Multi-Agent Hospitality System

Course Name: Agentic AI

Institution Name: Medicaps University – Datagami Skill Based Course

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Project Number: AAI-28

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1. Problem Statement & Objectives

1.1. Problem Statement

Planning a trip requires collecting information from multiple sources such as travel websites, blogs, and booking platforms, which can be time-consuming and overwhelming. Users often struggle to create personalized itineraries that match their preferences, budget, and schedule. There is a need for an intelligent system that can automatically understand user requirements and generate accurate travel plans efficiently.

1.2. Project Objectives

- To develop an AI-powered travel assistant that generates personalized itineraries.
- To use a multi-agent architecture for intelligent task coordination.
- To retrieve real-time travel information from external sources.
- To provide a user-friendly web interface for seamless interaction.
- To improve decision-making through automated travel recommendations.

1.3. Scope of the Project

The scope of this project includes the design and development of a web-based application capable of generating customized travel plans using artificial intelligence. The system processes user inputs such as destination, travel duration, and preferences to produce structured itineraries.

The project covers frontend interface development, backend orchestration, integration with AI agents, real-time data retrieval, and semantic search functionality. The system is designed to be modular so that additional features can be incorporated in future iterations.

However, the current implementation does not include payment processing, booking management, or full-scale user authentication. These aspects are considered part of future enhancements.

2. Proposed Solution

The proposed solution is a Multi-Agent Hospitality System that uses a collaborative network of AI agents to automate travel planning tasks. Each agent performs a specific function within the system workflow.

The coordinator agent acts as the central controller that interprets user queries and manages task delegation. The researcher agent retrieves relevant travel data from external APIs and

web sources, ensuring that the system has accurate and up-to-date information. The writer agent processes this data using a large language model to generate a comprehensive itinerary.

By combining real-time search capabilities with advanced natural language processing, the system delivers context-aware travel plans that are tailored to user needs. The modular architecture ensures flexibility, scalability, and ease of maintenance.

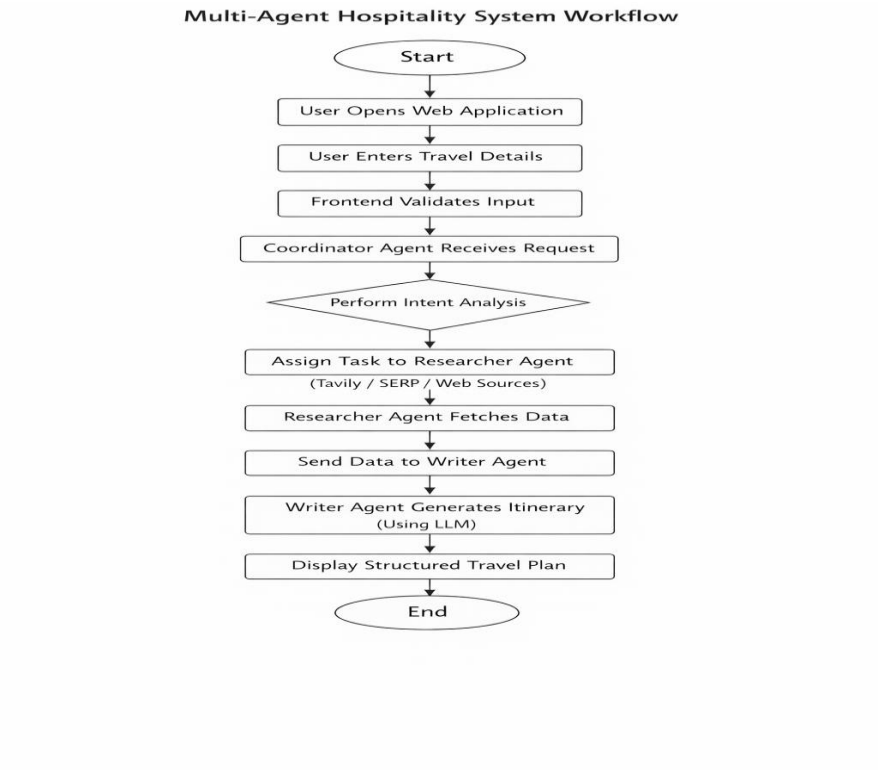
2.1. Key Features

- Personalized itinerary generation based on user input.
- Intelligent multi-agent collaboration for efficient task execution.
- Real-time travel information retrieval from external sources.
- Natural language understanding using large language models.
- Context-aware recommendations through semantic search.
- Interactive and responsive web interface.
- Modular architecture supporting scalability.
- Efficient workflow orchestration.
- Secure handling of API keys and system configuration.
- Reduced manual effort through automation.

2.2. Overall Architecture / Workflow

1. User enters travel details through the web interface.
2. Frontend sends request to backend.

3. Coordinator Agent analyzes intent.
4. Researcher Agent gathers travel information via APIs.
5. Writer Agent generates itinerary using LLM.
6. Response is returned to frontend.
7. User views the generated travel plan.



2.3. Tools & Technologies Used

Frontend

- React for building user interface
- TypeScript for type safety
- Tailwind CSS for styling
- Vite for fast development build

Backend / AI Orchestration

- CrewAI for agent coordination
- LangChain for LLM workflow management

Language Models

- Groq API for inference
- Ollama for local LLM execution

Data Retrieval

- Tavily Search API for real-time search
- SERP API for search engine results
- Selenium for automated data extraction

Databases

- FAISS / Chroma for vector storage
- MongoDB for logs and records
- MySQL for structured storage
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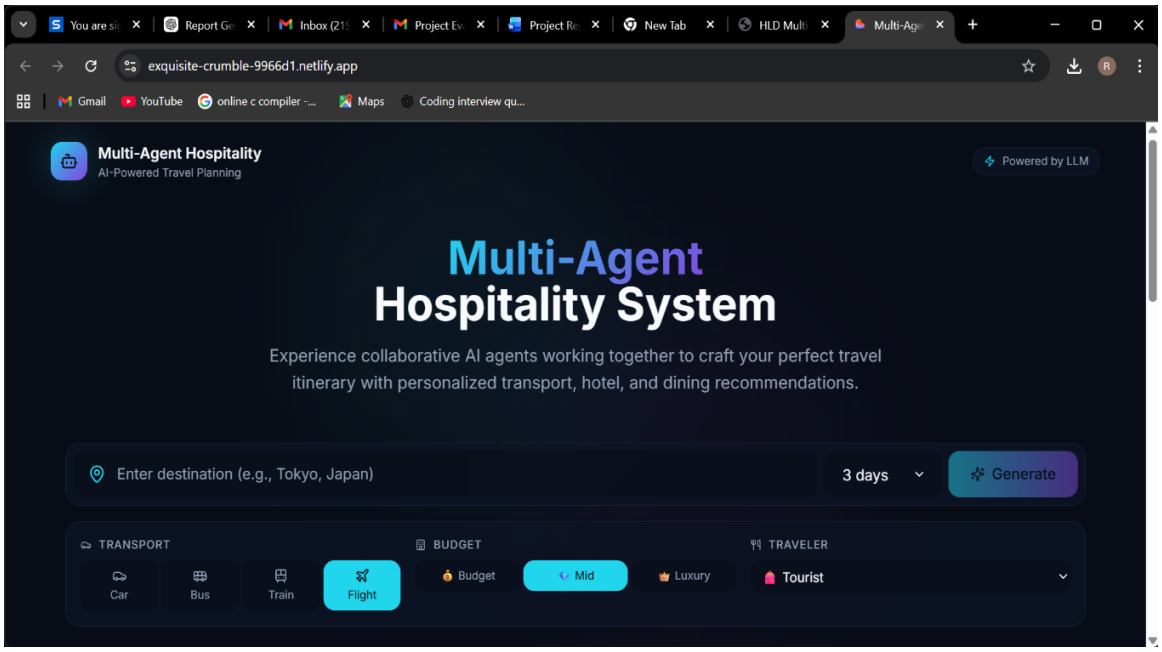
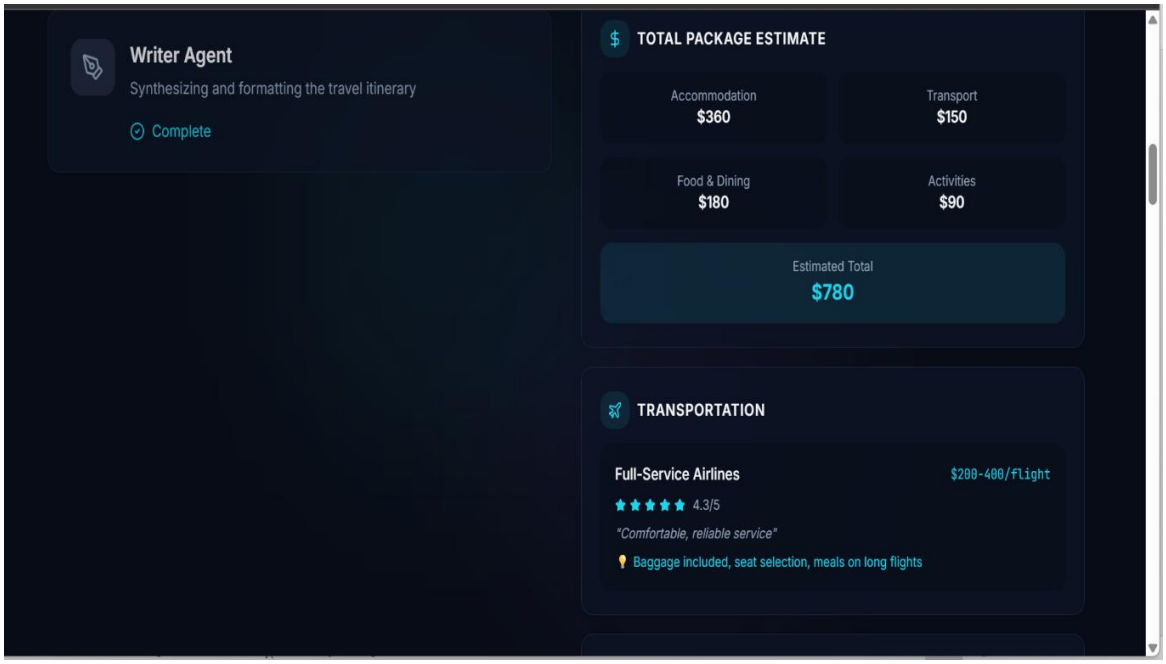
3. Results & Output

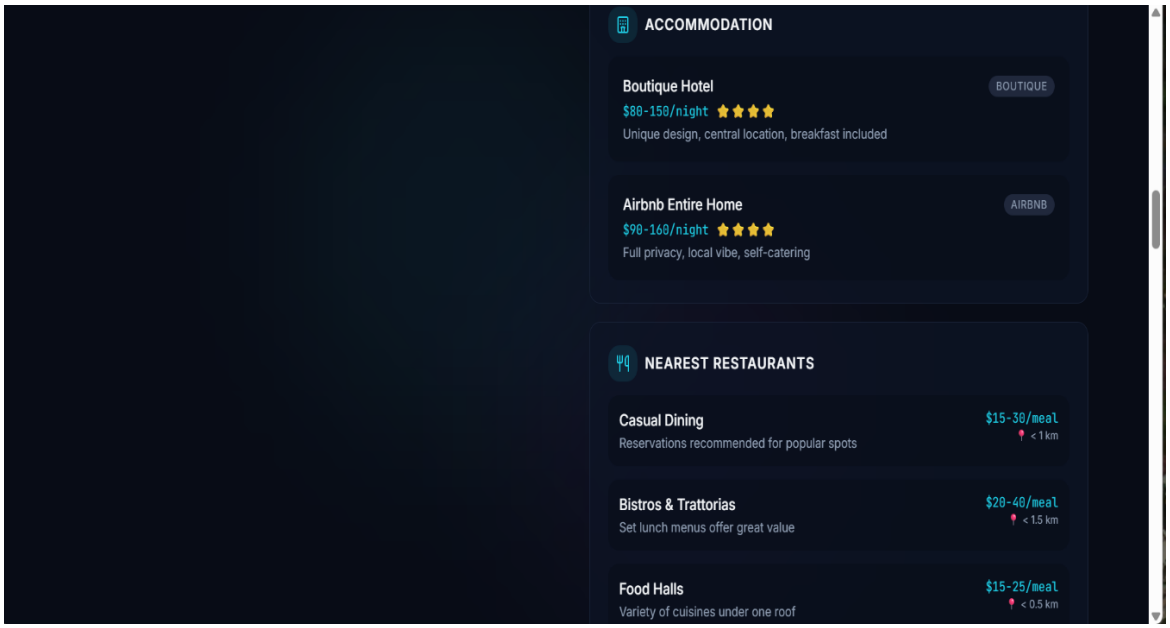
3.1. Screenshots / Outputs

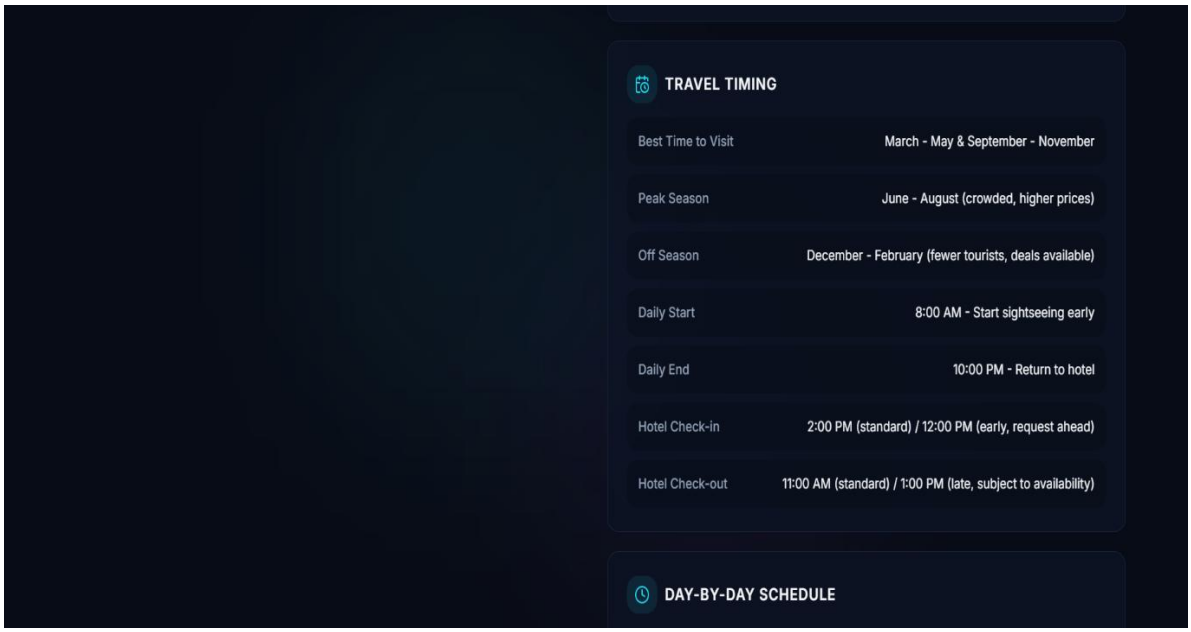
- User input interface

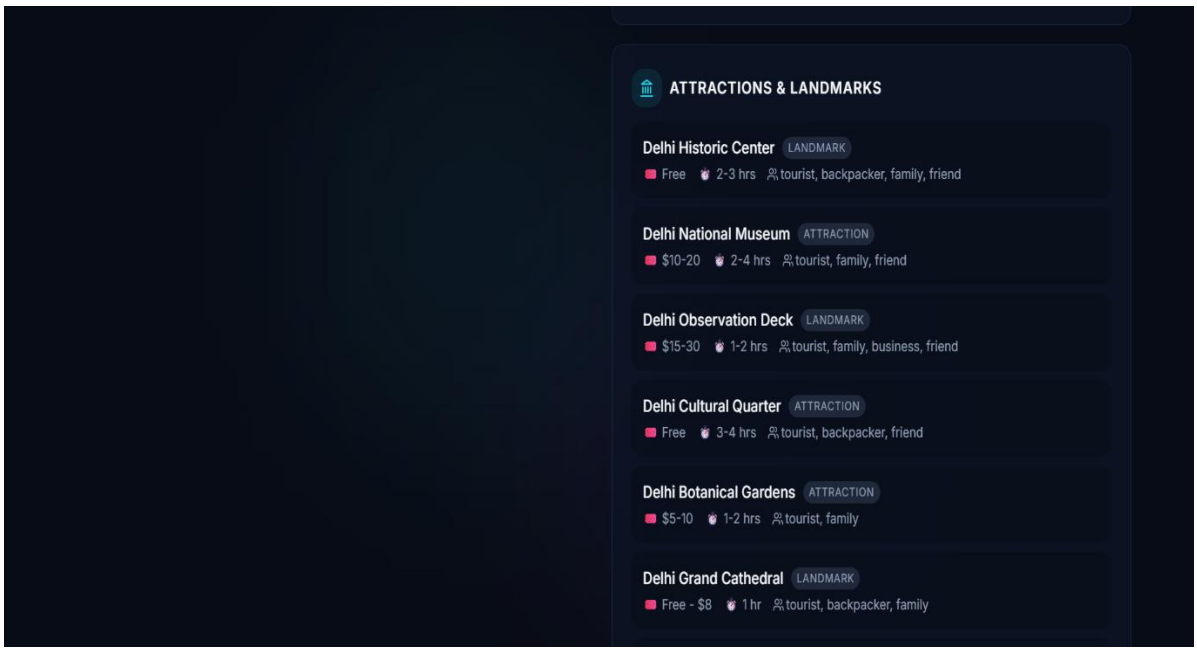


- Generated itinerary page






TRAVEL TIMING
Best Time to Visit
March - May & September - November
Peak Season
June - August (crowded, higher prices)
Off Season
December - February (fewer tourists, deals available)
Daily Start
8:00 AM - Start sightseeing early
Daily End
10:00 PM - Return to hotel
Hotel Check-in
2:00 PM (standard) / 12:00 PM (early, request ahead)
Hotel Check-out
11:00 AM (standard) / 1:00 PM (late, subject to availability)
DAY-BY-DAY SCHEDULE


ATTRACTIONS & LANDMARKS
Delhi Historic Center
LANDMARK
Free
2-3 hrs
tourist, backpacker, family, friend
Delhi National Museum
ATTRACTION
$10-20
2-4 hrs
tourist, family, friend
Delhi Observation Deck
LANDMARK
$15-30
1-2 hrs
tourist, family, business, friend
Delhi Cultural Quarter
ATTRACTION
Free
3-4 hrs
tourist, backpacker, friend
Delhi Botanical Gardens
ATTRACTION
$5-10
1-2 hrs
tourist, family
Delhi Grand Cathedral
LANDMARK
Free - $8
1 hr
tourist, backpacker, family

3.2. Key Outcomes:

- Accurate personalized travel plans generated.
- Efficient collaboration between agents.
- Real-time data integration validated.
- Smooth user interaction with minimal latency.

4. Conclusion

The Multi-Agent Hospitality System demonstrates the effective use of artificial intelligence in simplifying travel planning. By leveraging a collaborative multi-agent architecture, the system successfully automates information gathering, reasoning, and itinerary generation.

The project highlights how modern AI technologies such as large language models, semantic search, and real-time data integration can be combined to create intelligent applications. It also emphasizes the importance of modular design, scalability, and user-centered development.

Through this project, valuable insights were gained into agent orchestration, API integration, full-stack development, and AI system design. The system serves as a foundation for future innovations in intelligent travel assistance.

5. Future Scope & Enhancements

- Integration with booking platforms for end-to-end travel management.
- Implementation of user authentication and personalization features.
- Budget estimation and cost optimization tools.
- Real-time notifications and travel alerts.
- Mobile application development.
- Voice-based conversational interface.
- Machine learning models for adaptive recommendations.
- Cloud deployment for improved scalability.
- Integration with maps for navigation support.
- Multilingual support for broader accessibility.
- Recommendation learning based on user feedback.