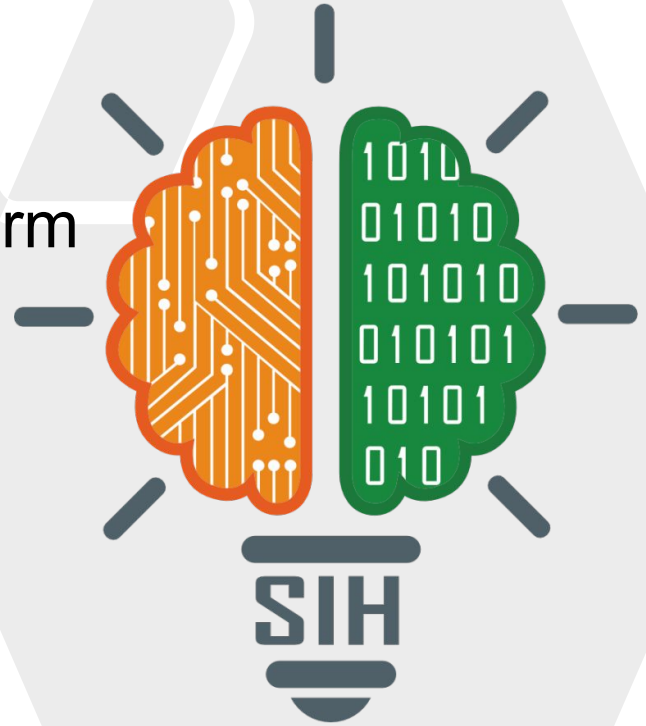
SMART INDIA HACKATHON 2025

SMART INDIA HACKATHON 2025

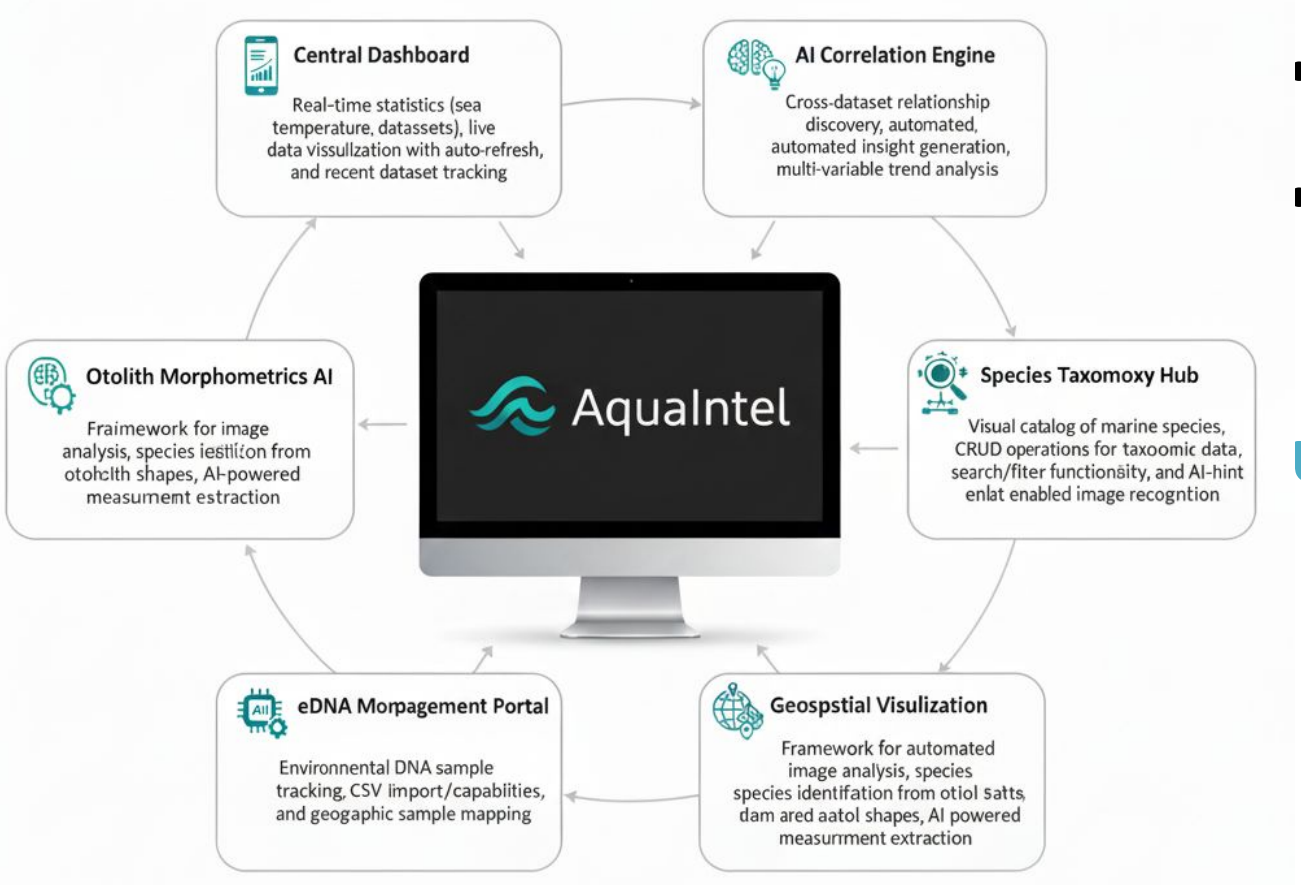
- **Problem Statement ID –** SIH25041
- **Problem Statement Title –** AI-Driven Platform for Unified Marine Insights
- **Theme –** Renewable / Sustainable Energy
- **PS Category –** Software
- **Team ID –** 58463
- **Team Name –** DeepSea Coders



DeepSea Coders

AquaIntel

SMART INDIA HACKATHON 2025



PROBLEM RESOLUTION

- **The Problem:** Analysis Takes **Months**, Not Minutes: Data Fragmentation Slows Research.
- **Our Solution:** AI-driven AquaIntel seamlessly **merges** physical, biological, and molecular data, collapsing cross-domain analysis time from months of manual effort down to mere **minutes**.

UNIQUE SELLING PROPOSITIONS(USPs)

- **Cross-Domain Integration:** seamlessly unifies oceanographic, molecular (eDNA), and morphological (Otolith) data in one environment.
- **Aqua Chat:** Built on the efficient **Llama 3.2 LLM** and designed for research, this chatbot processes your uploaded datasets and uses natural language prompts for rapid, detailed, and insightful analysis.

DeepSea Coders

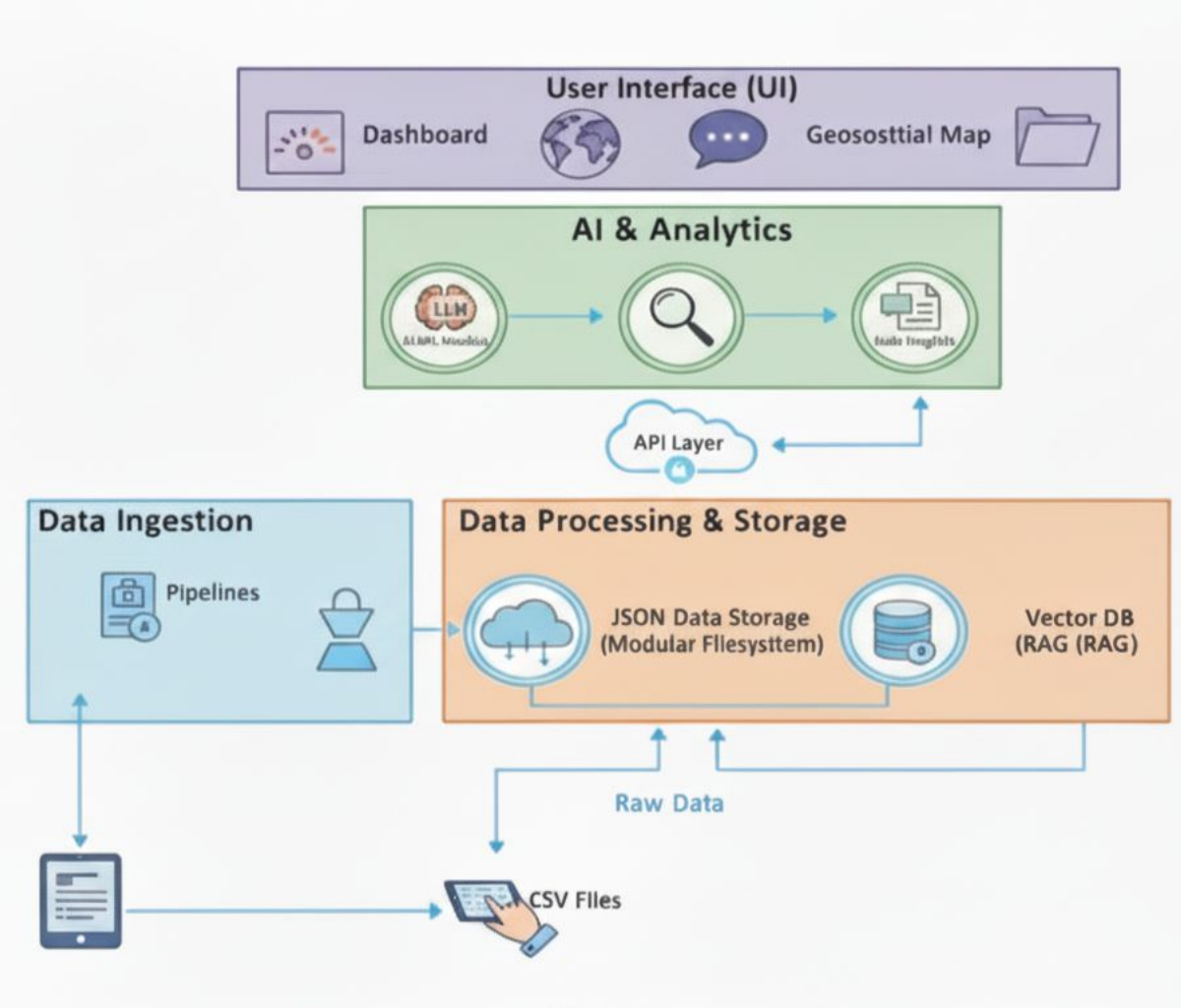
TECHNICAL APPROACH

SMART INDIA HACKATHON 2025

Technologies Used:

Frontend: Next.js 14 + TypeScript, (Shadcn/UI)
Backend Development: Express.js (Node.js)
LLM Inference: Llama 3.2 LLM, providing deep, contextual answers based on retrieved marine data.
Retrieval & Context: Vector Database (Pinecone/Chroma) & LlamaIndex for context-aware RAG retrieval.
LLM Workflow: LangChain to Manages complex, multi-step LLM workflows

TS LangChain Meta

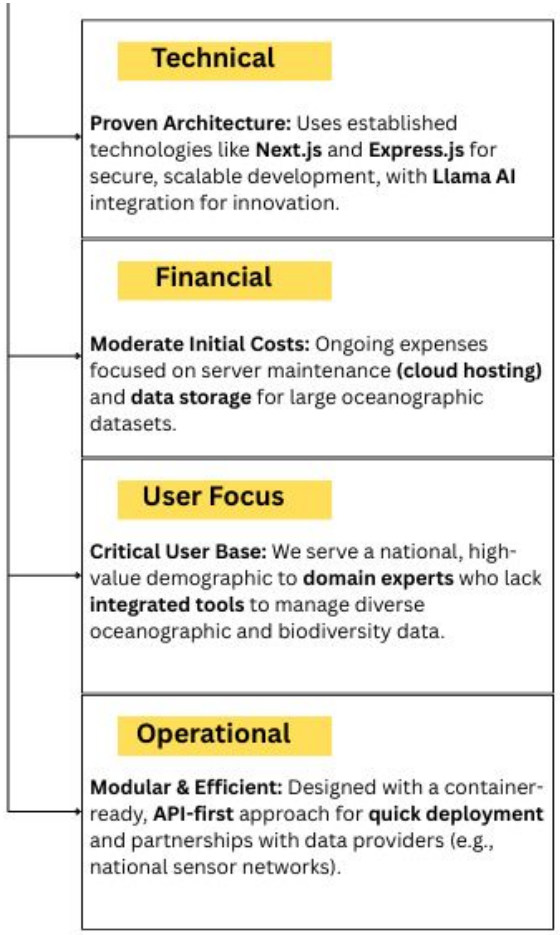


DeepSea Coders

FEASIBILITY AND VIABILITY

SMART INDIA HACKATHON 2025

Analysis of Feasibility



Potential Challenges:

1. **Cloud Resource Management:** Managing high costs associated with storing and processing petabytes of sensor and image data.
2. **Researcher Adoption:** Convincing institutions and researchers to migrate from legacy systems to a new platform.
3. **Data Heterogeneity:** Ensuring standardization and normalization across highly diverse sensor, sequence, and survey formats.

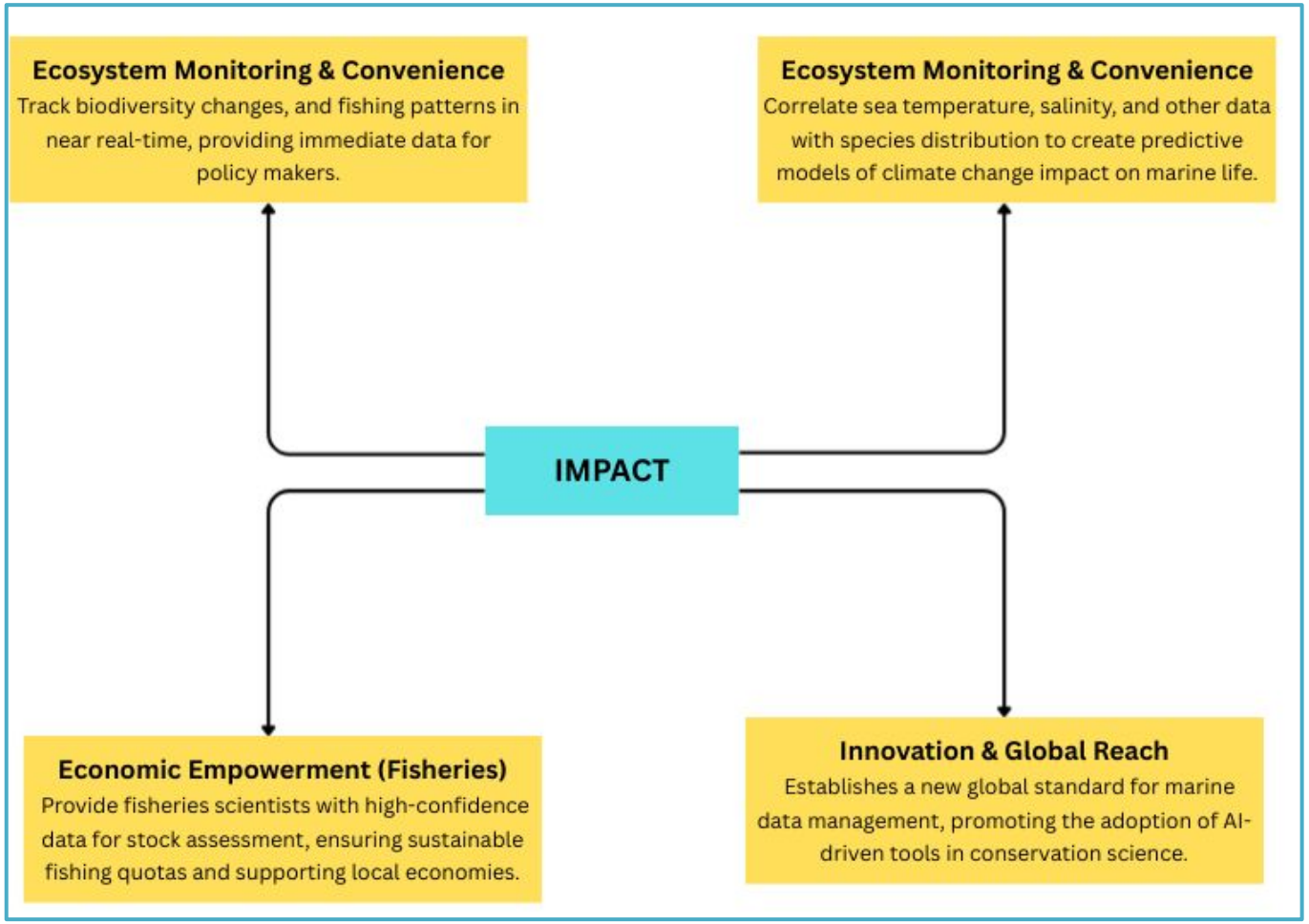
Strategies for Overcoming Challenges:

1. **Financial Strategy:** Opt for **cost-effective cloud solutions** and secure grants or partnerships to offset hosting costs.
2. **Adoption Strategy:** Conduct targeted user education, highlighting the platform's ability to automate analysis and accelerate publication.
3. **Implementation Strategy:** Develop AI-driven data ingestion pipelines to automatically map and standardize data schemas.

DeepSea Coders

IMPACT AND BENEFITS

SMART INDIA HACKATHON 2025



Benefits

1. **Enhanced Data Integrity:** Centralized platform reduces data fragmentation and ensures all analyses are performed on a single source of truth.
2. **Accelerated Discovery:** AI automation slashes the time required for cross-dataset correlation from weeks of manual work to minutes.
3. **Global Collaboration Ready:** Platform design facilitates shared datasets and findings, promoting a global, open-science approach to ocean research.

DeepSea Coders

RESEARCH AND REFERENCES

SMART INDIA HACKATHON 2025

Research

[1] A recent review of the U.S. National Marine Environmental DNA Workshop emphasizes that **eDNA** is "**revolutionizing exploration**, measurement, and monitoring of biodiversity" across marine and freshwater systems. [Reference]
[2] More broadly, leading oceanographic institutions (e.g. WHOI, Scripps) are **investing** in **AI / computational methods** for image, acoustic, and time-series analysis to **automate detection** of species, events (e.g., blooms, eddies, fronts), and anomalies.
[3] The **marine big data market** (i.e. collection, integration, analytics of ocean/environmental data) was estimated at **~ USD 973.7 million** in 2023, and is projected to grow at a CAGR of **~ 11.35%** from 2024 to 2030.[Reference]

References

[1] Valentini, A., et al. (2016) / Pereira, A., et al. (2021). (Cited as foundational papers confirming eDNA's efficiency for species occurrence data collection.
[2] Moen, E., et al. (2018). "Automatic interpretation of otoliths using deep learning." PLoS ONE 13(12): e0204713. (Cited as proof that CNNs can perform otolith analysis with high precision.)
[3] Devika Raj, K., Anas, A., Jasmin, C., Jaleel, A.K.U., Menon, N., Nandini. (2024). Unveiling the faunal diversity in the water column adjacent to two seamounts in the deep Arabian Sea using environmental DNA metabarcoding. Journal of Marine Science & Engineering, 12(6), 971.