WAYWATCH A CROWD SOURCED - AI-ENABLED SMART ROAD MONITORING AND MAINTENANCE SYSTEM

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Introduction:

1. Road infrastructure monitoring is a critical aspect of urban development, yet existing methods such as manual inspections and complaint-based systems are often slow, inefficient, and lack real-time responsiveness. These limitations lead to delayed issue resolution, increased safety risks, and poor coordination between citizens and authorities. With the widespread availability of smartphones and advancements in artificial intelligence, there is a strong opportunity to modernize this process through digital and data-driven solutions.
2. **WayWatch** is a real-time, crowd-sourced road monitoring system that enables users to capture and upload images of road issues such as potholes and cracks using a mobile application. The system integrates AI-based image analysis to identify and classify road damage, along with geospatial mapping to visualize reported issues on an interactive map. Additionally, it incorporates hazard-aware navigation, providing users with alerts and alternative routes based on real-time road conditions.
3. By combining user-driven reporting, deep learning, and location-based services, waywatch offers a scalable and efficient solution for improving road safety and infrastructure management. The system promotes active citizen participation while enabling authorities to make faster and more informed decisions, contributing to the development of smarter and more responsive urban environments.

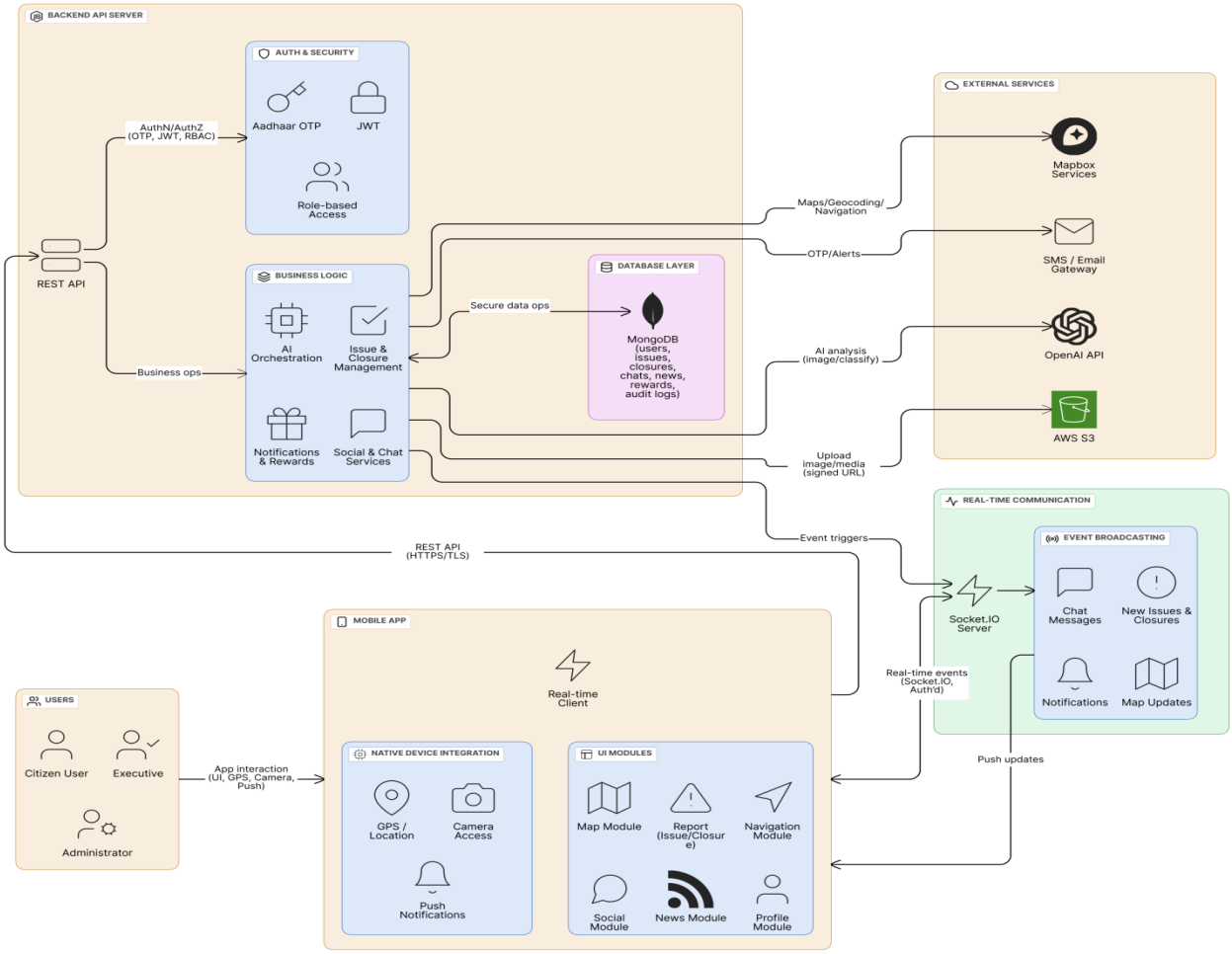

Figure 1: System Architecture of WayWatch

Objectives:

1. To design a cross-platform mobile app for reporting road issues and closures.
2. To integrate an AI-based image analyzer for automatic issue classification.
3. To incorporate Mapbox-powered dynamic maps with categorized markers and route visualization.
4. To develop a real-time navigation alert system for drivers.
5. To provide role-based dashboards for executives and administrators for resolving road issues and closures.
6. To implement email and in-app notifications for communication and tracking.
7. To promote community-driven participation and data accuracy in civic management.

Methodology:

The project WayWatch system follows a modular approach that integrates crowd-sourced data collection, AI-based image analysis, geospatial mapping, and hazard-aware navigation. The methodology is designed to ensure real-time reporting, accurate detection of road issues, and effective decision support for both users and authorities.

1. User Registration and Authentication: Users register via the mobile app and are verified using secure JWT tokens.

2. Image Capture and Submission: 4 The app allows users to capture or upload a photo, which is then sent to the AI service for classification.
3. AI-Based Categorization: The AI model processes the image, determines the issue type, and estimates severity.
4. Data Storage and Notification: The processed report is saved in the MongoDB database, and notifications are sent to executives and admins.
5. Visualization and Tracking: Issues and closures appear on the interactive Mapbox map, categorized by type and severity.
6. Resolution and Monitoring: Executives mark issues as resolved through the management dashboard. Activity logs are updated, and citizens are notified of resolution status.
7. Reward and Ranking Updates: Users earn points for active participation, contributing to the leaderboard displayed in the social module.

Result and Conclusion:

In conclusion, WayWatch presents a real-time, crowd-sourced solution for efficient road issue reporting and monitoring by integrating AI-based detection, geospatial mapping, and hazard-aware navigation. The system improves reporting accuracy, enhances user safety through timely alerts, and enables better coordination between citizens and authorities. Overall, it offers a scalable and effective approach for modernizing road infrastructure management in smart city environments.

References:

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Future Scope:

The future scope of this project includes:

1. Integration with vehicle dashcams to automatically capture road issues and accidents during travel without manual user input.
2. Use of existing smart city surveillance cameras for continuous monitoring and automatic detection of road defects, congestion, and hazards.
3. Instant accident detection and automatic alert dispatch to nearby hospitals, emergency services, and traffic authorities to reduce response time.
4. Expanding the platform to support multiple cities and regional languages would improve accessibility and encourage wider adoption across diverse user groups