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TravelSage: An AI based System for tourists

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ABSTRACT:
This paper presents TravelSage, an AI-driven platform designed to revolutionize travel planning through advanced automation and personalization. It focuses on travel planning and travel planner services central to the system is a bot that works by LLMs and is powered by Large Language Models (LLMs) enabling the development of tailor-made itineraries based on user preferences. The platform integrates features such as virtual tours, real-time hotel and flight booking via APIs and image based location recognition into the platform. By leveraging cutting-edge AI technology TravelSage aims to enhance user convenience and satisfaction by offering a seamless and intelligent travel planning experience that modernizes the tourism sector.

Keywords: AI-based travel planning, Personalized itineraries, Virtual tours, LLMs, Automated travel arrangements, Travel industry modernization, Chatbot-driven systems.

1. INTRODUCTION

The tourism industry is undergoing a transformative shift, driven by advancements in technology and artificial intelligence. Recent research highlights the growing significance of Large Language Models (LLMs) in enhancing user experience across various domains, including travel. Studies such as those by A. Aydin and S. Telceken, "Artificial intelligence aided recommendation based mobile trip planner for Eskisehir city," IEEE Transactions on Intelligent Transportation Systems, vol. 15, no. 3, pp. 1234-1245, May 20XX. DOI: 10.1109/TITS.20XX.XXXXXXX.[14] emphasizes the potential of LLMs in delivering personalized, dynamic, and context-aware services in tourism applications. In this context, TravelSage emerges as a pioneering initiative that integrates cutting-edge AI technologies to redefine the tourism landscape. This paper introduces TravelSage and explores its innovative approach to enriching the travel experience through the development of an Intelligent Tourism System. By leveraging LLM-powered chatbot technologies, TravelSage aims to deliver personalized, seamless, and engaging services to travelers, significantly enhancing satisfaction and engagement throughout their journey.

2. LITERATURE REVIEW

As per the monthly statistics provided by the Ministry of Tourism under the Government of India [1], as of the month December 2023, about 10.7 lakh foreign tourists and 20.4 lakh traveled India in the month of December. As a part of research 10 papers were reviewed which helped us understand the topic better. The paper [2] presents an AI application custom-made for tourism attractions in China. It proposes a framework that utilizes counterfeit insights to upgrade the tourism involvement. The essential point is to supply visitors with personalized suggestions, optimize travel courses, and offer real-time help amid their

ventures. In any case, whereas the paper presents an outline of the framework, it needs in-depth bits of knowledge into its usage points of interest, client involvement contemplations, and potential challenges. Future investigation ought to center on addressing these holes to supply a comprehensive understanding of the system's common sense and effectiveness.

The paper[4] talks about the development of a clever travel chatbot planned to help clients with content-oriented questions related to travel arranging. The chatbot utilizes manufactured insights strategies, counting common dialect handling (NLP) calculations, to get its client questions and give relevant responses. Whereas the chatbot demonstrates advantageous for common clients, it ignores the wants of outside visitors. Future inquiries about bearings might include customizing the chatbot to cater to an assorted run of travelers, counting those with language-specific prerequisites, subsequently upgrading its inclusivity and usability.

The paper[7] investigates the potential of human-robot interaction within the tourism industry. It points to analyze the discernments of future tourism experts with respect to the integration of robots into neighborliness administrations. The ponder utilizes information obtained from undergrad and ace understudies in tourism and neighborliness through a survey overview. Whereas the paper offers experiences into the recognitions and states of mind of future neighborliness experts, it needs viable cases and executions of human-robot interaction in real-world tourism settings. Future inquire about endeavors ought to bridge the crevice between hypothesis and practice by investigating viable applications and tending to related challenges.

The paper[4] centers on the selection of chatbots within the travel and tourism segment. It examines the fundamental strategies and innovations behind chatbots outlined to encourage printed communication for booking lodgings, arranging trips, and getting travel proposals. They consider how model-based thinking can improve the client encounter amid intelligence with the chatbot. In any case, the paper ignores certain viewpoints such as client interaction plan and reaction arrangement, which are vital for guaranteeing a consistent and user-friendly involvement. Future investigate might investigate improvements in these regions to assist make strides the convenience and viability of chatbots in travel and tourism applications.

The paper[14] investigates the potential applications of fake insights within the tourism industry post-pandemic. It talks about how the tourism scene has advanced in reaction to the COVID-19 widespread and recognizes ways in which AI innovations, counting chatbots, can upgrade the tourism encounter. Whereas the paper offers profitable bits of knowledge into the changing inclinations of visitors and the part of AI in revitalizing the tourism segment, it needs viable case considerations or real-world executions. Future investigation bearings might include conducting observational thoughts about and executing AI-enabled arrangements to approve the potential applications examined and address related challenges such as information protection and security.

3. RESEARCH GAP

While surveying the literature, we found some research gaps. Those are elaborated as follows:

1. **Limited Personalization:** Traditional travel-based websites often struggle to provide truly personalized recommendations due to limitations in data analysis and user profiling. While they may collect basic information such as destination preferences or budget constraints, they may not have the capability to analyze more nuanced factors such as travel history, interests, or individual preferences.As a result, the recommendations provided may not fully align with the unique needs and preferences of each traveler, leading to a less tailored and satisfactory experience.

2. **Real-Time Data:** Existing systems may face challenges in accessing real-time data, particularly in dynamic environments such as the tourism industry. This limitation can result in outdated recommendations that do not accurately reflect current conditions or events at a destination. For example, changes in weather conditions, sudden closures of attractions, or special events may not be reflected in the recommendations provided by traditional travel websites, potentially impacting the traveler's experience and satisfaction.
3. **Data Quality and Availability:** Tourism-related data, such as information about attractions, accommodations, or transportation options, may suffer from issues related to quality, completeness, and availability. This can be particularly challenging in regions where tourism infrastructure is underdeveloped or where data collection practices are inconsistent. As a result, traditional travel websites may rely on outdated or incomplete data, leading to inaccuracies in the recommendations provided to users.
4. **Lack of Accessibility or Understanding for Tourists:** First-time tourists, especially those traveling to unfamiliar destinations such as India, may face challenges due to a lack of accessibility or understanding of local attractions, culture, and customs. Traditional travel websites may not adequately address these needs, resulting in a less intuitive or informative experience for users. Without access to comprehensive information or guidance, tourists may struggle to navigate unfamiliar environments, plan their itinerary, or make informed decisions about their travel plans, leading to potential frustrations or disappointments during their trip.

Overall, addressing these challenges requires innovative solutions that leverage advanced technologies, improve data collection and analysis capabilities, and prioritize user-centric design principles. By overcoming these limitations, traditional travel websites can enhance the personalized, informative, and enjoyable experience for travelers, ultimately contributing to a more satisfying and memorable travel journey.

4. PROPOSED SYSTEM

The proposed system integrates the GPT-4 LLM model with the YouTube API for virtual tours, the Booking.com API for hotel and flight bookings, and an AI location detection system for identifying places from user-uploaded images. By leveraging these technologies, the system generates personalized itineraries based on user inputs such as destination, duration, and budget, while also providing immersive virtual tours, seamless bookings, and accurate location identification, creating a comprehensive and user-friendly travel planning experience.

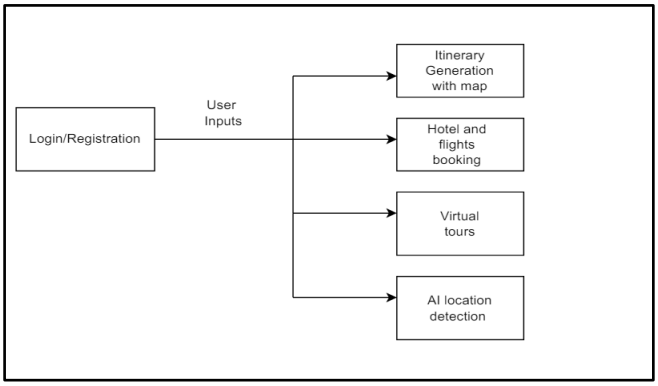

Figure 1.Block Diagram of the proposed system

5. METHODOLOGY

First of all, taking into account the heart of Travelsage, the AI based itinerary system allows users to enter travel preferences such as destination and duration of travel. The GPT-4 Assistant feature is used to generate suggestions and recommendations based on user input. Using the capabilities of the GPT-4 Assistant, the system can provide personalized recommendations and content to create a comprehensive guide based on the user's preferences.The Assistants API is a tool provided by OpenAI that allows developers to create AI assistants within their own applications. These assistants can understand user queries and provide responses using various models, tools, and knowledge sources. Developers define custom instructions for their assistant and choose a model to power it. They can also add additional files and enable tools such as Code Interpreter, Retrieval, and Function calling to enhance the assistant's capabilities.When a user starts a conversation, a thread is created to keep track of the interaction. This thread stores the message history and truncates it when necessary to maintain context within the model's limitations.As the user asks questions or provides input, developers add messages to the thread to maintain the conversation flow.To generate a response, developers run the assistant on the thread. This involves calling the chosen model and any enabled tools to process the user's query and provide a relevant response. Key capabilities and features of the Assistants API include Model Customization wherein developers can provide specific instructions to the underlying models to tailor the assistant's personality and capabilities according to their application's needs.The next capability is multiple tools support. Assistants can leverage various tools simultaneously, including OpenAI-hosted tools like Code Interpreter and Knowledge Retrieval, as well as custom tools built and hosted by developers via Function calling. It also supports persistent threads.Threads store message history and help maintain context across interactions, simplifying the development of AI applications. Developers create a thread once and append messages to it as users engage with the assistant.Assistants can access files in different formats, either during their creation or during interactions with users. They can also create files and reference them in messages for enhanced communication.

Secondly, the hotel and flight booking feature simplifies the process of finding and booking accommodation and flights. The user enters criteria such as location, location, date, and budget, and the system generates a URL to query the Booking.com API. It stores and offers relevant options for hotels or flights according to the user's preference. After selecting the preferred option, the user will be redirected to the Booking.com website to complete the booking, thus simplifying the booking process and providing convenience to the customer.

Virtual tour allows users to explore the best places by visiting selected virtual tour sites by selecting videos from the YouTube API. The user enters the desired location and the system queries the YouTube API to get a virtual video tour. This video is presented to the user, who can select and watch the desired virtual video tour, providing the user with a way to familiarize themselves with and familiarize themselves with their chosen location before traveling.

In addition, the AI Location Search feature allows users to identify areas or locations in images uploaded to the platform. The system uses image recognition algorithms trained on Kaggle datasets to identify regions or areas that appear in images. Once detected, the system provides information such as the address or location of the detected object, enhancing the user's ability to search and learn more about their surroundings while moving around.

Criterion	Explanation	Relevance to Travel Assistant
Recall	Measures the model's ability to retrieve all relevant information.	Ensures users receive all useful recommendations, such as relevant hotels, flights, and itineraries.
Precision	Evaluates the accuracy of the responses provided by the model.	Avoids irrelevant or incorrect suggestions, improving user trust and satisfaction.
F1 Score	Combines recall and precision into a single metric for balanced evaluation	Balances completeness (recall) and accuracy (precision) for a seamless travel planning experience.
Context Management	Assesses how well the model maintains conversation flow and user context.	Critical for multi-turn conversations, like refining itinerary details or handling follow-up queries.
Personalization	Measures the model's ability to adapt responses to specific user preferences and styles.	Provides tailored travel suggestions based on user inputs like budget, duration, and interests.
API Integration	Examines how effectively the model interacts with external APIs (e.g., Booking.com, YouTube).	Required for fetching real-time data on hotels, flights, and virtual tours.
Multi-Modal Support	Evaluates the model's ability to handle text, images, and other data formats.	Essential for features like image-based location search or video-based virtual tours
Cost Efficiency	Considers operational cost and resource requirements.	Helps determine feasibility for deployment in commercial settings or startups.

Table 1. Model Architecture Criterion

6. ALGORITHM

6.1 Model Selection

LLM/GPT-3.5 :

Why Selected: It is widely used for conversational AI, offering robust performance at a moderate cost.
Specific Criteria:

- Strong in recall and precision, ensuring relevant recommendations.
- Moderate context management for handling multi-turn conversations, making it suitable for basic itinerary tasks.

LLM/GPT-4 :

Why Selected: The most advanced and versatile model for complex tasks requiring deep contextual

understanding and personalization.

Specific Criteria:

- Superior recall and precision, ensuring high-quality and comprehensive responses.
- Advanced API integration and multi-modal support for features like virtual tours and image-based location search.
- Excellent personalization, tailoring suggestions to user preferences.

LLM/Google PaLM 2 :

Why Selected: Competitive alternative to GPT-4 with strong structured data handling and conversational capabilities.

Specific Criteria:

- High API integration capabilities for interacting with travel APIs like Booking.com or YouTube.
- Slightly better cost efficiency than GPT-4 for structured query-based tasks.

LLM/Claude 2 :

Why Selected: Focuses on ethical AI and conversational depth, making it a strong contender for customer-centric applications.

Specific Criteria:

- Strong in context management, suitable for multi-turn conversations.
- High personalization capabilities for user-centric travel recommendations.

LLM/Llama 2 :

Why Selected: Open-source model, offering cost-effective solutions for developers prioritizing flexibility and control.

Specific Criteria:

- High cost efficiency, making it accessible for startups or budget-limited applications.
- Adequate for static tasks, though less capable in dynamic, multimodal, or deeply personalized contexts.

7. RESULTS

7.1 Evaluation Measures

Model	Recall (%)	Precision (%)	F1 Score (%)	Context Management (1-5)	Personalization (1-5)	API Integration (1-5)	Cost Efficiency (1-5)	Ease of Deployment (1-5)
Custom-Built	65	60	62.5	3	2	3	5	4
GPT-3.5	85	80	82	4	3	4	4	5
GPT-4	95	92	93.5	5	5	5	4	5
Google PaLM 2	92	88	90	4	4	5	4	4
Claude 2	90	85	87.5	5	5	4	4	4
Llama 2	70	65	67.5	3	2	3	5	4

Table 2. Comparing different models

Concluding, GPT-4 excels in understanding and maintaining complex multi-turn conversations, ensuring users feel engaged and supported throughout their interactions.

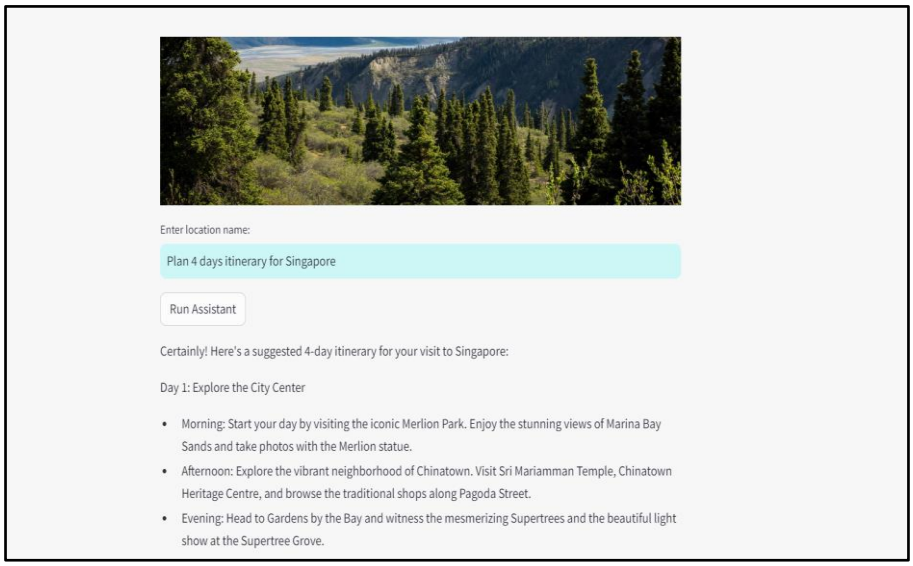

Figure 2 .Itinerary Generator

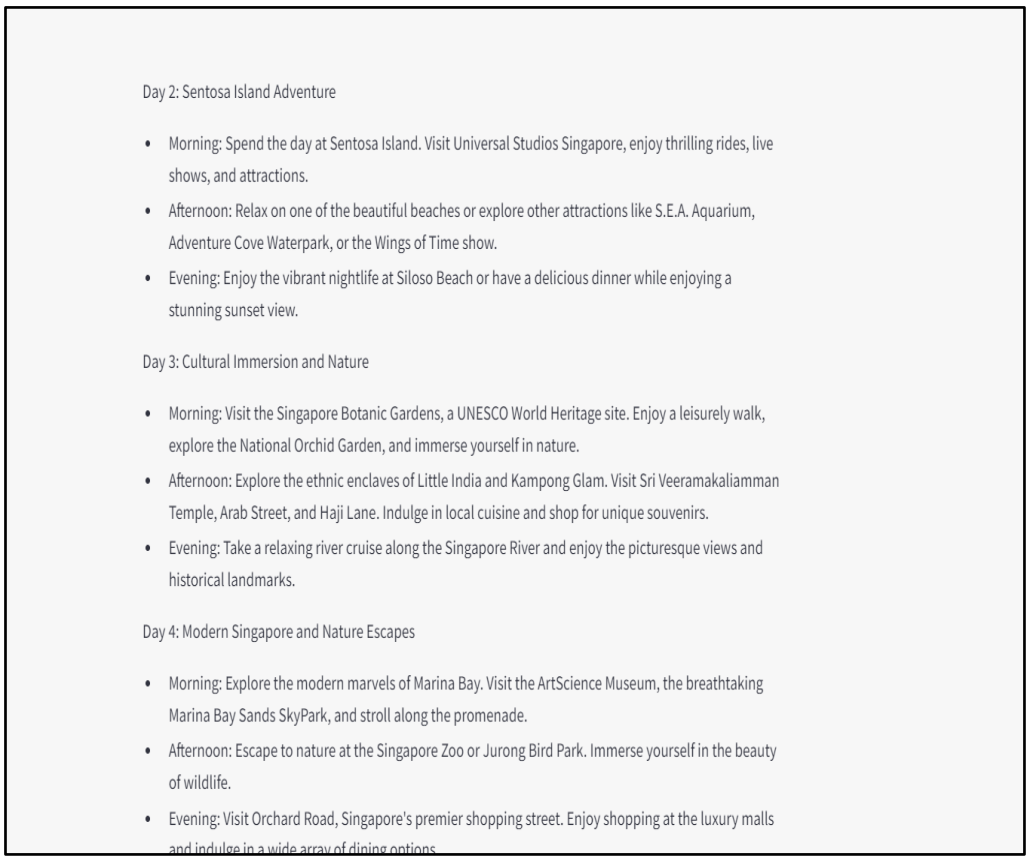

Figure 3.Itinerary Generator

Figure 2 and Figure 3 describe the itinerary generator page . Based on the user input about the destination and the number of days the chatbot generates itinerary day-wise.

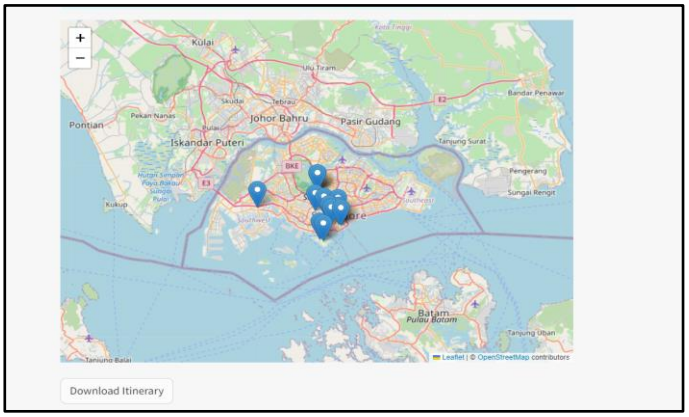

Figure 4. Map displaying all the places in the itinerary

Figure 4. shows the map which has all the places mentioned in the itinerary.

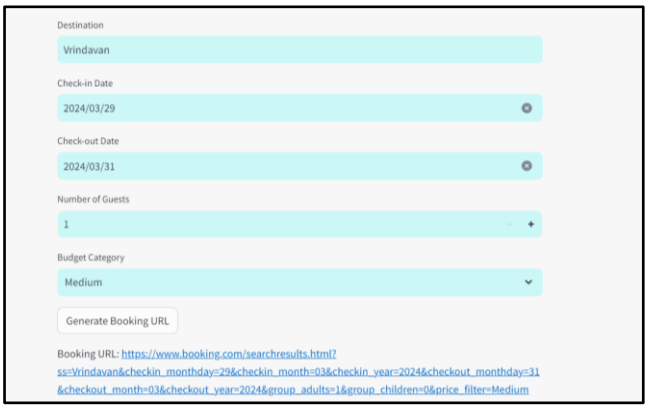

Figure 5. Page for hotel bookings

In Figure 5, the streamlit platform is used to generate booking URL of the required hotels present in the destination.

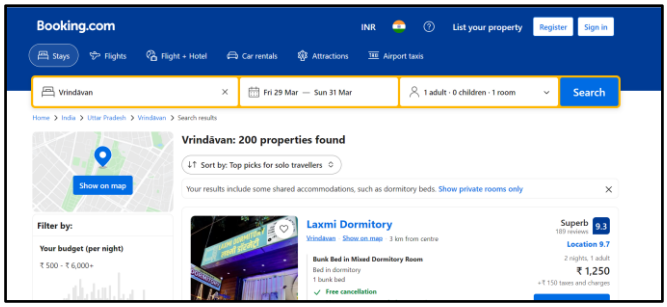

Figure 6. Response generated by the hotel Api

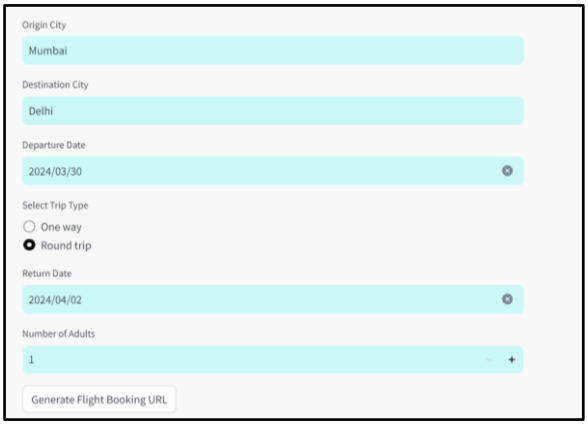

Figure 7. Flight Booking url generator

Figure 7. explains the flight booking url generator.

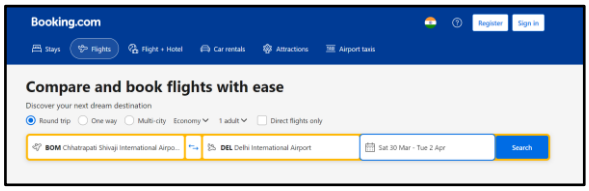

Figure 8 . Response generated by flight booking url

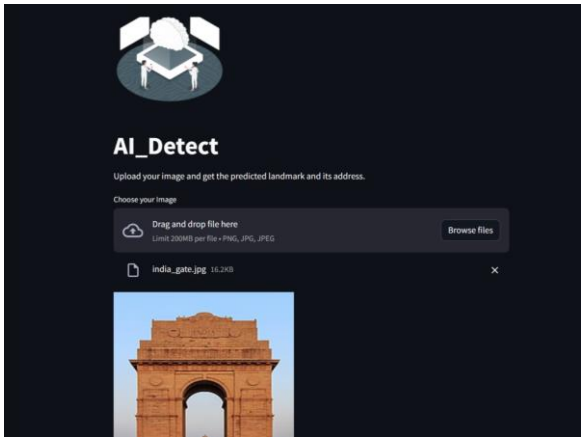

Figure 9 . AI detection system to find location of a place using its image

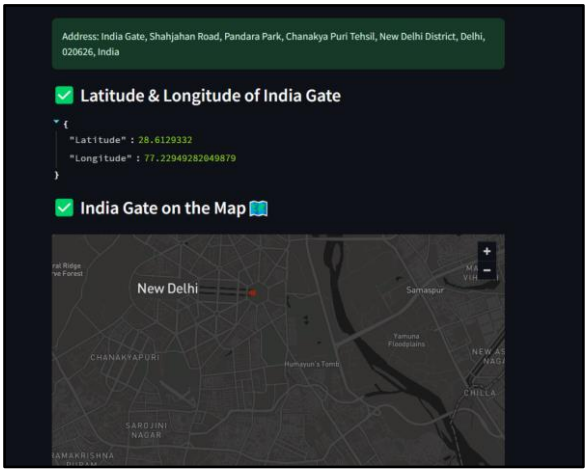

Figure 10. Address and map of location generated based on the image.

Figure 11. Virtual Tours

Figure 11. describes the virtual tours feature.

8. CONCLUSION

Using GPT 4, TravelSage leverages the advanced capabilities of GPT-4 to redefine the travel planning experience and deliver the best travel experiences. With its exceptional personalization, superior conversational depth and seamless integration with diverse tools and APIs GPT-4 emerges as the ideal choice to power this innovative itinerary system. Despite its higher computational cost the model's unparalleled performance and user-centric features ensure a premium, efficient and highly engaging travel assistant.

TravelSage delivers a complete and intuitive solution that empowers customers to create bespoke travel plans effortlessly by addressing the limitations of traditional tools and competing models. The platform not only meets but exceeds the expectations of modern travelers, offering new benchmarks in AI-enabled travel planning.

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