IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 14, Issue 12, December 2025

DOI: 10.17148/IJARCCE.2025.1412128

Travel-Bot Planner using Large Language Models (LLM) and Retrieval Augmented Generation (RAG)

Dr. Chetana Prakash[1], Akangnungba Walling[2], Anusha V[3], Bhagyashree S A[4], Bhavana P[5]

Professor, Department of Computer Science and Engineering, Bapuji Institue of Engineering and Technology, Davangere, India[1]

U.G. Student, Department of Computer Science and Engineering, Bapuji Institue of Engineering and Technology, Davangere, India[2]

U.G. Student, Department of Computer Science and Engineering, Bapuji Institue of Engineering and Technology, Davangere, India[3]

U.G. Student, Department of Computer Science and Engineering, Bapuji Institue of Engineering and Technology, Davangere, India[4]

U.G. Student, Department of Computer Science and Engineering, Bapuji Institue of Engineering and Technology, Davangere, India[5]

Abstract: An AI-powered system called the Travel-Bot Planner is developed to enhance and simplify the travel planning experience for users by combining intelligent route analysis, destination discovery, and automated itinerary generation. The platform provides an interactive, adaptive, and scalable travel-assistance environment by utilizing advanced technologies such as Large Language Models (LLMs) for natural language understanding, Retrieval-Augmented Generation (RAG) for real-time information retrieval, and geospatial services for accurate routing and map-based visualization. Users are guided through AI-driven conversations where their queries, preferences, and destinations are processed using NLP and vector-based search to deliver personalized recommendations, travel timelines, and route-specific popular attractions. The system enables travellers to receive structured itineraries, budget estimates, and booking simulations instantly, reducing manual effort and ensuring informed decision-making powered by intelligent automation.

Keywords: Travel Assistance, Large Language Models (LLM), Retrieval-Augmented Generation, Geospatial Intelligence.

I. INTRODUCTION

Traditional travel planning methods often fail to provide personalized, dynamic, and real-time assistance. These approaches require users to manually search across multiple websites for routes, attractions, hotels, and travel details, resulting in fragmented and time-consuming experiences. To overcome these limitations, the Travel-Bot Planner uses advanced artificial intelligence to generate smart travel recommendations through natural conversation. With real-time routing, destination insights, and itinerary generation, the system enables seamless interaction for various travel needs. The project introduces an AI-powered travel assistance and route-planning system that helps users explore attractions, find popular places along their travel path, and generate detailed itineraries. It surpasses conventional planning techniques by integrating map-based analysis, text-based conversation, and intelligent travel predictions. By providing personalized suggestions, route insights, and budget simulation, the system transforms how travel planning is performed-bringing automation, convenience, and intelligence to every step of the journey.

In addition, the system dynamically adapts recommendations based on user preferences, travel duration, and location context. The integration of Retrieval-Augmented Generation ensures that responses are accurate, relevant, and supported by up-to-date travel data. The platform also reduces dependency on travel agencies by enabling users to independently plan and customize their journeys. Its conversational interface simplifies complex planning tasks, making the system accessible even to non-technical users. Overall, the Travel-Bot Planner offers a scalable and intelligent solution that enhances user experience while significantly reducing travel planning effort.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 14, Issue 12, December 2025
DOI: 10.17148/IJARCCE.2025.1412128

II. RELATED WORK

Several travel planning systems and applications have been developed to assist users in exploring destinations and planning routes using digital platforms. Popular tools such as Google Maps and TripAdvisor provide navigation, nearby attractions, and user reviews, but they largely rely on static searches and predefined filters, offering limited personalization and no conversational interaction. Recent research has introduced AI-based travel assistants using chatbots and recommendation systems to improve user engagement; however, many of these solutions depend on rule-based logic or isolated models, resulting in limited adaptability and contextual understanding.

More advanced approaches employ Natural Language Processing (NLP) and Large Language Models (LLMs) to enable conversational travel assistance, yet they often lack real-time data integration and updated contextual knowledge. Although Retrieval-Augmented Generation (RAG) and vector-based retrieval methods have been explored to improve response accuracy, their use in complete travel route planning systems remains limited. The proposed Travel-Bot Planner addresses these gaps by integrating LLM-based conversation, RAG-powered information retrieval, real-time routing, attraction discovery, and budget estimation into a unified and intelligent travel planning platform.

III. SYSTEM ARCHITECTURE

The Travel-Bot Planner is designed with a modular, scalable, and intelligent architecture that ensures efficient operation and accurate real-time travel assistance. The platform incorporates multiple technologies to deliver a seamless, interactive experience

- Frontend Layer: Built using HTML, CSS, and JavaScript, the interface provides a smooth user experience, enabling users to enter source and destination, explore map routes, and interact with the AI chatbot.
- Backend Integration: LLM-based reasoning and a RAG pipeline generate context-aware travel recommendations by retrieving relevant information and combining it with AI-generated responses.
- Database Layer: MongoDB stores destination metadata, embeddings, route data, and saved user itineraries, ensuring reliable and scalable data management.
- Routing and Geospatial Services: OSRM and Nominatim provide real-time route calculating, geocoding, and mapping support for distance, time, and coordinate retrieval.
- AI Response Generation: The system uses vector search and LLM processing to generate itineraries, popular-place suggestions, and adaptive route-based recommendations.

IV. FEATURES AND FUNCTIONAITY

The Travel-Bot Planner offers travellers an AI-assisted route-planning experience by integrating intelligent search, map analysis, and personalized suggestions. Its features are designed to enhance usability and deliver meaningful travel insights.

Route-Based Search Customization

- Users can enter source and destination to receive personalized travel routes.
- Popular places along route: The system identifies attractions automatically along the selected travel path.
- Flexibility Queries: Users can refine route preferences and explore alternatives.

Real-Time Travel Recommendation

- AI-Generate Responses: The system uses LLM reasoning to provide destination descriptions, attractions lists and travel suggestions.
- Metadata Analysis: The AI evaluates category, popularity, distance, and timings to refine results.

Itinerary Planning

- Enables structured itinerary creation for 1-day or multi-day trips.
- Timeline Management: Users receive ordered lists of places based on proximity and preferences.
- Performance Insights: The AI adjusts suggestions dynamically through continuous conversation.

Multiple Modes of Interaction

- Enhances accessibility and convenience.
- Text-Based Chat: Users type queries and receive instant AI replies.
- Voice-Based Interaction: Optional voice input and output for hands-free travel assistance.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 14, Issue 12, December 2025

DOI: 10.17148/IJARCCE.2025.1412128

Security and Privacy

- Secure Access: Ensures user data and stored itineraries remain accessible only to authenticated users.
- Encrypted Storage: Travel plans and metadata are stored securely using encrypted database practices.

V. PROBLEM STATEMENT

Travelers find it difficult to access reliable, personalized, and up-to-date information for planning trip, as they are forced to search across multiple disconnected platforms to gather details on destinations, routes, accommodations, and activities. Existing travel applications and Chatbots provide generic suggestions without understanding individual preferences or adapting to factors such as budget, interests, travel duration, and real-time conditions. The lack of a centralized and intelligent travel-planning support system results in information overload and high manual effort for users. Consequently, the overall travel-planning process becomes time-consuming, confusion, and inefficient.

VI. EXISTING SYSTEM

Existing travel planning platforms present various limitations. Users typically rely on separate websites for routes, attractions, maps, and booking details, making the process time-consuming and disjointed. Most platforms do not offer conversational assistance, lack route-specific attraction discovery, and provide static information without intelligence. Traditional tools do not analyze travel preferences, do not generate personalized itineraries, and do not integrate vector-based knowledge retrieval or LLM-driven conversation. This leads to inefficient planning and insufficient decision support for travelers.

VII. PROPOSED SYSTEM

The proposed AI-based travel assistant provides an intelligent, interactive, and adaptive solution for modern travel planning. The system integrates multiple technologies to deliver a personalized travel experience with minimal manual effort. Key feature include:

- Secure user input handling and structured travel data storage using MongoDB.
- LLM-based reasoning and NLP for intelligent travel recommendation generation.
- RAG-based retrieval for up-to-date, context-rich travel information.
- Route-specific attraction discovery using geospatial computation.
- Automated itinerary generation and budget estimation.

A map-based interface for exploring routes, attractions, and hotel suggestions

VIII. SYSTEM REQUIREMENTS AND SPECIFICATIONS

The system requirements define the necessary hardware, software, and technological constraints required to support AI-driven travel planning and real-time route processing. These specifications ensure efficient interaction between the frontend interface, backend services, geospatial APIs, and the AI-based recommendation engine. Proper system requirements are essential to guarantee reliable performance, scalability, and accurate travel assistance across different user scenarios.

Functional Requirements

- Source and Destination Input: Users must be able to enter travel locations for route calculations.
- Route Generation: System should compute distance, travel time, and feasible paths.
- Attraction Discovery: AI must display popular places along the travel path.
- Itinerary Generation: System should generate structured itineraries based on user preferences.
- Budget Estimation: Provides estimated travel cost and optional booking simulation.
- Chatbot Interaction: Users must receive AI-generated responses to travel queries.
- Save/Download Plans: Users should save or export itineraries for future use.

Non-Functional Requirements

- Performance: Must handle multiple travel queries efficiently with minimal delay.
- Scalability: Should support growing data, users, and travel metadata without performance loss.
- Reliability: Ensures stable mapping, routing, and AI response generation.
- Usability: Provides easy-to-navigate interface for users of all technical levels.
- Maintainability: Allows developers to update travel datasets, models, and UI components easily.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 14, Issue 12, December 2025

DOI: 10.17148/IJARCCE.2025.1412128

Hardware Requirements

- Processor : Intel i5/i7 or AMD Ryzen 5/7
- RAM : 16 GB or more
- GPU : Optional for acceleration of LLM processing

Software Requirements

System Software:

- Operating System
- Windows 10/11 (64-bit)

Cloud/Backend Services:

- OSRM(routing engine)
- Nominatim(geocoding)
- LLM API(AI response generation)

Application and Software Tools:

- IDE: Visual Studio Code or JetBrains WebStorm
- Runtime: Node.js (v16 or higher)
- Git & GitHub (for version control)
- Postman (for API testing)

IX. SYSTEM DESIGN

The system design illustrates a layered architecture that integrates the frontend interface, backend services, AI & ML components, data storage, and external APIs to enable intelligent travel planning and route assistance. This design ensures seamless data flow, modular processing, and efficient interaction between user requests, AI-driven recommendations, and real-time mapping services.

The frontend layer of the Travel-Bot Planner is responsible for capturing user inputs such as source, destination, travel preferences, and budget constraints through an intuitive and interactive interface. User requests are processed and forwarded to the backend services, which coordinate routing logic, itinerary generation, and interaction with AI models. This separation of concerns allows the system to remain flexible, user-friendly, and responsive while supporting real-time updates and dynamic travel queries.

The backend and AI layers work together to analyze travel data, generate personalized recommendations, and manage itinerary planning. AI models handle natural language understanding, attraction discovery, and budget estimation, while external APIs such as mapping and location services provide accurate route visualization and geospatial information. Data storage components maintain user preferences, saved itineraries, and historical queries, ensuring continuity and personalization across sessions and enabling scalable and reliable system performance.

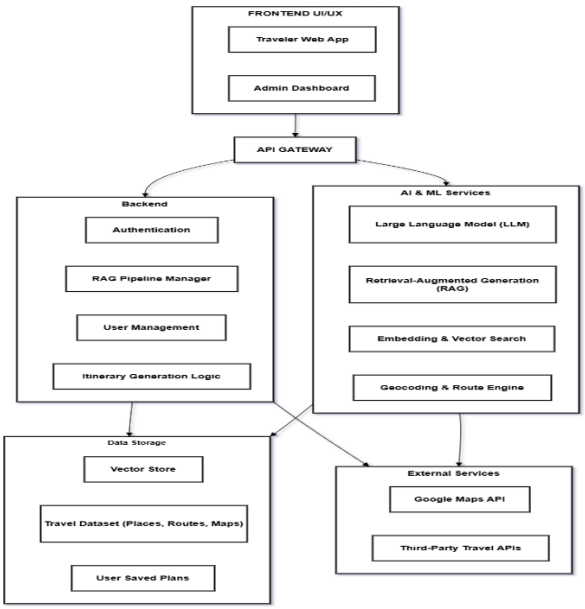

Fig 9.1 System architecture diagram of Travel-Bot planner using LLM and RAG

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 14, Issue 12, December 2025

DOI: 10.17148/IJARCCE.2025.1412128

X. TESTING

The goal of integration testing is to confirm how various Travel-Bot planner modules such as the frontend (web interface), backend (LLM + RAG engine), and geospatial services (OSRM, Nominatim) interact with one another. The objective is to ensure that these individually developed modules operate as a unified system with correct data flow.

How Integration Testing Operates

Determine Integrated Modules

- Modules such as route generation, attraction retrieval, and itinerary creation are selected for integrating testing.

Describe Integration Situations:

- Workflows such user source → destination input → route generation → AI recommendations → itinerary creation are tested

Check the flow of data:

- Output of one module (e.g., popular places along route) is verified as correct input to the next module (e.g., itinerary generator).

Debugging and retesting:

- Any data mismatch or service failure is logged, corrected, and the integrated workflow is re-executed for stability verification.

XI. RESULTS AND DISCUSSION

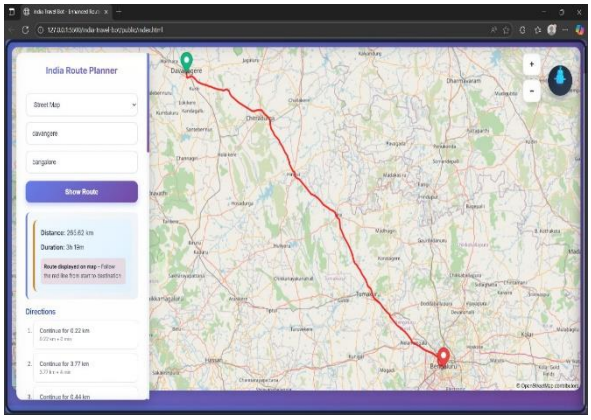

Figure 11.1.1 Route Visualization

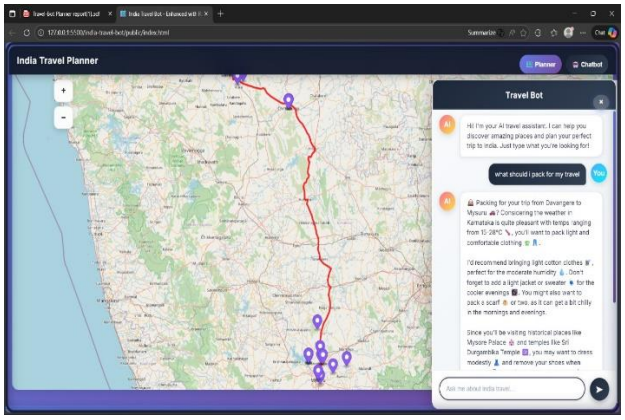

Figure 11.1.2 Travel chatbot Interface

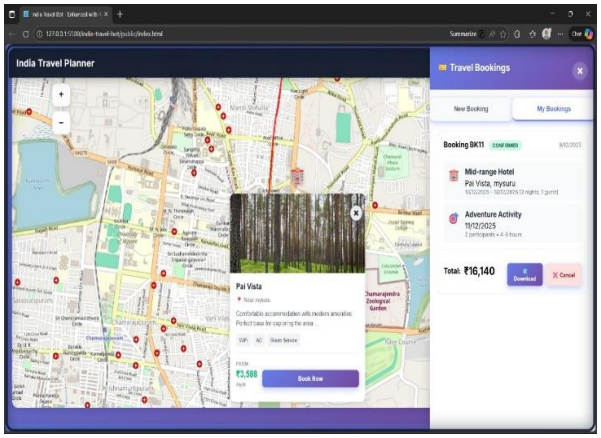

Figure 11.1.3 Hotels Along Route

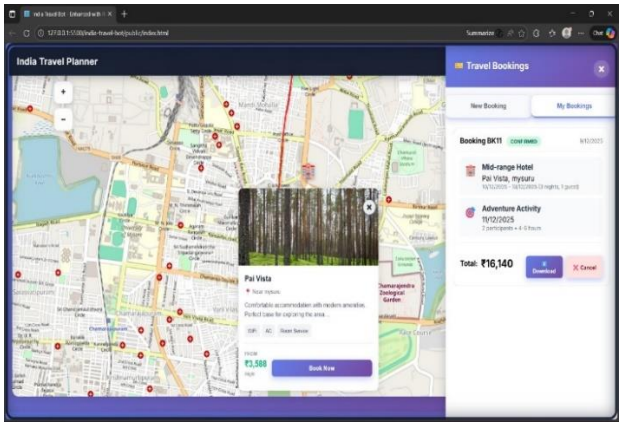

Figure 11.1.4 Travel Bookings-Cost Estimation

The figure 8.1.1 shows the travel route generated between the selected source and destination on an interactive map. It highlights the optimal path along with distance and estimated travel time for effective navigation.

The figure 8.1.2 illustrates the AI-powered chatbot interface assisting users with travel-related queries. The chatbot provides real-time suggestions and guidance while interacting alongside the map view.

The figure 8.1.3 presents hotel recommendations displayed along the selected travel route. It includes accommodation details such as price, location, and booking options for user convenience.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 14, Issue 12, December 2025
DOI: 10.17148/IJARCCE.2025.1412128

The figure 8.1.4 depicts the travel booking and cost estimation feature of the system. It summarizes accommodation costs and provides an estimated budget through simulated booking details.

XII. CONCLUSION

The AI-powered Travel-Bot Planner demonstrates how modern technology can transform traditional travel planning by combining intelligent routing, conversational interaction, and automated itinerary generation. By leveraging LLMs, geospatial services, and retrieval-based intelligence, the system provides users with personalized, accurate, and efficient travel assistance. Travellers can explore attractions, understand routes, and create itineraries with ease through an interactive chatbot and map interface. One of the platform's strongest advantages is its ability to generate fast, data-driven recommendations that adapt to user preferences. This ensures a practical, engaging, and highly informative travel-planning experience. The Travel-Bot Planner establishes a reliable, user-friendly, and future-ready approach to exploring destinations and planning journeys.

REFERENCES

[1]. Cui, X., Wang, Z., Li, P., & Xu, Q. (2025). I-AIR: Intention-aware travel itinerary recommendation via multi-signal fusion and spatio-temporal constraints.
[2]. Nie, T., et al. (2025). Exploring the roles of large language models in reshaping transportation systems.
[3]. Shao, Z., et al. (2025). A Preference-Driven LLM-Solver System for Travel Planning.
[4]. Wang, S., Wang, Q., Cui, Q., & Lan, T. (2025). Artificial Intelligence in Tourism: A Systematic Literature Review and Future Research Agenda.
[5]. Song, S., et al. (2024). TravelRAG: A Tourist Attraction Retrieval Framework Based on LLM and Knowledge Graph.
[6]. Udandarao, V., et al. (2025). Roamify: LLM-based Google Chrome Extension for Personalized Itinerary Planning.
[7]. Liu, T., & Meidani, H. (2025). Graph Neural Networks for Travel Distance Estimation and Route Recommendation Under Probabilistic Hazards.
[8]. Song, S., et al. (2024). TravelRAG: A Tourist Attraction Retrieval Framework Based on LLM and Knowledge Graph.
[9]. Chiang, W.-L., et al. (2024). Chatbot Arena: An Open Platform for Evaluating LLMs.
[10]. Wang, X., Dai, H., Gao, S., & Li, P. (2024). Characteristic AI Agents via Large Language Models.
[11]. IRJET. (2024). AI Based Personalized Trip Planner with Multi-Criteria Real-time Travel Optimization.
[12]. Londhe, K. (2024). Enhancing Travel Experience using Artificial Intelligence.