COMPARATIVE STUDY ON METHODS FOR 3D MODELLING OF URBAN AREAS

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ABSTRACT: This article presents (comparatively) the methodology for creating a 3D model of the urban area, based on terrestrial laser scanner, traditional technologies of terrestrial photogrammetry and aerial images. We are reviewing the data sources, their preliminary processing to be brought in a common system and the software used for this purpose. The case study presents the comparative results obtained using the methods listed above. To obtain the 3D models with terrestrial laser scanner systems have been used the dates achieved with ScanStation 2. To obtain the 3D model drawn by traditional photogrammetric methods using the UMK terrestrial camera, have been used auxiliary dates from topographic measurements with GPS systems and total stations as well as the current topographic plans. For the 3D model creation based on the dates taken with aerial digital cameras, were used the aerial images, taken with the ADS40 photogrammetric aerial camera. The comparative study between the three methods was accomplished by analyzing the object space representation fidelity, the precision of the 3D models obtained by comparison of the distances, areas and volumes, comparing the execution time and execution costs. The article presents the conclusions, the advantages and disadvantages of the three technologies based on the criteria listed above.

1. INTRODUCTION

3D Modeling using multiple images represents one of the most atractive and provocative researching domain in photogrammetry and remote sensing. One practical application of the 3D modelling techniques is automatic generation of the digital model of the reflectance surface (MDSR), which, after being filtered produces the altimetric model of the terrain (MDA), of the digital surface of the terrain (Digital Surface Models (DSM)), using satelite, aerial or terrestrial images. Another important application that represents the object of this study is 3D modelling of the urban area.

In order to address our theme, we have created a 3D data base for the study area. The base level of these data consists in the precise topographic elevation captured with GPS systems and Leica TC(R) 405 total station.

This station is a high-quality electronic total station, ideally suited for simple construction surveys and setting out tasks. It allows the measurements without reflector, with the integrated visible laser beam, with a range of up to 100m. The accuracy in the angle measurement is 5" and in the case of distances is 5mm±2ppm.

The terrestrial photogrammetric measurements taken with UMK 10/1318 camera have been inserted in this data base.

The *UMK 10/1318* is a metric terrestrial camera and was built in 1973 by the Carl Zeiss Jena company. As a photosensitive material this camera uses photo plates 13×18, which have the useful format of the raw image 120 mm×166 mm. The focal length of the camera is 100 mm with a focus setting from ∞ to 1.4 m for long-range photogrammetry (Linder, 2006). After the exposure one could notice that the raw images have a radiometric and geometric high quality.

For modern digital image processing methods to be applied, the raw images have been scanned. By adequately processing, based on the control points determined on the buildings surface the corresponding orthophotos are generated.

Separately, field works using ScanStation 2 have been made for the building in the testing area, for the purpose of 3D buiding model generation, based on this measurements.

The *ScanStation2*, produced by Leica Geosystems, is a terrestrial scanner system using 3D laser technology, used mainly in static measurement, being a scanning flexible solution which rapidly captures and measures all the details in a scene, not just what may be considered important at the time, ideal for complex environments (Leica brochure).

The specific processing of these observations from the field, using the data base previously created, permitted 3D model generation of the construction under discussion. For this 3D model the texture captured from non-metric digital photos of the facades has been added as a supplementary information.

The aerial images have been captured with ADS40 photogrammetric camera and we have obtained three band images in panchromatic domain, with the spatial resolution of 15 cm and four multi-spectral band images.

The ADS40 digital photogrammetric aerial camera, with a pushbroom sensor, offers enough informatio and a detailled description of the complex urban environment and they also raise the eficiency of the photogrammetric process. These images have been processed with ERADS – PRO 600, v11.0 system, obtaining the data for the 3D model by stereoscopic measurements.