Commercial Devices for a Quick and Non-Invasive 3D Survey and Geometrical Monitoring of Buildings

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SUMMARY

Modern technologies and approaches changed the way we document the real world, leading to increasing demand for 3D data. The fields of application range from land, water, and resource management, building maintenance, to interior, mechanical and civil design.

In this work, we will mainly focus on the modern strategies for surveying and monitoring buildings. Aging of materials, land movements, and human activities, and negligence can cause structural damage requiring smart strategies for assessing and monitoring structural health conditions. Laser scanning technology and UAV/terrestrial photogrammetry are largely used to acquire 3D datasets to record and document buildings conditions and can provide data for further design activities or maintenance planning (Alshawabkeh et al., 2020; Farahani et al., 2020; Boché et al., 2015; Santoso et al., 2015). These methods guarantee excellent performance in terms of accuracy and resolution of the result, when a remote and non-destructive investigation is required (Castagnetti et al., 2016). They can be cost and time ineffective if the monitoring of multiple small scale and localized damage phenomena is required (eg. cracks). Using a single digital camera and image processing techniques can offer a more convenient approach to damage detection and quantification from 2D images producing excellent results (Mohan and Poobal, 2018). However, advanced skills with image processing software are required.

In many cases, lots of 3D survey interventions are required solely for small portions of a site (e.g. excavations, rooms, single apartments, etc) without requiring high accuracy data. Also, it can be often useful for technicians involved in the site inspection activities to acquire quick 3D information, without interacting with specialized teams with specific skills and tools. In these specific cases laser scanning systems, photogrammetric, and image processing software are non-convenient in terms of performances, costs, and expertise. Recent technological advances in 3D sensors and their deployment in common mobile devices have opened the

way to low-cost methodologies for 3D reconstruction, suitable for non-expert users and useful in multiple applications. The Lidar sensors, implemented in the latest generation iPhone and iPad, allows calibrating the data acquired by these devices and make it usable for 3D reconstruction processes. In this paper, the workflows proposed by the CANVAS and PIX4D Catch applications will be analyzed (https://canvas.io/ ; https://www.pix4d.com/product/pix4dcatch). The functioning of the proposed methodologies will be briefly described, and the obtained products will be compared with "traditional" approaches to evaluate the overall accuracies. Also, the relevance of the proposed methodologies will be discussed in specific fields.

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