

# SAT-SIGHT

An Agentic Vision–Language System for  
Satellite Image Question Answering

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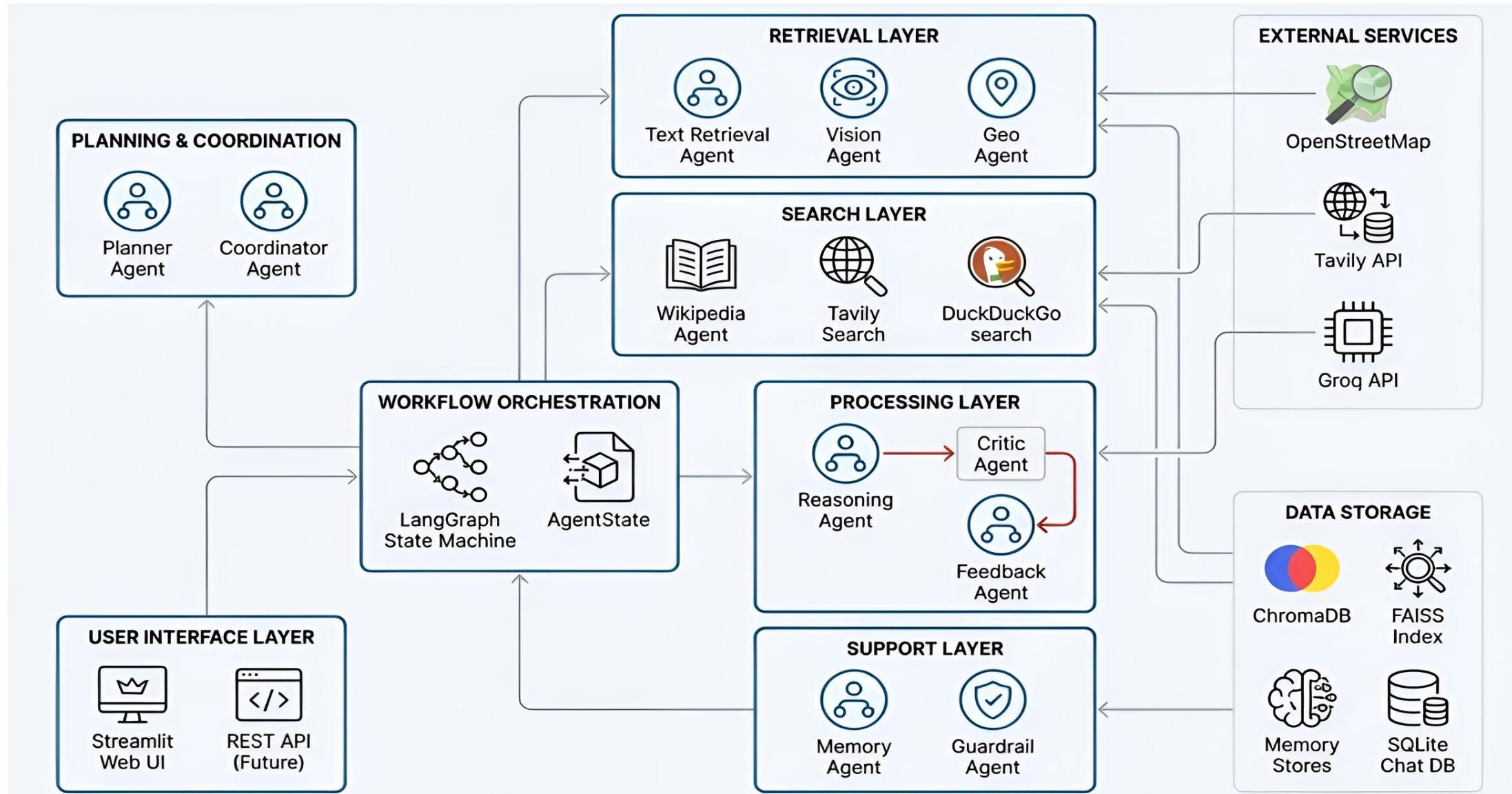
# BACKGROUND & MOTIVATION

- 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.

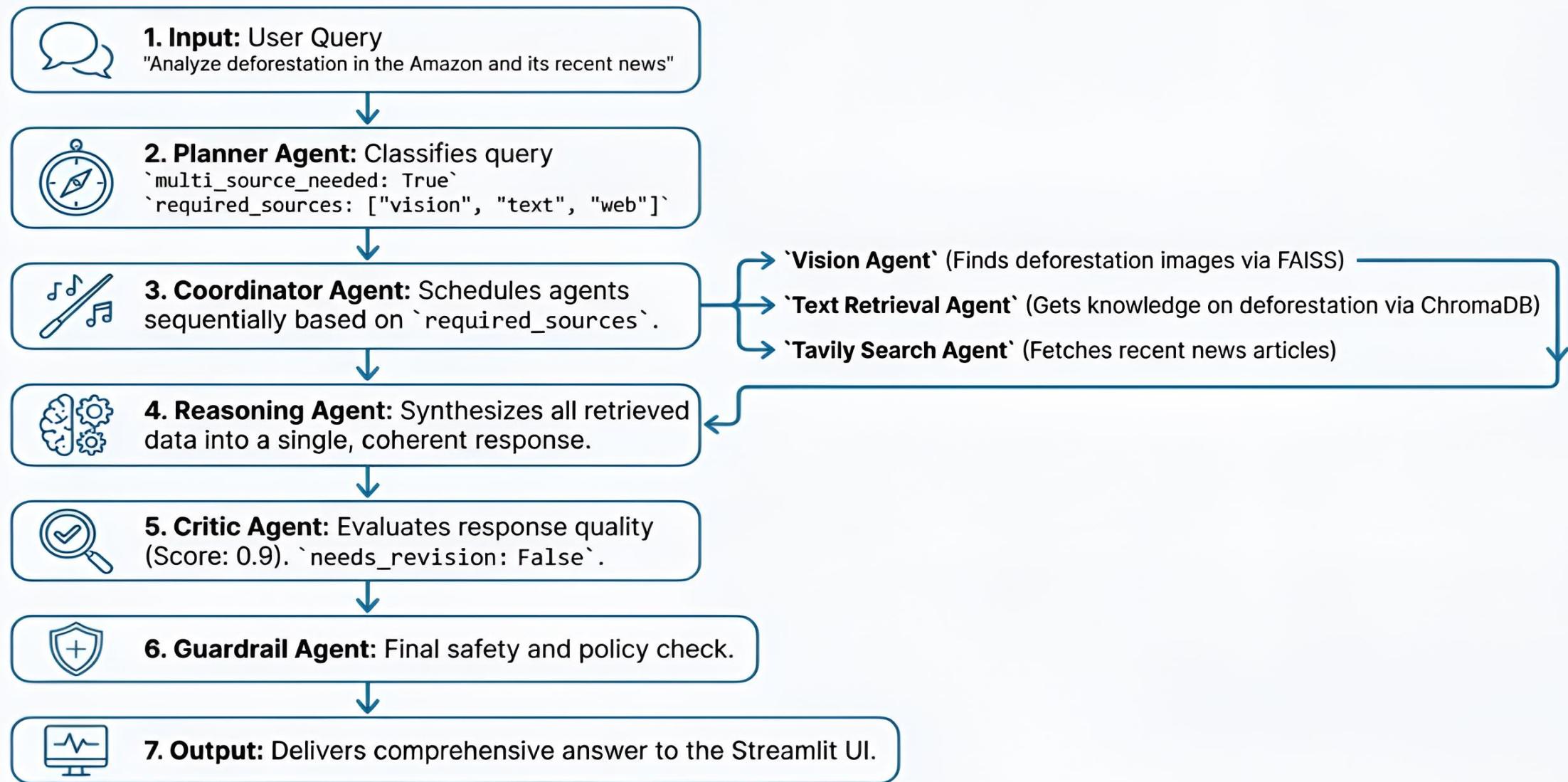
# MULTI-AGENT ARCHITECTURE



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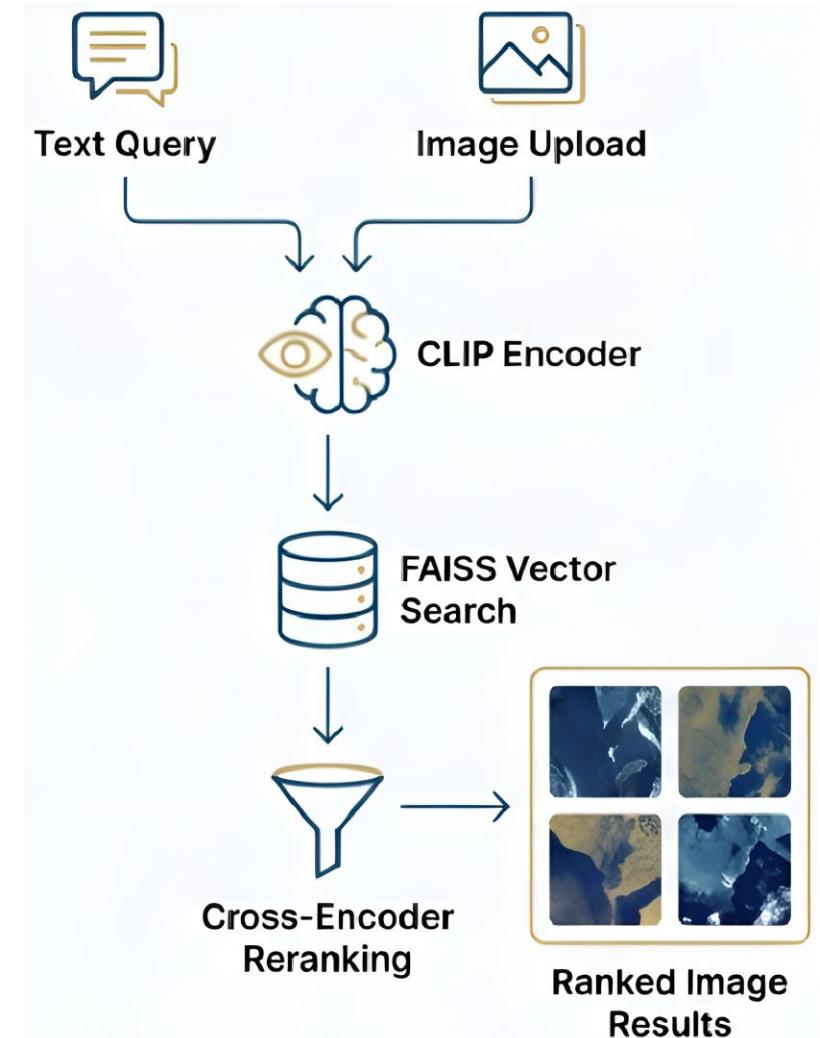
- 1. User Interface:** Streamlit WebUI & future REST API.
- 2. Planning & Coordination:** Planner & Coordinator Agents.
- 3. Workflow Orchestration:** LangGraph State Machine & AgentState.
- 4. Retrieval Layer:** Vision, Text Retrieval
- 5. Search Layer:** Tavily, Wikipedia, DuckDuckGo Search Agents.
- 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:** FAISS 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

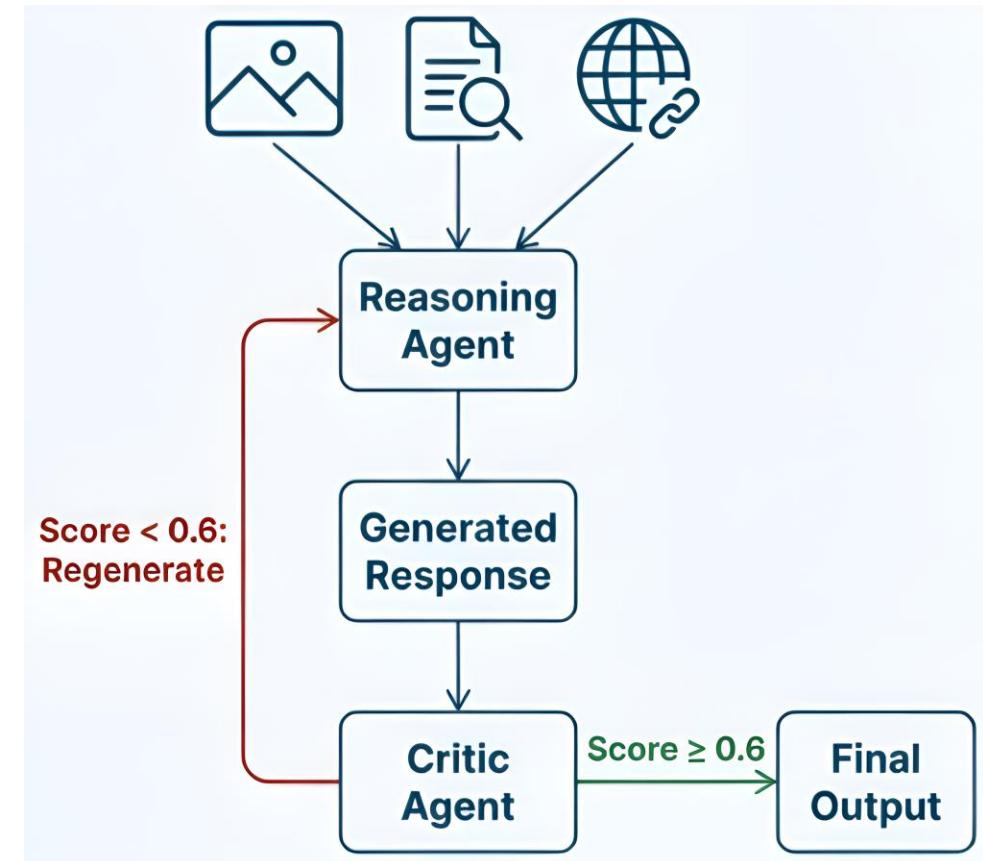
- Core synthesis engine
- Assembles info from all retrieval agents
- Uses the MCP to generate final response

## Critic Agent

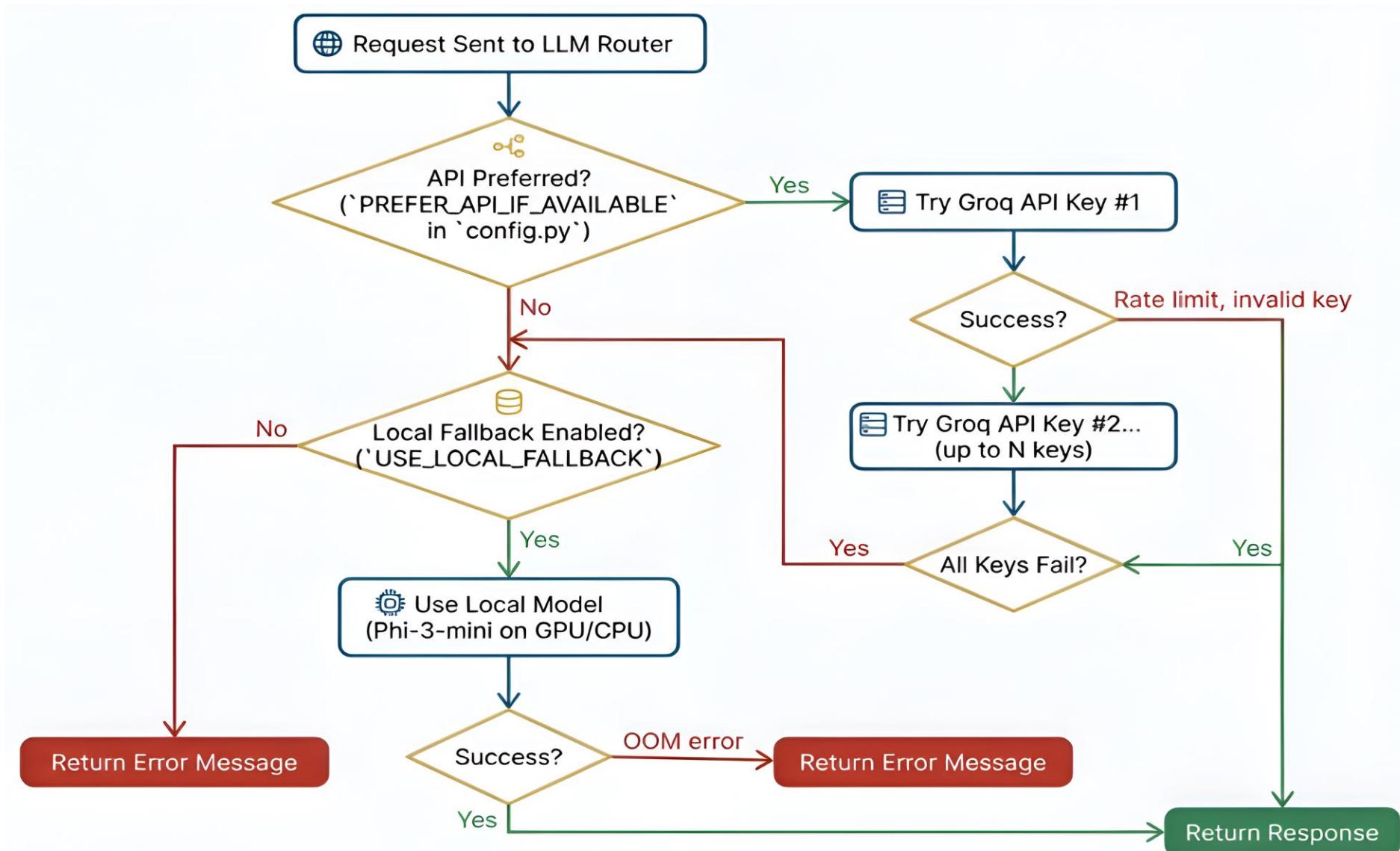
- Evaluates generated response (0–1 scale)
- If score < 0.6 → regenerate
- Creates a continuous quality loop

## Feedback Agent

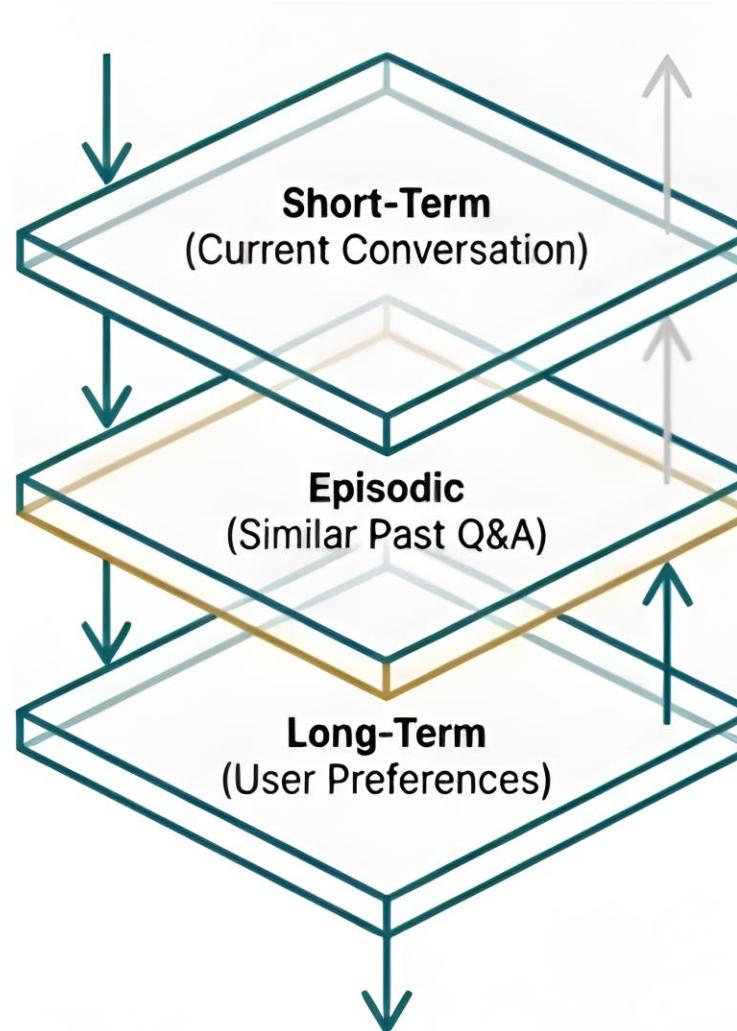
- Triggers iterative improvement for low-quality responses



# ROBUST APIFallback



# 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

The screenshot displays a user interface for analyzing satellite imagery. On the left, a sidebar titled "Chat Sessions" shows a single chat entry for "Possible Threats" dated 2025-12-02 21:49. The main area features three satellite image panels. The first panel shows a river with a score of N/A. The second panel shows a river and a highway with a score of N/A. The third panel shows a forest with a score of N/A. Below these panels is a green "Sat-Sight" card containing the following text:

**Sat-Sight**

The region in your satellite image appears to be at risk from flooding due to the presence of rivers and streams. These water bodies can overflow their banks during heavy rainfall or snowmelt, posing a threat to nearby infrastructure and habitats. The proximity of highways and major road infrastructure to these water bodies also increases the risk of damage from flooding. The combination of rivers, highways, and surrounding land use patterns suggests that this region may be vulnerable to environmental hazards. For instance, urbanized areas near rivers are often at a higher risk of flooding, which can be exacerbated by factors like sea-level rise, storm surges, or heavy precipitation. Additionally, the presence of highways and major roads can disrupt natural water flows and increase the risk of erosion, further complicating flood management efforts. According to some estimates, urban flooding can affect up to 40% of cities worldwide, highlighting the need for proactive planning and mitigation strategies.

Given the potential risks associated with flooding in this region, it's essential to consider the long-term implications for local ecosystems, infrastructure, and communities. Effective flood management and urban planning can help reduce these risks, protecting both the environment and human settlements. By understanding the complex interactions between physical geography, climate, and human activities, we can work towards

Ask about satellite images or environmental topics... (Press Enter to send) >

# THANK YOU!