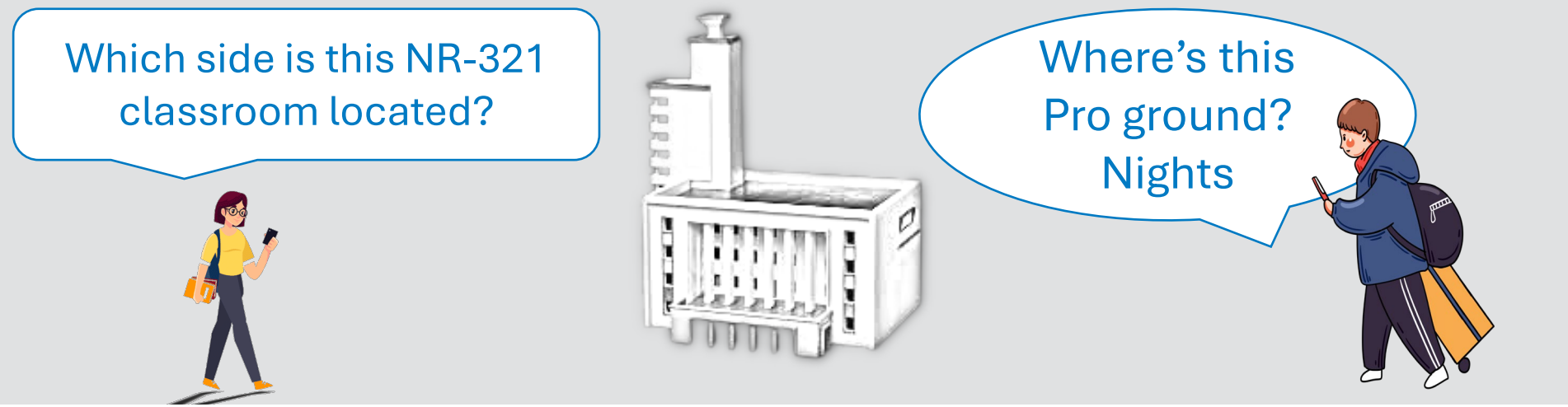


Boddepalli Navjoth, Ranbir and Chitra Gupta School of Infrastructure Design and Management, Indian Institute of Technology Kharagpur

Project Motivation

The GeoAI-Driven Geocoding System for IIT Kharagpur improves urban accessibility in university towns, overcoming limitations of mainstream navigation apps in dynamic campus environments. Traditional tools struggle with frequent changes and dense activities.

FEATURE	TRADITIONAL NAVIGATION APPLICATIONS	CUSTOMIZED GEOAI-BASED GEOCODING SYSTEM
Adaptability to Changes	Slow to update for campus changes.	Quickly adapts to campus changes using VGI and GeoAI.
Precision & Relevance	Less precise for complex campus layouts.	High-precision tailored to campus specifics.
Local Knowledge	Limited campus-specific details.	Integrates detailed local knowledge through NLP and VGI.
Scalability	General use, not optimized for campuses.	Designed for easy adaptation to various university campuses
Unique Land Coding	Does not assign unique codes to specific locations	Assigns unique, precise codes to every parcel of land, enhancing location identification.



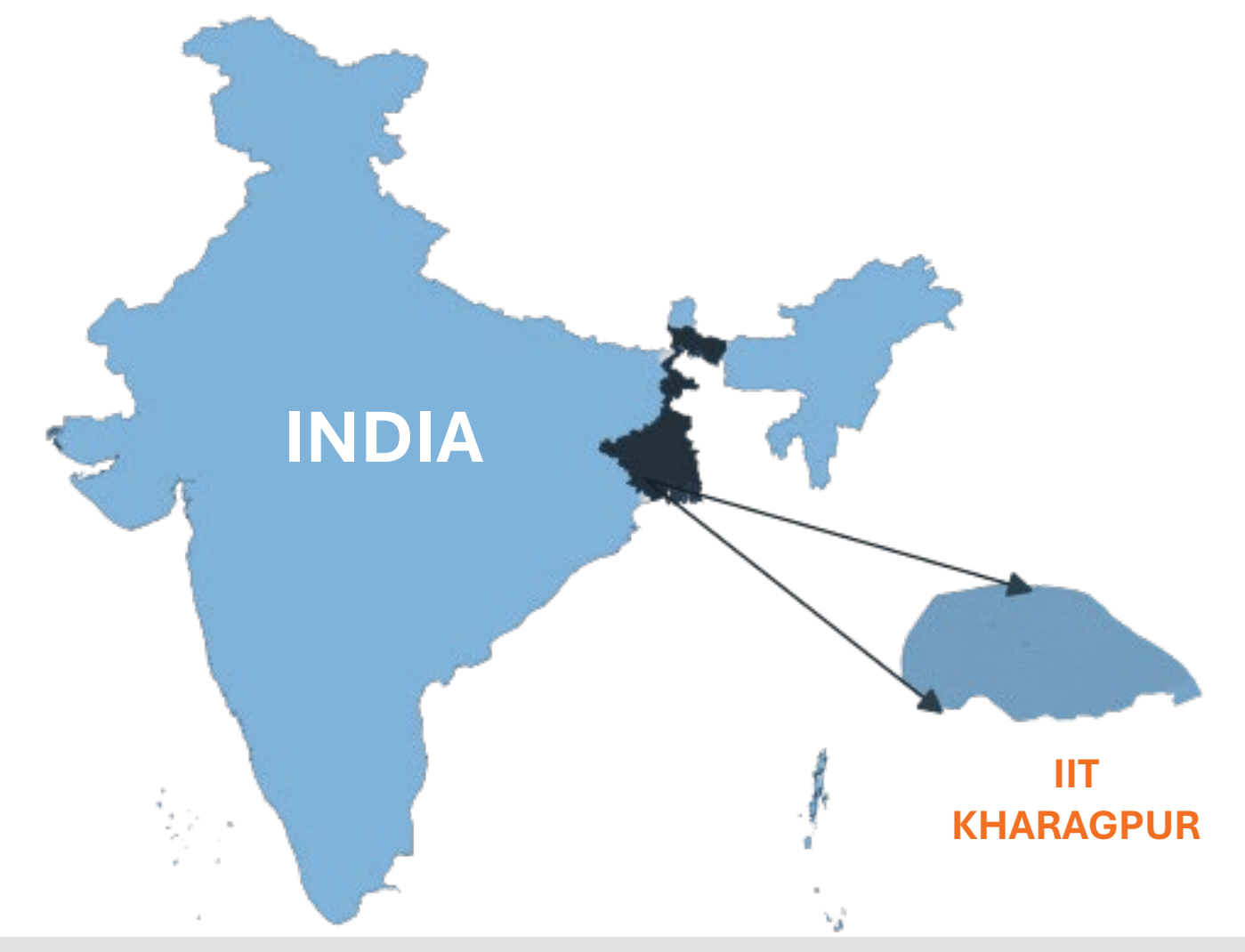
Aim and Objectives

To create a customized GeoAI-powered geocoding system for the IIT Kharagpur campus, utilizing geohashing, VGI, and NLP techniques to enhance location-based services and navigation accuracy.

- To collect location-specific data and types of diverse questions or queries users asked while commuting through VGI techniques.
- Implementing a geohashing algorithm to divide the university campus into customized grids with a standardized geohash code naming convention
- Developing NLP and BERT models to process user queries and integrate them into a WebGIS app for seamless result display.

Core Objective: Assigning a unique Geohash code to each parcel of land

Study Area



The study area centers on IIT Kharagpur, a prestigious institute sprawling over 2,100 acres in West Bengal. Addressing the navigational challenges posed by its diverse mix of academic buildings, residential quarters, and green spaces, the project aims to develop a GeoAI-driven customized geocoding system for precise location identification and navigation within the campus.

Need for a Custom Geocoding System

"Why is there a need to develop a custom geocoding system with geospatial indexing for a campus like IIT Kharagpur, given the availability of many robust systems?"

➤ Customized, easy-to-remember alphanumeric codes

Example Custom Code
A JC 3 306

➤ High precision with detailed infrastructure information

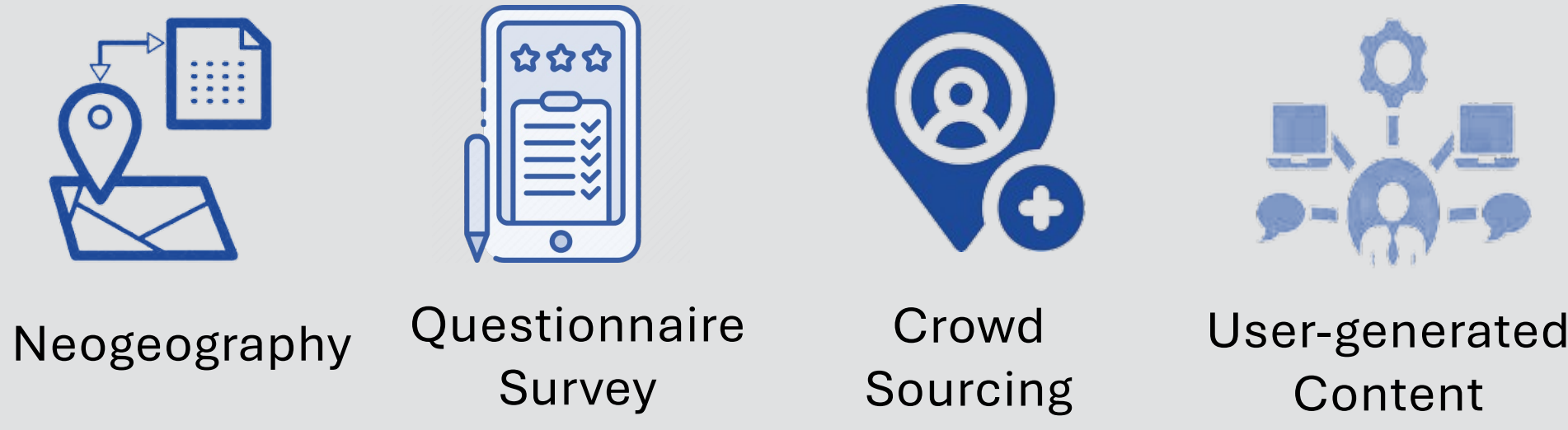
➤ Seamless integration with campus systems

Event	Start Time	End Time	GEOHASH CODES
NRITYAKALA	8:00 AM	11:00 AM	AMB0342
RANGMANCH FINALS	8:00 AM	1:00 PM	AMB0382

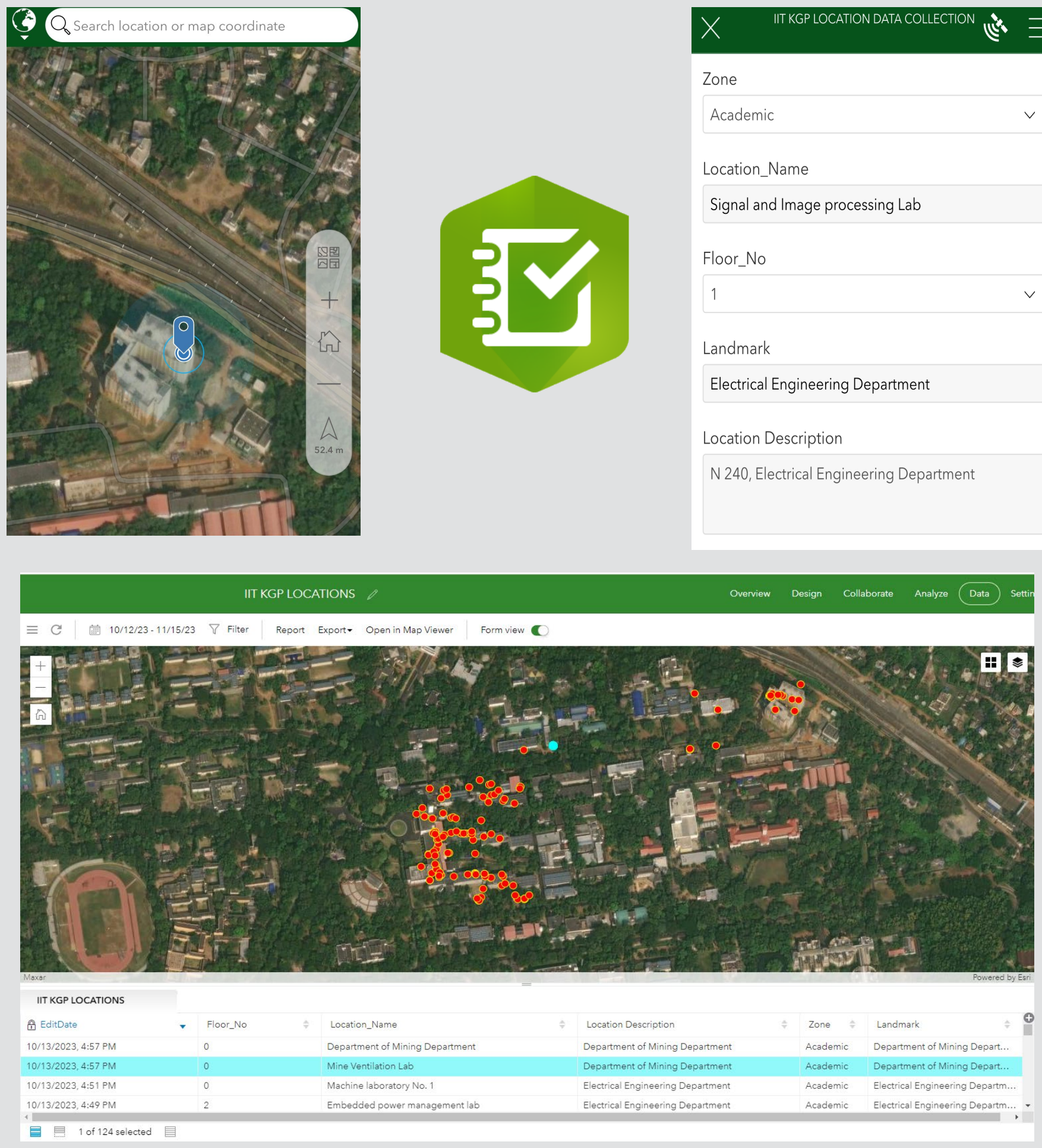
➤ Efficient navigation and wayfinding

Data Sources

Incorporating VGI techniques for gathering data

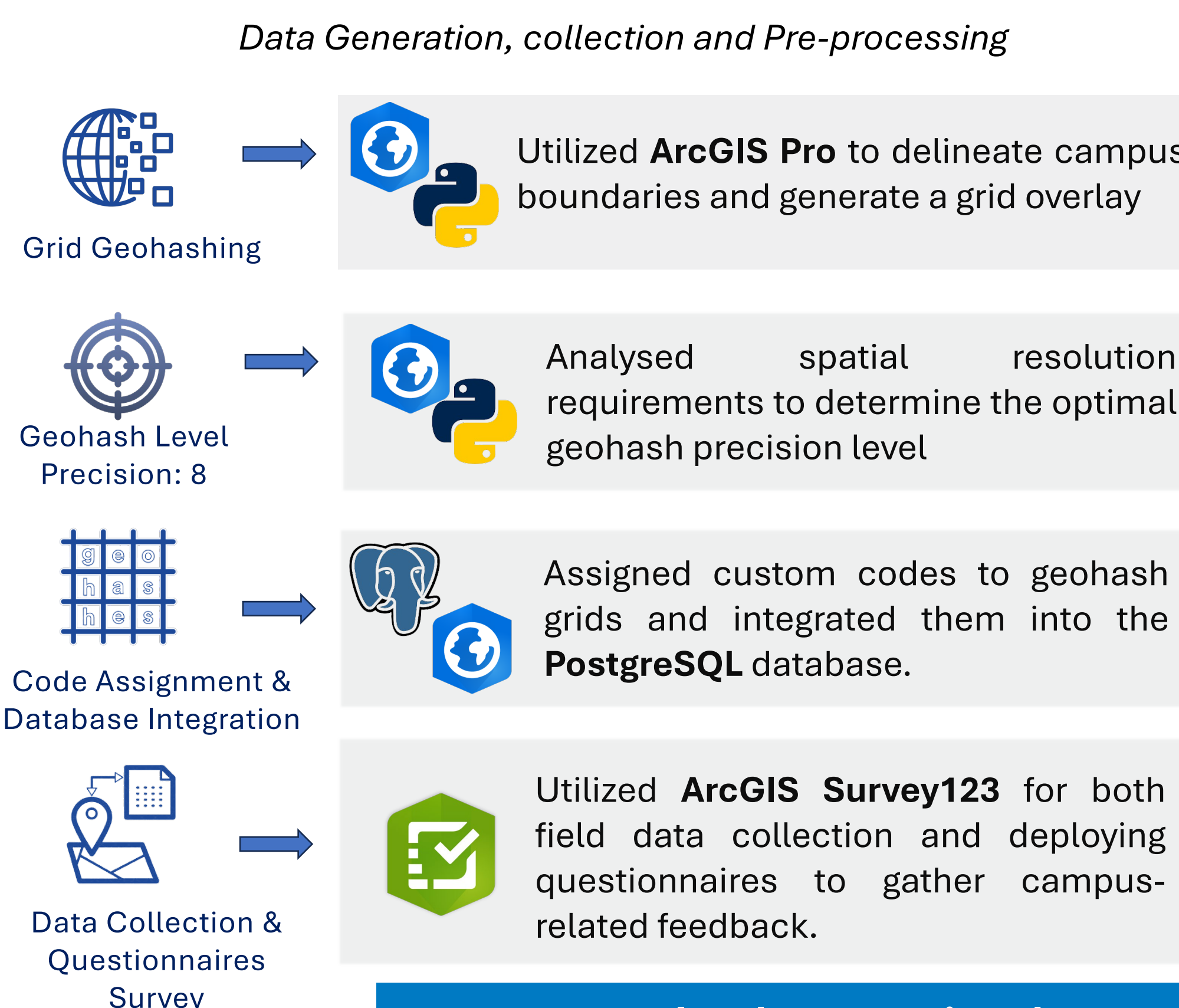


Pol Collection using ArcGIS Survey123

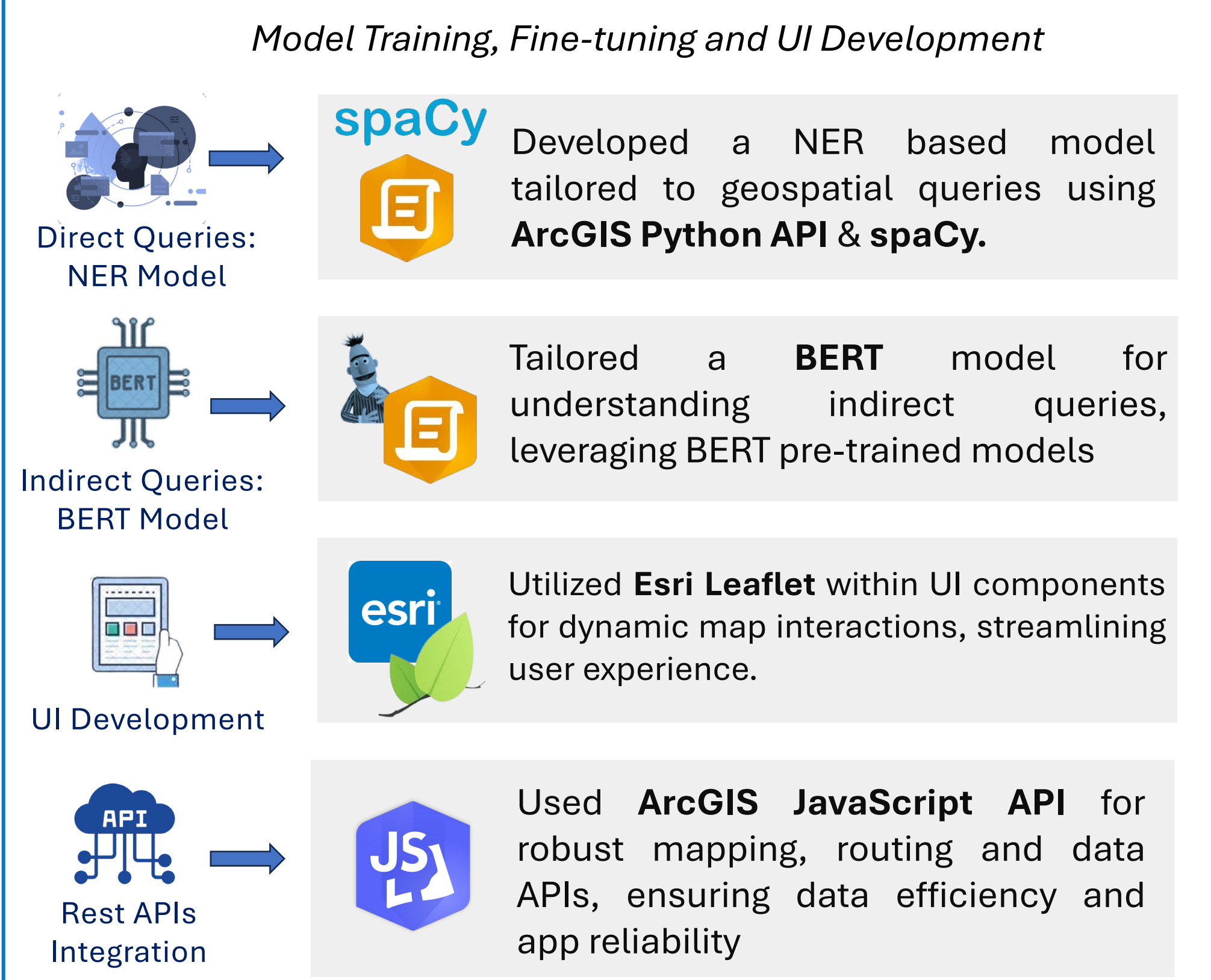


Methodology

Phase 1: Geo-grid, Custom Code Assignment, & VGI Data Collection

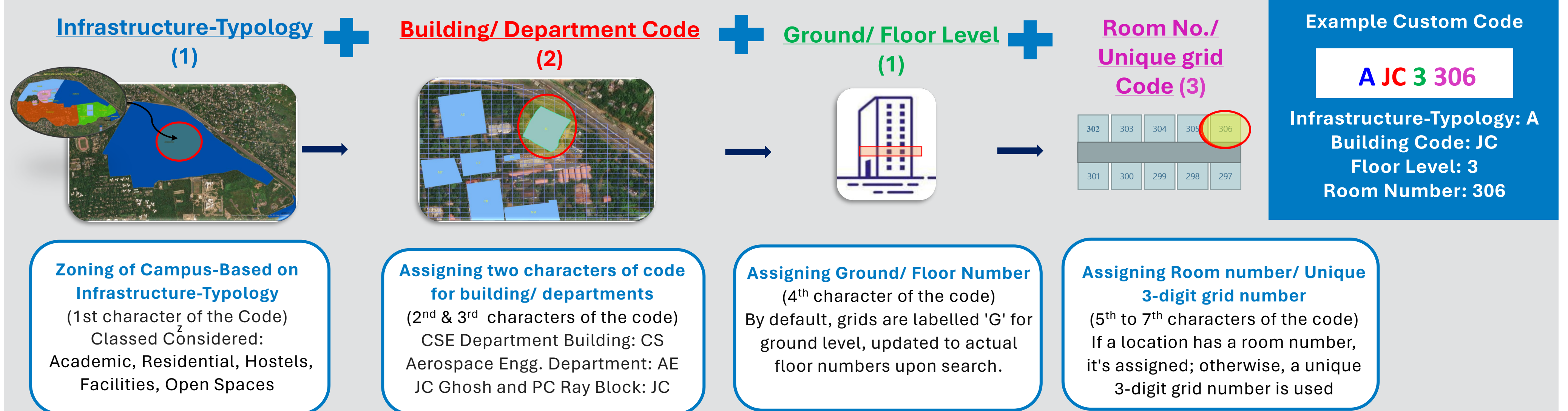


Phase 2: NLP Models and Application development



Implementation done using ArcGIS core GeoAI workflow

Custom Geohashcode Nomenclature



Conclusion

- A new geocoding system for IIT Kharagpur, blending Geohashing, VGI, and NLP has been developed.
- It divides the campus into manageable grid cells with custom geohash codes for precise navigation.
- These codes are versatile and user-friendly, applicable beyond campus boundaries in various contexts such as urban planning and emergency response, simplifying location input with speech recognition integration.

Use case in other domains

- Integrating ULPIN and Bhu Aadhar with geohash codes streamline land consolidation by offering precise parcel identification and spatial analysis.
- This fusion enhances land management efficiency, accuracy, and transparency, simplifying the merging of adjacent parcels.

Acknowledgement

I extend heartfelt gratitude to Dr. Bharath H. Aithal (Associate Professor, IIT Kharagpur) for invaluable mentorship, and to all supporters and my dear ones for unwavering encouragement. Special thanks to Dr. V S S Kiran (CEO, Garudalytics Pvt. Ltd) for his support throughout my project.

Results

➤ Additionally, users can generate custom codes for their locations, integrated into a WebGIS application with voice and navigation tools for simplified geospatial exploration.

➤ Spacy's NER model extracts location entities from text with high precision (**0.887**) and recall (**0.853**) and **F1 score of 0.87**, linking mentions to the database for enhanced usability.

➤ A BERT-based QA model efficiently answers **indirect questions**, enriching the system's information retrieval capabilities.

- The Geohashing algorithm divides the campus into grids, each with a unique code stored in a PostgreSQL DB for precise location tracking.