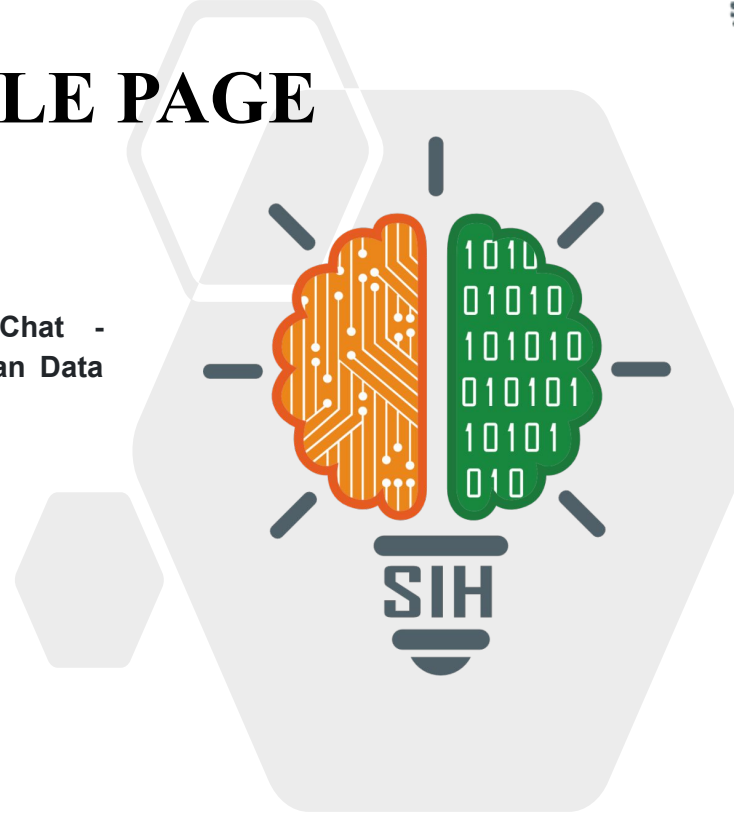


SMART INDIA HACKATHON 2025



TITLE PAGE

- **Problem Statement ID** – 25040
- **Problem Statement Title**- FloatChat -
AI-Powered Conversational Interface for ARGO Ocean Data
Discovery and Visualization
- **Theme**- Miscellaneous
- **PS Category**- Software
- **Team ID**-
- **Team Name** - Synergetics



Problem

- Ocean/ARGO data is vast, complex, NetCDF/CF-based, so non-experts struggle to query and trust it.
- Access typically needs ERDDAP filters + parsing—time-consuming for simple where/when questions
- Indian Ocean users (research & policy) need fast, reproducible views of floats and profiles.

Solution

What it is?

- A chat-based interface where you ask in **natural language** and it turns queries into safe ERDDAP/SQL with sources—**no jargon needed**.
- Provides an **interactive dashboard** to explore, visualize, and export ocean data effectively.

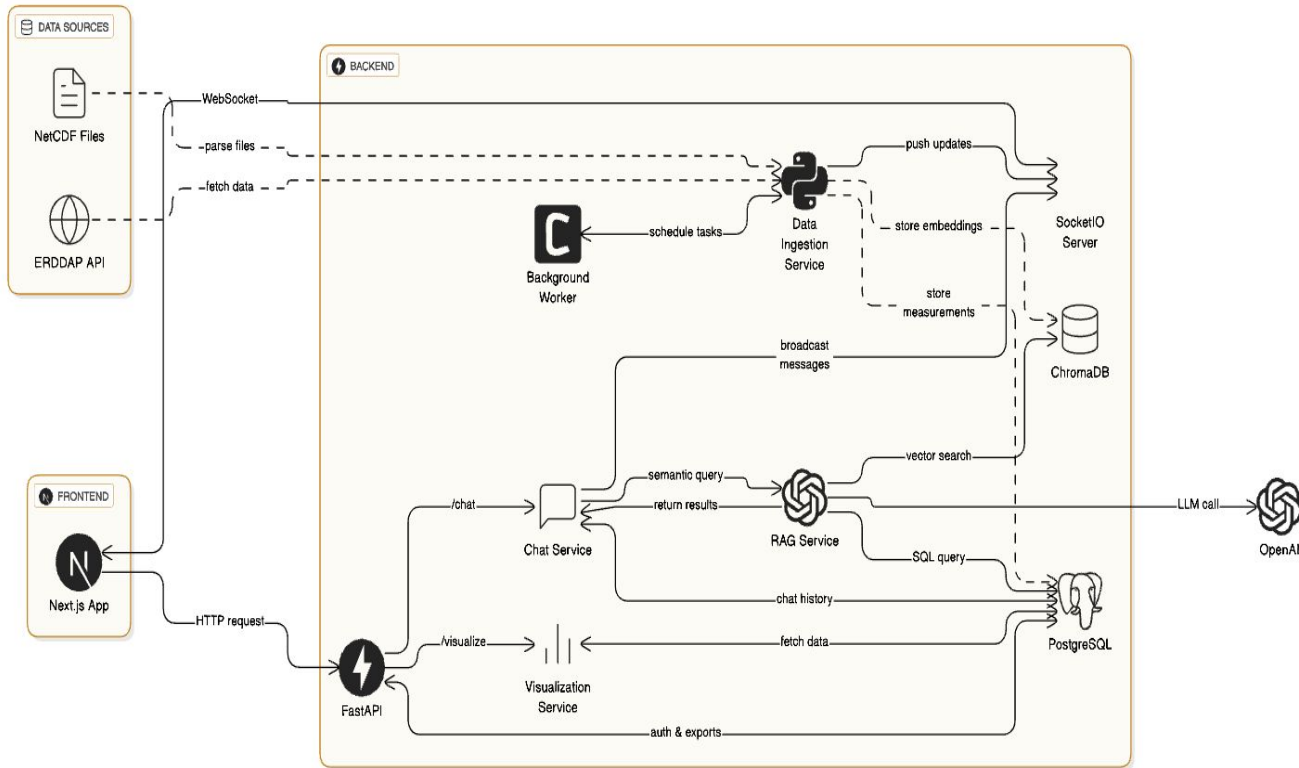
How it helps?

- Hides NetCDF/CF/QC **complexity**; delivers **trustworthy**, reproducible results with **exact links**.
- **Democratizes** access for researchers, policy-makers, and the public.

Why Unique?

- **Context-aware responses** with **98.5% data quality** and scientific accuracy.
- **Real-time streaming**, 3D visualizations, and sub-100ms responses from **4,000+ ARGO floats**.





Tech Stack

NEXT.JS  



 LangChain



OpenAI

 FastAPI

 plotly



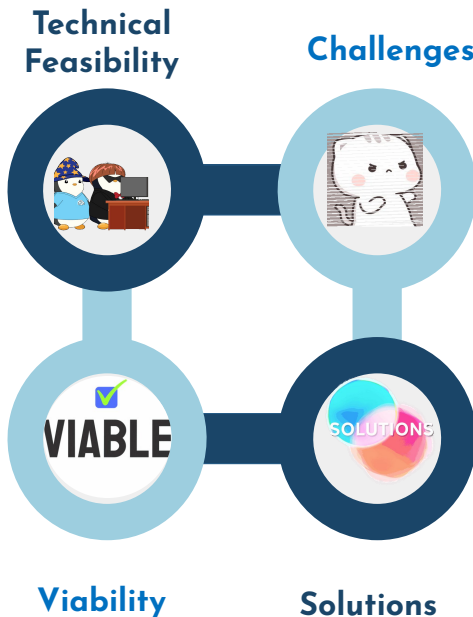
1) Uses proven open-source tools like PostgreSQL for structured storage and fast querying, Chroma for vector search and knowledge retrieval, and Streamlit for rapid dashboard development.

2) The entire stack requires only minimal infrastructure, can run smoothly on a modest cloud instance or local VM, and leverages widely adopted libraries with strong community support.

1) Directly addresses a critical gap in Indian Ocean research and decision-making by making complex Argo float datasets intuitive and accessible.

2) Currently, only domain experts with NetCDF and SQL skills can fully explore this data, which limits its impact.

3) With Float Chat, INCOIS scientists, policymakers, educators, and even students can interact with the data using natural language and visual dashboards.



Challenge 1-Real-Time Data Processing – Handle 50M+ measurements from 4,000+ floats with sub-100ms responses for 1,000+ concurrent users.

Challenge 2-AI Query Understanding – Translate complex oceanographic questions into accurate SQL, ensuring scientific precision and handling ambiguity.

Challenge 3-Cross-Platform Visualization – Deliver rich ocean visualizations at 60fps, fully responsive across web and mobile

1) **Asynchronous Data Pipeline** – PostgreSQL with indexing, ChromeaDB for vectors, Redis caching, and 98.5% data quality validation.

2) **Hybrid RAG Architecture** – GPT-5 with rule-based fallbacks, ChromeaDB knowledge base, and specialized query handlers for accuracy.

3) **Multi-Layer Visualization** – Plotly.js + WebGL, Leaflet maps, progressive data loading, responsive design, and real-time WebSocket updates.

Students

Experience ocean science in an interactive, visual, and engaging way, making complex concepts easier to grasp.

1

Researchers

Gain rapid, intuitive access to large-scale ARGO data, reducing analysis time

2

Communities

Benefit from early warnings and ocean health monitoring that improve safety and resilience

3

Policymakers

Receive real-time, evidence-based insights that support climate action, marine regulations

4

01

Social

Democratizes complex ocean data, making it understandable and usable by researchers, students, and coastal communities alike.

02

Economic

Provides actionable insights for fisheries, shipping, and maritime industries, helping reduce risks and optimize operations.

03

Environmental

Strengthens monitoring of ocean health, enabling conservation efforts and early detection of climate-related anomalies.

04

Innovation

Promotes AI-driven collaboration across science, policy, and education, pushing the boundaries of ocean research.

Dataset

<https://data-argo.ifremer.fr/geo/>

<https://erddap.ifremer.fr/erddap/tabledap/ArgoFloats.html>

Research Papers

<https://www.sciencedirect.com/science/article/pii/S0078323422000975>

https://www.aoml.noaa.gov/phod/docs/Poquiquen_ArgoDataManagment.pdf

<https://openai.com/index/learning-to-reason-with-llms/>

