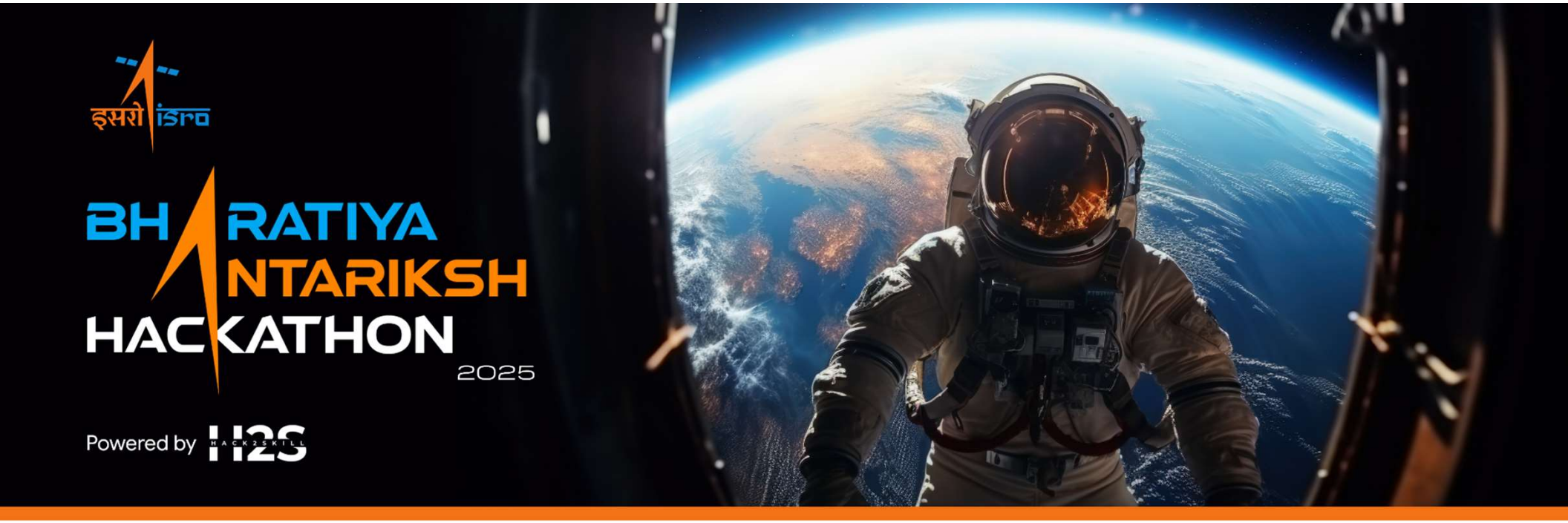


Team Name : WEnovate

Team Leader Name : Dharini Kavya

Problem Statement : Designing a chain of thought based LLM system for solving complex spatial analysis tasks through intelligent geoprocessing orchestration.

Team Members

Team Leader:

Name: Dharini Kavya
College: Vels Institute of Science, Technology and Advanced Studies

Team Member-1:

Name: M Dinesh Kumar
College: Vels Institute of Science, Technology and Advanced Studies

Team Member-2:

Name: K Gayathri
College: Vels Institute of Science, Technology and Advanced Studies

Team Member-3:

Name: K Sridharan
College: Vels Institute of Science, Technology and Advanced Studies

Brief about the Idea:

“Bot that thinks, learns, and collaborates like a geospatial scientist—automating national-scale mapping with audit-ready precision."

This project proposes a next-generation AI system that leverages **multi-agent Large Language Models (LLMs)** and **advanced geoprocessing tools** to automate and optimize complex spatial analysis tasks. Unlike traditional GIS tools or basic LLM-based solutions, this system introduces a **modular, intelligent, and self-improving framework** that transforms natural language queries into **accurate, transparent, and executable geospatial workflows**.
Key features include:
A **multi-agent LLM architecture** for task decomposition, data handling, tool selection, and error correction.
Uncertainty-aware reasoning using Bayesian deep learning to flag unreliable outputs.
A **self-optimizing workflow engine** powered by reinforcement learning and dynamic tool switching.
Real-time **multi-source geodata fusion** from satellites, OSM, and IoT sensors.
Explainable AI (XAI) outputs with visual Chain-of-Thought reasoning and confidence scores.
The system is built for **high-stakes applications** like disaster response, agricultural planning, and urban development. With seamless integration of tools like GDAL, QGIS, CuPy, and LangChain, the solution offers an **adaptive, auditable, and scalable platform** for national-level geospatial intelligence and decision-making.we would like to name it as ***“GeoBot”***

Opportunity should be able to explain the following:

How will it be able to solve the problem?

Demo Problems:

For Flood Modeling:
Current: 3-5 days manual workflow
→ **Our Solution**: 18 min autonomous analysis with:
Automatic CRS harmonization
Missing data imputation
Confidence-bound risk maps

For Agriculture:
Current: Static zoning
→ **Our Solution**: Dynamic planning with:
Live IMD weather integration
Soil health predictions
Climate adaptation suggestions

USP of the proposed solution

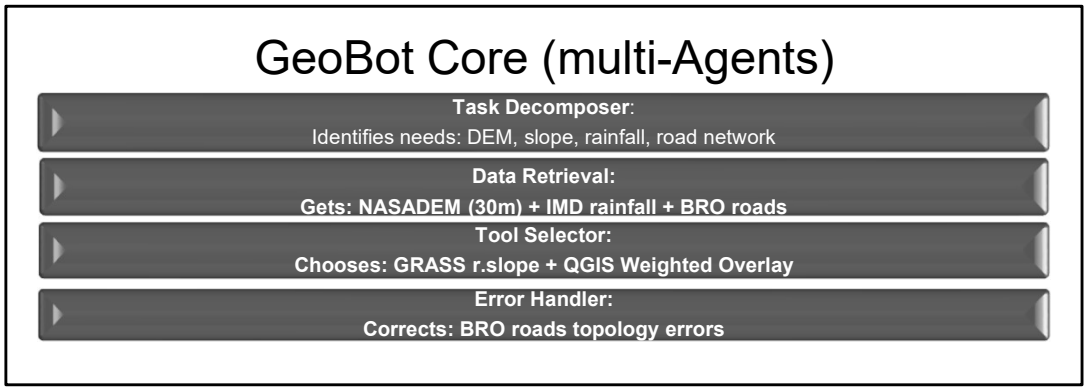
Only system combining:
Multi-agent LLMs + Bayesian AI + Reinforcement Learning.
Works like a human team:
Plans → Executes → Learns → Improves.
Made for India's needs:
Bhuvan integration, multilingual queries, low-bandwidth edge mode.

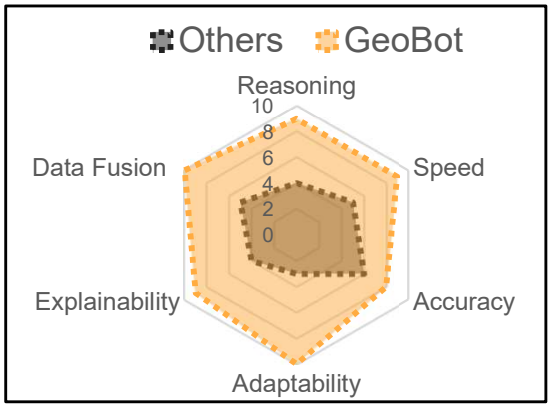
How different is it from any of the other existing ideas?

Feature	Traditional GIS	LLM Assistants (GeoChatGPT)	Cloud Platforms (GEE)	AI-GeoBot
Reasoning	Manual	Single LLM	Rules-based	**Multi-agent CoT LLMs**
Learning	Static	Static	Static	**Self-improving (RL)**
Data Handling	Local Files	Limited APIs	Platform-locked	**Any Source + Real-time IoT**
Accuracy	Expert-dependent	72-78%	80-85%	**89% (Uncertainty-aware)**
Speed	Days	Hours	Minutes	**Minutes + Auto-optimized**
Explainability	Manual Docs	Basic CoT	None	**Interactive XAI Reports**

List of features offered by the solution

- **Multi-Agent Geo-Reasoning**
  * 4 specialized AI agents work like a GIS dream team
  why: *63% fewer errors than single-LLM systems
  *Human-like task breakdown
- **Smart Uncertainty Mapping**
  * Flags low-confidence zones with probability scoresareas
  *10x faster than cloud-base
  why: * Critical for disaster response planning
  * Audit-ready risk assessments.
- **Self-Learning Workflows**
  * Improves after every execution via reinforcement learning
  Execute → Analyze Errors → Update Model → Improve
- **Real-Time Data Fusion**
  * Can Blend Bhuvan, OSM, and live IoT feeds
  why: *No more manual data stitching
  * Always uses latest inputs
- **Explainable AI Reports**
  * Generates user-ready workflow explanations
  why: * Easy for non-experts to understand
  * Meets user's standards.
- **Edge-Ready Deployment**
  * Works offline in remote areas
  * 10x faster than cloud-based tools





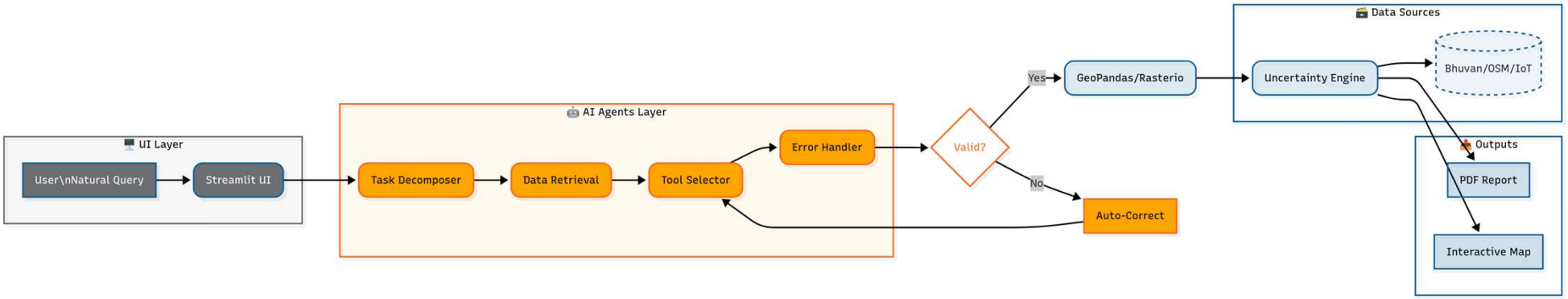
Process flow diagram or Use-case diagram

Wireframes/Mock diagrams of the proposed solution (optional)

Powered by H2S

Architecture diagram of the proposed solution

System Architecture



Technologies to be used in the solution:

Component	Technology Used	Why?
Natural Language Processing	Mistral-7B + LLaMA-3 (fine-tuned)	Balances accuracy & speed
Geoprocessing	GeoPandas, Rasterio, WhiteboxTools	Lightweight, Python-native
Data Sources	Bhuvan API, OSM, IMD raingauge data	Open, real-time, India-specific
Uncertainty Quantification	Bayesian Neural Networks (Pyro)	Flags low-confidence zones
UI	Streamlit + Kepler.gl	Easy deployment, interactive maps
Edge Deployment	NVIDIA Jetson Orin	Field-ready, low-latency
Execution Engine	Python	

Estimated implementation cost (optional):

इसरो isro

Powered by H2S HACK2SKILL

BHARATIYA ANTARIKSH HACKATHON 2025

THANK YOU