application.

Key Components:

1. **Mobile Application**
2. **Priority Management System**

Mobile Application (UrbanFlow):

Features:

1. **User Registration and Login:**
   - Secure authentication for vehicle owners, commuters, and emergency service drivers.
   - Firebase Authentication ensures data security and user privacy.
2. **Real-Time Traffic Updates:**
   - Notifies users of traffic light statuses and estimated wait times.
   - Emergency vehicle drivers send GPS coordinates to the API every 15 seconds for real-time updates.
3. **Priority Notification:**
   - Receives priority alerts for emergency vehicles to adjust routes and traffic light timings.
4. **Route Prediction:**
   - Predicts emergency vehicle routes using Google Maps API and real-time GPS data.

Priority Management System:

Innovations:

1. **Dynamic Priority Calculation:**
   - Calculates priority scores based on the number of emergency vehicles and traffic conditions.

- ○ Adjusts traffic light timings dynamically to prioritize emergency vehicles.
  2. **Integration with Traffic Data:**
     - ○ Utilizes traffic and security cameras for real-time data collection.
     - ○ Analyzes data using computer vision for accurate traffic flow predictions.
  3. **Machine Learning Enhancement:**
     - ○ Integrates machine learning models for predictive analysis of traffic patterns and emergency vehicle routes.
     - ○ Enhances priority management accuracy and system efficiency over time.

Implementation Plan:

Phase 1: Development

1. **User Interface Development:**
   - ○ Designs a user-friendly interface with specific color schemes in Android Studio.
2. **Backend Development:**
   - ○ Implements FastAPI for secure user authentication and real-time data handling.
3. **Traffic Data Integration:**
   - ○ Integrates traffic data sources and computer vision techniques for data-driven decision-making.

Phase 2: Testing and Optimization

1. **Simulation and Visualization:**
   - ○ Simulates traffic scenarios using Unity for visual impact assessment and system optimization.
2. **System Testing:**
   - ○ Conducts rigorous testing of the Android app and Priority Management system.
   - ○ Collaborates with local authorities for feedback and real-world testing.

Phase 3: Deployment and Scaling

1. **Pilot Deployment:**
   - ○ Deploys UrbanFlow in a controlled urban area for initial performance evaluation.
2. **Full-Scale Deployment:**
   - ○ Scales UrbanFlow to broader urban environments based on pilot results and user feedback.
   - ○ Continuously monitors and updates the system for optimal traffic management.

Conclusion:

UrbanFlow represents a significant advancement in urban traffic management by focusing on dynamic Priority Management and an intuitive Android application. By prioritizing emergency vehicles and optimizing traffic flow in real time, UrbanFlow aims to enhance urban mobility, reduce congestion, and improve overall safety on city roads.