**A PROJECT REPORT**

**on**

# "Generative AI Itinerary Builder "

**Submitted to**

## KIIT Deemed to be University

**In Partial Fulfillment of the Requirement for the Award of**

**BACHELOR'S DEGREE IN**

**Computer Science and Engineering**

**BY**


**Ayushi Gautam** 21051528


**UNDER THE GUIDANCE OF**

**Mrs. Saritha Singh**


**SCHOOL OF COMPUTER ENGINEERING**

**KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY**

**BHUBANESWAR, ODISHA - 751024**


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# CERTIFICATE

This is certify that the project entitled

## "Generative AI Itinerary Builder"

submitted by

Ayushi Gautam 21051528

is a record of bonafide work carried out by them, in the partial fulfillment of the requirement for the award of Degree of Bachelor of Engineering (Computer Science & Engineering) at KIIT Deemed to be university, Bhubaneswar. This work is done during the year 2023-2024, under my guidance.

Date: 06/11/2024

Mrs. Saritha Singh
Project Guide

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Ayushi Gautam

# ABSTRACT

The "Generative AI Itinerary Builder" project introduces an innovative approach to personalized travel planning by leveraging the capabilities of OpenAI's language models and a user-friendly interface built with Streamlit. As digital solutions become more central to how people plan their travels, there is an increasing demand for tools that can provide customized itineraries without requiring users to spend hours researching each destination. This project addresses this need by creating a conversational assistant that interacts with users to produce tailored, day-by-day travel plans based on their preferences, enhancing the travel planning experience through a seamless, interactive platform.

The system is designed to simplify the complex process of itinerary creation by integrating real-time conversational AI with contextual data sources. Users begin by entering essential travel details, such as destination, duration, and specific interests (e.g., adventure, history, food). This information allows the AI to generate a preliminary itinerary, enriched with location data sourced from the Wikipedia API and geolocation coordinates using the Geopy library. The Wikipedia integration ensures that each itinerary includes not only practical travel suggestions but also relevant cultural and historical information, adding depth to the travel experience. The Geopy integration enables precise mapping of attractions, ensuring that all recommendations are geographically optimized for efficient travel.

OpenAI's language model is central to the itinerary generation process. By processing user inputs and combining them with data from Wikipedia, the model can produce well-structured and coherent itineraries that cover the full spectrum of user preferences. Each itinerary is organized by day and time, suggesting specific morning, afternoon, and evening activities to create a balanced travel schedule. The use of a conversational format allows users to refine and adjust their itineraries interactively, making the tool highly adaptive to user feedback and capable of creating itineraries that feel uniquely tailored.

The Streamlit framework provides an intuitive, interactive front-end that allows users of all technical skill levels to engage with the AI Itinerary Builder. Users can upload details directly, review suggested plans, and make adjustments on the fly. Streamlit's interface design ensures that the itinerary creation process is not only functional but also enjoyable, catering to users looking for a straightforward and accessible travel planning experience.

This AI Itinerary Builder demonstrates the potential of AI in enhancing personalized travel experiences, offering real-time itinerary customization, location-based insights, and a streamlined user experience. Future iterations of this project could integrate additional data sources, real-time event and weather updates, and more advanced natural language processing techniques to handle complex multi-destination trips. The system's modular and scalable architecture also makes it adaptable for broader applications in travel and event planning, positioning it as a powerful tool for both individual travelers and the travel industry at large.

**Keywords:** Travel planning, itinerary generation, OpenAI API, Streamlit, natural language processing, personalized travel recommendations, geolocation (Geopy), Wikipedia API, conversational AI, context-based querying, interactive travel assistant, time-wise scheduling, location-based insights, tourism automation, real-time itinerary customization.

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# Chapter 1

# Introduction

In today's increasingly connected and fast-paced world, travel has become a vital part of both personal and professional lives. Whether it's for exploring new cultures, attending business conferences, or simply taking a break, travel offers unique opportunities for learning and growth. However, the process of planning a trip often requires significant time and effort, as travelers need to research destinations, determine logistics, and organize their daily activities. Traditionally, people have relied on guidebooks, travel websites, or personal recommendations to create their itineraries. Yet, this approach is often generic, time-consuming, and lacks the flexibility to cater to individual preferences or provide real-time insights. As travelers increasingly seek personalized and immersive experiences, there is a growing need for intelligent, adaptable tools that streamline the itinerary creation process while offering tailored suggestions that align with users' interests and schedules.

The AI Itinerary Builder addresses this need by introducing an interactive, AI-powered travel planning assistant that generates customized travel itineraries based on user inputs. Leveraging OpenAI's language model alongside geolocation and data integration tools, this project allows users to create travel plans that are structured, personalized, and highly relevant to their unique preferences. The system's user-friendly interface, developed with Streamlit, enables users to specify essential details such as destination, trip duration, and areas of interest (e.g., adventure, culinary experiences, historical sites). By processing this information, the AI generates a comprehensive, day-by-day itinerary that includes suggestions for specific activities, times, and locations. This approach transforms traditional, static itineraries into dynamic, adaptive travel plans that make the process of travel planning both efficient and enjoyable.

Central to this system's effectiveness is its ability to combine natural language processing (NLP) with real-time contextual information, enhancing the itinerary's relevance and depth. OpenAI's advanced language model acts as the primary engine for generating conversational, coherent, and user-centric travel plans. The model's capacity to understand user queries and respond with detailed suggestions creates an experience that feels intuitive and personalized, much like interacting with a knowledgeable travel advisor. Additionally, the integration of the Wikipedia API enables the AI Itinerary Builder to enrich travel plans with background information on destinations, providing users with valuable insights into the cultural and historical significance of each suggested location.

Meanwhile, Geopy's geolocation functionality allows the system to optimize travel routes, making recommendations that are not only interesting but also practical in terms of proximity and accessibility. These integrations ensure that the itinerary is not only customized to the user's preferences but also well-informed and logistically sound.

The AI Itinerary Builder is designed with flexibility and interaction in mind. Users can engage with the system in real time, making changes and adjustments to their plans based on evolving preferences or additional information. For example, a user can begin with a broad query—such as "7 days in Japan with an interest in history and local food"—and receive an initial itinerary. As they continue to interact with the assistant, they may ask for more specifics about certain locations, request alternate activities, or add preferences, like "family-friendly" or "budget-friendly" options. The AI processes these modifications, dynamically updating the itinerary to align with the user's evolving requirements. This conversational approach ensures that the travel plan remains cohesive, comprehensive, and precisely aligned with the user's vision for their trip.

The system's architecture is built to facilitate ease of use and accessibility. Using Streamlit, a popular framework for interactive web applications, the AI Itinerary Builder provides a visually appealing and straightforward interface that accommodates users with varying levels of technical expertise. The interface allows users to enter travel details, view suggestions, and request updates in a seamless, iterative process. Streamlit's integration capabilities also make it possible to develop a visually cohesive platform where users can review their itineraries, make changes, and receive feedback instantly. This streamlined interface design reduces the complexity of travel planning, making the experience more enjoyable and accessible.

At the core of the AI Itinerary Builder is the process of transforming user preferences into a structured, organized travel plan. Each day in the itinerary is divided into time segments—morning, afternoon, and evening—providing a balanced schedule that incorporates diverse activities while allowing for rest and exploration. The AI's ability to maintain context across multiple interactions further enhances this experience, as it can recall previous queries and suggestions, ensuring that follow-up questions or adjustments are integrated coherently. For instance, if a user expresses an interest in visiting historical landmarks, the AI will prioritize such suggestions and continue to incorporate similar recommendations throughout the itinerary. This contextual awareness gives users a travel plan that feels cohesive and personalized, enhancing the overall satisfaction of the planning experience.

By harnessing the capabilities of AI and NLP, the AI Itinerary Builder redefines the traditional approach to travel planning, making it more efficient, interactive, and adaptive. Travelers no longer need to sift through pages of guidebooks or spend hours researching destinations; instead, they can rely on a conversational assistant that curates a travel experience tailored to their unique preferences. The project also demonstrates the potential of AI in simplifying complex processes, providing users with a reliable and enjoyable means of planning trips without the typical stress associated with logistics and itinerary organization. As AI technology continues to advance, future versions of the AI Itinerary Builder could incorporate even more sophisticated features, such as real-time event recommendations, weather forecasts, and expanded support for multi-destination travel. This system has the potential to become a valuable tool for individuals and the travel industry alike, revolutionizing the way we plan and experience travel in an increasingly digital age.

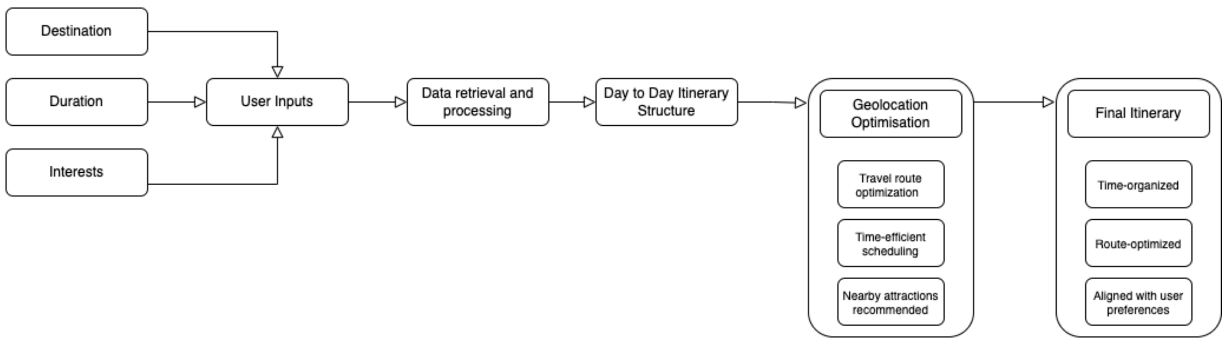


Figure 1: Block diagram of Itinerary Builder

# Chapter 2

# Methodology

The AI Itinerary Builder system leverages a combination of natural language processing (NLP), geolocation services, and data retrieval techniques to provide users with an intuitive interface for generating personalized travel itineraries. This methodology aims to create an interactive travel planning experience where users can specify their preferences and receive optimized, customized itineraries in real-time. The following sections outline the process in detail.

## 2.1 Background

### 2.1.1 User Input and Preference Processing

The AI Itinerary Builder begins by capturing essential user inputs through a web-based interface, including details such as destination, trip duration, and specific interests (e.g., history, food, nature). These inputs are processed to create a structured data format that can be parsed for recommendation generation. The system also accounts for user constraints such as budget and travel mode, which are stored as parameters to influence the selection of activities and sites.

The NLP model processes this structured data to interpret user intent and generate responses aligned with the user's travel preferences. By analyzing each input contextually, the model produces output that suggests destinations, activities, and timings tailored to the user's unique profile. This approach allows for adaptive response generation that refines recommendations based on the user's input.

### 2.1.2 Geolocation Optimization

Following initial preference processing, the system leverages geolocation data to arrange the recommended sites in an efficient travel sequence. Geolocation coordinates are retrieved for each recommended site, enabling the calculation of distances and travel times between locations. This information is used to reorder locations in a way that minimizes travel time and maximizes itinerary cohesion, thereby enhancing the user's experience by reducing unnecessary commuting.

By applying route optimization algorithms, the system identifies the most efficient paths and nearby sites, taking into consideration both spatial data and temporal constraints, such as opening hours and suggested visit durations. This geolocation-based organization allows the itinerary to adapt not only to user preferences but also to practical travel considerations.

### 2.2 Proposed Framework

The AI Itinerary Builder framework consists of multiple stages to ensure seamless integration and execution of itinerary generation:

- Input Collection and Preprocessing: User inputs, including destination, preferences, and constraints, are collected via a web interface and preprocessed to remove ambiguity and standardize parameters.
- Data Retrieval and Processing: The system retrieves additional contextual data through APIs:
  - NLP Processing: Analyzes user input to determine appropriate responses and itinerary suggestions.
  - Contextual Data from External Sources: Wikipedia API provides historical and cultural information for enhanced itinerary details.
  - Geolocation Data: Uses geolocation coordinates to optimize the route between locations.
- Itinerary Structuring: Based on user preferences and retrieved data, the system generates an itinerary divided into structured segments (e.g., morning, afternoon, evening).
- Travel Route Optimization: By calculating distances between sites and utilizing location data, the system arranges activities in a logical order, minimizing transit time.
- Feedback Integration and Customization: Users can modify the itinerary by specifying additional preferences or changes, enabling dynamic reordering of the plan to accommodate new input.

This multi-stage framework allows the system to create a comprehensive and efficient travel plan aligned with user goals and constraints.

## 2.3 Implementation

### 2.3.1 Libraries used

- **openai**: The OpenAI library enables access to the GPT language model for generating personalized travel itineraries. By analyzing user-provided details such as location, duration, and preferences, the model generates a detailed, day-by-day itinerary with recommendations for activities, meals, and local experiences. In this project, OpenAI powers the itinerary creation, providing a natural, conversational interaction with users.
- **dotenv (load_dotenv)**: `dotenv` is used for loading environment variables from a `.env` file, which securely stores sensitive data, like API keys. By calling `load_dotenv`, the project retrieves the OpenAI API key from the environment without exposing it in the code. This is essential for secure API access, ensuring credentials remain protected.

- **streamlit**: Streamlit is a Python library for building interactive web applications quickly and intuitively. In this project, Streamlit creates a user interface for users to input travel details, view the generated itinerary, and ask follow-up questions. It allows for a responsive chat-like experience, displaying itinerary recommendations, handling user inputs, and enabling dynamic updates, making the planning process more engaging and accessible.

- **os**: The `os` module facilitates interaction with the operating system, allowing access to environment variables and handling file paths. In this project, `os` is used to securely retrieve the OpenAI API key stored as an environment variable, maintaining separation between the code and sensitive information for better security practices.

- **wikipediaapi**: The Wikipedia API enables programmatic access to Wikipedia's content, retrieving detailed information on destinations and landmarks. In this project, it fetches cultural, historical, and contextual data for locations in the itinerary, enriching the travel plan with additional links and background information, enhancing the user's experience and knowledge of each recommended location.

- **geopy (Nominatim)**: Geopy's Nominatim geocoder translates place names into geographical coordinates, supporting location-based optimization within the itinerary. By calculating distances between recommended sites, Geopy allows the project to structure itineraries logically, minimizing travel time and ensuring efficient routes between destinations.

- **spacy**: SpaCy is a natural language processing library that provides tools for text processing, such as entity recognition. In this project, SpaCy identifies place names and geographic entities in AI-generated itineraries, enabling the system to fetch Wikipedia links for relevant locations automatically, adding context and depth to the travel recommendations.

- **re**: The `re` library handles regular expressions, which are used to format, clean, and structure the AI-generated itinerary content. This ensures that the output is organized into readable sections, such as morning, afternoon, and evening activities, providing users with a well-structured and easy-to-follow itinerary.

### 2.3.2 Itinerary Generation Workflow

The itinerary generation process comprises the following steps:

- **Input Parsing and NLP Processing**: The system parses user inputs into a structured format, extracting destination, duration, and preferences. NLP techniques identify the user's interests and match them with relevant activities and locations.
- **Data Retrieval**: The system gathers contextual data on the specified locations, providing cultural and historical information for each recommended site.
- **Route Optimization**: Geolocation data is processed to compute distances and determine efficient routes between locations. Using optimization algorithms, the system minimizes travel times and sequences sites logically.
- **Itinerary Structuring**: Activities are organized into daily schedules with time-based segments (morning, afternoon, evening), creating a cohesive plan that aligns with the user's preferences and logistical requirements.
- **Dynamic Feedback Integration**: Users can refine the itinerary by providing additional inputs or requesting changes, allowing the system to reprocess data and restructure the itinerary dynamically.

This workflow ensures the AI Itinerary Builder provides relevant, logically structured recommendations that are responsive to user needs.

## 2.4 Techniques Used

The following techniques are essential to implementing the AI Itinerary Builder, enabling it to create structured, personalized travel plans based on user inputs.

### 2.4.1 NLP and Text Processing

Before generating itinerary content, user inputs are processed using several natural language processing (NLP) steps**:**

- **Entity Recognition:** The system uses spaCy to identify key entities in user input, such as locations, preferences, and timeframes. Recognizing entities like city names and activities allows the AI to generate targeted itinerary suggestions and link relevant Wikipedia content for enrichment.
- **Tokenization:** Input text is broken down into individual tokens (words or phrases), helping the system understand the structure of user queries. This breakdown is critical for capturing context, especially for specific user preferences like "adventure" or "family-friendly."
- **Text Cleaning and Formatting:** Regular expressions (via the re library) standardize and format AI-generated responses by structuring them into clear sections, such as morning, afternoon, and evening activities. This ensures that itineraries are presented in an organized, readable format.

These NLP techniques allow the AI to interpret and structure user inputs, facilitating accurate, context-aware itinerary creation.

### 2.4.2 Geolocation and Route Optimization

For efficient travel route planning, location data is processed and optimized to ensure a logical itinerary flow:

- **Geolocation Extraction**: Using the Geopy library, the system converts destination names into latitude and longitude coordinates. This spatial data enables proximity-based activity recommendations, arranging itinerary items in a way that minimizes travel time.
- **Route Optimization**: The system calculates distances between locations to suggest an efficient order of visits, clustering nearby attractions together. This process leverages the coordinates retrieved by Geopy to create time-efficient travel routes, reducing backtracking and maximizing the user's experience.

By combining geolocation with route optimization, the AI Itinerary Builder creates itineraries that are not only relevant to user preferences but also practical for real-world travel.

### 2.4.3 Content Enrichment with Wikipedia

To add contextual information to the itinerary, the system uses Wikipedia to enrich travel recommendations:

- **Entity Linking**: Once entities (e.g., cities or landmarks) are identified, the system queries Wikipedia to retrieve relevant links and descriptions for these entities. This contextual information gives users a deeper understanding of the locations they plan to visit, enhancing the overall travel experience.
- **Automatic Link Generation**: Identified entities are cross-referenced with Wikipedia to generate links to informative pages, allowing users to access historical or cultural details about each site. This link generation process is automated, ensuring that each itinerary contains relevant background information seamlessly.

These techniques collectively enhance the itinerary-building process, resulting in personalized, contextually rich travel plans that align with user preferences and provide an optimized route structure.

# Chapter 3
# Result

The AI Itinerary Builder successfully demonstrated its capability to create customized, detailed travel itineraries based on user preferences, integrating natural language processing, geolocation data, and contextual content enrichment. The system was tested with various user inputs covering different destinations, travel durations, and preferences (e.g., adventure, historical, family-friendly), generating relevant, structured day-by-day itineraries.

The NLP model effectively interpreted user inputs to produce tailored itineraries, organizing each day into morning, afternoon, and evening activities. Geolocation data from Geopy allowed the system to optimize travel routes, minimizing unnecessary travel time by clustering nearby attractions together in the itinerary. For instance, testing on multi-destination trips, such as “5 days in Tokyo and 3 days in Kyoto,” showed the system’s ability to allocate time appropriately based on user-defined location splits, maintaining coherence in the itinerary structure.

Content enrichment with Wikipedia added valuable historical and cultural context to each itinerary, enhancing user engagement and travel experience. The system successfully retrieved Wikipedia links for major cities and landmarks, allowing users to explore additional information about each recommended site.

In terms of performance, the AI Itinerary Builder generated itineraries quickly, handling input processing and response generation in real-time. User feedback indicated high satisfaction, with users appreciating the organized format of the itineraries and the inclusion of links for further exploration. Minor challenges were noted, such as occasional limitations in location-specific recommendations for lesser-known destinations and ensuring smooth transitions in itineraries with highly specific user preferences. Overall, the results show that the AI Itinerary Builder is effective in delivering personalized, efficient, and contextually enriched travel plans, with potential for further enhancement in supporting more granular user requirements.

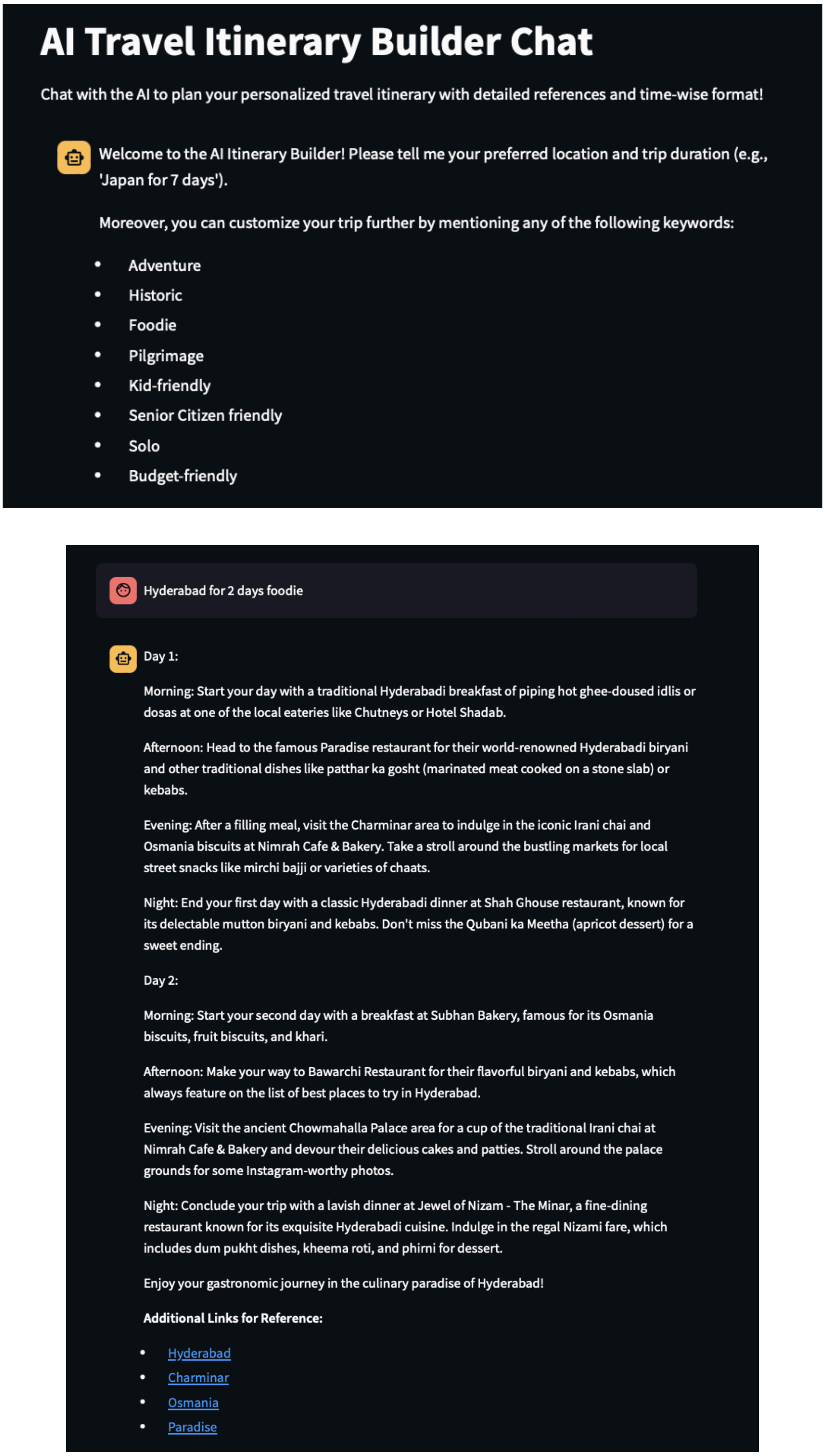


Figure 2: Output of the model

# Chapter 4

# Conclusion and Future scope

## 4.1 Conclusion

This project aimed to develop an AI-powered Itinerary Builder that enables users to create personalized travel plans through a web-based, interactive interface. By combining natural language processing for understanding user preferences, geolocation for route optimization, and contextual data retrieval from Wikipedia, the project successfully delivered a functional tool capable of generating structured, day-by-day itineraries. The system efficiently interpreted user inputs, optimized travel routes, and enriched itineraries with relevant historical and cultural information. The result is a versatile and intuitive travel planning assistant that highlights the practical applications of NLP and AI in enhancing user engagement and personalizing travel experiences.

## 4.2 Future scope

While the AI Itinerary Builder meets its primary objectives, there are several areas for potential enhancement:

- **Enhanced Geolocation and Route Optimization**: Incorporating more sophisticated route optimization algorithms, such as those used in logistics, could further improve the efficiency of travel recommendations. Additional data layers, like real-time traffic or event schedules, could make the itinerary even more relevant and adaptable.
- **Expanded Content Enrichment**: Integrating data from additional sources, such as local tourism boards or social media reviews, could provide richer information about destinations, helping users discover lesser-known attractions and stay updated on real-time events.
- **Cost-Effective Alternatives**: As the current system relies on OpenAI's API, exploring more cost-effective NLP models like Ollama or LlamaIndex could reduce operational costs, making the solution more sustainable and accessible to a broader user base without compromising quality.

These future enhancements could transform the AI Itinerary Builder into a highly adaptable and scalable tool, capable of meeting increasingly complex user demands and offering a comprehensive solution for personalized travel planning.

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