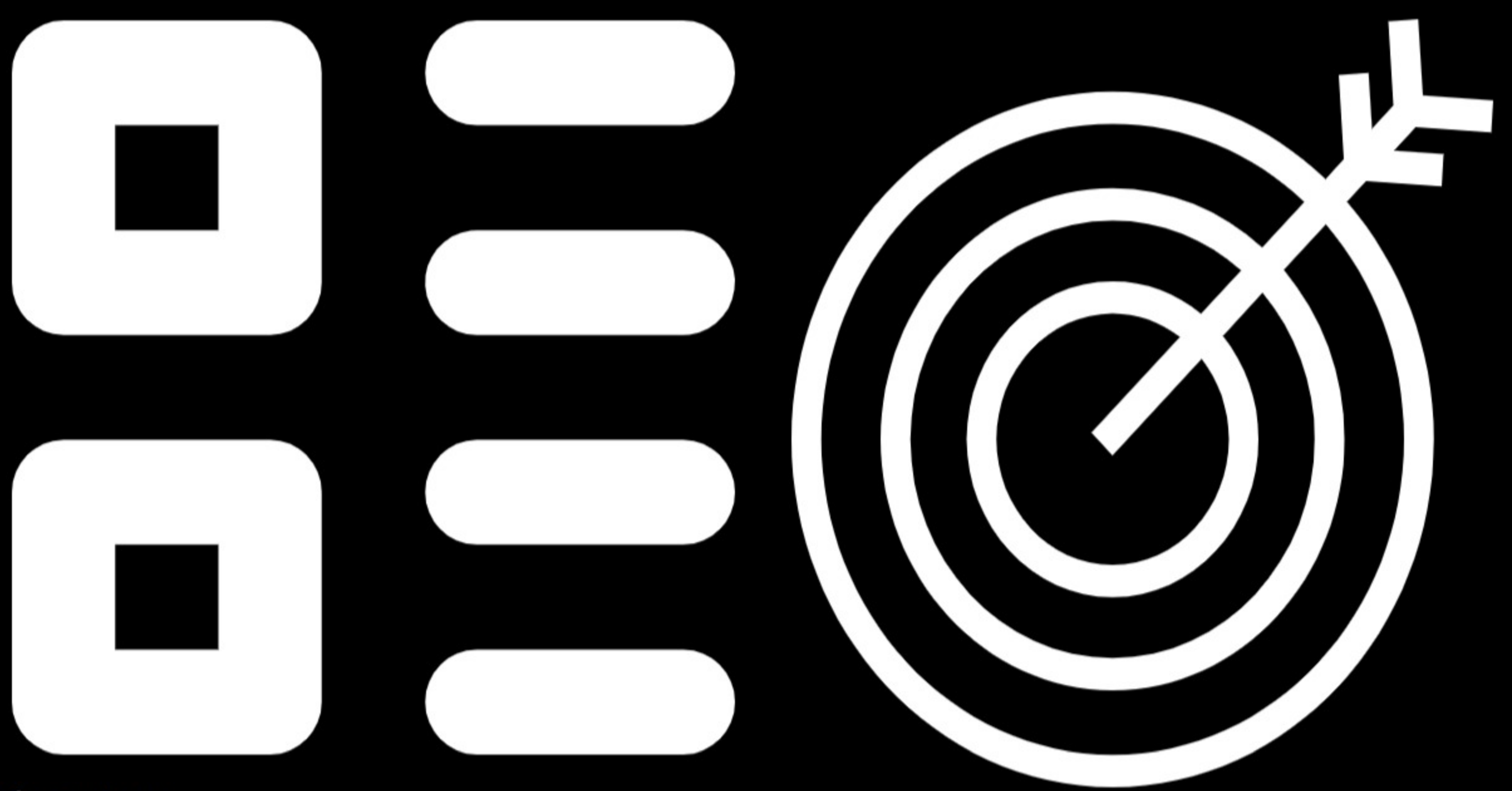


Satellite Image Matcher & Coordinate Projector



Visual tool for aligning aerial and reference satellite images and projecting coordinates



Overview.

This desktop application allows users to load high-resolution satellite reference and aerial images, perform feature matching, compute homography, and project pixel coordinates onto a geo-referenced map. Built with OpenCV, SIFT, and Tkinter, it serves as a lightweight GIS-inspired tool for educational and field applications.

Objective.

Load aerial and reference satellite images.
Perform accurate SIFT-based feature matching.
Compute a homography matrix for alignment.
Project aerial points to reference image coordinates.
Convert to real-world latitude/longitude.



Tools.

- **Language:** Python
- **GUI:** Tkinter
- **Libraries:** OpenCV, SIFT, Pillow, NumPy
- **Image Formats:** PNG (Aerial), TIFF (Reference)

System Workflow.

1. Load a reference image (geo-referenced TIFF)
2. Load aerial images (resized and aligned)
3. Compute features via SIFT
4. Match keypoints with Lowe's ratio test
5. Calculate Homography using RANSAC
6. On click, project points to reference and convert to lat/lon

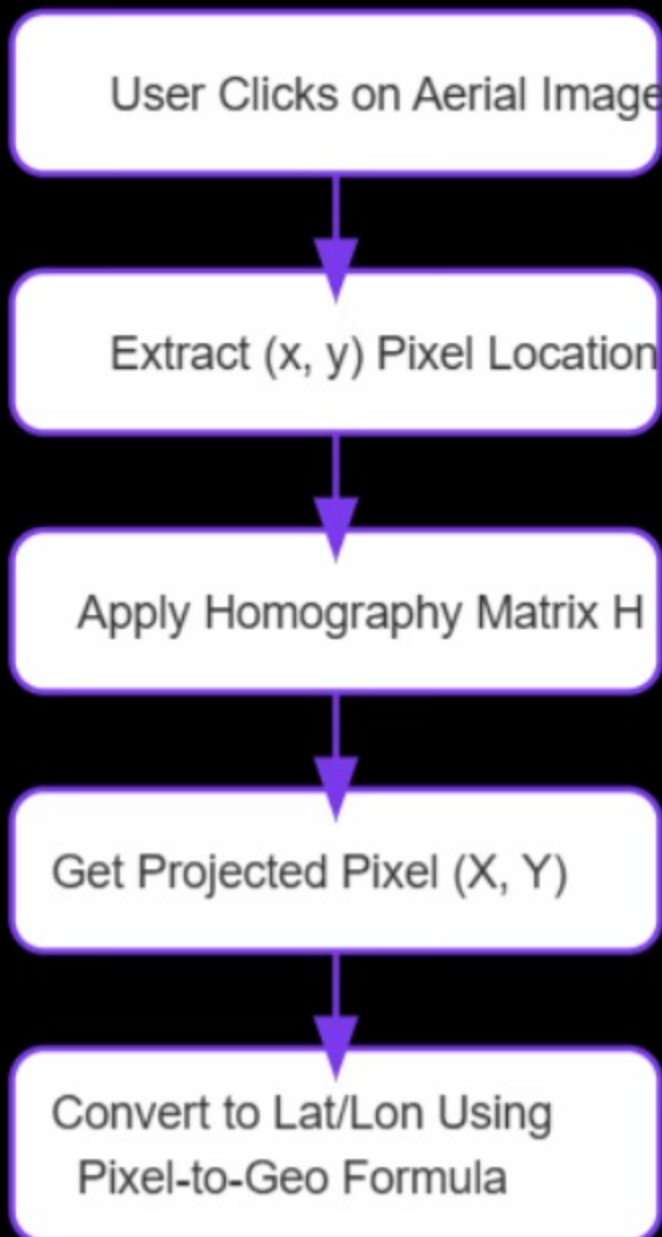
Geo-Projection and Interaction Logic

This section highlights how the user interaction system works with homography to project aerial points into geographic coordinates. It covers the click handling, coordinate transformation using the homography matrix, and the conversion to lat/lon based on image scaling.

Challenges & Process

- Ensuring robust feature matching under varying resolutions
- Handling poor aerial image quality and limited overlap
- Homography instability due to outliers (solved via RANSAC)
- Maintaining UI responsiveness during image rendering

Flowchart



Results, Learnings, and Impact

The application successfully overlays and aligns aerial and reference images using SIFT-based homography. Projected points reflect accurate spatial correspondence. This project highlighted the importance of normalization, image preprocessing, and point selection in geospatial workflows.