SAT-SIGHT

An Agentic Vision–Language System for Satellite Image Question Answering

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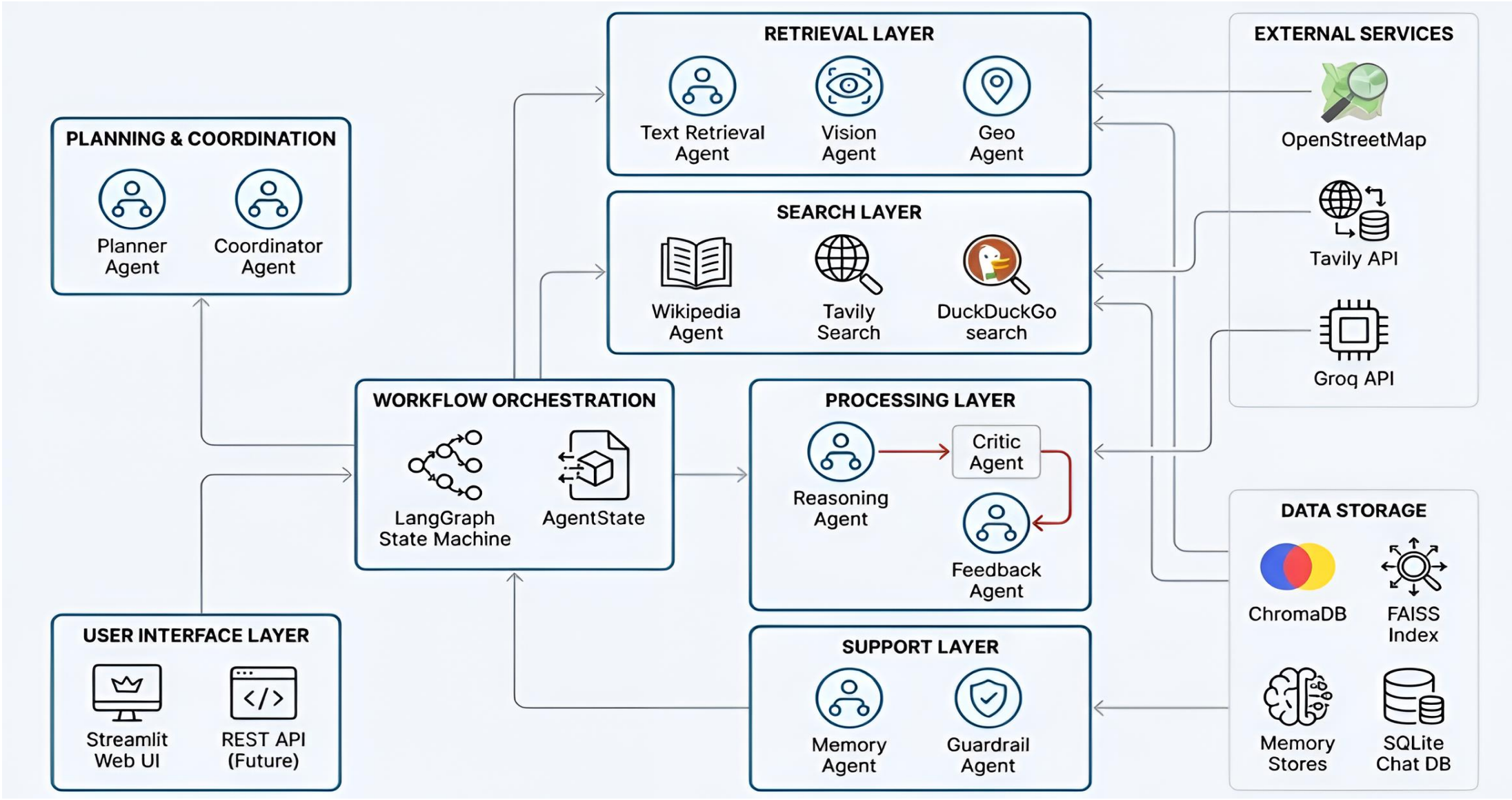
BACKGROUND & MOTIVATION

- Satellite imagery is crucial for **environment monitoring**, **urban planning**, **climate studies**, and **disaster response**.
- Modern satellites generate **terabytes of data daily**, making manual analysis difficult.
- Traditional interpretation requires expertise in **remote sensing**, **GIS**, and **spectral analysis**.
- AI models like **CLIP** and **LLMs** enable natural-language-driven analysis of complex satellite data.

PROJECT OBJECTIVES

- Build a **multi-agent architecture** with specialized agents for vision, text retrieval, search, geo-data, and reasoning.
- Create a **dynamic orchestration mechanism** using LangGraph.
- Implement **three-tier memory** for contextual conversation.
- Add **critic + feedback loops** for quality assurance.
- Provide a **user-friendly web interface** with multi-session management.

MULTI-AGENT ARCHITECTURE



MULTI-AGENT ARCHITECTURE

1. User Interface: Streamlit WebUI & future REST API.

2. Planning & Coordination: Planner & Coordinator Agents.

3. Workflow Orchestration: LangGraph State Machine & AgentState.

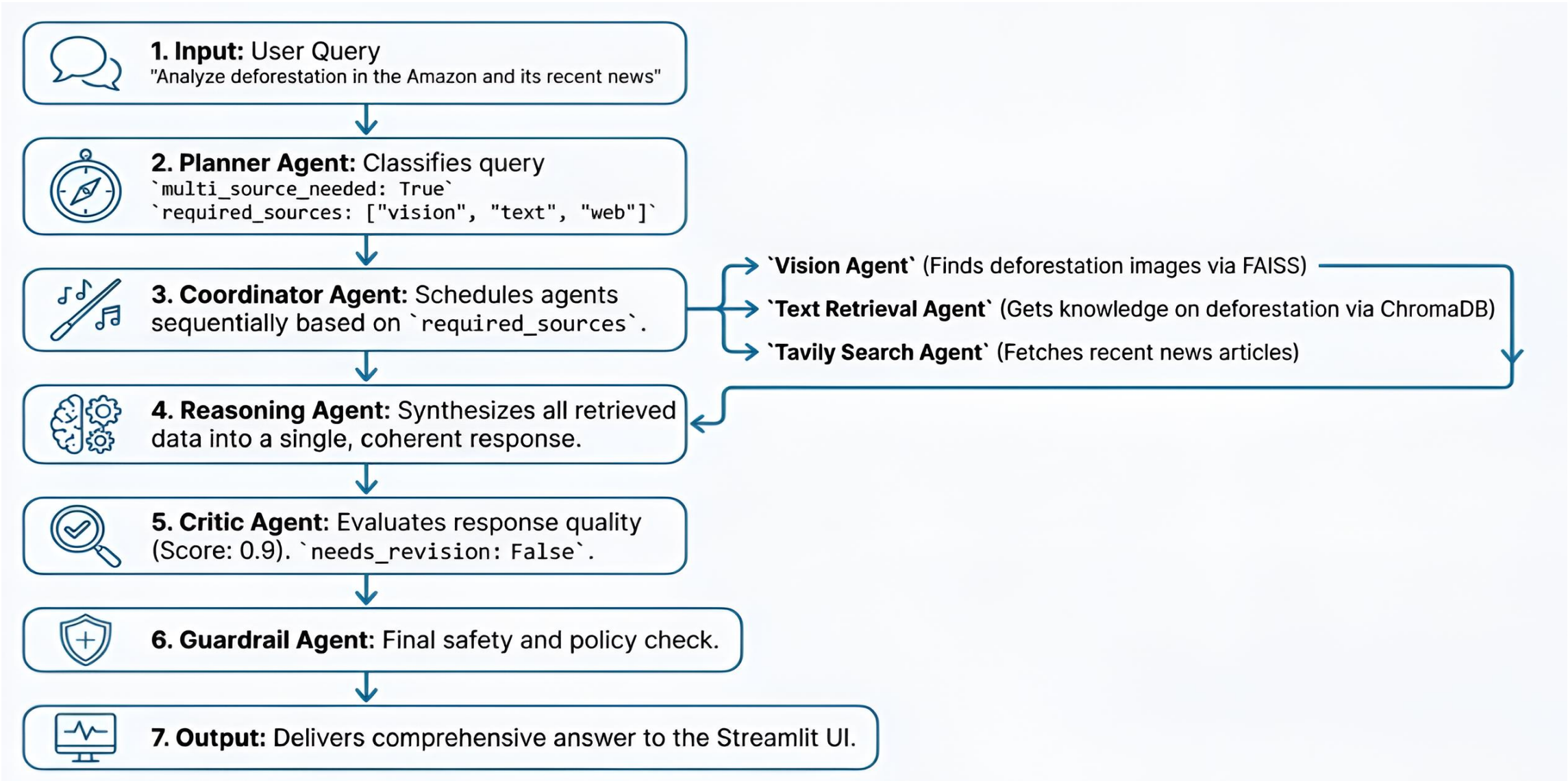
4. Retrieval Layer: Vision, Text Retrieval

5. Search Layer: Tavily, Wikipedia, DuckDuckGo Search Agents.

6. Processing Layer: Reasoning, Critic, Feedback Agents.

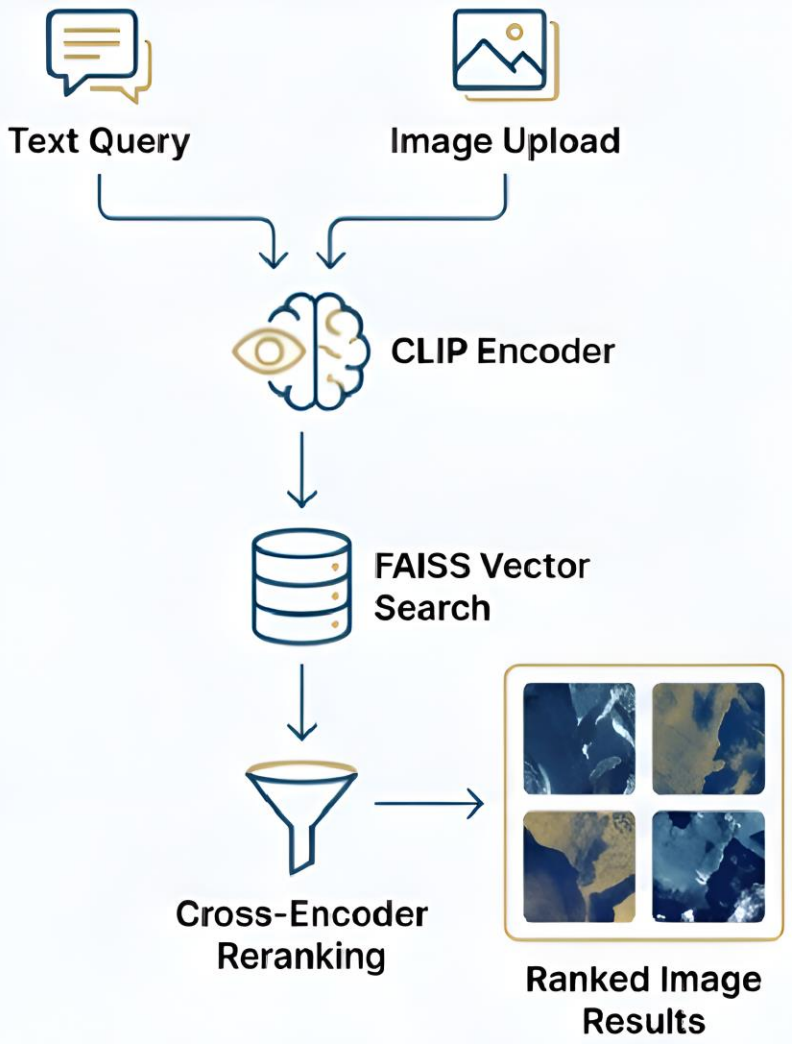
7. Support & Data Layer: Memory, Guardrail Agents, FAISS, ChromaDB, SQLite.

PRE-PROCESSING FLOW



RETRIEVAL LAYER: VISION AGENT

- **Task:** Semantic image search and analysis
- **Vision Model:** CLIP ViT-L/14 for 768 dimensions semantic embeddings.
- **Vector DB:** FIASS search on over 1050 embeddings.
- **Reranking:** Cross-Encoder (ms-marco-MiniLM-L-6-v2) refines top-k results for enhanced precision.



RETRIEVAL LAYER: TEXT & GEO AGENTS

Text Retrieval Agent

- **Purpose:** Search internal knowledge base for domain expertise.
- Uses "BGE-small-en-v1.5 (384-dim)" for embeddings.
- Uses ChromaDB for semantic search

Geographic (Geo) Agent

- **Purpose:** Handle location-based queries

SEARCH AGENTS

- **Tavily Search Agent:** Performs premium web search via Tavily API.
- **Wikipedia Agent:** Retrieves structured information from Wikipedia.
- **Search Agent:** General web search using DuckDuckGo

Reasoning Agent

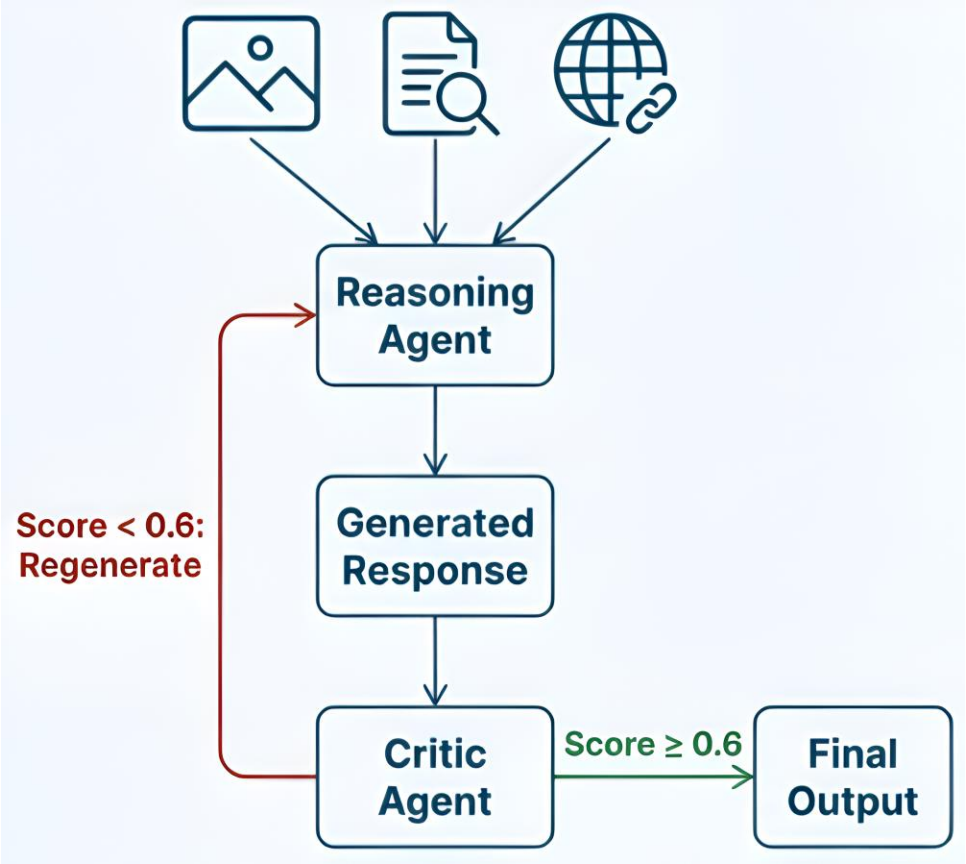
- Core synthesis engine
- Assembles info from all retrieval agents
- Uses the MCP to generate final response

Critic Agent

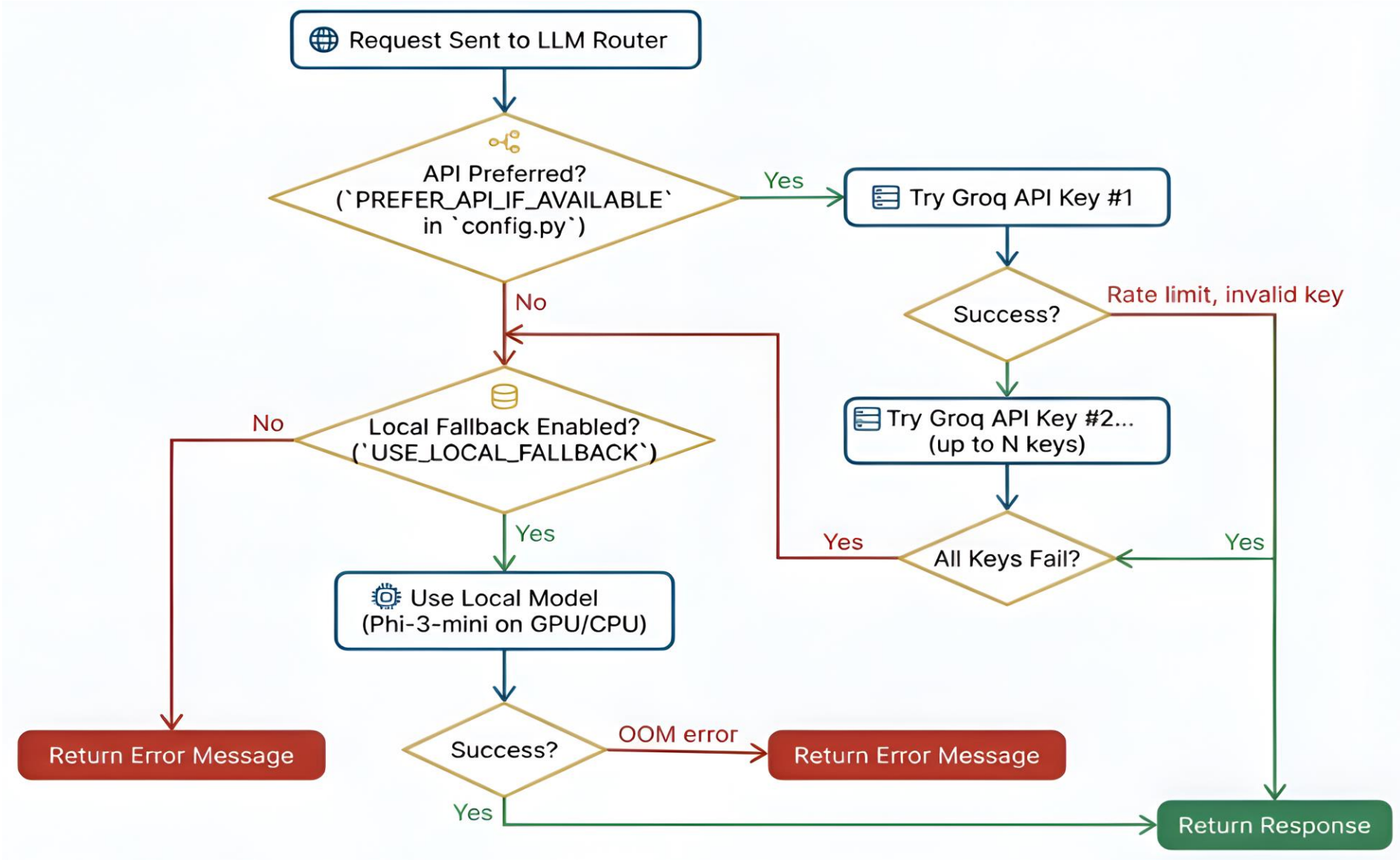
- Evaluates generated response (0–1 scale)
- If score < 0.6 → regenerate
- Creates a continuous quality loop

Feedback Agent

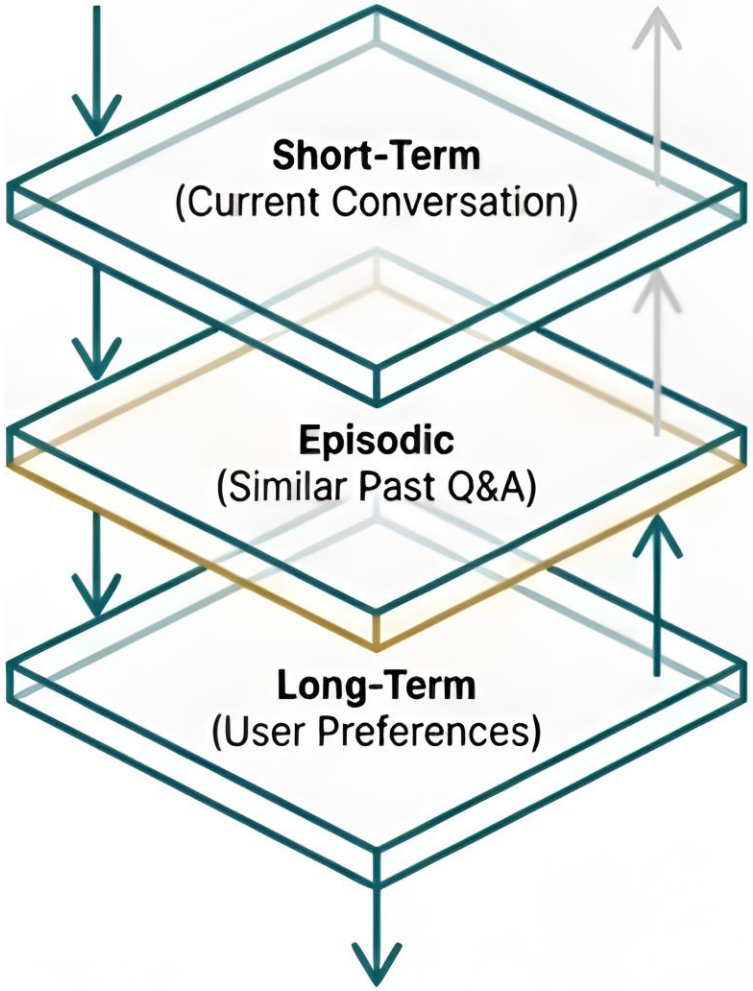
- Triggers iterative improvement for low-quality responses



ROBUST API FALLBACK

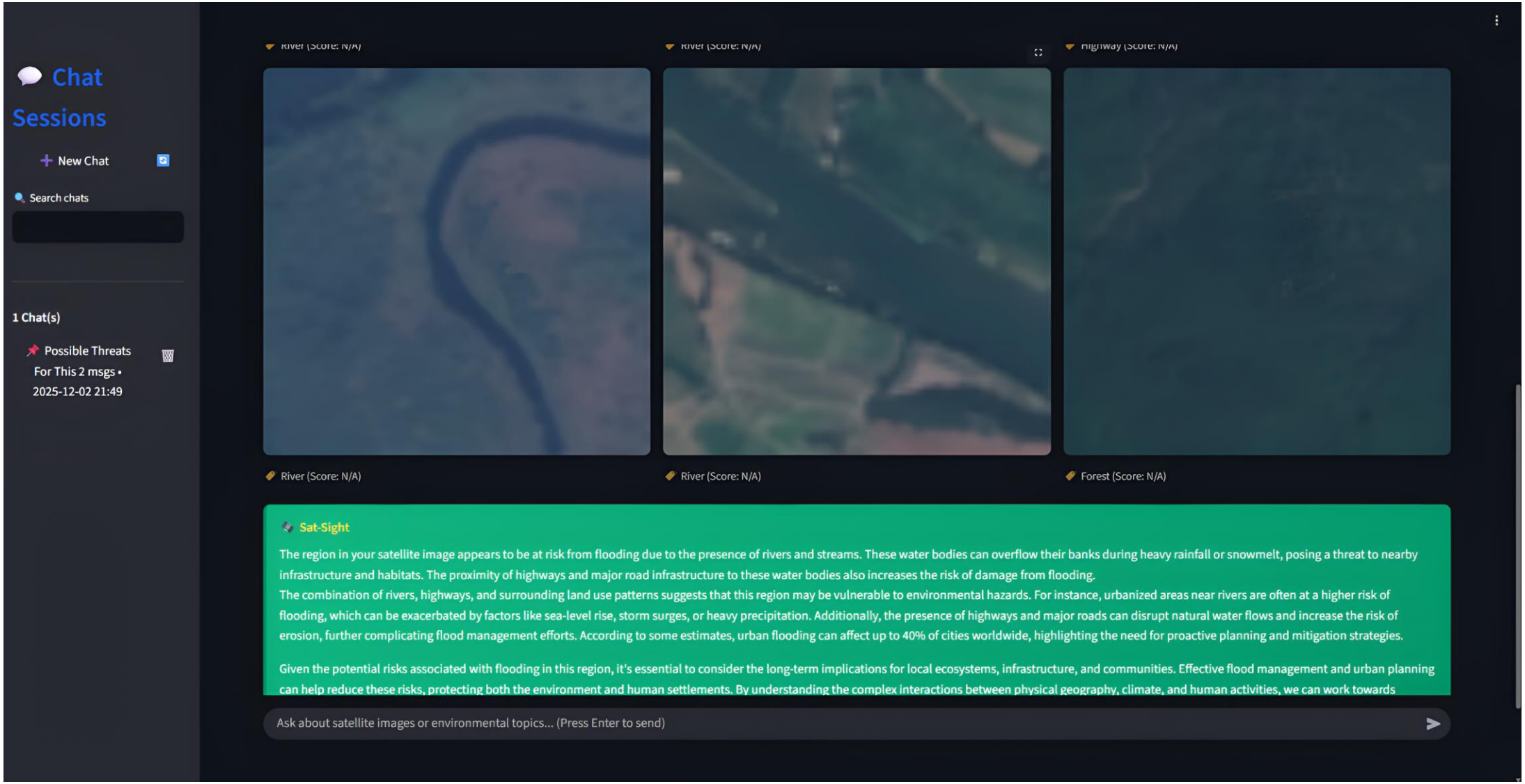


MEMORY STORES – THREE-TIER ARCHITECTURE



- **Short-Term:** Remembers the context of the current conversation (managed per session).
- **Episodic:** Retrieves similar past Q&A pairs to inform new answers.
- **Long-Term:** Learns user preferences and patterns over time (future implementation).

USER INTERFACE



THANK YOU!