

Digital mapping and surface modeling of historical objects using modern visualization techniques

Krzysztof Karsznia^{a,*}, Krzysztof Książek^a, Ewa Świerczyńska^a

^a *Warsaw University of Technology, Faculty of Geodesy and Cartography – krzysztof.karsznia@pw.edu.pl, krzysztof.ksiazek@pw.edu.pl, ewa.swierczynska@pw.edu.pl*

* Corresponding author

Keywords: mapping, data visualization, surface modeling

Abstract:

Historic buildings are an important element of national heritage. Both structures and their equipment are subject to inventory measurements and damage monitoring. Such surveys generally use non-invasive spatial measurement techniques, mainly laser scanning or close-range photogrammetry with varying resolution and different point positioning accuracy. Point clouds obtained in this way are the elements of specialized processing and visualization. Here, cartographic techniques are essential, particularly surface modeling and their projection onto the reference plane. Thanks to such mapping, it is possible to monitor the state of objects optimally and reliably. In this research, the authors present the results of works conducted on the objects of the Coal Basin Museum in Będzin, Silesia, Poland – in particular, the structural assessment of the historic wall paintings in the Mioszowski Palace and the "Mizrachi" Synagogue (Figure 1).



(a)



(b)



(c)



(d)

Figure 1. Historical artifacts being mapped: a) walls with cracks, b) wall paintings (Mioszowski Palace), c,d) Synagogue "Mizrachi".

Laser scanners – pulsed and a hand-held structured light were used to map the surface. In addition, the objects were photographed with a digital camera, and the results were processed in specialized software. Such a photomonitoring is an accurate source of data used for information audits and – thanks to the use of image recognition algorithms and cartographic visualization – for ongoing assessment of the condition of the examined surfaces. Using the appropriate data integration and analysis in the context of conservation, the authors developed decision models classifying the threat level to the studied objects.

Acknowledgements

The research is based on the grants: “Evaluation and modeling of geometric changes in the structures of historical buildings located in endangered areas” and “Application of modern 3D modeling tools to determine the technical state of historical buildings”, Scientific Council of the Discipline of Civil Engineering, Geodesy, and Transport, Warsaw University of Technology.