1M1B INTERNSHIP PROJECT-AI-Driven Automated LULC Change Detection for Sustainable Land Management

NAME:KARTHIK SRINIVAS SEKAR

DEPT,SEC:CSE-B

YEAR/SEM:3rd/6

SDG Alignment

Primary SDG: SDG 15 – Life on Land
Secondary SDGs: SDG 11 – Sustainable Cities and Communities, SDG 13 – Climate Action

Problem Statement

Background

- Land Use and Land Cover (LULC) change is a critical indicator of environmental health, urban expansion, deforestation, and ecosystem degradation.
- Traditionally, LULC change detection relies on manual interpretation or semi-automated GIS workflows that are time-consuming, inconsistent, and difficult to scale across large regions or frequent time intervals.

Target Users

- Urban planners and municipal authorities
- Environmental monitoring agencies
- Researchers and students in geospatial sciences
- NGOs working on conservation and sustainability

Role of AI in the Project

AI plays a central role in automating analysis, improving accuracy, and enabling decision support:

- Classification: AI models classify satellite imagery into LULC classes (built-up, vegetation, water, barren land, etc.).
- Change Detection: Machine learning compares multi-temporal data (e.g., 2016 vs 2020) to detect spatial changes.
- Pattern Detection: AI identifies trends such as urban sprawl or vegetation loss.
- Decision Support: Summarized insights help stakeholders understand impacts.

- Automation: End-to-end workflow reduces manual GIS effort.

AI Components Used

- Prompt-based AI logic for explanation and summarization
- Machine learning classification models
- Retrieval-Augmented Generation (RAG) for policy and impact interpretation
- Explainable AI outputs (change statistics, maps, summaries).

Design Thinking Approach

Stage 1: Empathize

- Who faces the problem? Environmental agencies, planners, and researchers.
- Challenges: Manual mapping, delayed insights, inconsistent classifications.
- Why it persists: High data volume and lack of automation.

Stage 2: Define

- Problem: Lack of scalable and automated LULC change detection.
- Users: Decision-makers needing timely land insights.
- Gap: Traditional GIS workflows are slow and non-adaptive.

Stage 3: Ideate

AI-based solutions include:

- Automated image classification using ML
- Pixel-level change detection
- AI-generated summaries of land change impacts

Stage 4: Prototype

- Input historical LULC vector data (2016)
- Input multispectral satellite imagery (2020)
- AI-based classification of new imagery
- AI-generated impact explanation

Outputs:

- Change maps

- Area statistics
- Textual sustainability insights

Stage 5: Test & Refine

- Validate results using known regions
- Improve clarity of outputs
- Review ethical and environmental impact

Expected Impact

- Faster and scalable land change monitoring
- Improved environmental planning
- Early detection of deforestation or urban expansion
- Support for climate action and biodiversity conservation

Responsible AI Considerations

- Fairness: Avoid biased training data; ensure regional diversity.
- Transparency: Clearly explain classification logic and limitations.
- Ethics: No misleading environmental claims.
- Privacy: Use only open, non-personal satellite data.

Impact Statement

- If implemented, this solution enables authorities to monitor land changes in near-real time, improving sustainable land management, conservation planning, and climate resilience.
- Communities benefit from better environmental governance, while policymakers gain reliable, AI-assisted insights.

Conclusion

- This project demonstrates how AI can be a powerful tool for sustainability when applied responsibly.
- AI is not replacing human judgment—it is enhancing it for a sustainable future.