GEO
SPATIAL

Project Catalog

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Sharjeel

Exploring the Potential of Geoinformatics

To me, geoinformatics is not just about producing maps. It is fundamentally about interpreting the world around us through data. This catalog highlights how I use spatial analysis and remote sensing to tackle specific challenges like assessing urban temperature variations or developing interactive web-based GIS tools. My goal with every project is to take raw information and transform it into visual stories that drive sustainable decision-making. I want to show that when we combine rigorous analysis with clear design, we can turn complex geography into actionable insights that truly make a difference.

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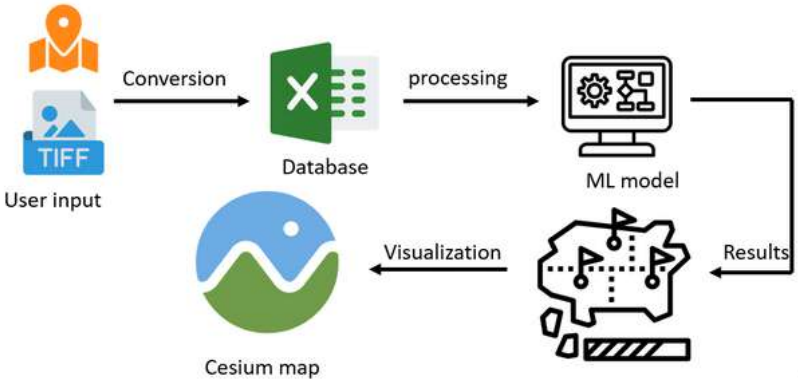
Landslide Prediction

Key deliverables

This project aims to predict landslide susceptibility and exposure risks by integrating diverse environmental and terrain-related datasets using Machine Learning and GIS techniques. A Random Forest algorithm powers an automated, web-based early warning system that provides real-time alerts and 3D visualizations to communities and authorities, enabling proactive disaster mitigation.

- These systems help us understand where landslides are most likely to occur, allowing for proactive measures like building restrictions or evacuation plans.
- Early detection of triggers like heavy rainfall allows authorities to warn communities before a landslide strikes, enabling evacuation and reducing casualties.
- Knowing landslide risks helps communities prepare emergency response plans, stockpile resources, and conduct public awareness campaigns.



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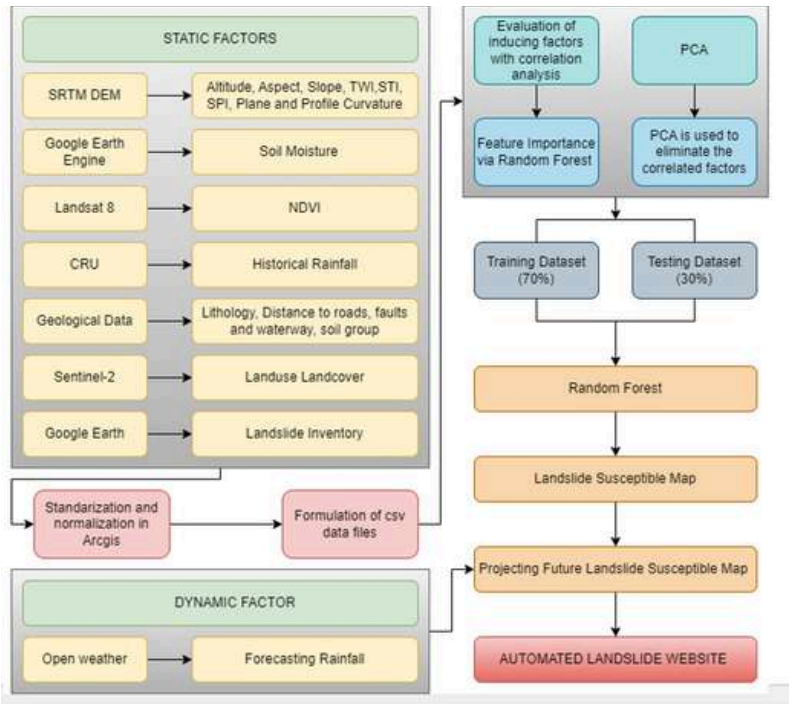
Constructed an interactive web dashboard featuring 3D geospatial visualizations and a crowdsourcing interface, allowing communities to visualize high-risk zones and contribute real-time ground observations for model validation.

- Engineered a multi-source spatial data pipeline by integrating satellite imagery (Landsat 8, Sentinel-2), SRTM DEM, and geological datasets to derive critical static factors like slope, aspect, and NDVI
- Performed rigorous data preprocessing and feature optimization using ArcGIS for standardization and Principal Component Analysis (PCA) to eliminate correlated variables and enhance model efficiency.
- Developed a predictive machine learning model using Random Forest, training it on historical landslide inventories to generate high-precision Landslide Susceptibility Maps (LSM).

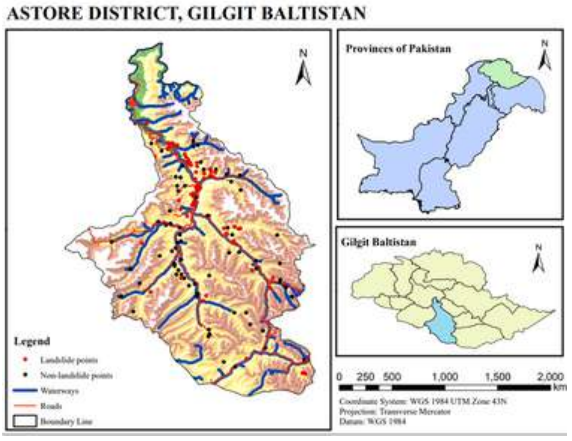


I contributed to this project as the team lead, during the final year of my undergraduate program.

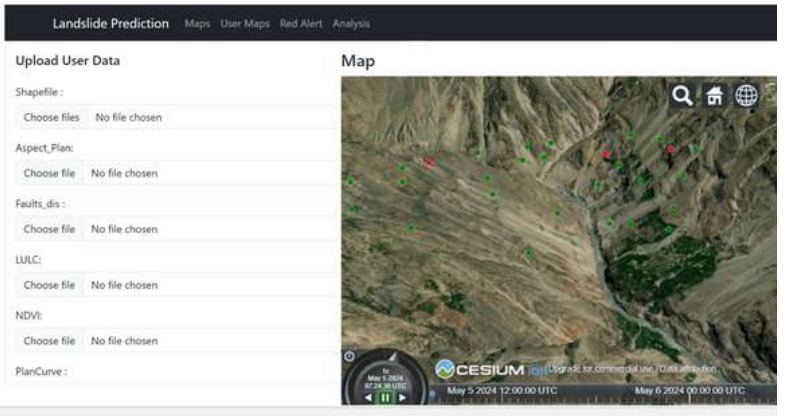
Landslide Prediction

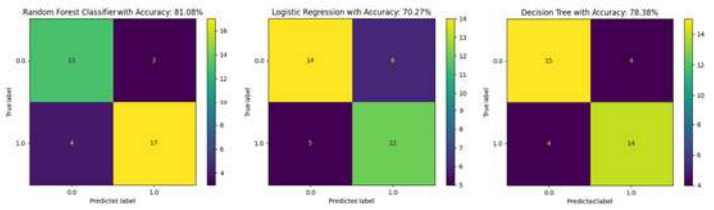
QGIS MySQL python Flask node.js React GeoServer Google Earth Engine ArcGIS jupyter

- Integrated real-time meteorological data via the OpenWeather API to account for dynamic rainfall triggers, enabling the system to project future susceptibility based on live weather forecasts.

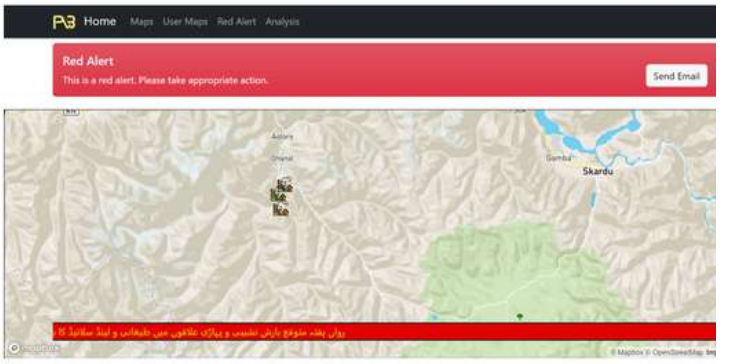


- Deployed an automated web-based warning system that visualizes risk zones and delivers actionable alerts, supporting disaster risk reduction for vulnerable communities.

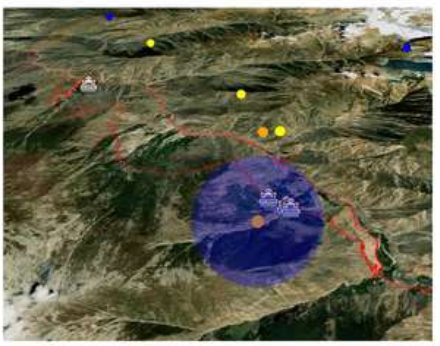




WARNING ALERT



RISK EXPOSURE ANALYSIS



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Web Maps

Leaflet mapbox OSM OpenStreetMap TECH STACK

Key deliverables

Developing and deploying interactive web maps using **Leaflet.js** and **Mapbox**, enabling users to explore geospatial data from multiple dynamic sources.

- Created a graduated symbol map to visualize global sales performance, enhancing strategic decision-making through spatial insights.

- Developed a custom **WordPress** geolocation tool that returns administrative boundaries (cities, countries) on search, effectively replicating Google Maps API functionality and offering a cost-free alternative for boundary queries.

- Integrated Excel-based datasets directly into the map interface, allowing users to click markers for rich, location-specific details streamlining data interpretation without backend processing.

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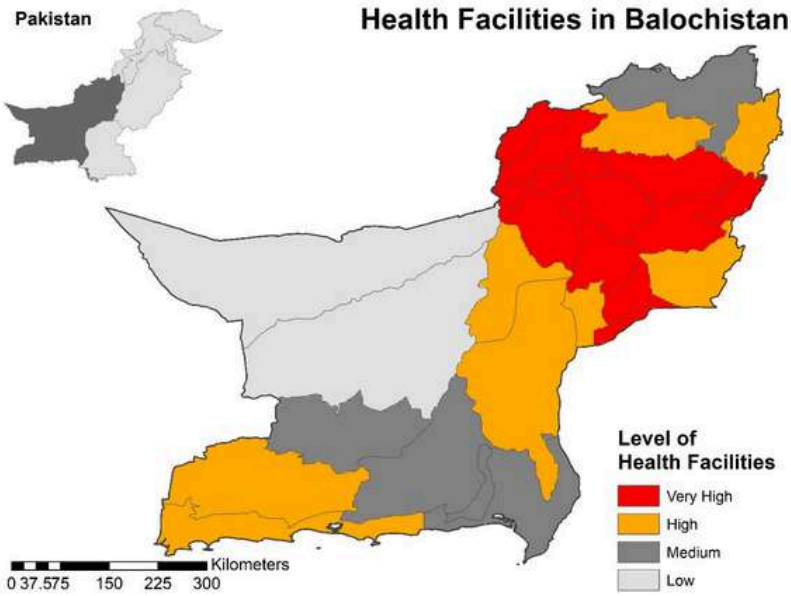
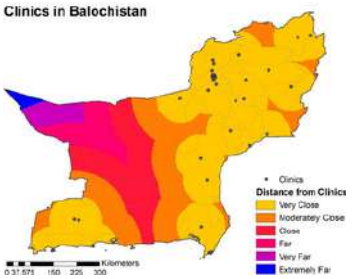
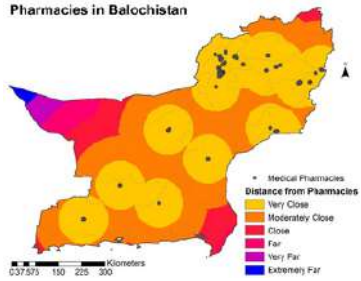
Static Maps

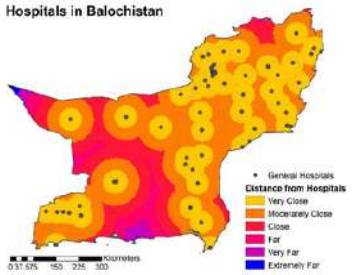
ArcGIS QGIS TECH STACK

- Proficient in creating static maps using **ArcMap** and **QGIS**, with full workflow capabilities: data cleaning, geoprocessing, spatial analysis, and cartographic design.

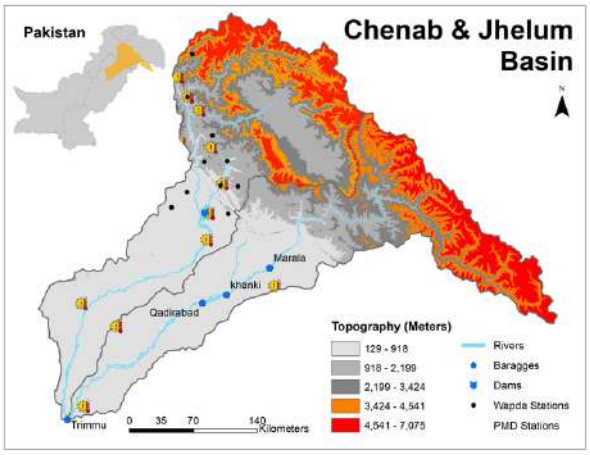


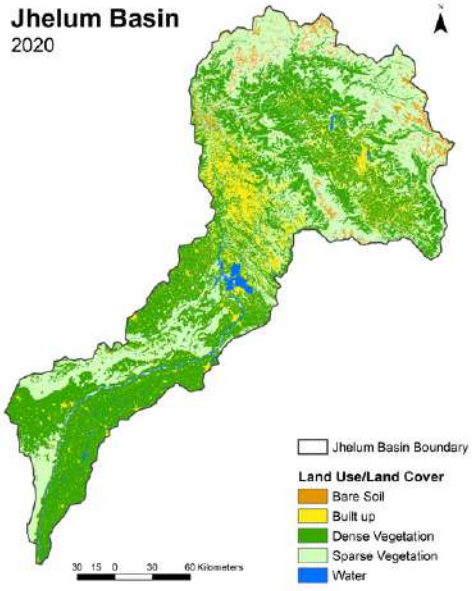




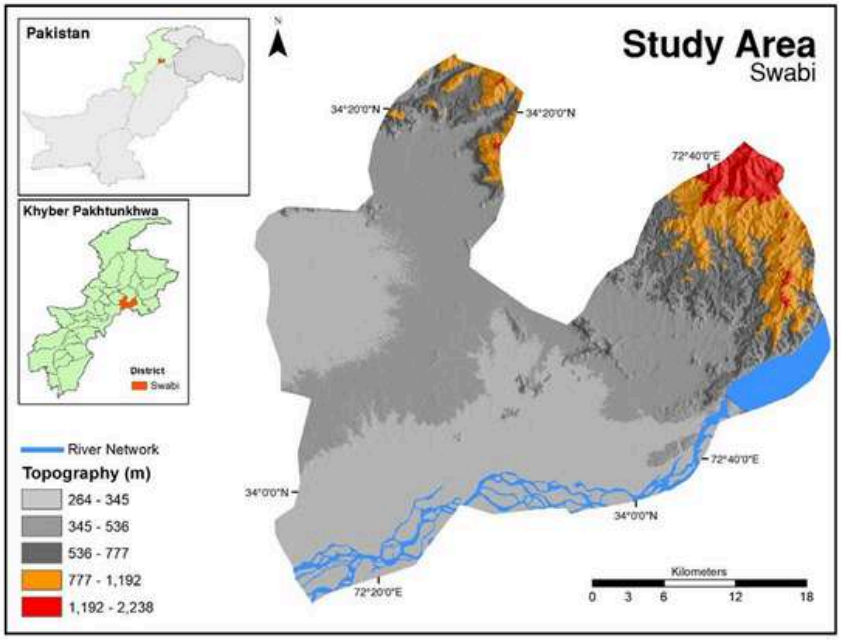


- Developed a spatial analysis project evaluating health facility access across districts by applying Euclidean distance analysis and spatial overlays (using maximum operation), classifying regions into high, medium, and low accessibility.





- Demonstrated advanced cartographic design skills, producing visually compelling, information-rich maps that balance clarity, precision, and aesthetics effectively communicating complex spatial patterns.



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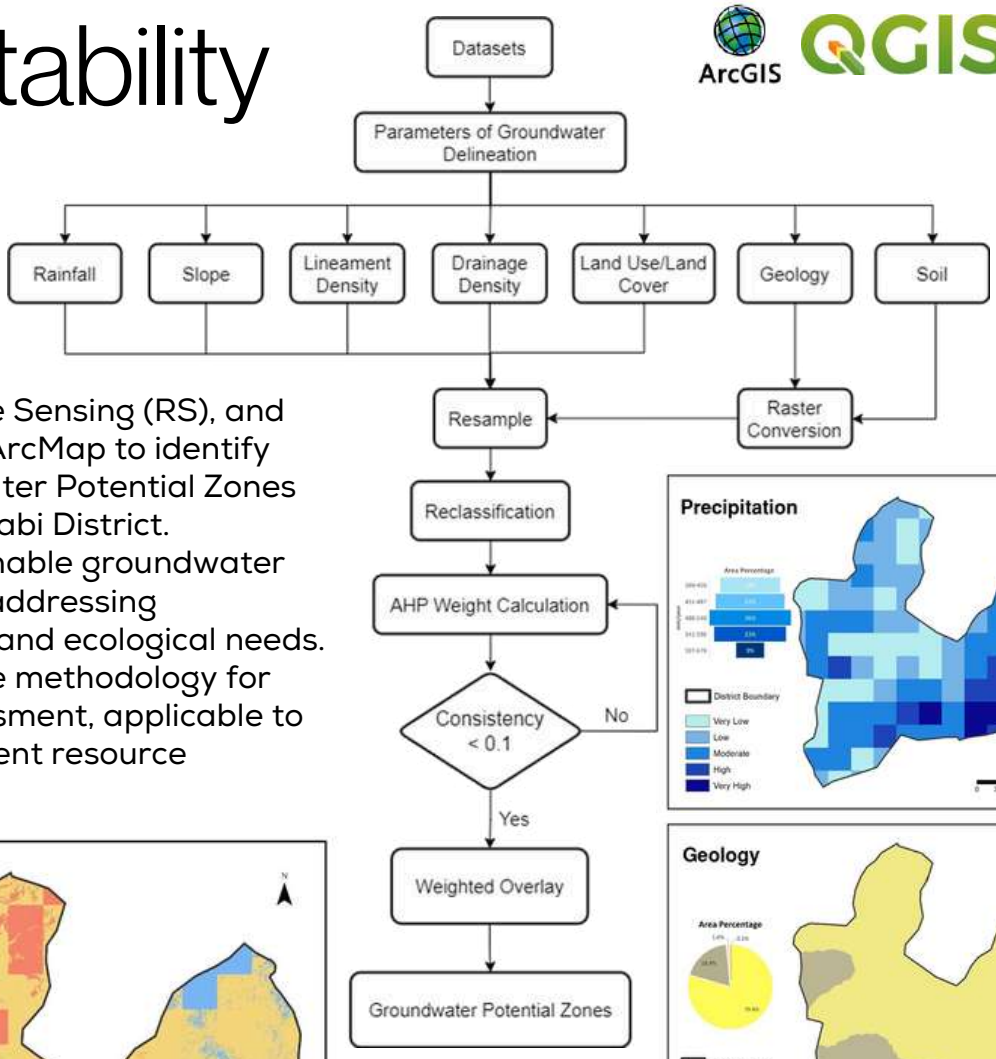
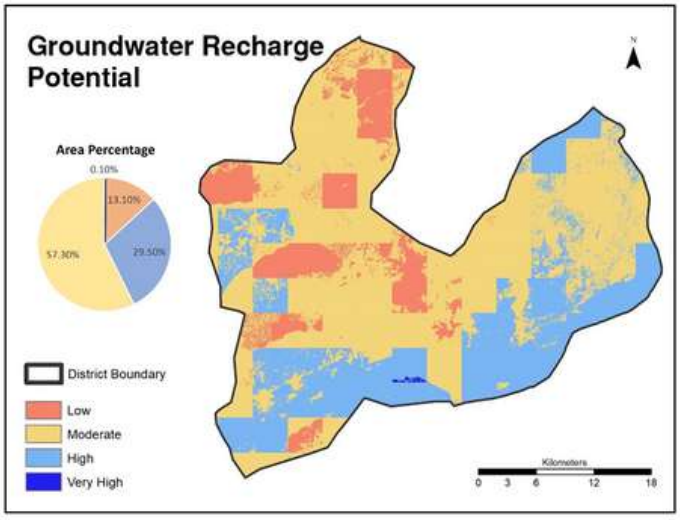
Site Suitability

ArcGIS QGIS TECH STACK

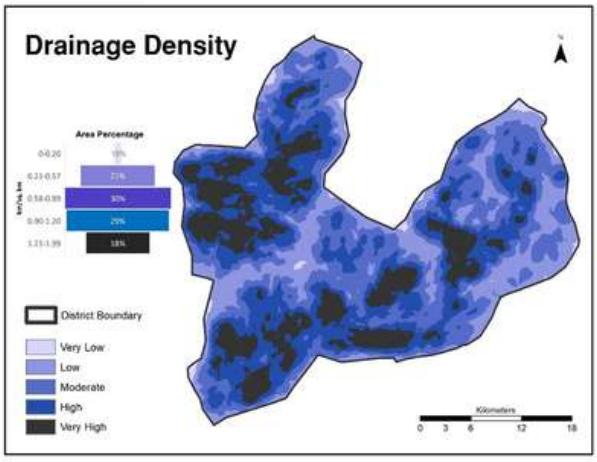


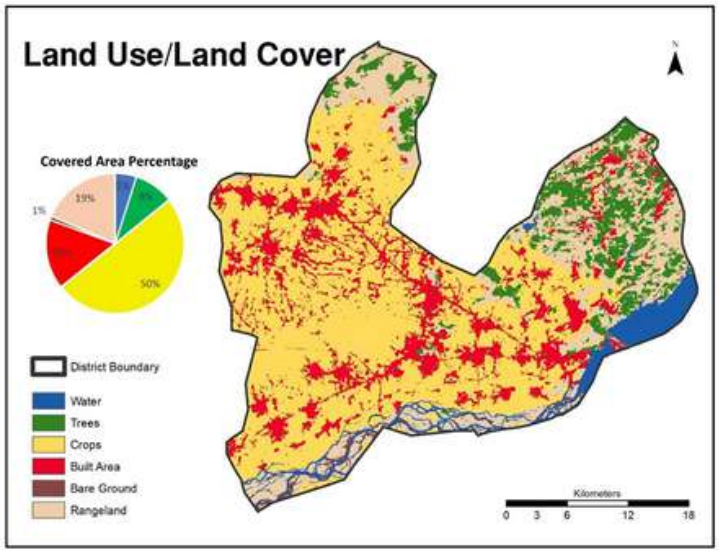
Key deliverables

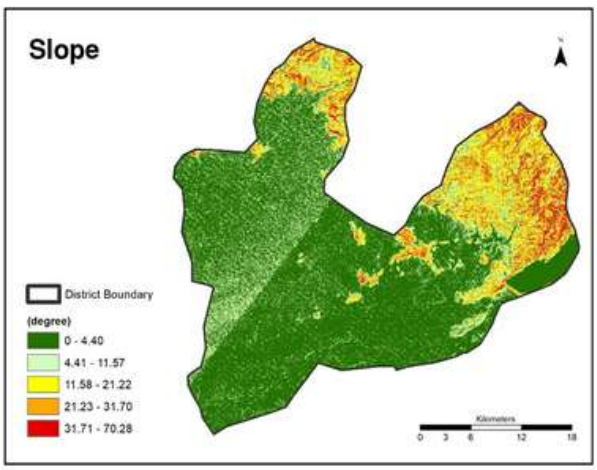
- Utilized GIS, Remote Sensing (RS), and AHP techniques in ArcMap to identify and map Groundwater Potential Zones (GWPZs) across Swabi District.
- Developed a sustainable groundwater management plan addressing agricultural, urban, and ecological needs.
- Proposed a scalable methodology for groundwater assessment, applicable to any region for efficient resource management.



- Created detailed thematic maps showcasing GWPZs, integrating various spatial datasets for clear, actionable insights.







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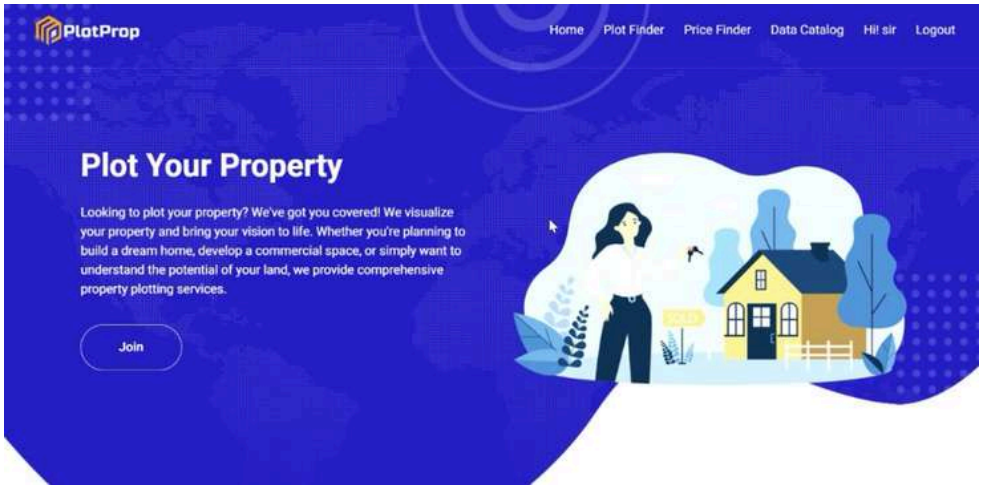
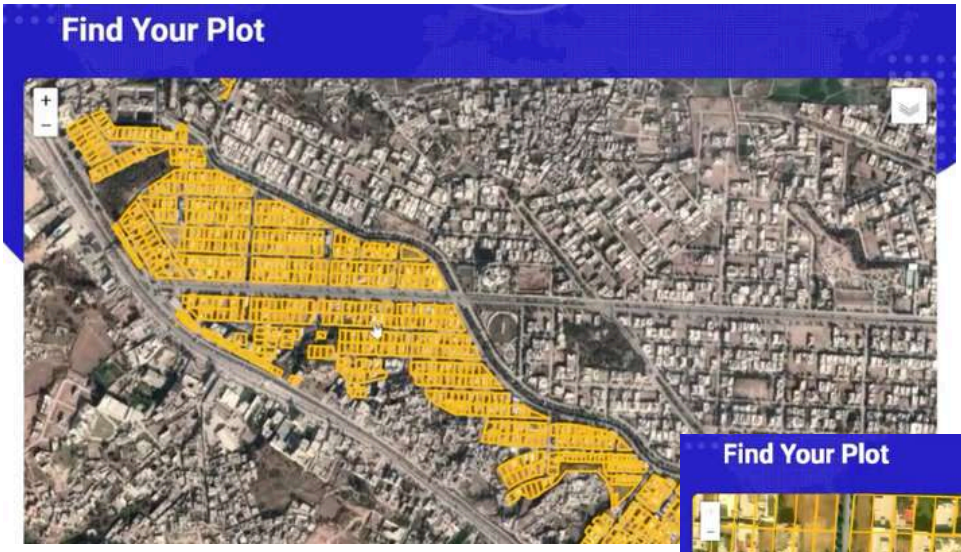
Plot Prop

PostgreSQL GeoServer django TECH STACK

Key deliverables

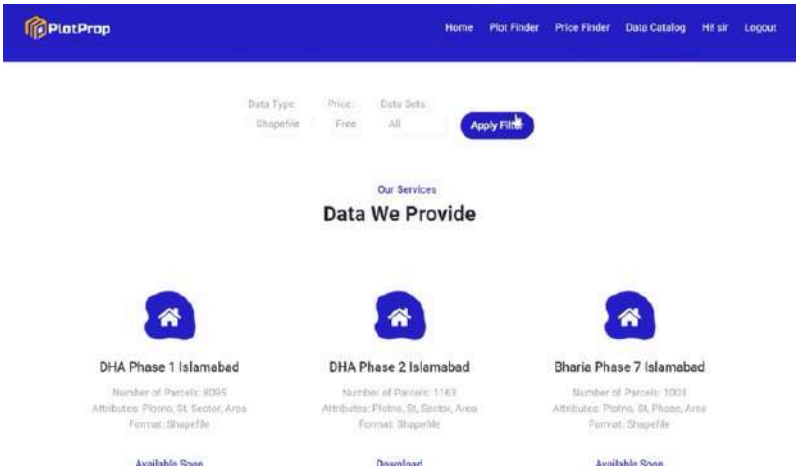
- Developed a full-stack GIS web application using PostgreSQL, Django, **Bootstrap**, and GeoServer to manage and visualize real estate plots.





- Integrated WMS and WFS services from **GeoServer**, applied custom **SLD** styling, and rendered interactive map layers via Leaflet—enabling users to click plots and view detailed property information.

- Implemented user authentication and role-based access using Django's built-in libraries, allowing admins to access extended analytics and management features.



- Enabled polygon-based spatial search for plots within a user-drawn area, returning results dynamically via AJAX.
- Explored and tested multiple data formats (e.g., XML) for flexible data ingestion and interoperability.

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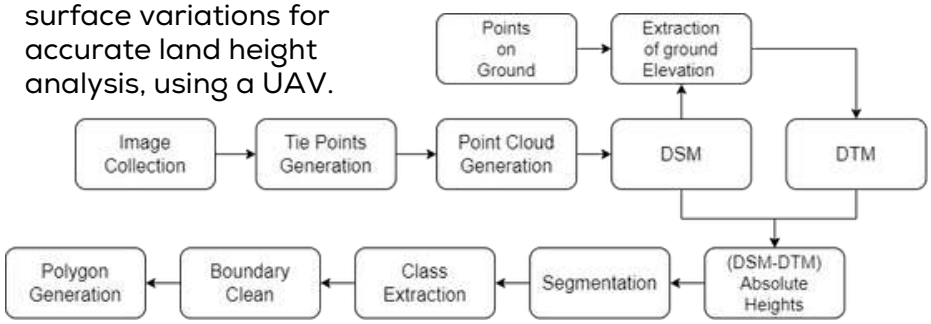
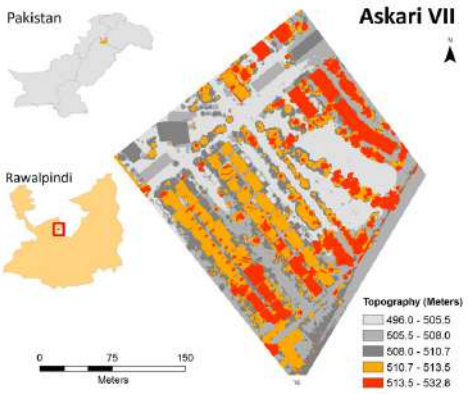
Digitization Automation

ArcGIS QGIS TECH STACK

Key deliverables

- Developed an automated system to extract land parcels from high-resolution UAV imagery using GIS spatial tools, significantly streamlining cadastral mapping for urban planning.
- Generated precise **Digital Surface Models** (DSMs) and Digital Terrain Models (DTMs) to capture terrain elevation and built-up surface variations for accurate land height analysis, using a UAV.

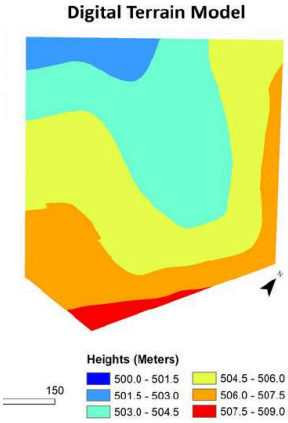


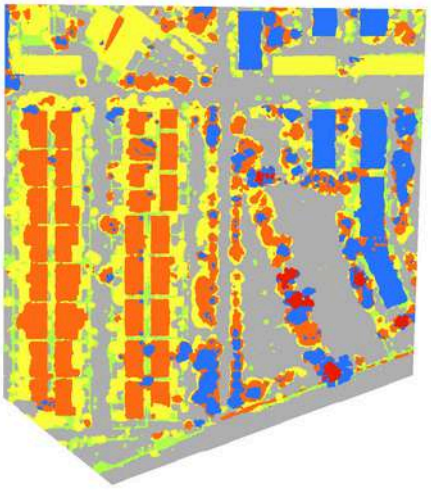


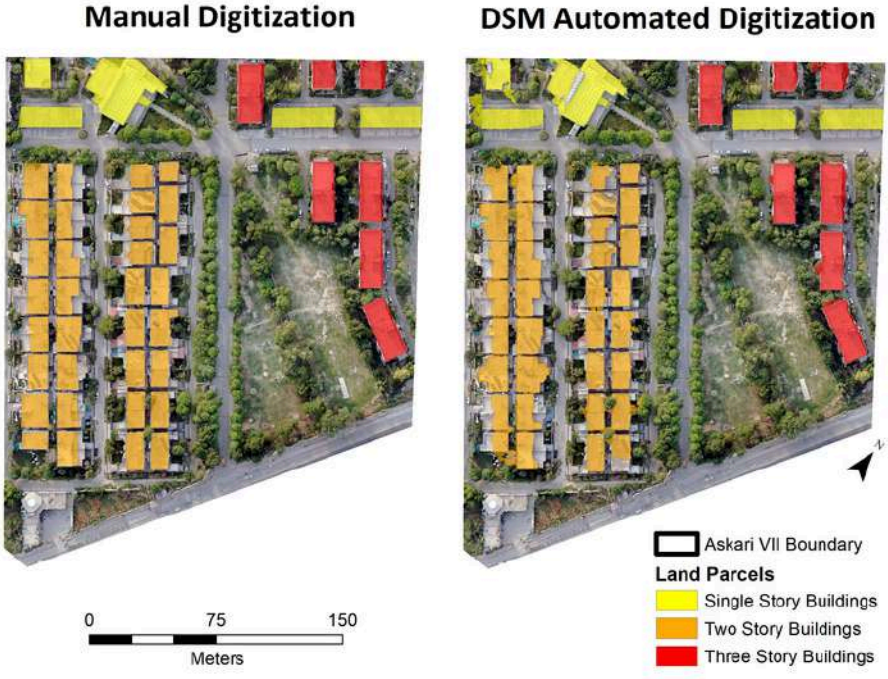
- Integrated UAV-captured imagery to produce high-resolution orthomosaic datasets for urban land analysis.
- Automated land parcel boundary extraction using ArcGIS and Pix4D, reducing reliance on manual digitization.
- Generated detailed DSM and DTM layers to accurately compute parcel elevations, supporting effective land valuation and management.

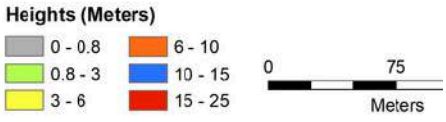
- Delivered a cost-effective and time-efficient workflow that reduced manual digitization efforts in land management processes.
- Contributed to data-driven, transparent urban planning by improving accuracy in land boundary delineation and supporting evidence-based decision-making for sustainable development initiatives in Pakistan.

https://doi.org/10.31428/10317/13599









Utilized GIS-based tools to overlay digitized boundaries onto topographic and cadastral maps, ensuring accurate representation of spatial features.

Snapshot of the 3D Model

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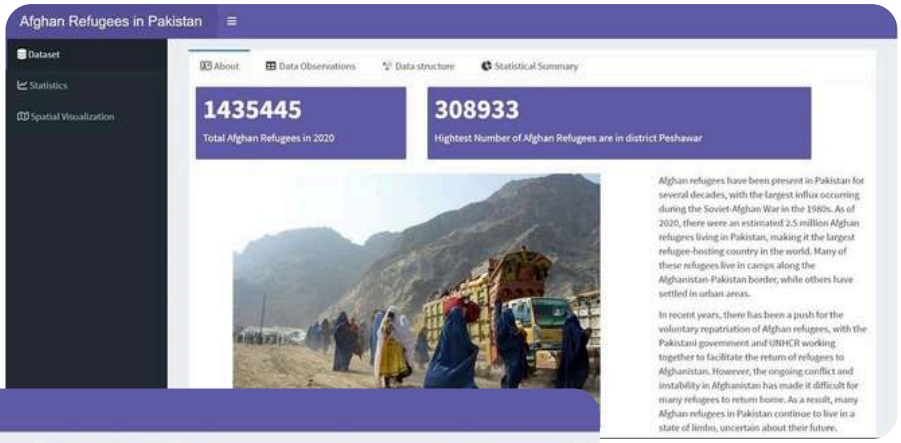
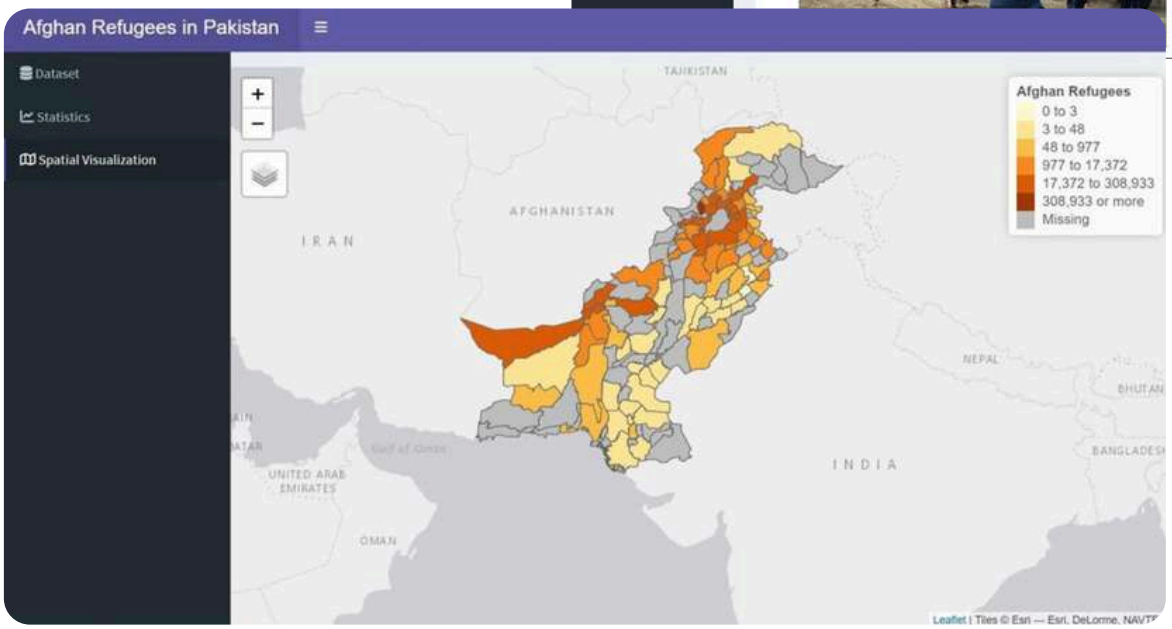
Statistical Dashboard

TECH STACK

Key deliverables

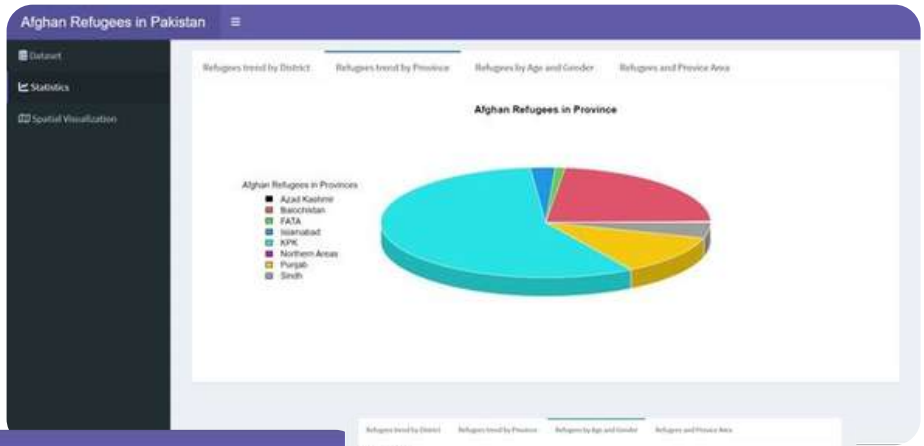
- Developed a statistical dashboard using the **R Shiny** framework to visualize refugee distribution across districts in Pakistan.
- Integrated CSV-based statistical data with district-level shapefiles using sf, leaflet, and rgdal libraries for spatial mapping.

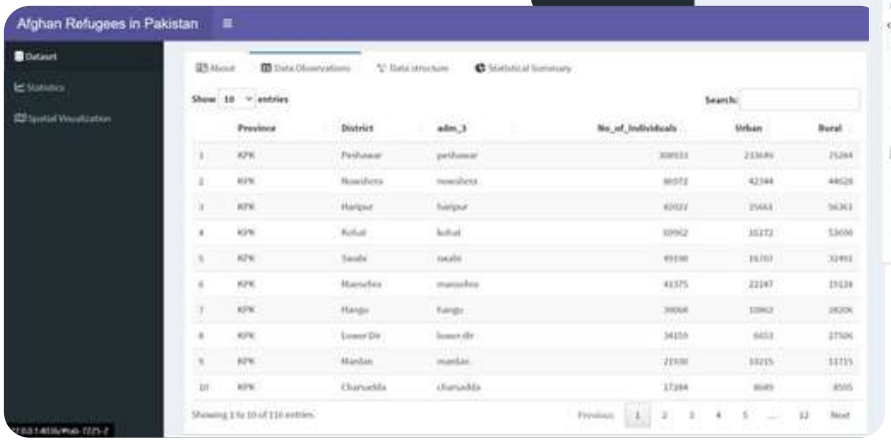




- Presented key indicators through interactive bar charts, pie charts, and data tables using **ggplot2** and plotly for dynamic user exploration.

- Enabled policy-level insights by linking spatial and numerical data into a cohesive, user-friendly interface—supporting data transparency and humanitarian planning.





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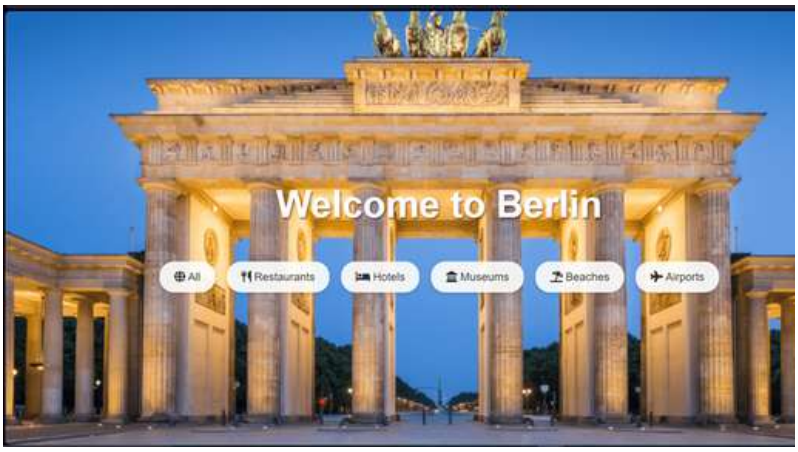
Berlin Map

Key deliverables

- Develop an interactive Mapbox GL JS interface to visualize distinct tourist categories, including museums, hotels, restaurants, and recreational spots.
- Render custom GeoJSON data layers to provide spatial context and categorize points of interest across the Berlin cityscape.
- Integrate Google Maps Geocoding API to enable precise address search functionality, allowing users to locate specific destinations instantly.
- Design interactive popups that display essential location details and imagery immediately upon selecting a specific point of interest.
- Optimize map rendering performance to ensure smooth zooming, panning, and rotation for a seamless user exploration experience across devices.



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THANK YOU