AI Personalized Search and Trip Planning System

Team Members:

Surya Abhishek Tadiparthi (surya142@umd.edu)

Sahithya Shetty (sshetty7@umd.edu)

Dhanush P Sukruth(dsukruth@umd.edu)

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1.0 Introduction

The rapid growth of the travel and hospitality industry has significantly raised demand for personalized travel experiences. Traditional search and trip planning methods often fail to meet the diverse preferences of individual travelers, leading to dissatisfaction and missed opportunities for businesses. This gap presents a challenge for companies like Airbnb, which strives to provide tailored services.

Our AI-powered Personalized Search and Trip Planning System for Airbnb addresses this issue by offering customized recommendations that enhance user experience and satisfaction. The AI system includes a travel assistant that suggests accommodations, activities, and transportation based on the user's preferences and trip duration, ensuring a more immersive and personalized experience.

Additionally, our AI leverages advanced machine learning models to analyze user history, past bookings, and preferred locations, providing even more refined recommendations. By understanding a traveler's past choices and integrating real-time data on seasonal demand, pricing trends, and destination popularity, the system ensures highly relevant suggestions tailored to each individual. Whether a user prefers beachside resorts, bustling city centers, or remote retreats, the AI dynamically adapts to their unique travel style.

This approach not only boosts customer satisfaction but also increases revenue from Airbnb's Experiences marketplace and fosters long-term customer loyalty, providing Airbnb with a competitive edge in the dynamic travel industry.

2.0 Implementation Plan

2.1 AI-Driven Personalized Airbnb Recommendation System

This system is powered by three AI agents utilizing Mistral-7B-Instruct-v0.1 to deliver highly adaptive and real-time recommendations. These agents collaborate seamlessly, analyzing seasonal demand, user behavior, and personalized preferences to provide tailored travel suggestions.

2.1.1 Seasonal Demand & Pricing Agent

- Fetches real-time seasonal demand and pricing trends from online sources.
- Uses Google Trends API for retrieving the seasonal demand at a location

2.1.2 User Behavior & Booking History Agent

- Connects to Airbnb's backend (or simulated dataset) to extract:

    - Previous bookings
    - Preferred property types
    - Search patterns
    - Stay durations and locations
    - User budget preferences
- In this project, since we couldn't retrieve user data from external sources, we created an augmented dataset for demonstration purposes.

2.1.3 Orchestrator Agent (Main LLM Agent)

- Combines insights from both agents.
- Utilizes the Public Opensoft API to fetch the top 20 most-reviewed Airbnb listings for a given location.
- Utilizes **Mistral-7B-Instruct-v0.1** to rank and recommend the top 2-3 locations based on:
    - Current seasonal trends
    - Historical user preferences
    - Budget constraints and availability
    - Trending destinations from external sources
- Dynamically refines recommendations as new data is received in real-time.

2.2 AI Travel Planner

This module generates personalized travel itineraries based on user preferences, budget, and travel dates, utilizing insights from a single intelligent agent to recommend destinations, activities, and accommodations.

2.2.1 User Preference Collection

- A UserPreferenceAgent class gathers user input, including:
    - Destination
    - Trip duration
    - Budget
    - Interests (e.g., adventure, sightseeing, relaxation)
    - Travel style (e.g., luxury, backpacking)
    - Dietary restrictions

2.2.2 Fetching External Data

- The fetch_weather(destination) method retrieves real-time weather data from the **free wttr.in** API to include relevant climate conditions in the itinerary.

2.2.3 Itinerary Generation

- The generate_itinerary(preferences) method constructs a prompt incorporating:
    - Destination details
    - Personalized travel itinerary with morning, afternoon, and evening plans
    - Travel recommendations (flights, trains, etc.)
    - Restaurants, scenic locations, accommodations, and activities based on user preferences
- The prompt is processed using Llama-3.2-1B-Instruct, which generates a complete itinerary.

2.2.4 Leveraging LLM for Personalized Itinerary Generation

- The system utilizes Llama-3.2-1B-Instruct to dynamically craft detailed and engaging travel plans tailored to the user's profile.
- Instead of relying on static rule-based approaches, the model captures contextual nuances from user preferences, current events, and seasonal trends.
- The agent intelligently adapts suggestions based on inferred interests, optimizing travel recommendations in real time.
- By leveraging few-shot learning and contextual understanding, the LLM ensures highly relevant itinerary suggestions, making each itinerary feel custom-curated rather than generic travel plans.

3.0 DATA

3.1 DATA used for Personalized Airbnb Recommendation system

We utilized the API from OpenDataSoft to retrieve the top 20 most-reviewed Airbnb listings for a given location. Additionally, we incorporated augmented data to simulate user inputs based on a given user ID. Please check mock_users.csv to refer to users data.

3.2 DATA used for AI Travel Planner

The user provides their travel preferences, including budget, interests, travel style, dietary restrictions, trip duration, destination, and origin as manual inputs.The system also fetches real-time weather data for the destination using the wttr.in API to enhance trip planning. Based on the user’s inputs, the AI-powered travel assistant suggests personalized accommodations, activities, and transportation options.

4.0 Results

4.0.1 Results from Personalized Airbnb Recommendation System

User data is sourced from **`mock_user.csv`**, and based on the user's desired travel location, the system generates personalized recommendations.

Example input:

```
user_id = "user_1"
location = "Sydney"
```

And the corresponding output:

```
Based on the user's budget preference of 'Low' and desired amenities of
'Balcony', 'Kitchen', and 'Ocean View', the ideal Airbnb listings would
be:

1. Central l Pool l Rooftop Harbour Views - Sydney - Reviews: 485 - Price:
152 - Room Type: Entire home/apt
2. Sydney at your doorstep! - Sydney - Reviews: 288 - Price: 159 - Room
Type: Entire home/apt
3. George's Luxury Studios - Hyde Park - Sydney - Reviews: 217 - Price:
144 - Room Type: Entire home/apt

These listings are within the user's budget range and offer the amenities
they are looking for, including a balcony, kitchen, and ocean view. They
are also located in Sydney, which is the user's travel destination.
However, it is important to note that the availability and pricing of
these listings may vary depending on the time of year and other factors.
The user may want to consider booking in advance to secure the best deals.
```

4.0.2 Results from AI travel Planning System

We collect user preferences, including budget, interests, travel style, dietary restrictions, trip duration, destination, and origin. Based on this information, the system generates a personalized itinerary with accommodation options, travel recommendations, and restaurant suggestions.

Example Input:

```
user_input = {
       "budget": 1000,
       "interests": ["beaches", "museums", "local culture"],
       "travel_style": "relaxed",
       "dietary_restrictions": "none",
       "trip_duration": 2,
```

```
      "destination": "Cancun",
      "origin": "New York"
   }
```

```
Generated Itinerary:
        **Cancun**

Cancun is a popular tourist destination located on the Caribbean coast of
Mexico. Known for its white-sand beaches, crystal-clear waters, and
vibrant nightlife, Cancun is a top destination for beach lovers, history
buffs, and culture enthusiasts.

**Cancun Itinerary**

**Day 1:**

* Morning: Arrive at Cancun International Airport and take a shuttle or
taxi to your hotel in the hotel zone (e.g. Hotel Zone or 5).
* 9:00 am: Start the day with a visit to the **Museo Maya de Cancun**
(Cancun Maya Museum), a museum showcasing the history and culture of the
Maya civilization.
* 12:00 pm: Head to **Playa Delfines** (Delfines Beach) for lunch and some
relaxation time.
* 2:00 pm: Take a **Xel-Ha Park** tour, a snorkeling and swimming tour in
a natural aquarium.
* 7:00 pm: Enjoy dinner at **La Parroquia**, a local restaurant serving
traditional Mexican cuisine.
* Evening: Explore the lively **Mango Hill**, a popular spot for nightlife
and people-watching.

**Day 2:**

* 9:00 am: Visit the **Palacio de Belles Artes**, a beautiful art museum
featuring Mexican and international art.
* 11:00 am: Take a **Tulum Beach** tour, a scenic drive to this stunning
beach town, known for its ancient Mayan ruins.
* 1:00 pm: Enjoy lunch at **La Casa de Toño**, a local eatery serving
traditional Mexican dishes.
* 3:00 pm: Visit the **Cenote Azul**, a beautiful swimming hole surrounded
by lush vegetation.
* 7:00 pm: Enjoy a farewell dinner at **El Fogoncito**, a cozy restaurant
serving local cuisine.

**Travel Options:**

* From the US: Fly into Cancun International Airport (CUN) and take a taxi
or shuttle to your hotel.
```

* From Mexico City: Take a domestic flight to Cancun International Airport (CUN) and then take a taxi or shuttle to your hotel.

Accommodations:

* **Hotel Zone 5**: Stay in this area for easy access to beaches, restaurants, and nightlife. Recommended hotels include the **Hyatt Zilara Cancun**, **Barcelo Maya Palace**, and **The Grand Park Royal Cancun**.

Restaurants:

* **La Parroquia**: Traditional Mexican cuisine
* **La Casa de Toño**: Local eatery serving traditional Mexican dishes
* **El Fogoncito**: Cozy restaurant serving local cuisine

Scenic Locations:

* **Playa Delfines**: A stunning beach with crystal-clear waters
* **Xel-Ha Park**: A natural aquarium with snorkeling and swimming opportunities
* **Cenote Azul**: A beautiful swimming hole surrounded by lush vegetation

Things to Do:

* **Snorkeling and swimming**: Explore the underwater world of Xel-Ha Park
* **Beach relaxation**: Enjoy the sun, sand, and sea at Playa Delfines
* **History and culture**: Visit the Museo Maya de Cancun and explore the ancient Mayan ruins of Tulum Beach
* **Nightlife**: Explore the lively Mango Hill and enjoy the local nightlife

Budget:

* Accommodation: $200 per night (avg.) for a hotel in the hotel zone
* Food and drink: $30 per meal (avg.) for local restaurants and cafes
* Transportation: $20 per day (avg.) for taxis and shuttle services
* Activities: $50 per person for Xel-Ha Park tour and $20 per person for Tulum Beach tour

Total budget: $1000

5.0 Conclusion

All in all, our project focuses on enhancing the travel experience through two interconnected systems. The Personalized Search Recommendation System identifies the top three Airbnb options based on user preferred location, ensuring convenient and well-suited accommodations. Meanwhile, the AI Travel Assistant for Airbnb creates a customized itinerary by considering factors such as budget, interests, travel style, dietary restrictions, trip duration, origin, and destination. Once these systems are integrated with Airbnb, they will provide a seamless and highly personalized travel experience—offering users real-time accommodation recommendations alongside an optimized travel plan, making trip planning more efficient and tailored to individual needs.