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Original Article

AI TRAVELMATE - An Intelligent Agent for Smart Travel Planning and Assistance

Enuguru Hanuman Sai Gupta, Garaka Sneha Latha, Pratti Gayatri, Teki Vijayaratnam, Tanimki Prabhu Das, Satti Bhanu Prakash Reddy

Sri Vasavi Engineering College, Department of Computer Science Engineering, Tadepalligudem, Andhra Pradesh, India.

Correspondence

Enuguru Hanuman Sai Gupta

Sri Vasavi Engineering College, Department of Computer Science Engineering, Tadepalligudem, Andhra Pradesh, India.

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Abstract

Planning a trip typically involves travelers going through several platforms for flights, hotels, and tourist attractions, which is cumbersome and overwhelming. Current travel planning resources mainly offer standard results and are not equipped with the feature to conform to specific user tastes or live updates. This study presents an AI TRAVELMATE that can offer completely personalized and dynamic travel schedules using the combination of Streamlit, SerpAPI, and Google's Gemini AI models. The application takes necessary inputs from the user, including departure and destination cities, travel dates, trip length, budget, and activities, and subsequently processes these in intelligent agents. The SerpAPI module is utilized to retrieve actual flights in real-time to provide users with the most accurate and economical means of travel. At the same time, Gemini-driven AI agents deal with creating itineraries: the Research Agent recommends appropriate activities and attractions, the Planner Agent plans a day-wise itinerary, and the Hotel & Restaurant Agent recommends places to stay and eat based on user inputs. It is hosted on Streamlit for delivering the interactive and visually engaging interface so that it eases the trip planning experience.In contrast to traditional tools, the suggested system integrates real-time data access along with smart natural language processing, which guarantees flexibility, individualization, and effectiveness. The findings indicate that the planner is capable of delivering customized advice, trip schedule optimization, and streamlined decision-making for travelers. This method illustrates how AI integration and real-time API can turn conventional trip planning into a streamlined, adaptive, and enjoyable experience for contemporary travelers.

Introduction

Planning travel is commonly complicated, with travelers needing to look on various platforms for flights, hotels, and activities, a task that can prove lengthy and daunting. Classic travel sites, although informative, are unable to offer truly personalized or real-time answers tailored to a person's specific tastes. In order to overcome these issues, this project suggests an AI-enabled Travel Planner that utilizes Stream-lit for a user-friendly interface, SerpAPI to obtain real-time flight and hotel data, and Google Gemini AI agents for creating dynamic itineraries and suggestions. The users provide inputs like source and destination cities, travel dates, budget, trip type, and activities of interest, and the system generates personalized itineraries with flights, accommodation, restaurants, and activity suggestions. The novelty is in the union of personalization and real-time adaptability, providing an integrated single-stop platform which dynamically manages trips based on user need and context, in contrast with traditional platforms that give static or generic results. The project seeks to revolutionize travel planning as a non-stop, smart, and user-friendly experience that optimizes convenience and enhances the overall travel experience.

Motivation

The necessity to develop the AI TRAVELMATE arises from the shortfalls of existing travel planning tools. Although the majority of websites offer information regarding flights, accommodation, and destinations, they do not always provide personalized and optimized travel plans. Most travelers have to switch between a number of websites, compare the choices manually, and paste information together, and the planning becomes cumbersome and prone to errors.

Additionally, existing systems do not incorporate real-time data like current flight prices or situational suggestions. This results in out-of-date or irrelevant suggestions, inconveniencing travelers. With the use of AI agents, real-time APIs, and an interactive interface, our project aims to fill such shortcomings and offer a clever, adaptive, and convenient solution.

Problem Statement

Though there are various websites to book flights, hotels, and activities, most of them

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provide incomplete and generic information that the user must manually compare and organize from various sources. The websites do not provide a personalized itinerary that aligns with the traveler's interests, such as budget, travel length, or activity type. Another significant limitation is that they lack real-time integration; the majority of systems do not update flight information or local recommendations in real time, and hence are not able to present recent and relevant suggestions. Therefore, travelers face information overload, inefficiency in trip planning, and a reduced overall experience. To overcome these limitations, this project proposes an AI-Powered Travel Planner that leverages real-time flight data through SerpAPI and applies Gemini-based AI agents to build adaptive, user-centric itineraries that ensure a seamless and optimized travel planning experience.

Obejectives

The objective of this project is to develop a smart, scalable, and user-centric travel planner that surmounts the shortcomings of conventional tools. The system shall be made to provide a trouble-free interface by accepting the required information such as departure city, destination, dates of travel, trip duration, budget, and activity preferences. Based on this input, the planner should be able to provide real-time flight information using SerpAPI while the Gemini AI agents generate personalized itineraries with day-wise activity scheduling, hotel and restaurant recommendations, and best schedules. Another objective is to ensure that the system supports user-specific constraints such as budget and travel interest, with solutions that are interactive and functional. Finally, the project seeks to grow the architecture modularly so it can be extendable for future additions like multilingual, voice interaction, and immersive technology like AR/VR-based travel experiences.

Scope of project

The purpose of this project is broad enough to cover various classes of travelers such as couples, adventure travelers, families, and solo travelers, who need an intelligent and dynamic planning platform to plan their trips. The planner seeks to do away with reliance on various platforms by offering one integrated platform that produces real-time flights, customized itineraries , and recommended hotel and restaurant plans. The integration of real-time access to information and AI-driven personalization allows the project to provide users with accurate travel schedules that are also customized according to their needs and limitations. Besides this, modularity of the system provides an assurance that the system can scale and be upgraded in the future to accommodate more advanced features like automated reservation links, currency exchange, visa and insurance recommendations, and detailed descriptions of destinations. This extensive collection makes the AI travel planner an end-to-end and future-proof system for contemporary traveling needs

Literature survey

The paper proposes an opinion-based sentiment analysis and collaborative filtering integrated hotel recommendation system to aid large-scale heterogeneous data (textual reviews, ratings, etc.).They extract sentiment for specific hotel features via lexical, syntactic, and semantic analysis and also profile guest types (individual, couple, family, etc.) for personalization. Their system runs on a big-data platform (Hadoop) and even uses fuzzy rules to translate guest type to hotel class. Experiments using real hotel review data from two hotel websites exhibit improved accuracy (precision, recall, F-measure) and response times compared to more traditional recommendation methods. [1]

The survey "Tour Recommendation and Trip Planning using Location-based Social Media" surveys research on employing geo-tagged data from sites such as Flickr, Foursquare, and GPS traces to suggest tourist spots and create customized itineraries. It organizes existing work by data sources, algorithms, and problem settings from point-of-interest (POI) recommendations to complete trip planning with time and location constraints. The paper highlights challenges such as data sparsity, noise, and real-world constraints (e.g., traffic, opening hours), while stressing the need for more dynamic, real-time, and personalized solutions. It concludes by outlining future directions like integrating multi-source data, improving personalization, and conducting user-centric evaluations.[9]

The authors introduce a system, PERSTOUR, to produce customized travel plans that more accurately depict a user's genuine interests. Rather than being dependent on the frequency with which a user accesses a type of POI, they introduce time-based user interest, where they factor in how long a user stays at a particular category of POIs compared to average users. They also customize the visit lengths at every POI accordingly. The planning of the itinerary is formulated as an instance of the Orienteering problem, weighing POI popularity, user interest, travel time, and a user's time budget and start/end constraints. Experiments on Flickr-based datasets across several cities demonstrate that PERSTOUR performs better than baseline methods with respect to measures such as precision, recall, F1, and closer approximates real user behavior both in terms of what POIs are visited and how long one spends at each.[11]

This article suggests an interactive approach to constructing travel itineraries, where users provide feedback in cycles on Points of Interest (POIs) recommended by the system. At each iteration, the system (a) presents a small set of candidate POIs, (b) the user specifies which ones he/she prefers (or dislikes), and (c) the system refines and recommends the current top itineraries. The cycle continues until the user is content. The authors establish that both choosing the optimal batch of POIs and building the optimal itinerary are NP-complete problems, and subsequently construct heuristics and optimizations to render the approach feasible. Using experiments on real data sets, they demonstrate that their algorithms are effective and produce high-quality interactive itineraries.[17]

The work presents BTRec, a personalized tourist itinerary generation approach based on a BERT-style model trained for trajectory of Points of Interest (POIs). In contrast to most systems, which prioritize popularity or route constraints alone, BTRec incorporates users' histories of previous POI visits and demographic details (e.g., where they are originally from) into the model. It solves the itinerary generation task somewhat analogous to the sentence completion problem in NLP: given a source POI and destination POI (and constraints like overall time and POI category preferences), BTRec forecasts the intermediate POI sequence that most closely fits the user. Experiments on data for multiple cities demonstrate that BTRec is superior to other sequence prediction programs with respect to precision, recall, and F1 score. [18]

The work introduces Hotel2vec, a neural embedding approach that learns hotel vector representations by jointly incorporating diverse sources of information into a single embedding space. In contrast to those that make exclusive use of user click sequences, Hotel2vec also uses structured hotel features (e.g., star rating, amenities, property type), geolocation, and user click information.By combining these complementary signals, the model generates richer embeddings that help counteract the

cold-start problem for hotels with little or no past interactions (because their features remain known).They train on more than 40 million user click sessions across over one million hotels and demonstrate that learned embeddings improve performance on downstream hotel recommendation tasks.[21]

Proposed system

The AI Travelmate architecture is built to provide an immersive, interactive, and personalized trip planning experience through the incorporation of frontend user interaction, backend processing, and AI-based itinerary generation. The system utilizes Streamlit for the user interface, Gemini AI agents for smart reasoning, and SerpAPI for retrieval of real-time travel data. The following is a detailed explanation of the proposed system:

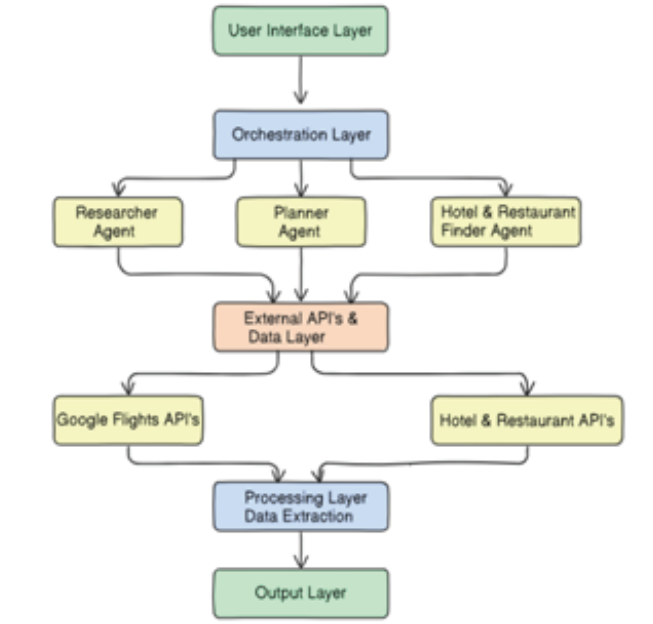

Figure 1: System Architecure

1. User Interface Layer

Streamlit frontend offers an easy-to-use and beautiful-looking interface to user interactions with AI Travelmate. Users can input travel preferences and get real-time suggestions. The following trip information is captured by the system:

- Departure city (IATA code)
- Destination city (IATA code)
- Duration of trip (number of days)
- Travel theme (adventure, family vacation, solo travel)
- Preferable activities (sightseeing, adventure, nightlife)
- Departure date and return date

2. Orchestration Layer

The backend validates user input, structures it for AI processing, and coordinates the overall workflow. It handles API requests, communicates with AI agents, and aggregates results to prepare them for frontend display. This ensures seamless integration of all system components and error-free processing.

3. AI Agents Layer

Three Gemini AI agents perform specialized tasks:

- **Researcher Agent:** Collects destination information including attractions, culture, climate, and activities matching user preferences.
- **Planner Agent:** Creates an elaborate day-wise plan incorporating flights, hotels, restaurants, and activities.
- **Hotel & Restaurant Finder Agent:** Recommends high-rated restaurants and hotels based on user budget and preferences.

The agents utilize natural language processing and reasoning algorithms to make context-aware recommendations.

4. External API & Data Layer

The system uses real-time travel information from APIs like SerpAPI and Google Flights. It has airline choices, departure and arrival times, flight time, fare, and links for booking. Methods like fetch_flights() and extract_cheapest_flights() sort and filter best travel options.

5. Processing Layer / Data Extraction

Raw API information and AI responses are cleaned, processed, and formatted to produce a meaningful travel plan. Flight, hotel, restaurant, and activity information is combined, filtered, and sorted to make it relevant, affordable, and useful.

6. Output Layer

The completed travel plan is displayed to the user, which includes:

- **Flights:** The lowest fares with logos, departure/arrival times, flight durations, prices, and booking URLs.
- **Hotels & Restaurants:** AI-suggested accommodation and eating places around attractions.
- **Personalized Itinerary:** Day-wise itinerary with activities, transport, and approximate cost.

Methodology

Instead of having an inefficient, rigid, and in user-friendly system, the AI Travelmate is developed on a structured and focused process. It starts with the careful analysis of requirements where the goal of planning the trip is defined, the target users of the product are outlined, and the defining of major features. This is tailored itinerary generation, real-time travel intelligent integrated, and interactive suggestions, to be brought as much as possible to user expectations and requirements in terms of system design.

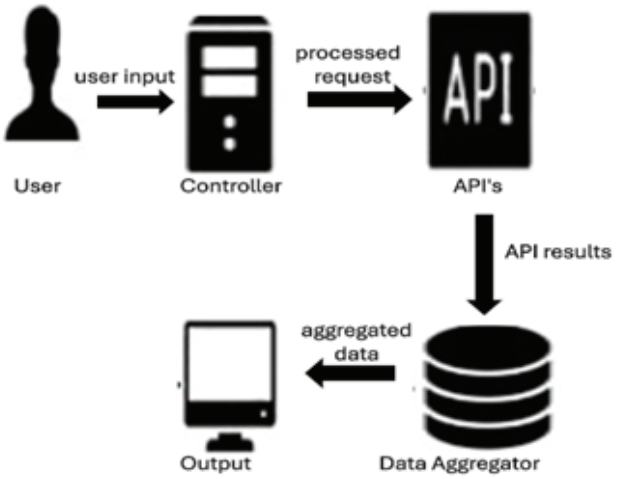

Figure 2: Working Flow

Once the requirements are set, the process progresses to data gathering. The system gathers in-depth information from different sources like tourist attractions, transportation hours, hotel reservations, weather, and frequent traveler routines. This diverse data is the foundation for AI-driven suggestions and itinerary creation.

After data collection, the raw data is preprocessed for enhancing quality and usability. Missing or incomplete data handling, error removal, normalization of formats, and data transformation to appropriate forms for computational processing, such as JSON for API integration, constitute this step. Properly formed and cleaned-up data ensures the AI algorithms can function appropriately and dependably.

The second step is the algorithm and model selection, during which appropriate artificial intelligence and machine are selected.learning methods are selected. Natural language processing (NLP) is used to decode what the user wants, and recommendation systems offer personalized advice on travel destinations, hotels, and activities and optimization algorithms create optimal and practical travel plans. Vicious testing The models used will be capable of producing intelligent, adaptive, and personalized planning. After here is the model development and integration. In this step, the generating routes, infrastructure of AI planner, such as Gemini large language model. Frameworks, and contextual analysis modules, is generated. The experience on these models is conditioned to make sense of user.Plans, aggregates a number of sources, and forms personal travel arrangements on demand.

Lastly, the system enters the deployment step and is finally deployed on a web are with the help of Streamlit. The deployment makes the planner dynamic, flexible, and responsive besides being user friendly. Dynamic information of interactive trip plans, proposed places, and accommodation option is presented to the users. To ensure that the AI Travelmate becomes not just a reliable tool but a proactive and efficient one, there are feedback features that are used to constantly check the performance and enhance the model accuracy and overall user experience.

Technologies used

Gemini API

Ai Travelmate system is mainly facilitated by Gemini API. It takes in user-created inputs like destination, travel dates, stay duration, and budget and interests in activities to come up with personal travel itineraries. The API collects data regarding places to visit, where to stay, restaurants, transportation, and the existing weather conditions to develop flexible and customized travel or itinerary plans to each user, ensuring that every itinerary is relevant to the user and current conditions.

Streamlit

Streamlit is utilized to construct the web-based interactive front-end for AI Travelmate. It allows users to enter their travel information and immediately see itineraries generated by AI. Streamlit has a responsive and simple-to-use UI with slider, dropdown, date picker support, and dynamic content presentation, enabling real-time interaction without page refreshes.

HTML/CSS

HTML is employed to organize the web pages, such as input fields, buttons, and areas for displaying itineraries and flight/hotel details. CSS is applied to beautify the visual appearance by specifying color schemes, typography, structure, and styling objects like cards, borders, and shadows so that the interface will be aesthetically pleasing and usable across various devices.

SerpAPI

SerpAPI is utilized to retrieve current data from Google, including flight information, hotel choices, and other travel information. It enables AI Travelmate to download the best flight offers, journey timetables, and booking links, which are incorporated into the itinerary.

Python

A python is applied to carry out AI, process data, and organize the API calls. Data is pre-processed using Pandas libraries and API answers are formatted before running the results of Gemini and SerpAPI into a final travel plan.

JSON

The APIs use JSON to format and exchange data with each other. JSON makes the data of flights, hotels and itineraries concluded regularly to be presented and processed by AI agents always in Riverlit.

Optimization & Scheduling Logic

Algorithms that are specially designed in Python are used to adapt the travel plan according to the length of trip, tourism activities, places to visit and personal preferences. This will help in making the traveling schedule realistic, affordable and customized to as much suitability and amusement as possible.

Results

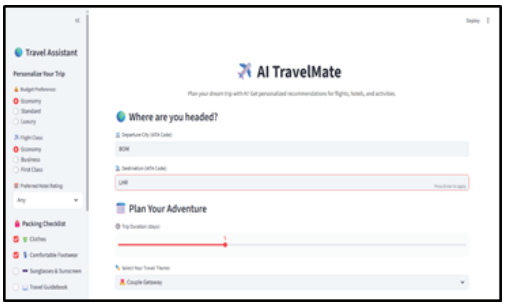

Fig: User Input Page

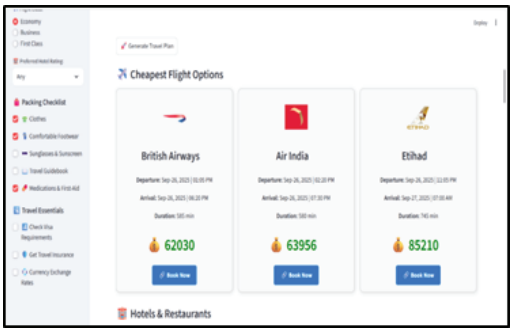

Fig:Flight Recommendation Section

Fig: Hotels and Restaurants Section

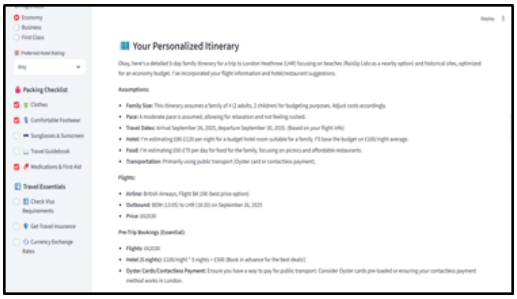

Fig: Personalized Budget Plan

Fig: Places to visit Section 1

Fig: Places to visit Section 2

Fig: Places to visit Section 3

Fig: Places to visit Section 4

Fig: Places to visit Section 5

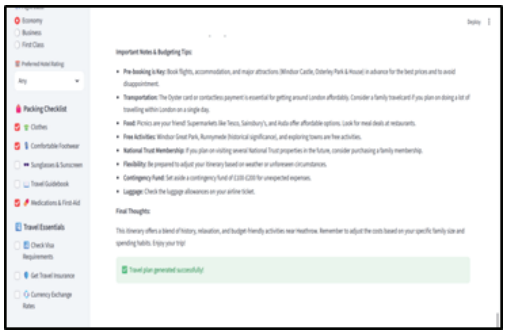

Fig: Tips for Journey

Conclusion

The history of AI Travelmate is the manner in which artificial intelligence transforms the manner of planning and enjoying the holidays that people have. Others, like the Gemini API intelligent itinerary design, SerpAPI real-time travel information, and Streamlit interactive tool, are some of the advanced technologies that have been integrated in the system to offer an easy and smooth remedy to tourists. Communication between component functionality is enabled through the application of backend processing with both Node.js and Python, and structured manipulation of data with both JSON, which makes both reliability and precision.

The project is effective in helping passengers to overcome some of the most common traveler pain points, including debilitating choices, time restrictions, and real-time information requirements. AI Travelmate offers optimized, customized, and adaptive travel plans, therefore, making it easier to decide and making travel more enjoyable. The system is thin slicable and adaptable, but also future-proof, with the possibility of migration to voice interaction, multi-language services and some binding to a booking platform.

To summarize, AI Travelmate is a unique product of using AI in a travel industry, combining technology and convenience to harness smarter, faster and more enjoyableity in trip planning, is a power of the users.

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