Team Name : **KaariruL (காரிருள்)**

Team Leader Name : ABISHEIK S

Problem Statement : AI/ML-driven automated feature detection and change analysis of glacial lakes, road networks, and urban drainage systems from multi-source satellite imagery

Team Members

Team Leader:

Name: Abisheik S
College: *Mailam Engineering college*

Team Member-1:

Name: Ayan Guchait
College: *Ramakrishna Mission Vivekananda Centenary College*

Team Member-2:

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Team Member-4:

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AI/ML-Driven Automated Feature Detection and Change Analysis

From Multi-Source Satellite Imagery

This presentation outlines a novel approach to automatically detect and analyze changes in critical geographical features using advanced Artificial Intelligence and Machine Learning techniques applied to multi-source satellite imagery.

The focus areas include glacial lakes, road networks, and urban drainage systems, providing timely and accurate insights for environmental monitoring, infrastructure management, and urban planning.

Opportunity: Why Our Solution Stands Out

How different?

Leverages multi-source satellite imagery (SAR, Optical) and advanced AI/ML models (U-Net, DeepLabV3+, SAM, Random Forest) for comprehensive feature detection and change analysis. Enhanced accuracy and robustness across challenging conditions (cloud, shadow, snow) compared to single-source methods.

USP:

Multi-temporal change analysis with high accuracy and scalability across diverse terrains and timeframes. Integration of various satellite data and state-of-the-art AI/ML models ensures reliable detection in complex environments, offering a robust and comprehensive monitoring solution.

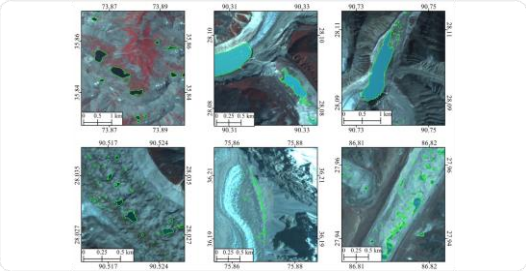
Solves the problem by:

Automating labor-intensive manual tracking of glacial lakes, road networks, and urban drainage systems. Provides timely, accurate geospatial vector data (shapefiles/GeoJSON) and interactive dashboards for proactive decision-making in environmental monitoring, disaster management, and infrastructure planning.

Features:

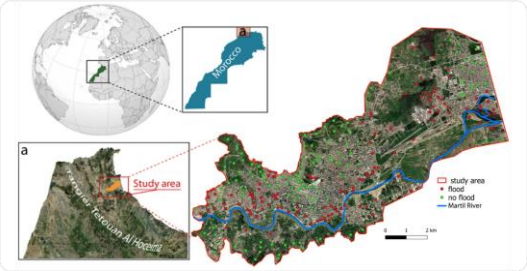
- Automated detection & delineation (glacial lakes, roads, urban drainage).
- Multi-temporal change analysis.
- Multi-source satellite imagery (SAR & Optical).
- High accuracy & robustness in challenging conditions.
- Geospatial vector data output (shapefiles, GeoJSON).
- Interactive dashboard visualization (e.g., Google Earth Engine).
- User-driven querying & downloadable outputs.
- Scalability to pan-Himalayan/global regions.

Visual Representations



Glacial Lake Detection

Road Network Extraction



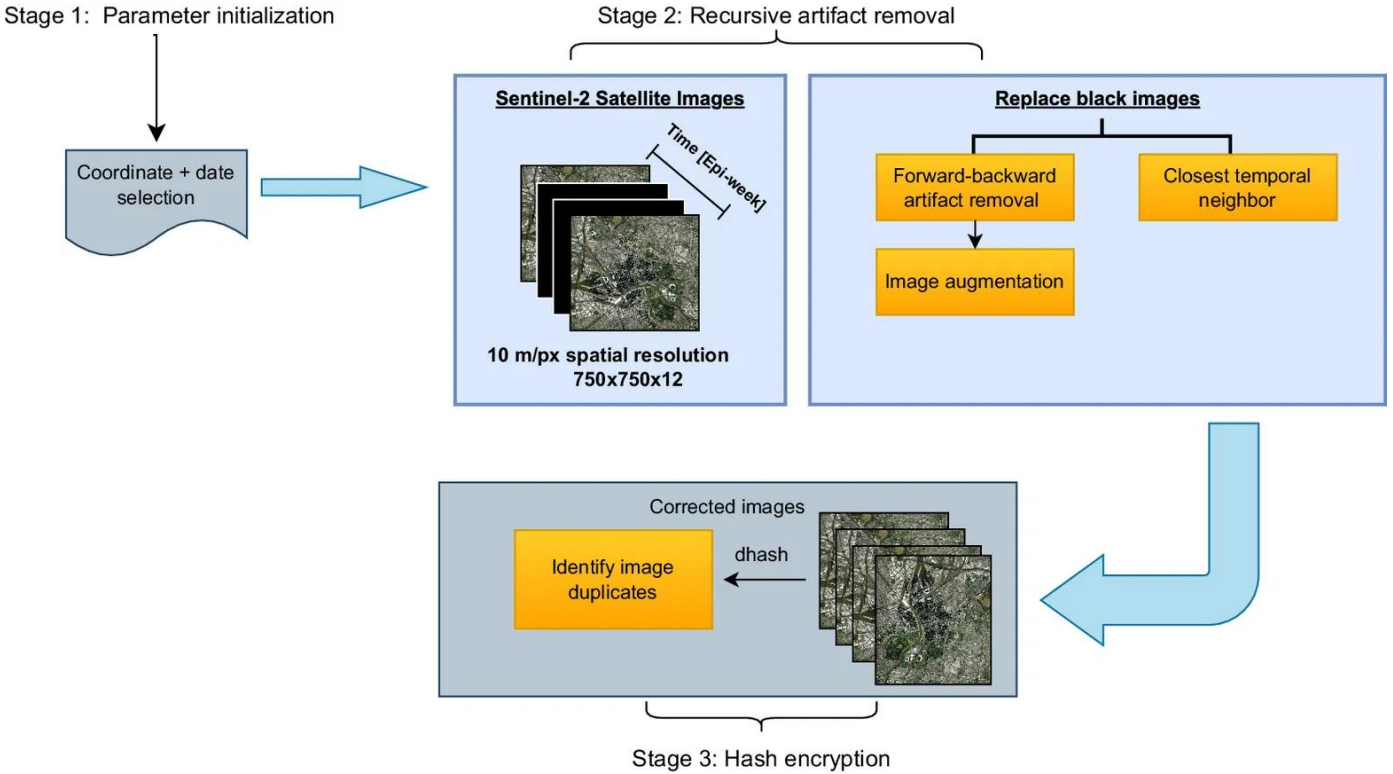
Urban Drainage Mapping

AI/ML in Satellite Imagery

ML Algorithms Application

Geospatial AI Potential

Process Flow Diagram



Architecture Diagram of Proposed Solution

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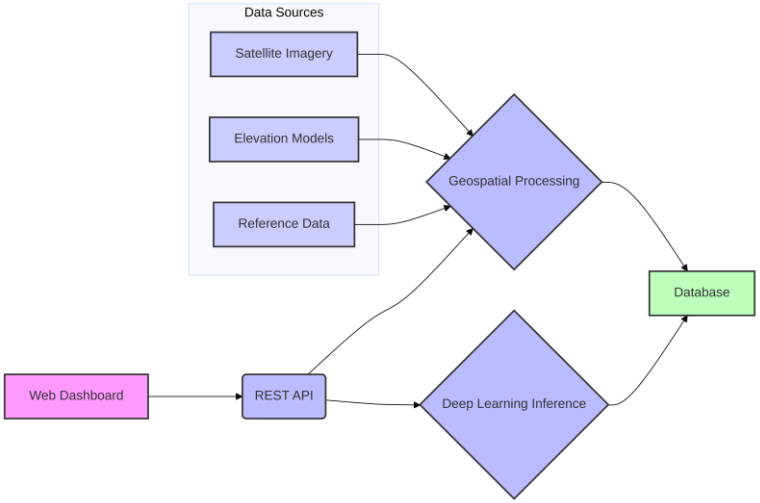

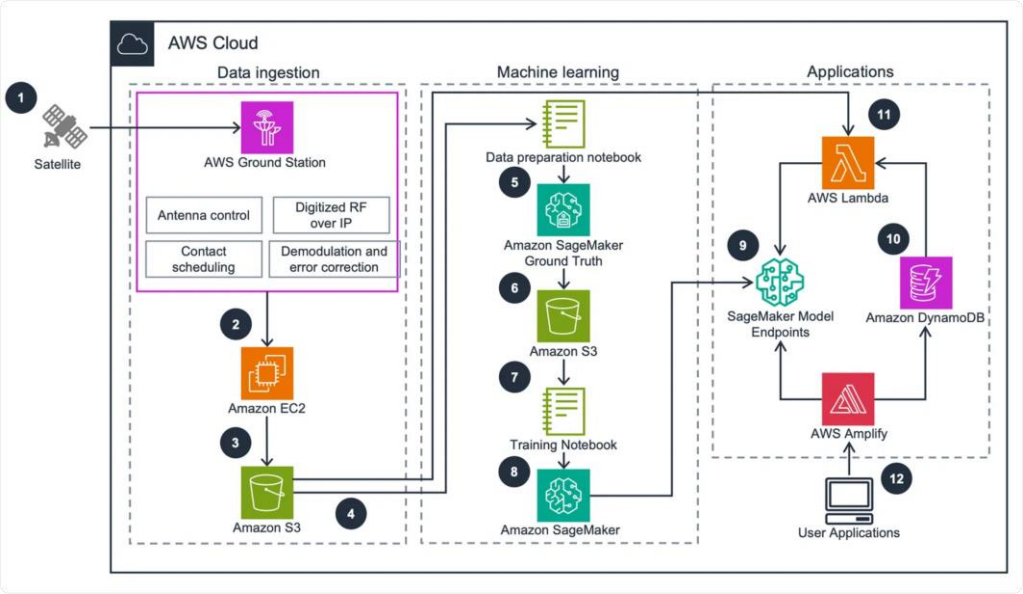

Wireframes/Mock Diagrams of Proposed Solution

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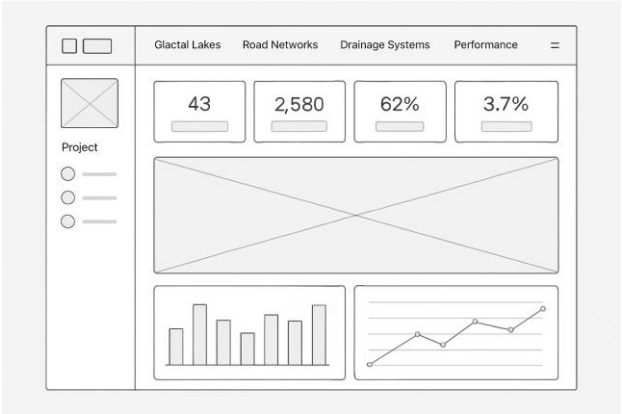

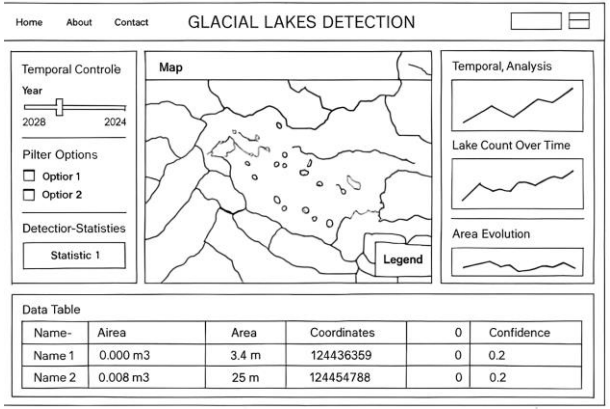

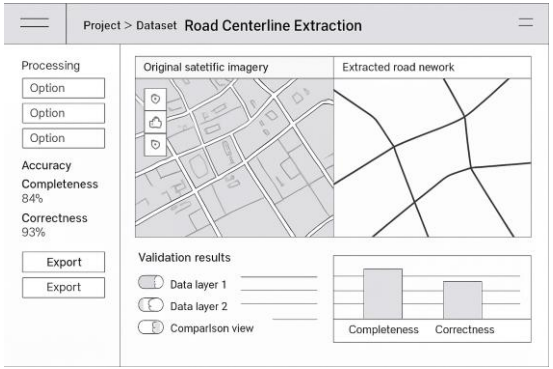

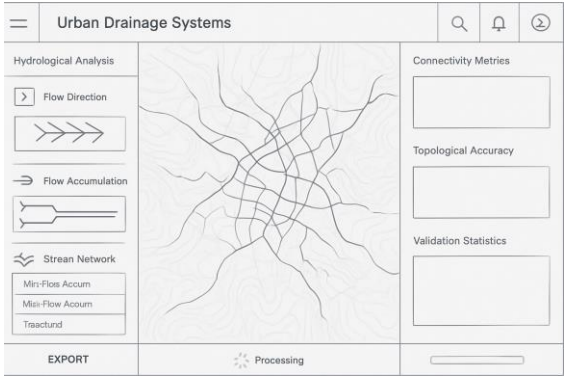

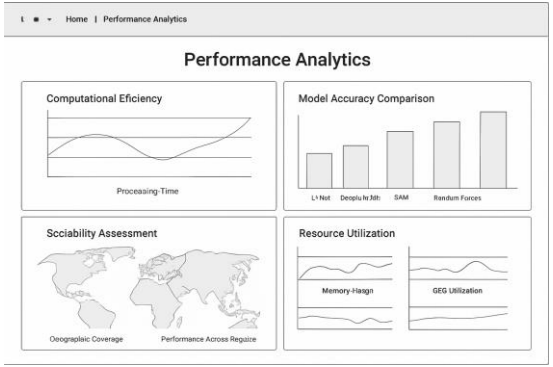

Technologies to be Used in the Solution

Programming & ML Frameworks

- Python as the primary programming language
- TensorFlow / PyTorch for deep learning models
- scikit-learn for traditional ML algorithms
- GDAL, Rasterio, GeoPandas for geospatial data processing

AI/ML Models

- U-Net for semantic segmentation
- DeepLabV3+ for feature extraction
- Segment Anything Model (SAM) for object detection
- Random Forest for classification tasks

Data Sources & Processing

- Sentinel-1A/1B (SAR) imagery
- Sentinel-2A/2B (optical) imagery
- Landsat 5/7/8/9 via Google Earth Engine
- NRSC-GL Inventory, GLIMS, Hi-MAG, ICIMOD datasets

Visualization & Deployment

- Google Earth Engine for interactive visualization
- Web-based dashboard using Flask/Django
- Cloud infrastructure (AWS/GCP) for scalability
- Docker containers for deployment consistency

Estimated Implementation Cost for Hackathon Project

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Development Resources (Hackathon)

Cloud Computing Credits (AWS/GCP)	$500
API Access for Satellite Data	$0
Development Tools & Libraries	$0

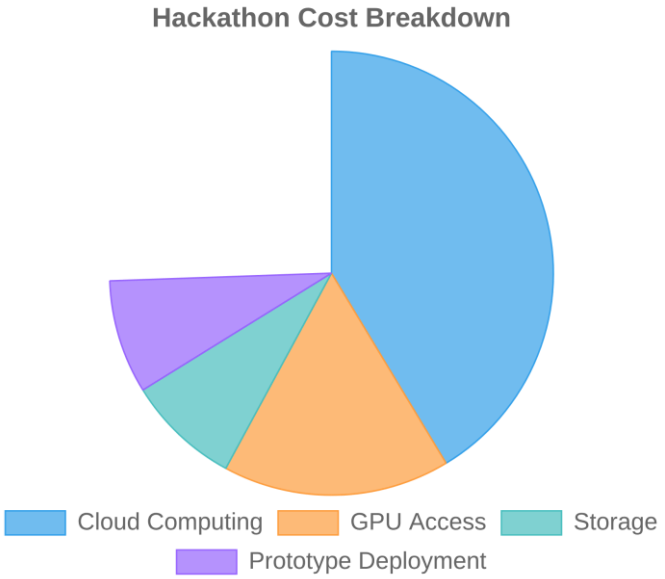
Hardware Requirements

GPU Access for Model Training	$200
Storage for Satellite Imagery	$100

Team Resources

Collaboration Tools	$0
Prototype Deployment	$100

Total Hackathon Implementation **$900**



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THANK YOU