Comparative Analysis of the Point Clouds Generated from UAV Image Data and Terrestrial Laser Scanning for Modeling Information About Historic Buildings (hBIM)

Anna Fryskowska-Skibniewska and Piotr Grzywna (Poland)

Key words: Geoinformation/GI; Laser scanning; Photogrammetry; Remote sensing; UAV, point clouds

SUMMARY

Documentation of historic buildings by methods that do not require direct contact with the surface of the object is very common nowadays. The model in HBIM (Heritage Building Information Modeling) technology is particularly useful for conservation purposes, because a correctly made model contains comprehensive information about the object, such as geometric data, used building materials and painting decor, or data on the functionality of the object.

The aim of the article was to compare the data obtained from the unmanned aerial vehicle (UAV) and from the terrestrial laser scanning (TLS). Point clouds were generated on the basis of UAV image data and acquired with a Faro Focus scanner. UAV data were acquired at different flight altitudes and generated using different parameters. TLS point clouds were compared with UAV clouds for data completeness. The accuracy of the mapping of such elements as the basement of the building, the interior of the building or the upper parts of the building was checked. Then, analyzes were carried out in terms of geometric consistency of the object mapping on the TLS and UAV data. The following subjects were analyzed: the accuracy of georeferencing of point clouds obtained for a historic object, various measurement methods, as well as 3D modeling methods.

Georeferencing of image data from UAV was made on the basis of data from the GPS / INS module and a photogrammetric network of Ground Control Points, where GPS measurement accuracy was ± 2cm. This allowed to obtain a very precise georeferencing of point clouds, where the average RMSEXY point position error was ± 3cm for the cloud processed in Agisoft PhotoScan and in PIX4D. The RMSEZ position error for the point clouds from the flight over 40 meters was ± 2cm.

On the basis of the conducted experiments, it was found that 3D modeling using the method of extrusion of shapes along a given path turned out to be the best approach to creating this type of

model and allowed to maintain the assumed geometric accuracy of the mapped elements in the range of 2-3 cm and to fit the model into a cloud of points with an average error of the size ± 7mm. Other methods used are CGS and editing the parametric mesh of the object.

The paper gives a look at the problem of the accuracy and the quality of point clouds from modern photogrammetric systems.