PULSEMAP AGENT

Real-time community and disaster intelligence on a single live map

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KRISHNA VAMSI DHULIPALLA

Project Description

Problem Statement
When disasters, crimes, or emergencies happen, people nearby often know about them before official channels do. But right now, local knowledge is scattered across social media or personal chats. This delays awareness, wastes response time, and can even cost lives.

Our Solution
PulseMap Agent is an AI-powered, map-based assistant that lets people **report hazards, crimes, or emergencies in real-time** with location and photo evidence. It also integrates **official feeds** (USGS, NWS, NASA EONET, FIRMS fire hotspots) into a single live map. This gives communities a **shared situational awareness layer** that combines bottom-up (citizen reports) and top-down (official data) information.

What does your project do?

- Lets a user select a point on a map (by search, GPS 📍, or click) and **report incidents** like floods, gunshots, missing persons, accidents, or blocked roads.
- Supports **photo uploads**—images are stored, displayed in the sidebar, and associated with map markers.
- Displays **live global hazard feeds** (earthquakes, storms, fires, floods, etc.) using official APIs.
- Provides an **AI chat assistant** that:
    - Decides whether to add a report or find reports near the user.
    - Auto-classifies incidents (crime, accident, hazard, etc.) and assigns the right emoji/icon.
    - Summarizes tool actions so users see both the data and natural-language response.
- Stores and retrieves conversations with **long-lived memory** (SQLite checkpointing), so sessions persist across refreshes.
- Sidebar shows **detailed report cards** (title, category, severity, confidence, source, and attached image).

How did you use AI?

- **LLM Routing with LangGraph:**
  Used GPT-4o with LangGraph to act as a reasoning agent. It decides when to call add_report or find_reports_near based on user input.
- **Text Classification:**
  A classifier maps free-text reports to structured categories (e.g., crime.gunshot, accident.car) and assigns emojis/icons for the map.
- **Context Awareness:**
  The LLM is always given the user's lat/lon and photo context so reports are precise (no more "always near Dallas" errors).
- **Memory:**
  LangGraph's SqliteSaver is used to persist multi-turn conversations and tool calls, so context is not lost between refreshes.

What real-world problem does your project address and how?

- **Disaster Awareness:** Citizens can instantly flag floods, fires, or roadblocks that may not appear in official alerts for hours.
- **Community Safety:** Reports of crimes, accidents, or missing persons can quickly reach others nearby.
- **Unified Hazard Dashboard:** Instead of checking many sites (USGS, NWS, NASA), people see everything on one live map.
- **Augmented Trust:** Official feeds come with confidence=1, while user reports carry LLM-inferred confidence, making the mix transparent.
- **Accessibility:** Simple UI—map, sidebar, chat—lowers the barrier for non-technical community members to contribute.

Tools, Frameworks, APIs, and Languages

- **Backend:**
  - **FastAPI** (REST endpoints for reports, feeds, chat, photo upload)
  - **LangGraph + LangChain** (AI agent orchestration with tool nodes and SQLite checkpointing)

    - **LangChain Tools** (add_report, find_reports_near)
    - **OpenAI GPT-4o** (reasoning + classification)
    - **SQLite** (session memory)
- **Frontend:**
    - **React + Vite + TailwindCSS** (UI)
    - **@vis.gl/react-google-maps** (interactive map with custom markers)
    - **Lucide-react** (icons)
- **APIs / Feeds:**
    - **USGS Earthquake API**
    - **NWS Alerts API**
    - **NASA EONET API** (storms, volcanoes, floods, etc.)
    - **NASA FIRMS Fire Hotspots API**
- **Languages:**
    - **Python 3.11** (backend, AI agent)
    - **TypeScript / React** (frontend)

Future Plans / Considerations

1. **Trust & Verification:**
   Add a lightweight **verification pipeline** (upvote/downvote, duplicate detection, cross-matching with feeds).
2. **Scalability:**
   Move from SQLite to a scalable DB (Postgres, Redis) for larger deployments.
3. **Streaming AI Responses:**
   Extend streaming so users see token-by-token replies (we already simulate typing).
4. **Mobile App:**
   A lightweight PWA or native app for quick on-the-spot reporting.
5. **Offline Mode:**
   Allow reports to be cached offline and synced when network returns.

6. **Community Governance:**
   Tools for moderators to manage false reports or abusive use.
7. **Multi-modal AI:**
   Extend LLM reasoning to analyze attached **photos** (e.g., confirm if it really shows fire/flood).

⚡ In short: **PulseMap Agent** is a community hazard intelligence system that fuses AI reasoning, citizen reports, and official data into one live map—helping communities become safer and more resilient.