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A Comparison of Photogrammetric Methods for the 3D Surveying of Civil Buildings

Arli Llabani[1], Eduart Blloshmi[2], Bledar Sina[2]
[1]Faculty of Civil Engineering/Polytechnic University of Tirana
Rruga Muhamet Gjollesha, Tirana, 1010, Albania
arli.llabani@fin.edu.al; eduart.blloshmi@fin.edu.al; bledar.sina@fin.edu.al
[2]Faculty of Civil Engineering/Polytechnic University of Tirana
Rruga Muhamet Gjollesha, Tirana, 1010, Albania

Extended Abstract

Photogrammetry has emerged as a pivotal technology in the 3D surveying of civil buildings, offering detailed and accurate models essential for construction, restoration, and urban planning. This study conducts a comprehensive comparison of three widely-used photogrammetric methods: Traditional Close-Range Photogrammetry (CRP), Unmanned Aerial Vehicle Photogrammetry (UAV-P), and Terrestrial Laser Scanning (TLS) [1], [2].

Each method is evaluated based on key performance metrics including accuracy, efficiency, cost-effectiveness, and suitability for various building types and surveying scenarios. CRP involves capturing images from multiple angles using standard digital cameras, which are then processed into 3D models. This method is highly accurate for small to medium-sized buildings with straightforward geometries and clear lines of sight, but its efficiency diminishes as building complexity increases due to the intensive manual effort required for image capture and processing. UAV-P, on the other hand, utilizes drones equipped with high-resolution cameras to capture aerial imagery, providing excellent coverage and efficiency for large and tall structures, particularly for roofs and external facades [3], [4].

However, UAV-P's accuracy can be affected by environmental factors such as wind, and its deployment is often limited by regulatory restrictions on drone flights. TLS combines photogrammetry with laser scanning technology, yielding superior accuracy and detailed 3D models, especially for complex architectural features and interior spaces. Despite its high accuracy, TLS is the most costly and time-consuming method due to the need for sophisticated equipment and extensive data processing [5].

The study involved the surveying of a diverse set of buildings, including residential, commercial, and historical structures, using each of the three methods. The resulting 3D models were compared to ground truth data obtained from traditional surveying techniques to evaluate accuracy [6].

Efficiency was measured in terms of the time required for data acquisition and processing, while cost-effectiveness was assessed by analyzing the expenses associated with equipment, software, and labor for each method. Suitability was evaluated based on the specific characteristics and requirements of different building types and surveying conditions. The findings indicate distinct advantages and limitations for each method: CRP is ideal for detailed surveys of small to medium-sized buildings but less efficient for larger, more complex structures [7].

UAV-P excels in efficiency and coverage for large-scale external surveys but faces challenges with accuracy in adverse environmental conditions and regulatory limitations. TLS offers the highest precision and detail, making it suitable for projects that demand intricate modeling, though its high costs and longer processing times are significant drawbacks.

The choice of photogrammetric method should therefore be guided by the specific requirements of the surveying project. A hybrid approach that integrates multiple techniques may provide the most balanced and effective solution, leveraging the strengths of each method to achieve optimal results [8], [9].

This comprehensive comparison underscores the importance of selecting the appropriate photogrammetric technique based on project-specific needs and highlights the potential for future advancements in photogrammetric technologies and hybrid approaches to further enhance 3D surveying practices. These insights are invaluable for practitioners seeking to optimize their surveying strategies and achieve high-quality 3D models of civil buildings [10].

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