Cultour—an AI-powered smart tourism application

Group 5: deptrAI

December 16, 2025

Abstract

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1 Team Information

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2 Idea

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3 System Overview

3.1 Main Stakeholders

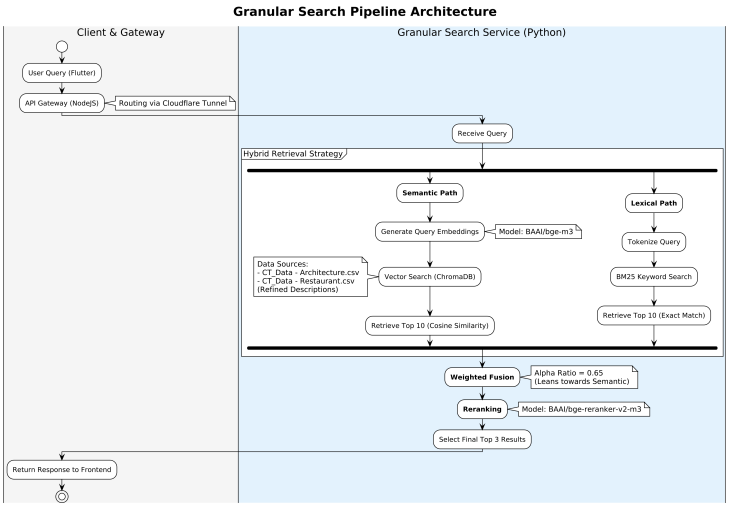
The platform is designed to address the specific pain points of two primary user groups who currently face significant friction in discovering cultural experiences:

- **Authenticity Seekers:** These are users driven by a desire for "backstage" elements of culture—local rituals, niche architecture, and specific ethnic history—that are often obscured by commercialized tourism. They struggle to find these experiences through generic search engines, which prioritize high-traffic, commercial venues over cultural depth.
- **International Visitors & Expatriates:** This demographic often finds online travel information overwhelmed by SEO-optimized generic lists. They perceive existing recommendations as repetitive and lacking in local nuance, making it difficult to distinguish between genuine cultural spots and tourist traps.

3.2 Core Functions

3.2.1 Granular Search Service

The search pipeline is built upon a hybrid architecture that combines semantic search and lexical search techniques to optimize both relevance and precision in results. The system supports **multimodal input**, allowing users to query the database using natural language prompts, image inputs for visual search, specific categorical filters, or direct entity name lookups. The key components of this pipeline are as follows:



3.2.2 Community Event Service

This module functions as a dynamic bridge between local culture providers and users, fostering active participation rather than passive observation.

- **Passive Discovery Engine:** The system automatically surfaces active festivals and events by correlating temporal data with location-specific tags. For example, a user browsing a specific pagoda will be notified of upcoming religious rites relevant to that location's history.
- **Decentralized Event Hosting:** Cultural organizations and community leaders are provided with a "Self-hosting" portal. This allows them to create, manage, and broadcast community-driven events directly to interested users, bypassing traditional media gatekeepers.
- **Cultural Differentiation:** Unlike standard event aggregators, this service focuses exclusively on participatory cultural activities, distinguishing the platform as a hub for deep community engagement rather than general entertainment.

3.2.3 Recommendation System

The recommendation engine employs a hybrid filtering approach to personalize the user experience, transforming raw interaction data into curated cultural journeys.

- **Explicit & Implicit Feedback Loops:** The system captures explicit signals (likes, dislikes) and implicit behaviors (visit history, dwell time, view counts). These inputs are used to build a dynamic user preference profile.
- **Preference Clustering:** By analyzing frequently selected tags (e.g., "Gothic Architecture," "Cham Culture") and visited locations, the algorithm identifies user cohorts with similar tastes. This allows for collaborative filtering, where a user is recommended niche locations that were highly rated by others in their "taste cluster," facilitating serendipitous discovery of new cultural sites.

3.3 Innovation Highlights

Unified Multimodal Search Interface: Unlike traditional travel platforms restricted to rigid keyword inputs, our system enables a seamless search-by-anything experience. Users can discover locations using natural language prompts, visual inputs, categorical filters, or direct entity names. This flexibility bridges the gap between vague user intent and specific cultural data (see Table 1).

Table 1: Examples of Multimodal Search Capabilities

Search Modality	**Example User Inputs**
Natural Language	"Quiet places in Saigon to read a book with colonial architecture" "Where can I see traditional water puppet shows?"
Visual Input	*[User uploads photo of Notre Dame Cathedral]* → System finds similar Gothic/Romanesque churches.
Categorical Filters	`{ "arch_style": "French Colonial", "district": "1" }` `{ "religion": "Buddhism", "active_worship": true }`
Direct Entity Lookup	"Ben Thanh Market" "Ho Chi Minh City Fine Arts Museum"

4 Sequence Diagram

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5 Class Diagram

6 Test Cases and Scenarios

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7 Completed Feature

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8 Planning

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9 Technical Solution and Architecture

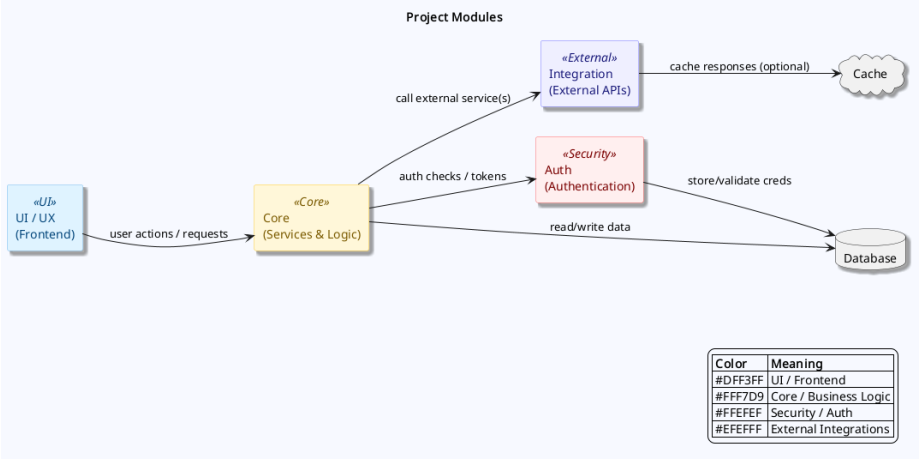
The project, in its core, is a Flutter mobile application that utilizes a NodeJS backend with assistance from Python backend servers that form into a single clean API that the frontend can use. The project's overall architecture can be split into three main architecture styles: the system-level architecture, the client architecture and the backend architecture.

System level architecture. The interaction between the frontend and the backend is a classic three-tier client-server architecture. More specifically, the Flutter client, which we call the *presentation*, utilizes the Node and Python API (the *application*). The backend then utilizes the database and external services to parse upstream data and pass it to the downstream clients. This is the simplest architecture for an MVP achievable within a reasonable time frame.

Client architecture. The frontend is primarily developed vertically via a feature-first architecture. The codebase can be grouped by separate features (including but not limited to login, map screen, trips, saved place, location searching), each has its own logic and UI implementation. We choose this architecture because it is a simple and intuitive architecture primarily derived from the user flow. This ensures ease of development and understanding from the team.

Backend architecture. The backend is a NodeJS express app comprising of multiple endpoints grouped into categories callable from the frontend via dio. In its core, it is an MVC architecture. An endpoint is structured by the core logic's within its service function, express handling and parameters fetching within its

controller functions, and routing via an express's Router object. Middlewares for authorization and checking are also included, allowing decoupling and reducing code duplication. Other minor backend servers are also made for training AIs and AI-based searching, and the main backend calls these servers via Cloudflare tunnels. This allows for separation of duties and dependency decoupling.



10 Conclusion and Future Development