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INTEGRATED SURVEYING OF THE IGREJA DA PENHA IN RIO DE JANEIRO: PLANIMETRIC AND ALTIMETRIC DOCUMENTATION FOR HERITAGE AND CADASTRAL PURPOSES

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INTRODUCTION

To produce accurate 3D documentation for heritage conservation and analysis.

Techniques combined:

GNSS;
UAV photogrammetry;
Terrestrial Laser Scanning (TLS) and
Conventional topographic methods.

Outcomes:

High-precision 3D models.

Georeferenced orthomosaic.

Multidimensional datasets for restoration, monitoring, and scientific studies.

Image 1 - GNSS

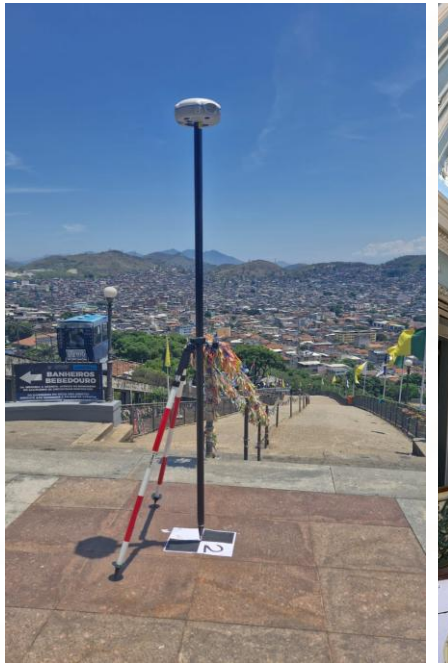


Image 2- TLS

Image 3 - UVA

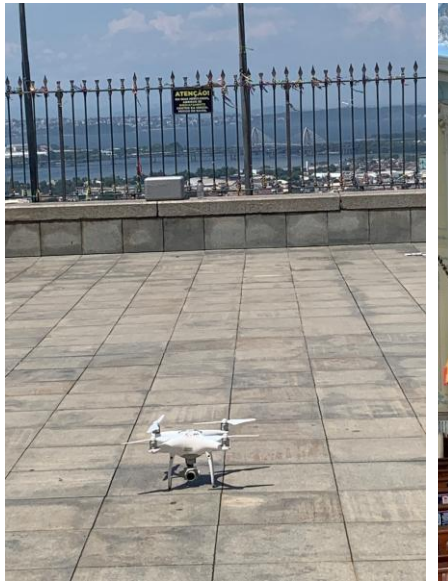


Image 4 - Conventional topographic

Source: Author

ABOUT THE CHURCH

Origin: 1635, when Captain Baltazar de Abreu built a chapel in gratitude after a miraculous event.

Became one of Rio's most important centers of Marian devotion.

382-step staircase built in 1819; expanded throughout the 19th and 20th centuries.

Elevated to the rank of Minor Basilica by Pope Francis in 2016.

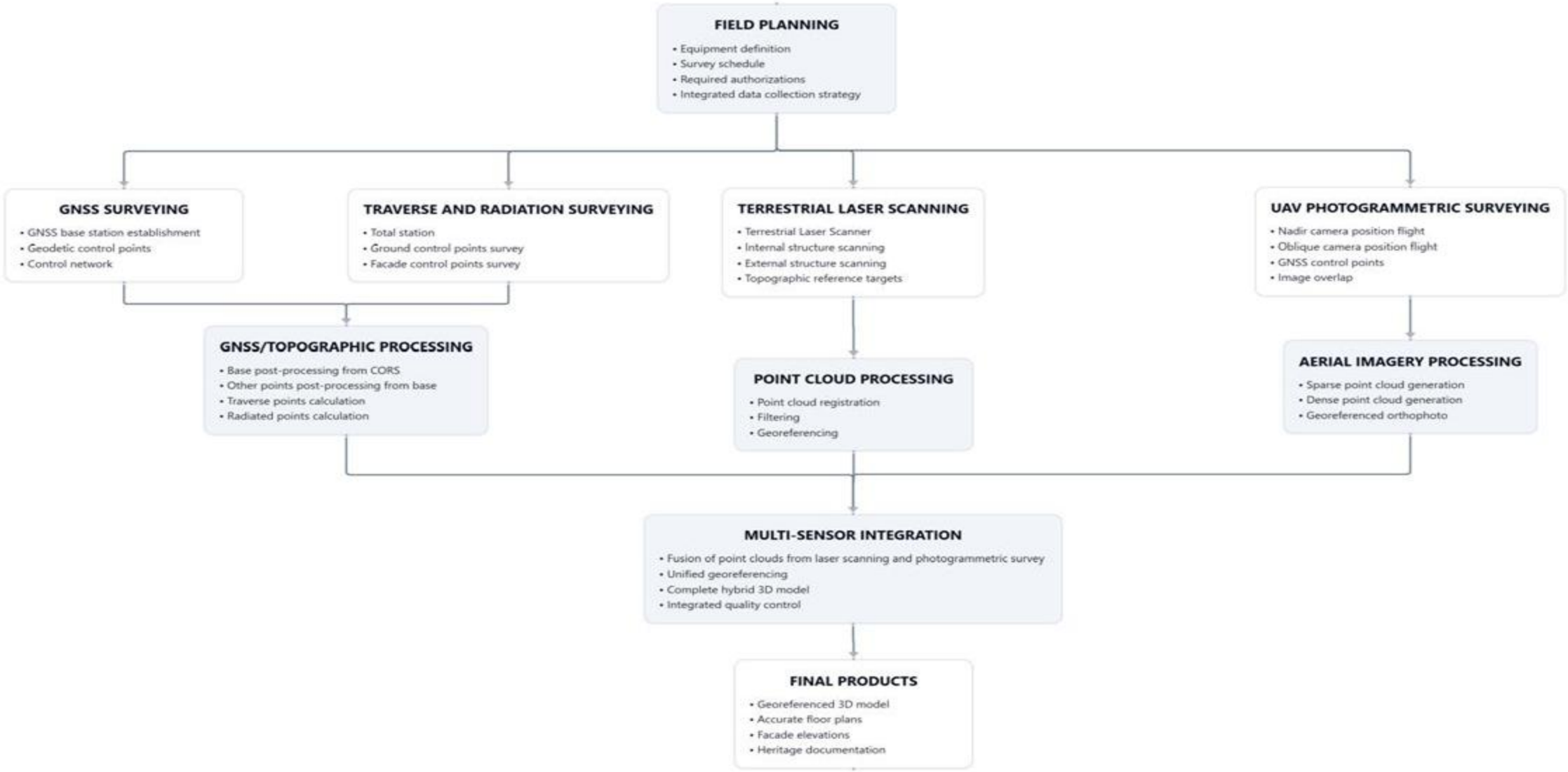
Complex includes the Hall of Miracles, museum, and cultural spaces.

The annual "Festa da Penha" is a key religious and cultural celebration in Rio de Janeiro.

Image 05 - Church of Penha, Rio de Janeiro

Source: Church of Penha, Rio de Janeiro

METHODOLOGY



RESULTS

High-resolution 3D reconstruction combining aerial photogrammetry and laser scanning.

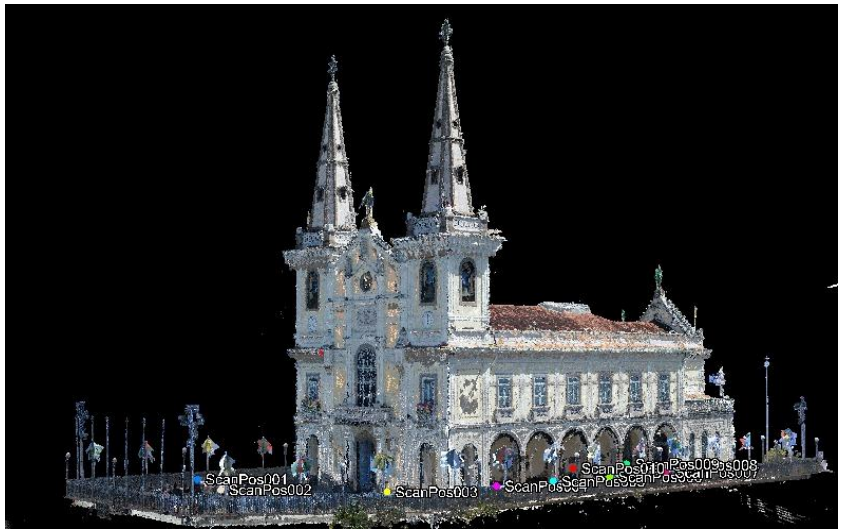
Accurate, dense point clouds and detailed textured model.

Reliable georeferencing and strong geometric consistency.

Integrated datasets improved coverage, continuity, and documentation quality.

Image 06 - Preliminary 3D model of the Penha Church and its limits

Image 07 - Alignment of aerial and terrestrial point clouds



Source: Author

Image 08 - 3D model

Source: Author

CONCLUSION

The integrated use of geotechnologies enabled precise and comprehensive 3D documentation of the Basilica.

Supports:

Architectural and structural analyses.

Restoration and conservation planning.

Long-term heritage management.

Highlights how multisensor integration ensures both metric precision and visual fidelity.

Reinforces geotechnologies as essential tools for sustainable cultural heritage preservation.

Image 09 - Our Lady of Penha

Source: Author

Uerj Official
@uerj_oficial

The Basilica Sanctuary of Penha received its first 3D mapping in October of last year. This pioneering initiative seeks to preserve the church's memory for future tourism promotion. The work brought together professors and students from the Engineering Faculty of UERJ (Rio de Janeiro State University). Read more:

Translate post

From uerj.br

3:16 pm · 17 Jan 2025 · **611** Views

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