



# BHARATIYA ANTARIKSH HACKATHON 2025

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Team Name : Trinetra Hack

Team Leader Name : N T Keerrthana

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 Member-1:

Name: N T Keerrthana  
College: Vellore Institute of Technology,  
Chennai

Team Member-2:

Name: Aviral Pratap Singh  
College: Adani Institute of Digital Technology  
Management, Gujarat

Team Member-3:

Name: Batta Srikanth  
College: Dr MGR Educational and Research  
Institute, Chennai

## Brief about the Idea:

- An AI-based Earth observation app that detects changes in glacial lakes, road networks, and urban drainage systems using multi-source satellite imagery.
  - 1) Features - compare before and after satellite images of selected regions on the earth
  - 2) Analysis that AI makes - detect changes like
    1. Glacial lake expansion
    2. Road construction
    3. Urban drainage blockage
  - 3) Region wise monitoring - users can browse areas
  - 4) User-defined uploads(optional) - Allow users to input their own locations or satellite images.
  - 5) Smart alerts - Get notified about rapid changes, flood risks, or encroachments.

Opportunity should be able to explain the following:

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

This idea is different because it combines multiple types of Earth surface monitoring like glacial lakes, road expansion, and urban drainage changes in a single, AI-driven platform. Solutions are either specialized for one problem (like flood alerts or glacier tracking) or are complex tools used only by researchers. This app aims to be simple, visual, and accessible to both citizens and local authorities.

2. How will it be able to solve the problem?

The app will help by using satellite imagery and AI to automatically detect changes in the environment such as expanding lakes, blocked drains, or new road construction. These changes are often missed until it's too late (e.g., a flood or encroachment). The app will provide early insights and visual comparisons.

3. What is the USP (Unique Selling Proposition) of the proposed solution?

- 1) Multi-feature change detection (glaciers + roads + drainage – all in one)
- 2) AI-based insights from satellite images without needing technical skills
- 3) Useful for small cities and remote areas where such monitoring is not easily available.

## List the features offered by the solution

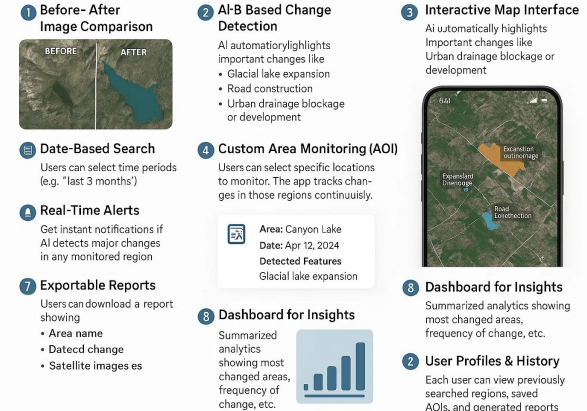
- Before–After Image Comparison - Users can select an area and see satellite images before and after a specific date to visually spot changes.
- AI-Based Change Detection –
  - Glacial lake expansion
  - Road construction
  - Urban drainage blockage or development
- Interactive Map Interface - Tap or zoom into a region to explore detected features with clear overlays on the map.
- Date-Based Search
  - Users can select time periods (e.g., “last 3 months”) and the app will find matching satellite images for comparison.
- Custom Area Monitoring (AOI) - Users can select specific locations to monitor. The app tracks changes in those regions continuously.
- Real-Time Alerts - Get instant notifications if AI detects major changes in any monitored region.


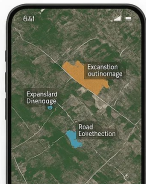

List the features offered by the solution

➤ Exportable Reports – users can download the following

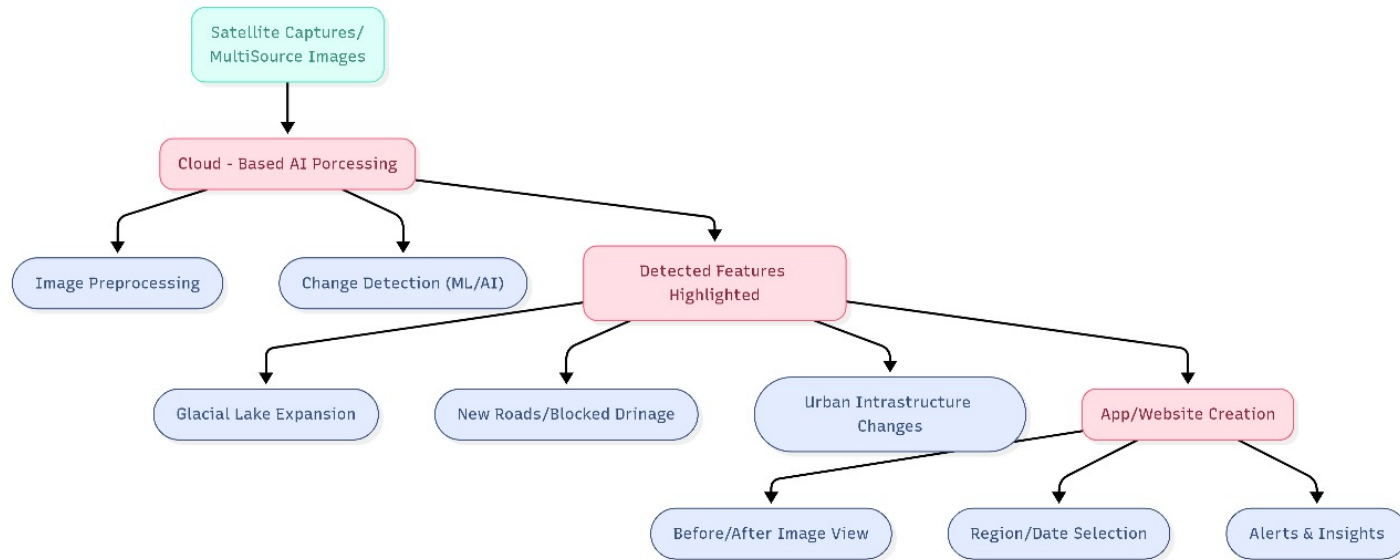
- Area name
- Date of change
- Detected features
- Satellite images (before/after)

- Dashboard for Insights - Summarized analytics showing most changed areas, frequency of change, etc.
- User Profiles & History - Each user can view previously searched regions, saved AOIs, and generated reports.



- 1 Before-After Image Comparison**  

- 2 AI-B Based Change Detection**  
 AI automatically highlights important changes like
  - Glacial lake expansion
  - Road construction
  - Urban drainage blockage or development
- 3 Interactive Map Interface**  
 AI automatically highlights important changes like Urban drainage blockage or development  

- 4 Custom Area Monitoring (AOI)**  
 Users can select specific locations to monitor. The app tracks changes in those regions continuously.  

- 5 Date-Based Search**  
 Users can select time periods (e.g. "last 3 months")
- 6 Real-Time Alerts**  
 Get instant notifications if AI detects major changes in any monitored region
- 7 Exportable Reports**  
 Users can download a report showing
  - Area name
  - Date of change
  - Satellite images
- 8 Dashboard for Insights**  
 Summarized analytics showing most changed areas, frequency of change, etc.  

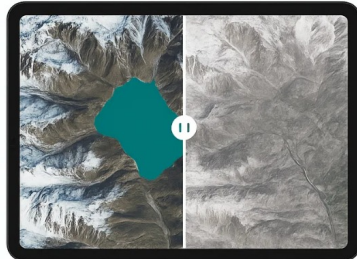

## Process flow diagram or Use-case diagram



## Wireframes/Mock diagrams of the proposed solution (optional)




### AI-BASED EARTH observation

An AI-based Earth observation app that detects changes in glacial lakes, road networks, and urban drainage systems using multi-source satellite imagery.




Compare before and after satellite images of selected regions on the earth


#### DETECT CHANGES LIKE

-  Glacial lake expansion
-  Road construction
-  Urban drainage blockage

#### REGION WISE MONITORING

-  Users can browse areas

#### USER-DEFINED UPLOADS (OPTIONAL)

-  Allow users to input their own locations or satellite images

#### SMART ALERTS




### AI-Based Earth Observation App



### COMPARE BEFORE AND AFTER



### REGION-WISE MONITORING

-  (optionally) Upload files

### SMART ALERTS

### DETECT CHANGES LIKE

- glacial lake expansion
- road construction
- urban drainage blockage

### REGION-WISE MONITORING

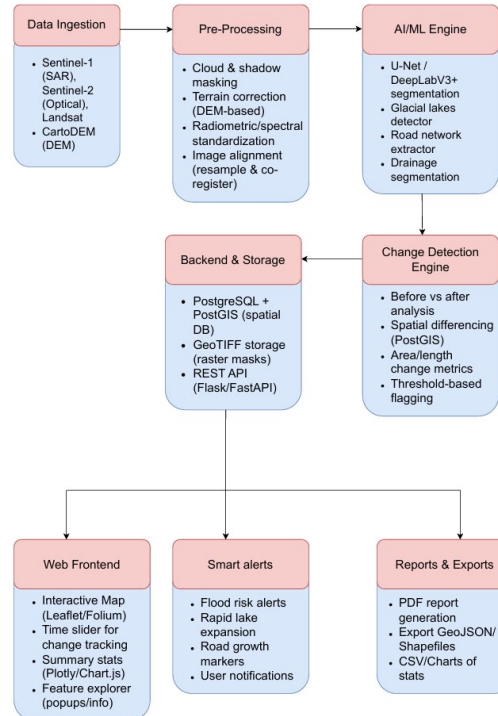


### SMART ALERTS

Get notified about rapid changes, flood risks, or encroachments



## Architecture diagram of the proposed solution



Technologies to be used in the solution:

1. Satellite Data Sources Sentinel - 1, Sentinel - 2, Carto DEM, SRTM
2. Cloud & Storage Google Cloud, AWS, Firebase (for image storage & app backend)
3. AI/ML for Change Storage Google, DeepLabV3+, SAMU-Net, Mask R-CNN (object detection)
4. Geospatial Processing Google Earth Engine, QGIS, GDAL, Rasterio, Geopandas
5. App Development Glide, Flutter (mobile app) Mapbox / Leaflet (map integration)
6. Backend & Database Python (Flask/FastAPI), PostgreSQL + PostGIS, Firebase
7. Visualization & Reporting D3.js, Chart.js, likes (charts, reports, exports)

## Estimated implementation cost (optional):

Our solution is designed to be cost-efficient and student-friendly, leveraging free and open-source technologies. Here's why it requires almost zero monetary investment at the MVP stage:

- ❖ **Satellite Data:** Sourced from public datasets like Sentinel, INSAT, and Landsat — all free.
- ❖ **AI/ML Tools:** We use open-source frameworks such as TensorFlow and PyTorch, available at no cost.
- ❖ **App Builder:** The app is being developed using Glide, which has a robust free tier for MVPs.
- ❖ **Backend Services:** Firebase and Google Sheets are sufficient for basic data storage and come with generous free tiers.
- ❖ **Design Tools:** Canva, Figma, and Draw.io are used for UI/UX design — all available for free.
- ❖ **Development:** All work is being done in-house by student developers, with no outsourcing required.

Estimated implementation cost (optional):

Actual Cost: ₹0

The only requirement is internet connectivity. Optional costs (like a custom domain or scaling beyond free limits) are minimal and not necessary for the prototype.

By leveraging open technologies and publicly available data, we've ensured that our solution remains highly affordable, scalable, and accessible to any research or educational team.

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**Actual Cost: ₹0** The only requirement is internet connectivity. Optional costs (like a custom domain or scaling beyond free limits) are minimal and not necessary for pilot.

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# THANK YOU

