Project Proposal: AI-Powered Feature Extraction from Satellite Imagery for Smart Urban Planning

1. Introduction

Urban areas are expanding rapidly, requiring more efficient methods for land-use assessment and sustainable development. This project aims to create an **AI-powered system** that uses **satellite imagery and deep learning** to automate **land classification, urban growth analysis.**

2. Objectives

This project will develop a geospatial intelligence system capable of:

- **Automated Land Classification** – Categorizing land into different types using satellite imagery.
- **Identifying Developable Land** – Detecting open spaces suitable for construction.
- **Vegetation and Environmental Monitoring** – Mapping and assessing changes in green cover.
- **Industrial Zoning and Suitability Analysis** – Recommending areas best suited for industrial development.
- **Predicting Urban Growth** – Using AI to forecast future land-use changes.
- **Real-Time Analysis** – Providing an interactive, web-based platform for ongoing urban monitoring.

3. Methodology

3.1 Data Acquisition and Preprocessing

- **Satellite Data Sources:** High-resolution images from Sentinel-2, Landsat-8, and Google Earth Engine.
- **Feature Engineering:** Applying remote sensing indices, such as:
    - **NDVI (Normalized Difference Vegetation Index)** – Measures vegetation health.
    - **NDBI (Normalized Difference Built-up Index)** – Detects urbanized areas.
    - **MNDWI (Modified Normalized Difference Water Index)** – Identifies water bodies.

3.2 System Architecture

- **Frontend:** A web-based GIS interface using HTML, CSS, JavaScript, and Leaflet.js for map visualization.
- **Backend:** Built with Django REST Framework (DRF) to manage API requests.

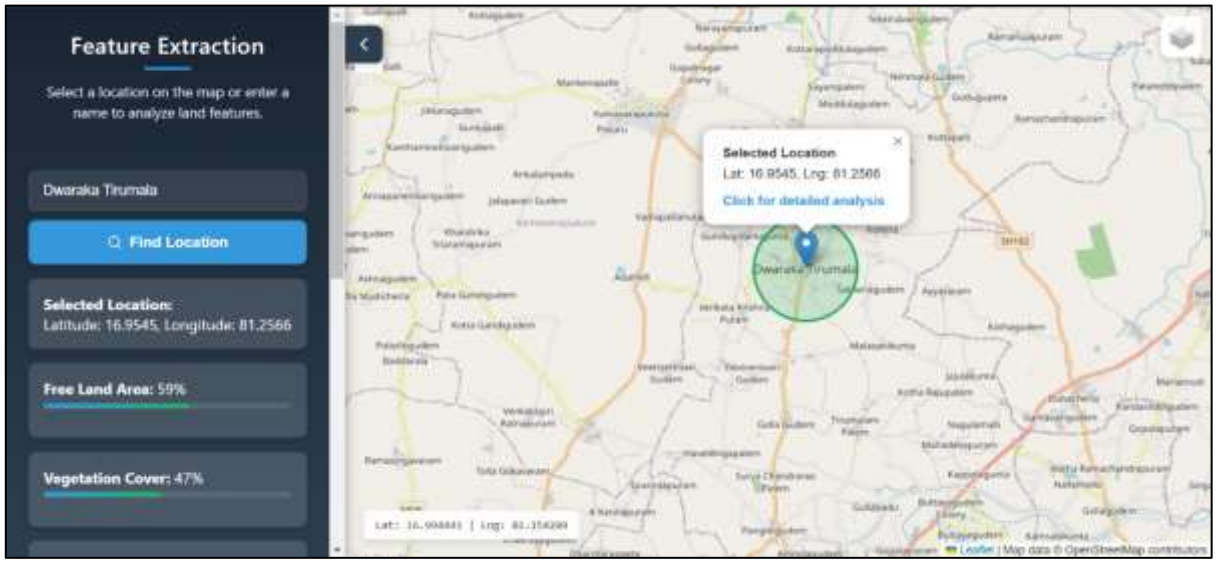
- **AI Model:** A TensorFlow/Keras-based U-Net for land classification and an LSTM model for predictive analytics
- **Database:** MySql to store and retrieve spatial data efficiently

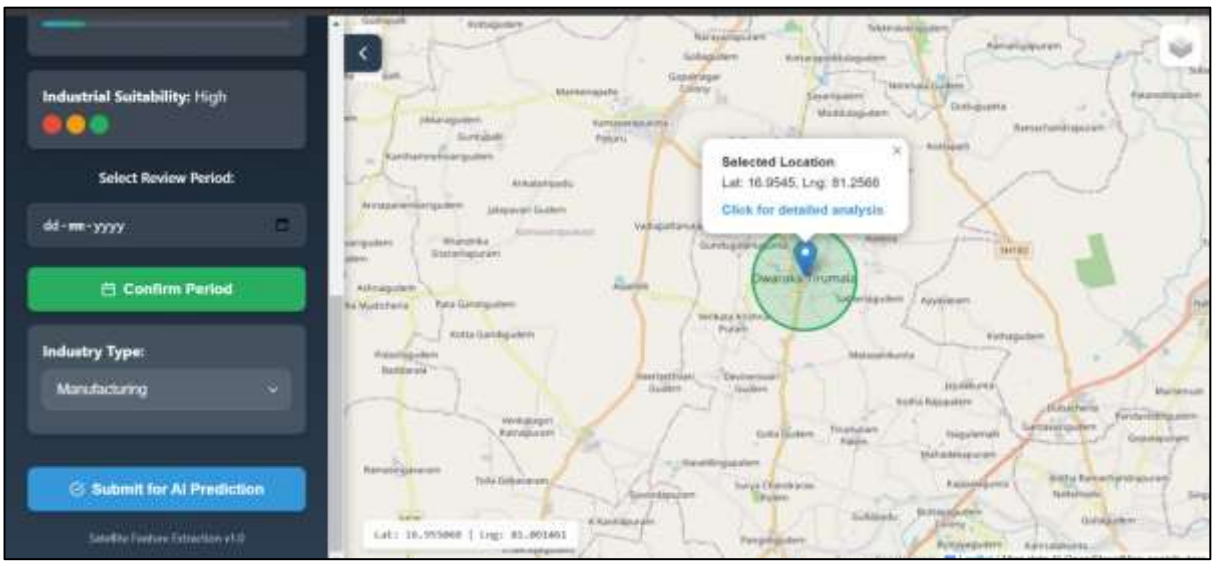
3.3 Functional Workflow

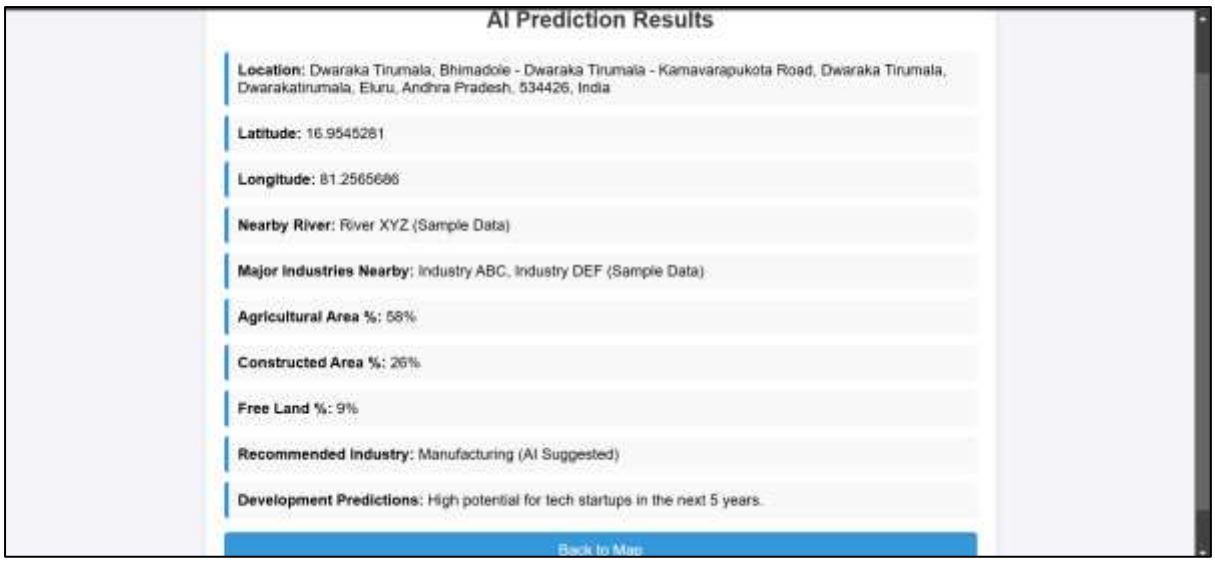
- **User selects a location** on the web interface.
- **Backend fetches the latest satellite image** from an external API.
- **AI model processes the image** and classifies land types.
- **Backend generates insights**, including land availability and industrial suitability.
- **Results are displayed** on the web dashboard, enabling users to explore real-time data

4. related diagrams and picture of the sample template

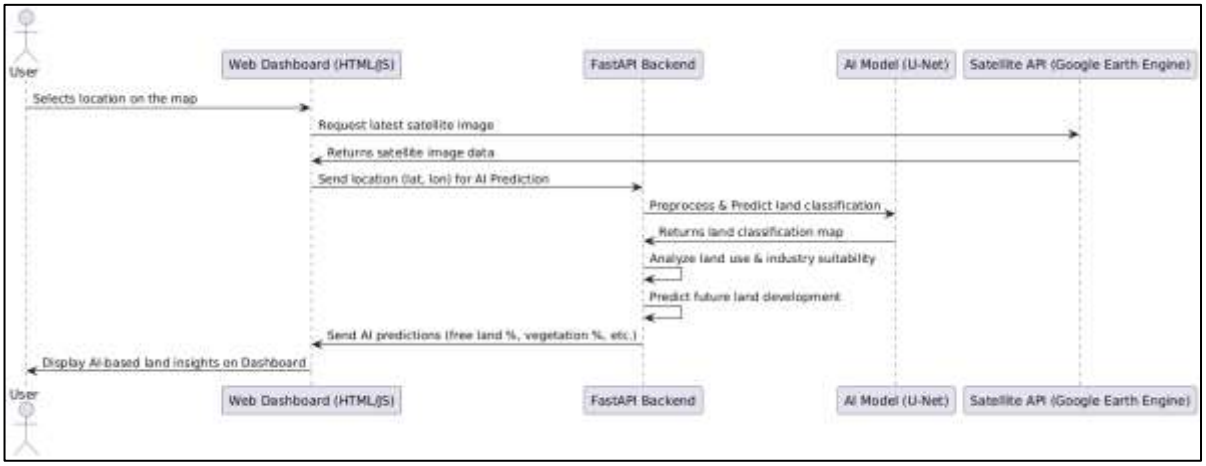
Note : The data displayed in these images, including numerical values and examples, is for illustrative purposes only. This data does not represent actual model results, as the model is currently in the planning stage and has not yet been developed.







Sequence diagram



5. Expected Deliverables

- **Automated Land Segmentation:** AI-powered classification of land into free land, vegetation, urban areas, and water bodies.
- **Urban Planning Insights**: Recommendations for land use, industry placement, and environmental preservation.
- **Interactive GIS Dashboard:** A web-based system to visualize and analyze urban expansion.
- **Predictive Urban Growth Model:** AI-driven forecasts of future land-use changes.

6. Conclusion

This project introduces a **scalable AI-driven geospatial system** for smart city planning. By combining **satellite imagery, deep learning, and predictive analytics**, it enables **automated land classification and urban growth forecasting**. this project aims to enhance efficiency in urban planning and land-use management.