**Vacation Planning Assistant: Architecture and Design Report**

**1. Introduction**

The **Vacation Planning Assistant** is an interactive web application that leverages AI to provide personalized vacation recommendations based on user preferences such as destination, budget, and travel style. Built using **Streamlit**, the app features a sleek and dynamic user interface, AI-driven suggestions, and customizable themes, ensuring both functionality and a seamless user experience.

**2. System Architecture**

The architecture of the Vacation Planning Assistant comprises the following key components:

**a. User Interface (UI)**

* **Framework**: Built with Streamlit for its simplicity and support for rapid prototyping.
* **Features**:
  + Input fields for vacation preferences (e.g., destination, budget, days available).
  + A sidebar for additional navigation and tools (e.g., budget breakdown, travel tips).
  + Theme toggling functionality (Light/Dark modes) for personalized appearance.

**b. Backend Logic**

* **Groq API Integration**: The app uses the **Groq API** to generate vacation recommendations. User inputs are compiled into a prompt and sent to the API, which processes the request using a Large Language Model (LLM).
* **Response Handling**:
  + The API’s response is parsed using regular expressions and validated with Python's ast.literal\_eval to ensure safe and structured data extraction.
  + The parsed data is displayed as a table using **pandas** for clarity and interactivity.

**c. Data Processing**

* **Budget Breakdown**: Real-time calculations for budget distribution are displayed in the sidebar.
* **Recommendations**: Data is dynamically presented as a Data Frame, allowing users to explore AI-suggested plans.

**d. Themes**

* Custom CSS is injected into the Streamlit app to support a **Light** and **Dark** mode. The user can toggle between themes, altering background colors, text styles, and UI element aesthetics dynamically.

**3. Chosen Large Language Model (LLM)**

* **Model**: **Groq API using Llama3-8b-8192**
* **Why Llama3?**
  + **Performance**: Known for handling long prompts and producing coherent, structured outputs.
  + **Customizability**: The model excels at adapting to specific prompt structures, making it ideal for generating vacation plans in dictionary format.
  + **Efficiency**: Balances performance and computational efficiency, ensuring quick responses for real-time applications.

The LLM is queried via the Groq API’s chat.completions.create endpoint. The app passes structured prompts to guide the model in generating outputs that meet user requirements (e.g., detailed vacation recommendations).

**4. Key Design Decisions**

**a. Technology Stack**

* **Streamlit** was chosen for its simplicity, rapid development capabilities, and built-in support for interactive widgets.
* **pandas** is used for manipulating and displaying structured recommendation data.
* **dotenv** enables secure storage of API keys in environment variables.
* **ast.literal\_eval** ensures safe evaluation of API responses, avoiding potential security risks associated with eval().

**b. AI Integration**

* The **Groq API** was selected for its reliability and support for advanced LLMs like Llama3.
* The prompt design ensures high-quality, structured responses by explicitly specifying the format (list of dictionaries with attributes like destination, cost, activities, etc.).

**c. User Experience (UX)**

* **Theme Switching**: Designed to improve accessibility and user comfort, the Light/Dark modes are easily toggled via the sidebar.
* **Interactive Layout**: Inputs and outputs are placed in a side-by-side layout, minimizing user navigation and improving usability.
* **Error Handling**:
  + Alerts users if the API key is missing or invalid.
  + Captures and displays structured error messages for issues like invalid API responses.

**d. Scalability and Extensibility**

* The modular design of the app ensures it can be extended to support additional features, such as integration with external travel booking platforms or the inclusion of more granular preferences (e.g., weather preferences, seasonal trends).
* The API-based architecture allows the app to easily switch to other LLM providers in the future if needed.

**5. Challenges and Solutions**

* **Parsing API Responses**: API responses required precise parsing to extract vacation data. Regular expressions and ast.literal\_eval were used for efficient and secure data extraction.
* **Dynamic Styling**: Streamlit’s default themes were insufficient for customization. Custom CSS was injected to ensure both functionality and aesthetic appeal for Light and Dark modes.
* **Error Handling**: Robust checks were added for missing API keys, parsing errors, and API response failures, improving reliability.

**6. Conclusion**

The Vacation Planning Assistant combines cutting-edge AI with a user-friendly interface to simplify vacation planning. The integration of **Llama3 via Groq API** ensures high-quality recommendations, while the thoughtfully designed UI and themes enhance the user experience. Its modular and scalable design lays the foundation for future enhancements, making it a versatile tool for travellers.