Honors thesis

DEGREE IN SUSTAINABILITY DESIGN

Abstract

Multiscale 3D metric survey methods for the built heritage. Aerial and terrestrial applications in different scenarios

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The aim of the thesis is to explain and illustrate different intervention methods in the field of Geomatics for the documentation of cultural heritage. Three different intervention scenarios, at different scale, were identified, and some surveys activities were conducted in order to define the actual state, with several instrumentations and techniques, to achieve a large amount of data, characterized by a multitude of thematic and metric information.

According to the continuous request of anthropic objects and landscape heritage knowledge, the use of innovative instrumentations and techniques are quickly increased, compared to the past survey methods, thanks to the technological progress and the automation process which allows the reduction of survey fieldwork time, and the laboratory process periods.

The final purpose of the interventions is to provide specific and accurate informations about morphology, geometry and conservation characteristics of the materials and construction systems of the survey object. Afterwards, this data should be usable by other users who will intervene on the conservation of the artefact.

The three case studies represent different fields of the Cultural Heritage: the first is an archaeological artifact in a high value landscape area (Rocca di San Silvestro in Campiglia Marittima); the second case is about a religious architecture with frescoes (Cappellone di San Nicola in Tolentino), and, in the end, the last one is an abandoned industrial archaeological building (Parabolode di Casale Monferrato).

For the documentation phase, several well known instruments and geomatics methods were used: the image based method which uses terrestrial and aerial digital photogrammetry, by the UAV (Unmanned Aerial Vehicle) platform, and the range based method by the terrestrial LIDAR (Light Detection and Ranging) technique.

The survey process is composed by two distinct periods: the first consisting of surveying in the field, where during the acquisitions, it’s important to reduce the use of human and time resources, tank to a sustainable approach. The second, instead, consists in organizing and processing data at the laboratori.

The final purpose is to update traditional architectural graphic works (territorial plans, building plans, elevations and sections) derived from 3D models, as point clouds properly analyzed and elaborated, in order to generate sections, contour sections analysis and metric interpretations of the artifact, or, to achieve geometric and radiometric informations by textured 3D mesh.

The analysis and the monitoring activities are driven by the increasingly growing awareness of the importance of our common cultural and landscape heritage, its fragility, constantly threatened by human negligence and natural events, which expose it both to slow degradation and disastrous events.
Fig. 1: Polygonal model (Rocca S. Silvestro)

Fig. 2: Polygonal model (Cappellone della Basilica di S. Nicola di Tolentino)
Fig. 3: Polygonal model (Paraboloid of Casale Monferrato)

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