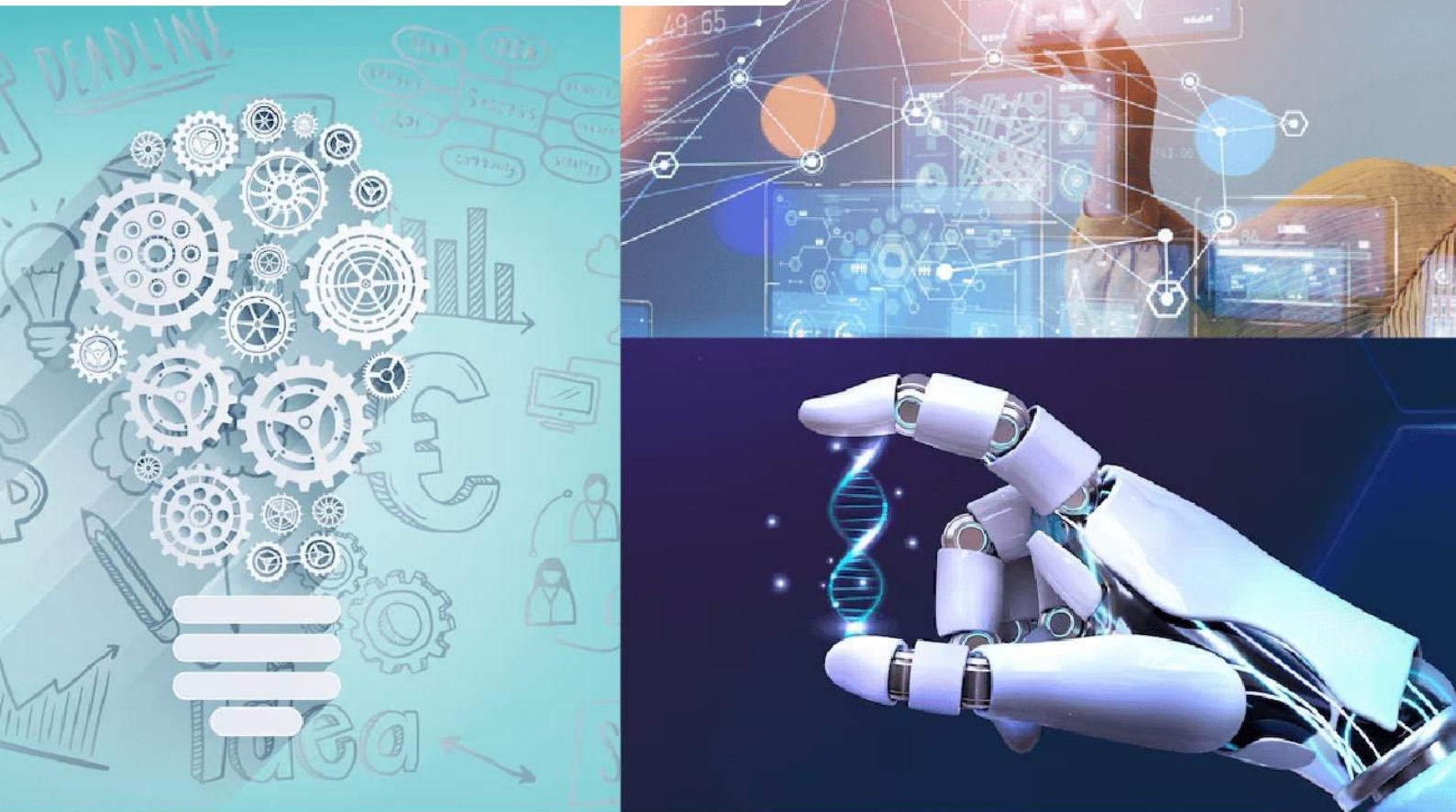




International Journal of Advanced Research in Education and Technology (IJARETY)

Volume 13, Issue 2, March - April 2026

Impact Factor: 8.152



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



AI-Powered Vacation Planning Assistant: A Full-Stack Web Application Integrating Large Language Models and Multi-Modal Transport Aggregation

K Vikram

Department of Master of Computer Applications, CMR Institute of Technology (CMRIT), Bengaluru, Karnataka, India

ABSTRACT: This paper presents an AI-powered vacation planning assistant that generates structured travel itineraries based on user preferences. The system integrates a Flask-based backend, SQLite database, and optional large language model support to produce day-wise plans, budget estimates, and travel recommendations. It aggregates multi-modal transport options, accommodation, weather data, and activities into a unified interface. The application supports both live API integration and offline demo mode for reliability. Experimental evaluation demonstrates efficient performance, scalability, and usability, making the system suitable for real-world travel planning applications.

KEYWORDS: Artificial Intelligence, Travel Planning, Itinerary Generation, Machine Learning, Web Application

I. INTRODUCTION

The global online travel industry has experienced rapid growth in recent years, surpassing USD 800 billion in 2024. Despite this expansion, travel planning remains a complex and fragmented process, requiring users to navigate multiple platforms for booking flights, accommodations, transportation, and activities. This fragmentation increases cognitive load and often leads to inefficiencies such as scheduling conflicts, budget miscalculations, and suboptimal travel decisions.

Traditional travel planning methods rely heavily on manual searching and comparison across various services, which can be time-consuming and error-prone. While existing platforms provide partial solutions, they often lack integration and fail to offer a unified, personalized planning experience. As a result, users are required to invest significant effort in organizing their travel plans, which reduces convenience and overall user satisfaction.

Recent advancements in artificial intelligence, particularly in large language models (LLMs), have opened new possibilities for automating complex decision-making tasks. These models are capable of understanding user preferences expressed in natural language and generating structured, context-aware outputs. In the context of travel planning, LLMs can assist in generating itinerary suggestions, summarizing travel options, and adapting plans dynamically based on user input [3].

However, LLM-based solutions alone are insufficient for building reliable travel systems, as they often lack access to structured data, real-time information, and persistent storage. Therefore, there is a need for hybrid systems that combine the flexibility of generative AI with deterministic, data-driven approaches. Such systems can ensure both accuracy and usability by integrating structured data sources with intelligent recommendation mechanisms.

To address these challenges, this paper proposes an AI-powered vacation planning assistant that integrates machine learning, large language models, and web technologies into a unified platform. The system is designed to generate comprehensive, day-by-day travel itineraries by aggregating multi-modal transport options, accommodation data, weather forecasts, and activity recommendations. It also includes features such as budget estimation, PDF export, and interactive map visualization to enhance user experience.

The proposed solution aims to reduce the complexity of travel planning by providing an automated, scalable, and user-friendly system. By combining modular architecture with AI-driven components, the system demonstrates how intelligent applications can transform traditional workflows into efficient and seamless digital experiences.

II. LITERATURE REVIEW

2.1 Automated Itinerary Planning Systems

Automated itinerary planning has been widely studied using optimization-based approaches such as constraint satisfaction and route planning algorithms [1]. These systems aim to minimize travel cost and maximize efficiency by considering time constraints and user preferences. While effective in structured environments, these approaches often require complete datasets and lack flexibility when handling dynamic user inputs or real-world uncertainties.

2.2 Recommendation-Based Travel Systems

Recommender systems based on collaborative filtering and content-based techniques have been used to suggest travel destinations and activities [2]. These systems analyze historical data and user preferences to provide personalized recommendations. However, they typically focus on individual suggestions rather than generating complete, structured travel plans, limiting their practical usability.

2.3 AI and LLM-Based Travel Assistants

Recent research has explored the use of large language models for travel planning applications. These systems can generate itinerary suggestions from natural language inputs and provide conversational interfaces for users [3]. Despite their advantages, they often lack integration with structured travel data and do not support persistent storage or real-time data aggregation.

2.4 Research Gap and Motivation

Existing systems either focus on recommendation or itinerary generation independently and fail to provide a unified solution. Many systems lack integration of multiple travel components such as transport, accommodation, and budgeting. Additionally, limited support for offline functionality and modular architecture reduces system reliability. Therefore, there is a need for an integrated solution that combines structured data processing with AI-driven recommendations in a scalable and user-friendly manner.

III. METHODOLOGY

3.1 System Overview

The proposed system is designed as a full-stack web application that integrates machine learning and modern web technologies. It processes user inputs such as travel preferences, destination, duration, and budget to generate structured itineraries. The system follows a modular architecture where each component handles a specific task, ensuring scalability and maintainability.

3.2 System Architecture

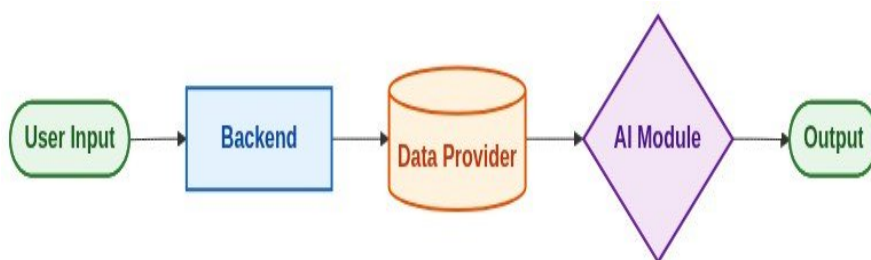


Fig. 1: System Architecture of AI Vacation Planning System

The system architecture illustrates the overall workflow of the proposed vacation planning assistant. The process begins with user input, where travel preferences such as destination, duration, and budget are provided through the interface. These inputs are processed by the backend system, which handles request management and data processing.

The backend interacts with the data provider module to retrieve relevant travel data, including transportation, accommodation, and weather information. The processed data is then passed to the AI module, which generates structured itineraries and intelligent recommendations. Finally, the output is presented to the user in the form of a complete travel plan.

3.3 Data Management and Storage

The system uses a SQLite database to store trip information, user inputs, and generated itineraries. JSON-based structures are used to represent itinerary data, allowing flexible storage and easy retrieval. This approach supports scalability and simplifies data handling for complex travel plans.

3.4 Data Provider and Integration

A data provider module is implemented to collect and manage travel-related data, including flights, hotels, weather information, and activities. The system supports both live API integration and offline demo datasets. This dual-mode functionality ensures system availability and reliability even in the absence of external data sources.

3.5 Use Case Representation

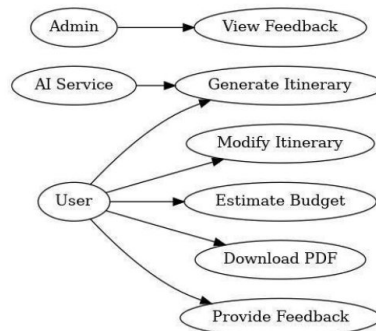


Fig. 2: Use Case Diagram of AI Vacation Planning System

The use case diagram illustrates the interaction between different actors and system functionalities. The primary actor is the user, who interacts with the system to generate travel itineraries, modify plans, estimate budgets, download itineraries in PDF format, and provide feedback. The system integrates an AI module to generate intelligent recommendations, while the administrator monitors user feedback and system performance.

3.6 Itinerary Generation Module

The itinerary generation module processes user inputs and constructs structured, day-wise travel plans. It selects optimal transport options based on cost and availability, filters accommodations according to budget constraints, and organizes activities into daily schedules. The modular design enhances system efficiency and supports future scalability [4].

3.7 AI Integration for Recommendation

The system incorporates a large language model to generate natural-language summaries and improve user interaction. The model processes structured itinerary data to produce readable and user-friendly travel plans. In cases where the API is unavailable, fallback responses ensure uninterrupted system functionality [5].

3.8 Frontend and User Interface

The frontend is developed using Bootstrap for responsive design and Leaflet.js for interactive map visualization. The user interface provides an intuitive experience, allowing users to explore travel plans, view locations, and interact with itinerary details effectively [6].

IV. RESULTS AND DISCUSSION

The results validate the effectiveness of the proposed system in generating accurate and user-friendly travel plans. The proposed system was evaluated using sample datasets containing travel-related information such as flights, accommodations, weather conditions, and activities. The system successfully generated structured, day-wise travel itineraries based on user inputs including destination, budget, and duration.

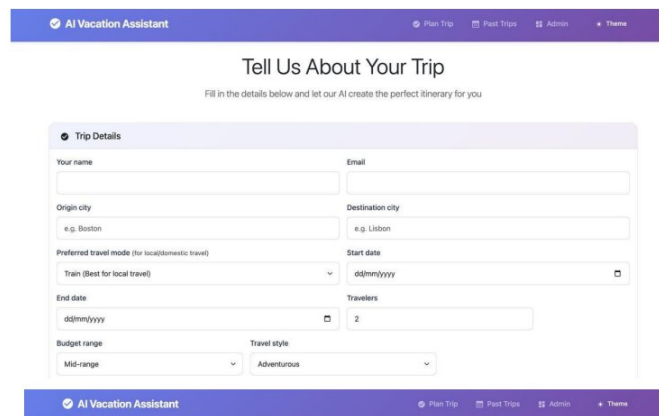
4.1 Itinerary Generation Output

The system produces detailed travel plans that include transportation options, accommodation details, and recommended activities. Each itinerary is organized in a structured format, ensuring clarity and ease of understanding for users. The generated plans effectively balance cost, time, and user preferences.

4.2 Budget Estimation

The system accurately estimates travel expenses by considering transportation, accommodation, and activity costs. This feature enables users to plan trips within their financial constraints and avoid unexpected expenses. The budget module dynamically adjusts estimates based on user inputs.

4.3 System Interface and User Experience



The screenshot displays the 'AI Vacation Assistant' web interface. At the top, a navigation bar includes links for 'Plan Trip', 'Past Trips', 'Admin', and 'Theme'. The main heading is 'Tell Us About Your Trip', followed by the instruction 'Fill in the details below and let our AI create the perfect itinerary for you'. Below this is a 'Trip Details' form with the following fields: 'Your name' and 'Email' (text inputs); 'Origin city' and 'Destination city' (text inputs with examples 'e.g. Boston' and 'e.g. Lisbon'); 'Preferred travel mode (for local/domestic travel)' (a dropdown menu with 'Train (Best for local travel)' selected); 'Start date' and 'End date' (date pickers in dd/mm/yyyy format); 'Travelers' (a text input with the value '2'); 'Budget range' (a dropdown menu with 'Mid-range' selected); and 'Travel style' (a dropdown menu with 'Adventurous' selected). The interface is clean and user-friendly, with a purple header and footer.

Fig. 3: User Interface of AI Vacation Planning System

The above figure shows the user interface of the proposed system, where users can input travel details such as origin city, destination, travel dates, number of travelers, budget range, and travel preferences. The interface is designed to be intuitive and user-friendly, allowing users to easily provide necessary inputs for itinerary generation.

The system processes these inputs and generates structured travel plans based on user preferences. The clean layout and organized input fields enhance usability and improve the overall user experience.

4.4 Performance and Efficiency

The system demonstrates efficient performance with minimal response time during itinerary generation. The modular architecture ensures scalability and smooth handling of user requests. The use of offline datasets also ensures system availability in the absence of external APIs.

4.5 Discussion

The results indicate that the proposed system effectively simplifies travel planning by integrating multiple components into a single platform. Compared to traditional manual planning methods, the system reduces time, improves accuracy, and enhances user convenience.

However, the system has certain limitations, such as dependency on predefined datasets and limited real-time data integration. Future improvements can address these challenges by incorporating live APIs and advanced personalization techniques.

V. CONCLUSION

This paper presented an AI-based vacation planning assistant that integrates machine learning, web technologies, and large language models to generate structured and personalized travel itineraries. The system effectively addresses the challenges of fragmented travel planning by combining multiple components such as transport aggregation, accommodation selection, weather analysis, and activity recommendation into a unified platform.

DOI:10.15680/IJARETY.2026.1302103

The proposed system improves efficiency by automating itinerary generation, reducing manual effort, and minimizing planning errors. It also enhances user experience through interactive visualization, budget estimation, and natural-language summaries, making travel planning more accessible and user-friendly.

Furthermore, the modular architecture ensures scalability and flexibility, allowing the system to adapt to different datasets and integration requirements. The results demonstrate that the system can generate accurate, well-structured, and practical travel plans suitable for real-world applications.

Future work can focus on integrating real-time travel APIs, improving personalization using advanced recommendation techniques, and incorporating conversational interfaces for dynamic itinerary modification. These enhancements can further improve system performance and user engagement.

REFERENCES

- [1] D. Vansteenwegen, W. Souffriau, and D. Van Oudheusden, "The orienteering problem: A survey," *European Journal of Operational Research*, vol. 209, no. 1, pp. 1–10, 2011.
- [2] F. Ricci, L. Rokach, and B. Shapira, Eds., *Recommender Systems Handbook*, 3rd ed. New York, NY, USA: Springer, 2022.
- [3] Z. Guo et al., "Large language models as travel planners: A benchmark study," in *Proc. ACL Findings*, Bangkok, Thailand, Aug. 2024, pp. 1120–1134.
- [4] M. Grinberg, *Flask Web Development: Developing Web Applications with Python*, 2nd ed. Sebastopol, CA, USA: O'Reilly Media, 2018.
- [5] OpenAI, "GPT-4o system card," OpenAI Technical Report, San Francisco, CA, USA, May 2024. [Online]. Available: <https://openai.com/research/gpt-4o>
- [6] V. Agafonkin, "Leaflet: An open-source JavaScript library for mobilefriendly interactive maps," Version 1.9.4. [Online]. Available: <https://leafletjs.com>
- [7] M. Ronacher, "Flask: A micro web framework for Python," Version 3.0.3. [Online]. Available: <https://flask.palletsprojects.com>
- [8] S. Bayer et al., "WeasyPrint: Visual rendering engine for HTML and CSS," Version 62.3. [Online]. Available: <https://weasyprint.org>

International Journal of Advanced Research in Education and Technology

ISSN: 2394-2975

Impact Factor: 8.152