Carnegie Mellon University
Tepper School of Business

MS in Business Analytics Capstone Project:

LLM DRIVEN TRAVEL AUTOMATION: SCALABLE AGENT DESIGN FOR PERSONALIZED PLANING

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ABSTRACT

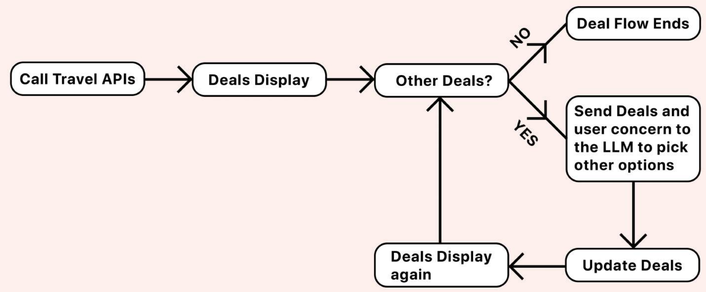
- Develop & optimize **APIs** to **enhance search engine** functionality to **improve the relevance and accuracy** of search results.
- Leverage **large language models (LLMs)** to generate more **precise, context-aware, and user-friendly** responses.
- Create an **AI-powered solution** to assist travelers with visa information and hotel & activity recommendations — all in one **personalized, interactive experience.**

INTRODUCTION

Why **TRAVEXP** matters?
- Info scattered across maps, blogs and social platforms
- Challenging to find itineraries tailored to unique personas
- Group trips planning is time-consuming & requires coordination

TRAVEXP Simplifies the **Planning Process**:
- AI/ persona-based experience **browsing**
- Collaborative itinerary **planning**
- Community experiences **sharing** & rewards earning

PROJECT DEVELOPMENT



STAY DEALS

Goal: To design a **personalized hotel recommendation system** to help users find the **best stay options** based on their demographics.

Key features:
- **Location-Based Search:** Fetches top 10 hotels near a user-specified city/address.
- **Filtering:** Shows only hotels within the selected budget ($, $$, etc.)
- **LLM Integration (Gemini):** One-line summaries of hotels. Personalized recommendations for each. Follow-up tips and nearby activities.
- **Rich Output:** Includes images, reviews, ratings, and direct booking links in a clean JSON/table format.

Conclusion: Blends **real-time hotel data** with LLM intelligence to deliver **faster, smarter, and more personalized** recommendations, ideal for deployment in travel platforms or chatbot interfaces.

ACTIVITY DEALS

Goal: To retrieve and recommend **personalized activity deals** using **Viator's API**, driven by **user geolocation** and **optimized data extraction**.

Key features:
- **API Research & Initial Testing**: Explored Viator API documentation & accessed endpoints.
- **Geolocation-Based Identification:** Implemented reverse geocoding using OpenStreetMap API.
- **Data Extraction & Preprocessing:** Retrieved structured data: activity cost, rating, booking links etc. Cleaned and formatted response data for system compatibility.
- **Output Enhancements:** Implemented multi-factor sorting: rating → review count → cost. Integrated activity images in UI and LLM responses.

Conclusion: Developed **a location-aware pipeline** that outputs structured and ranked activity data.

VISA ADVISORY

Goal: Provide users with **fast, verified visa information** based on nationality and travel destination.

Key Features:
- **Agentic AI**
- Use **Gemini 1.5 Pro and GPT-4 Turbo**
- Provide **concise**, 3–5 sentence answers
- Cites **official government/embassy** sources
- Suggest related follow-up questions
- **Maintain chat history** of 5 interactions

LLM Model Comparison:

	Gemini 1.5 Pro	GPT-4 Turbo
Answer Quality	Consise and Relevant	Good but sometimes lenthy
Official Link	Often included	Non consistent
Question Suggestions	Okay but can repeat information	More helpful and relevant
API Pricing	Free	Paid

Conclusion: Gemini 1.5 Pro was more suitable for **concise and verified visa advice** while GPT-4 Turbo provides better **follow-up question suggestions**, making it **more engaging** for users.

LARGE LANGUAGE MODEL TRAINING

Goal: To **enhance travel recommendations** with **advanced language model** intelligence, providing **personalized hotel and activity suggestions** based on user preferences and natural language inputs.

Key features:
- **Intelligent Category Classification:** Automatically categorizes activities into Outdoors, Cultural, and Laid-back groups for intuitive browsing.
- **Preference-Based Recommendation:** Transforms user natural language inputs (e.g., "low price") into tailored suggestions with explanations.
- **Structured Output Processing:** Ensures reliable extraction of LLM insights through robust JSON parsing and error handling.
- **Speed Optimization:** Parallel API calls with ThreadPoolExecutor. Caching reduces repeat request time. Up to 3× faster on subsequent runs.

Conclusion: Created an **AI-driven recommendation layer** that transforms raw API data into **personalized travel suggestions** with **clear rationales and organized presentation**.

Team QR Code

Visualization

ACCOMPLISHMENT

We didn't just build a recommendation system, we **integrated it directly into a functional web experience.** Users can now access **real-time hotel deals and visa guidance** through an interactive interface powered by LLMs and live APIs. Try it out here: **https://www.travexp.live/**