

# INTEGRATING TERRESTRIAL LIDAR AND LARGE LANGUAGE MODELS FOR 3D OUTDOOR SCENE UNDERSTANDING AND COMPLEX SPATIAL REASONING

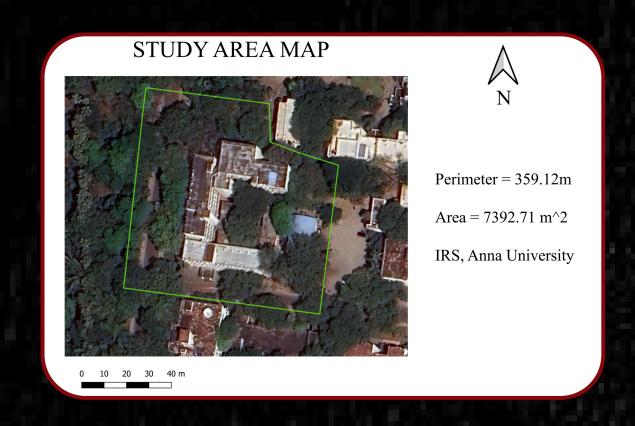


### INTRODUCTION

This project uses LiDAR technology to capture detailed 3D scans of real-world environments and applies machine learning to automatically detect and classify features like buildings, benches, and trees. By transforming raw point cloud data into organized, meaningful information, and integrating an Al-powered interface that responds to natural language queries, the system makes spatial data accessible and useful for everyone. The goal is to support smarter decision-making and create more responsive, user-friendly environments.

#### STUDY AREA

### INTRUMENT USED







RIEGL VZ 400i

# METHODOLOGY

**GCP Point Collection** 

Acquire LiDAR data

Pre Processing

**Down Sample** 

Noise Removal

**Cloth Simulation Filter** 

Point based Classification

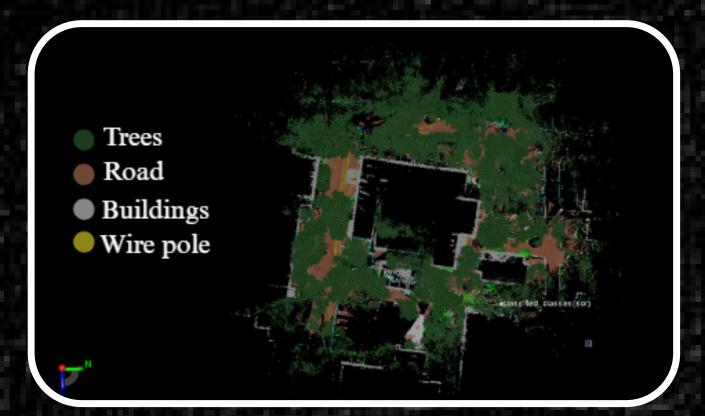
Object Classification

**Store Data in a Structured** File Format

Build LLM with RAG system

Query the UI to retrieve external answers.

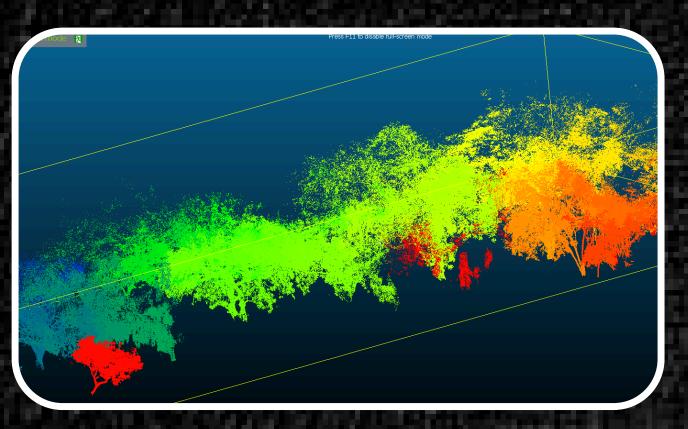
### RESULTS



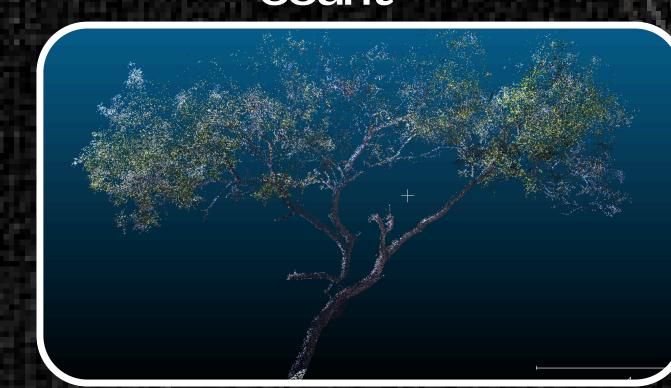
Classified las file (point based)



Yellow marked area is (POI) for tree count

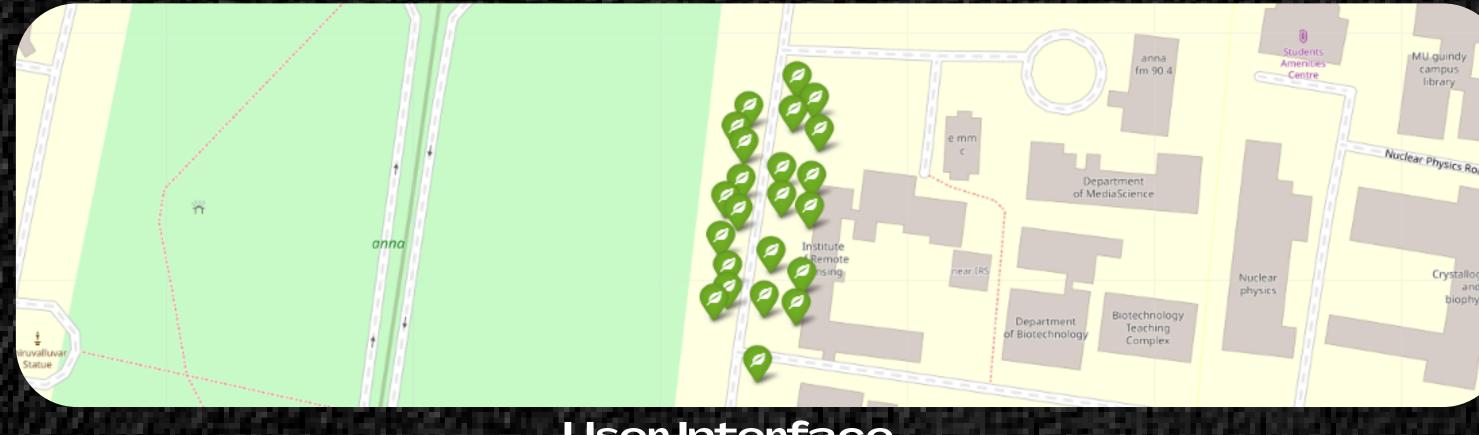


Final output las file



Tress points clustered into one object

	Urban Asset	Query Chatbot
Ask about urban assets		Answer
how many trees are there?		There are 23 trees.
Clear	Submit	Flag
		anna fm 90.4 Students Amenities Centre librar



User Interface

## CONCLUSION

We developed an Al-powered system that accurately detects and classifies campus assets from LiDAR point cloud data. The system structures spatial metadata in GeoJSON format and enables natural language querying through an LLM interface. This approach significantly enhances the efficiency, accessibility, and intelligence of campus asset mapping and management.

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