



UNIVERSITY OF LIFE SCIENCES "KING MIHAI I" FROM TIMISOARA

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USING MODERN TECHNIQUES THROUGH AERIAL SCANNING

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Abstract: Real estate 3D modeling has revolutionized the fields of architecture, engineering, and construction by providing an advanced and accurate method for designing, visualizing, and managing buildings and other structures. This technology involves the use of specialized software to create detailed three-dimensional digital representations of buildings that can be interactively analyzed and modified. In the contemporary digital age, modern measurement technologies have become indispensable in the process of building modernization, playing a very important role in ensuring the accuracy, efficiency and sustainability of construction and renovation projects.

Technologies such as global positioning systems, total stations, laser scanning, digital photogrammetry and building information modeling have revolutionized the way real estate surveying and planning is done.

These technologies enable fast and accurate data collection, providing detailed information on land topography, building structure and urban infrastructure, thus facilitating informed decision-making and optimizing construction processes.

Building modernization involves not only adapting to current safety and comfort standards but also integrating innovative solutions to meet energy efficiency and sustainability requirements. Advanced measurement technologies play a key role in this context, enabling accurate assessment of the existing condition of buildings and real-time monitoring of the progress of renovation works. Thus, errors are much lower and resources are used more efficiently, helping to reduce costs and execution time.

This topic was chosen due to the significant impact that modern measurement technologies have on the construction industry and the need to understand and capitalize on these technologies in the current context of building modernization.

• Introduction

3D modeling has transformed digital interaction, allowing the creation of highly detailed virtual representations of objects, buildings and people. This technology is widely used in industries such as design, gaming, film, and augmented reality due to advances that reduce creation time and costs. Innovations such as photogrammetry, 3D laser scanning, artificial intelligence and machine learning have improved the accuracy and realism of 3D models, expanding their applications in areas such as telemedicine, training and planning.

• Material and method

3D modeling using the DJI Phantom 4 drone, together with PIX4D Capture and Agisoft Metashape software, is a state-of-the-art technology that allows the creation of realistic three-dimensional models and details of terrain, buildings and complex objects. DJI Phantom 4 is a drone equipped with a high-resolution camera that captures images from multiple angles and at different altitudes, thus obtaining a rich and varied data set.

PIX4D Capture software is used to plan and automate drone flight paths, establishing data collection points and parameters critical to image accuracy. This allows consistent images to be obtained.

After the images are captured, they are fed into Agisoft Metashape, an advanced photogrammetry software, which aligns and combines them, creating a detailed 3D representation. Agisoft Metashape uses computational algorithms to recognize and record the coordinates of surface points, generating a realistic digital structure. Thus, the software provides complex details of topography, structure and textures that can be analyzed and searched to complete the decision-making process in large-scale projects.

These innovations are applicable in a wide range of industries, including cartography, architecture, urban planning, precision agriculture and construction, offering a fast, efficient and economical solution for projects that require detailed care. By using these methods, the time and costs associated with making 3D models are significantly reduced, and they are extremely accurate and realistic, thus contributing to the development and optimization of many fields.



DJI Phantom 4 drone



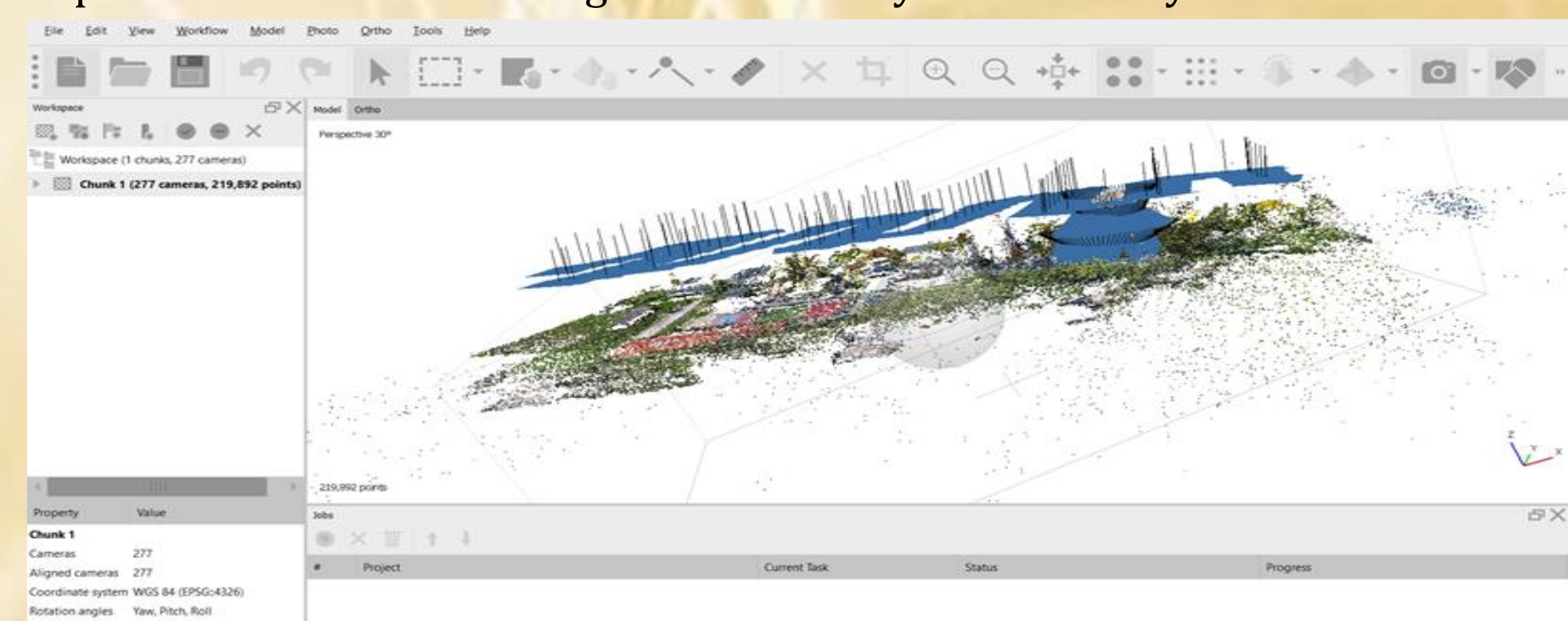
Flight plan with Pix4D Capture software

• Results and discussions

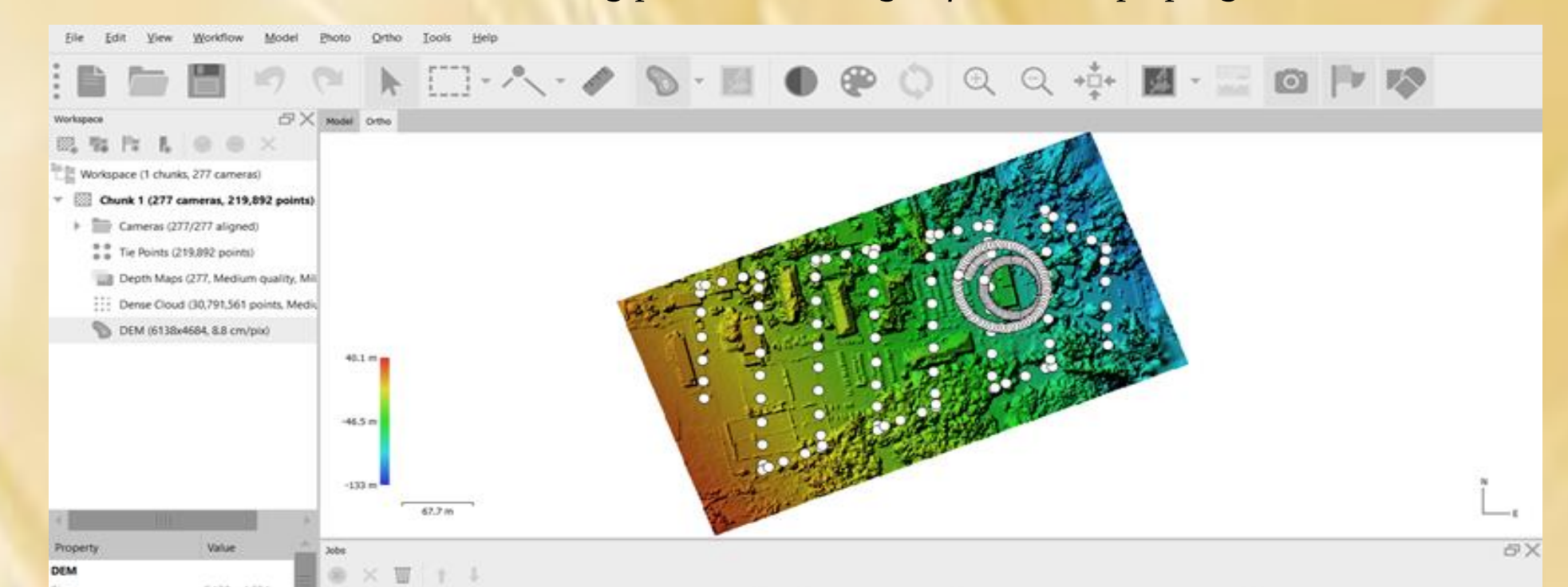
Among the most important modern methods are 3D laser scanning, photogrammetry and Lidar. These technologies allow the capture of extremely precise details in a short time, facilitating the digital reconstruction of real objects or spaces. For example, in architecture, laser scanning helps restore historic buildings by creating highly accurate 3D models.

Another innovative technique is drone-based photogrammetry, used in mapping and site monitoring, but also in geology and agriculture. By capturing aerial images, it allows the creation of 3D land models, allowing topographical analysis and monitoring of ecological processes.

Thus, the combination of precise measurements and advanced 3D modeling opens up new perspectives in the creation of digital models, simplifying the design, restoration and analysis processes while increasing their efficiency and accuracy.



Inserting photos in the Agisoft Metashape program



Build DEM



Orthophotomap

• Conclusions

In conclusion, every step of the process—starting with photo alignment, through dense point cloud creation, mesh construction, and culminating in digital terrain model (DEM) generation—is critical to achieving accuracy and fine detail. of the orthophotoplane. These steps work together to ensure that the final product accurately reflects real-world terrain. By correcting distortions and seamlessly integrating the images into a uniform mosaic, the resulting orthophotoplane provides a highly accurate and reliable representation of the landscape. This level of detail is crucial for a wide range of applications, including urban planning, geospatial analysis, environmental monitoring and natural resource management, where accurate and up-to-date information is essential for decision-making. Furthermore, the orthophotoplane generated using Agisoft Metashape, with its powerful tools and capabilities, provides tremendous value to any project that requires a detailed, accurate, and reliable digital model. Whether for large-scale infrastructure planning or environmental assessments, the tool ensures that the data generated is both robust and reliable, making it an indispensable asset for professionals.