



POLITECNICO  
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# Honors thesis

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COURSE OF ARCHITECTURE FOR HERITAGE  
PRESERVATION AND ENHANCEMENT

*Abstract*

**The Ducale Palace of Gubbio, integrated survey techniques**

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This paper aims to document the Ducale Palace of Gubbio (PG) through the use of new methods and the integration of innovative relevant technologies. The synergy and the integration of different technologies, complementary to each other, have allowed us to obtain a metrically correct model of the architectural complex, unique and coherent model useful for all subsequent operations. The work began with an initial bibliographic research that allowed a primitive knowledge of the architectural complex, an understanding of the events that characterized the evolution of the factory over time and allowed a critical realization of the relief. This phase was followed by the survey campaign, the methods of investigations used to understand the environments that characterize the palace have provided for the use of two laser scanners for mapping internal environments and some external areas; a mobile mapping instrument based on the SLAM algorithm that allowed to obtain a 3D model composed of point clouds of the archaeological excavations located in the basement floors of the building; and a drone for the acquisition of aerial photographs concerning the roofs of the complex. The use of different survey techniques responds to the environmental conditions in which the architectural object is located and this manifests itself in the diversification of the acquired data, through the use of different methods of investigation.



*Figure 1 Point Cloud of courtyard of honor, Ducale Palace of Gubbio*

Once the data have been processed through the use of specific software, we have tried to reproduce graphically and critically the unique characteristics of the Ducale Palace. From the point clouds we obtain a cad models, floor plans, sections and elevations, until the elaboration of a 3D model, of the courtyard, and the elaboration of a further architectural detail. These represent an example of what the potential of 3D survey offers in the field of cultural heritage documentation as AR / VR representations for fruition of cultural heritage, models for the management of technological systems, models for the management of historical documentation (H-BIM) and models useful for the design of temporary installations or restoration interventions, characterized by a unique metric base.

The result of this work was to create a database useful for future monitoring of the structure and for further studies, in fact this thesis represents a basis for the exhaustive knowledge of the complex and intends to outline a methodology that, using modern technologies for the survey of cultural heritage, is also applicable in other contexts.



*Figure 2 3D models of the palace's courtyard of honor*