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RESEARCH PAPER

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SMART ROUTE-BASED TRAVEL GUIDE USING LOCATION INTELLIGENCE

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Abstract- Traditional navigation tools prioritize fastest or shortest routes but rarely consider experiential travel (tourist attractions, food stops, scenic detours) that make journeys memorable. This work presents a "Smart Route-Based Travel Guide" that converts a route into an experience: it computes an optimized driving route, generates a 5–10 km route corridor, discovers points of interest (POIs) inside that corridor, and applies AI-driven scoring & filtering to present "route-aware, high-quality suggestions" under constraints of minimal detour and real-time availability. The prototype integrates Google Directions & Places APIs, geospatial buffering algorithms, and an AI ranking layer (Google Gemini) to produce context-aware recommendations displayed on an interactive map and list view. This paper details system architecture, algorithms (buffer generation, POI ranking), implementation considerations (tech stack, database schema, API handling), evaluation plan (Detour cost, user satisfaction), security and privacy measures, cost and deployment estimates, limitations, and future work. Prototype progress and demo link are documented in the project seminar materials.

Keywords- Location Intelligence, Travel Recommendation, Google Maps API, AI Filtering, Smart Navigation.

I. INTRODUCTION

The rapid advancement of navigation technologies has fundamentally transformed the way individuals travel and explore unfamiliar locations. Modern navigation platforms—like Google Maps, Waze, and Apple Maps—are widely adopted because they not only calculate optimal routes but also provide dynamic updates such as traffic conditions and estimated arrival times. These systems primarily focus on identifying the shortest or fastest path between two points, thereby optimizing efficiency in terms of distance or time.

However, while these applications excel at route calculation, they often overlook another critical aspect of travel — the journey experience itself. For many users, especially tourists and travelers, reaching the destination is not the sole objective. Instead, the value of travel often lies in discovering points of interest (POIs) such as tourist attractions, restaurants, cafés, heritage sites, and scenic locations encountered along the way.

Current navigation systems provide limited support in this regard. For example, they may show nearby places but rarely offer route-aware suggestions that consider detour costs, travel context, or user preferences. This gap leads to missed opportunities for exploration and reduced travel satisfaction.

To bridge this gap, our research proposes the development of a Smart Route-Based Travel Guide using Location Intelligence. The system does not merely compute a path between source and destination but enhances it by generating a 5–10 km corridor (buffer zone) around the route. Within this corridor, the system intelligently discovers and filters POIs using Google Maps API, Google Gemini AI, and OpenStreetMap API. This ensures that users receive relevant and high-quality suggestions directly connected to their journey.

What makes our approach unique is the integration of Artificial Intelligence (AI), specifically the Google Gemini Model, which adds a layer of intelligence and personalization. Unlike traditional static filtering methods, the AI model incorporates multiple factors such as ratings, categories, open/closed status, popularity, detour time, and user preferences to generate context-aware recommendations. For example, if a user specifies an interest in "street food" during evening travel, the AI will prioritize such options while minimizing detours.

II. LITERATURE SURVEY

With the rise of Location-Based Services (LBS), travel route planning and recommendation systems have advanced considerably. Early approaches were mainly focused on computing the shortest or fastest path between two points, aiming for efficiency in time and distance. However, these systems often neglected the experiential side of travel—such as discovering scenic spots, food joints, or cultural attractions along the way—which greatly limits the overall journey experience [7].

To address this gap, researchers began developing route-aware recommendation models. One such model emphasized suggesting tourist attractions along the travel path rather than only at fixed destinations, allowing travelers to explore more effectively during their journey [1]. Likewise, the use of Google

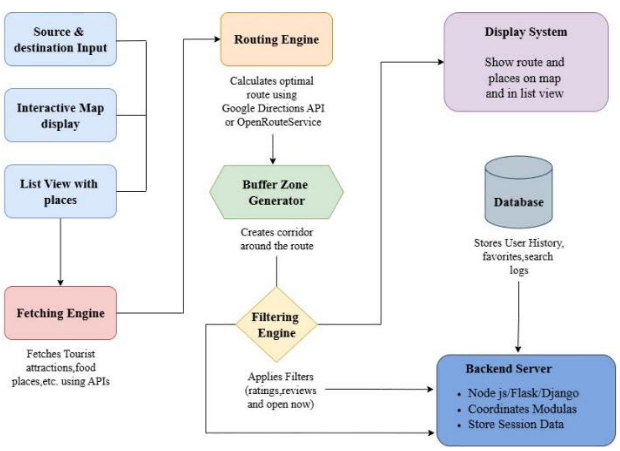
Maps and Places APIs enabled retrieval of restaurants, cafés, and other points of interest in real time. However, these solutions mostly provided raw, unfiltered data without any personalization, leaving users with too many options to process [2].

Further attempts have been made to create location-aware recommendation systems that combine multiple map APIs to enhance travel planning [3].

An intelligent assistant built on Map-based APIs improved usability by recommending relevant POIs, but problems such as information overload and lack of ranking mechanisms still persisted [5]. On the commercial side, platforms like Google Maps Platform [4] and Foursquare Places API [6] provide large volumes of POI data, yet the absence of intelligent filtering means users are often overwhelmed by excessive choices.

III. PROPOSED METHODOLOGY

The proposed system, Smart Route-Based Travel Guide using Location Intelligence, is designed to go beyond traditional navigation by combining route computation, corridor generation, POI retrieval, and AI-based filtering. The methodology integrates multiple technologies such Google Places API, OpenStreetMap API, and the Google Gemini AI model to ensure intelligent and personalized recommendations. The complete workflow is divided into several modules, as described below.



A. User Input and Route Calculation

The system begins by capturing the source and destination provided by the user through the web-based interface. This data is passed to the Google Directions API or OpenRouteService, which computes the optimized travel route. The route geometry (polyline) is stored for further processing.

B. Corridor Generation (5–10 km Buffer Zone)

Unlike conventional navigation systems that only focus on start and end points, the proposed model creates a 5–10 km buffer corridor around the calculated route. This corridor ensures that nearby but relevant POIs are included while minimizing unnecessary detours. Corridor generation is implemented using geospatial libraries (PostGIS, Shapely, Turf.js), which allow for accurate buffer creation around the route geometry.

C. Data Retrieval using APIs

Within the corridor, the system fetches real-time information on tourist attractions, restaurants, hotels, and cafes using Google Places API and OpenStreetMap API. The retrieved data includes attributes such as:

- Name and type of POI
- Ratings and reviews
- Location coordinates
- Opening hours and availability
- Popularity indicators

This raw data forms the candidate set of recommendations.

D. AI-Driven Filtering and Ranking

To avoid overwhelming the user with irrelevant or low-quality results, the system employs an AI-powered filtering engine. Based on the mentor's suggestion, the Google Gemini model is integrated for advanced reasoning and personalization. The AI applies multiple filters such as:

- Minimum ratings threshold (e.g., 4.0 and above).
- Open-now status to ensure usability in real time.
- Category relevance based on user preferences (e.g., historical sites, local food).
- Distance from the main route to minimize detours.
- Popularity score using review count and recent activity.

Each POI is assigned a score, and the system generates a ranked list of suggestions that balance quality, relevance, and travel efficiency.

E. Interactive User Interface

The results are presented in a dual format:

Interactive Map View: POIs are plotted on a map for visual exploration.

List View: A ranked, filterable list for quick decision-making.

Users can click on any POI to view details such as rating, address, photos, and reviews. The interface is designed for cross-platform compatibility, ensuring smooth functionality on desktop, tablets, and mobile devices.

F. User Personalization and Dashboard

The system includes a user authentication module with a secure database for storing login credentials. After login, users can:

Save trip plans for future use.

Customize preferences (e.g., food categories, attraction types).

Access a personalized dashboard showing previous trips, saved POIs, and recommended travel plans**.**
This feature transforms the platform from a simple map tool into a personalized travel assistant.

G. Workflow Summary

The complete workflow can be summarized in the following steps:

1. **User Input**: Source and destination entry.
2. **Route Calculation**: Optimized path generation.
3. **Buffer Creation**: Corridor generation around the route.
4. **POI Retrieval**: Fetch data from Google/ OpenStreetMap APIs.
5. **AI Filtering**: Apply Gemini-driven ranking and filtering.
6. **Results Display**: Map + list view presentation.
7. **User Personalization**: Save, customize, and revisit travel plans.

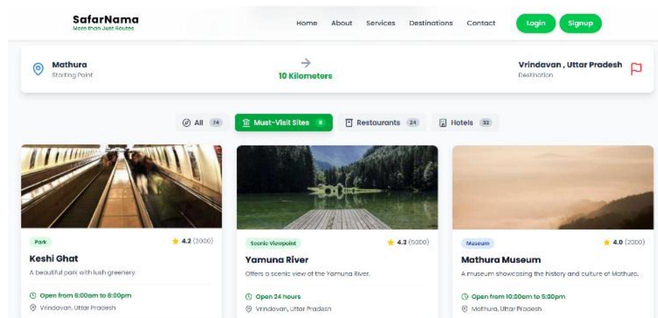
H. Innovative Contributions

The proposed system stands apart from conventional map applications due to:

1. AI-driven results that adapt to context and preferences.
2. Smart UI design that merges interactivity with usability.
3. Scalability across multiple platforms (web, mobile).
4. Advanced filtering mechanisms that ensure recommendations are high-quality and relevant.

IV.EXPECTED RESULT

The proposed system, Smart Route-Based Travel Guide using Location Intelligence, is expected to deliver results that enhance both the efficiency of travel and the quality of user experiences. Unlike conventional navigation systems that only provide shortest paths, this system integrates AI-driven recommendations, ensuring that travel becomes more interactive, personalized, and meaningful. The expected outcomes are detailed below:



A. Personalized Recommendations

The AI-powered filtering mechanism will ensure that each user receives customized travel suggestions. Tourist attractions, restaurants, and cafes will be displayed according to user preferences, ratings, and real-time availability. This reduces decision fatigue and enhances satisfaction by presenting high-quality and relevant options.

B. Route-Aware Discovery

By generating a 5–10 km corridor around the calculated route, the system ensures that all recommendations are directly connected to the journey path. This approach guarantees minimal detours while still providing opportunities for discovery. The expected result is that users can enjoy additional stops without significantly affecting travel time.

C. Improved Filtering and Ranking

The use of the Google Gemini AI model will provide context-aware filtering, ensuring that suggestions are not just numerous but also intelligent and meaningful. Only POIs with high ratings, open-now status, and category relevance will appear in the results, thereby increasing trust and usability of the system.

D. Interactive and User-Friendly Interface

The web-based platform will offer an interactive map view and a list view of POIs. Users are expected to benefit from easy navigation, quick filtering, and direct interaction with travel suggestions. This makes the system accessible across multiple devices (desktop, tablet, and mobile).

E. User Dashboard and Travel Plan Management

Another expected result is the ability for users to save and customize their travel plans. The personalized dashboard will allow access to saved trips, previous suggestions, and user-specific preferences. This transforms the system into a personal travel planner rather than just a navigation tool.

F. Performance Metrics

The system is expected to achieve measurable improvements in the following areas:

- **Accuracy**: Only relevant and high-rated POIs will be displayed.
- **Efficiency**: Average detour time will be kept under 5–10% of total travel duration.
- **Usability**: Reduced decision-making time due to intelligent ranking.
- **User Satisfaction**: Increased likelihood of users saving and reusing the platform for future trips.

G. Overall Outcome

The overall expected outcome is a smart, scalable, and AI-driven travel guide that transforms traditional route planning into a holistic travel experience. By integrating real-time APIs, intelligent filtering, and user personalization, the system will enable travelers to explore more engaging journeys while maintaining the efficiency of their routes.

V. CONCLUSION & FUTURE WORK

The proposed Smart Route-Based Travel Guide overcomes the limitations of traditional navigation by turning route planning into a more interactive and personalized experience. Using OpenStreetMap, Places APIs, and Google Gemini AI, the system not only identifies nearby POIs but also ranks them based on quality, relevance, and user preferences. A 5–10 km corridor around the route ensures meaningful stopovers with minimal detours. With AI-driven filtering, an intuitive map and list interface, and features like saved plans and dashboards, the system acts as a personal travel assistant. Its key contributions are twofold: improving travel efficiency through smart POI discovery and enhancing user satisfaction with personalized, high-quality recommendations.

Future Work

Although the current prototype demonstrates significant progress, several enhancements can be pursued in future iterations:

1. Real-Time Context Integration

Future versions should not only recommend POIs but also respond to live conditions such as traffic, weather, and ongoing local events. For example, if heavy rain is expected, the system could prioritize indoor activities like museums or cafes instead of outdoor sightseeing.

2. Smarter Personalization

Instead of relying only on user inputs, the system could learn from travel history and behavior. Over time, it might recognize that a user enjoys local street food or heritage sites and automatically highlight those kinds of options on new routes.

3. Breaking Language Barriers

To truly support global travelers, the platform should offer multilingual support. A tourist in Spain who speaks only English should still be able to discover local attractions with accurate translations and culturally relevant recommendations.

4. Beyond Road Navigation

Currently, the system is road-centric. Future work should include other modes of travel such as trains, buses, and even walking trails, enabling a more holistic journey planner that works for both urban commuters and backpacking explorers.

5. Expanding Globally

A natural next step is scaling the system for cross-border journeys. This involves considering factors like currency, cultural differences, visa/travel restrictions, and country-specific POI databases.

6. Direct Bookings and Reservations

To make the system more practical, users should be able to book a restaurant table, hotel, or attraction ticket directly from the app—turning recommendations into actionable plans.

7. Trust and Privacy

As with any system that relies on personal data, safeguarding user privacy will remain a top priority. Future improvements should strengthen security measures and align with global standards like GDPR, ensuring users feel confident sharing their preferences.

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