PROXIMITY REMOTE SENSING: PRELIMINARY RESULTS AT THE BATIA CHURCH (TORTORICI, SICILY)

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Abstract. The paper presents the results of scientific investigations carried out at the Batia Church located in the small village of Tortorici (Messina, Sicily). We performed several geophysical surveys and reconstruct 2D and 3D digital models of the monument using digital photogrammetry. From the 3D model accurate digital elevation models. A detail mapping was carried out using the derived 3D digital model identifying mayor fractures as well as quantifying the extent of original pain and the modern interventions.

1. Introduction

The church of the Annunciation or "Batia", located in the village of Tortorici (Messina, Figure 1), was built on the current site in 1757 at the behest of Bishop Gaetano Galbato. It is Called "Batia" because of the abbey of the Clares for noble girls. The abbey was attached to the church complex. The Mass was celebrated in the church until 1963 when, due to its bad state of conservation, it was definitely closed. In the late 1990s it was recovered and it now used for cultural activities. Inside the church, there are several important paintings and statutes dated in the period from 1500 to 1700. This paper presents the main results obtained by mean of geophysical investigations, digital photogrammetry and analysis of the derived 3D digital model. The results are going to be used to plan and support the different future restoration phases of the structure.

Previously a Ground Penetrating Radar survey has been performed in the church [1] and it identified a potential anomaly that has been related to foundation of an old structure as well as some burial sites. Figure 1 show the location of the test site and the reconstructed 3D digital model. It has been reconstructed by the use of photogrammetry. The development of the 3D model was carried out with free and open source licensed software such as VisualSFM, Meshlab and Blender. The final model (obtained by fusing the internal an external part) is perfectly scaled and measurable with a millimeteric

precision. Furthermore, the results of geophysical investigations have also been included in the digital model. The digital model has also been uploaded to a computer platform that can be consulted remotely and can be used for the enhancement of the artifact as well as for the creation of special content for documentary purposes.

Figure 1: Location of the test site (top panel) and digital 3D model of the external part of the church

2. Methodology, Data Acquisition and Processing

The photogrammetric process consists of several phases of processing (see [2] for details). Various markers have been placed throughout the area of interest (mainly on the ground) and the relative spatial coordinates have been detected through accurate measurements. To create the model presented in Figure 1, approximately 1500 images were acquired during two separate campaigns. The images were collated at different distances about 70% overlap forward and 60% overlap sideways.

The digital 3D model was used to map several features of the monument. Figure 2 shows the mapping carried out on the model. In particular we were able to map and distinguish the parts that undergone through recent restoration (e.g. new ceiling; modern plastering etc.). This process was done for the three main wall of the church and samples were also collected to perform future analysis on the materials to identify nature of pigments and also information on the masonry materials using during the construction.

Figure 2: Mapping of different feature on the structure

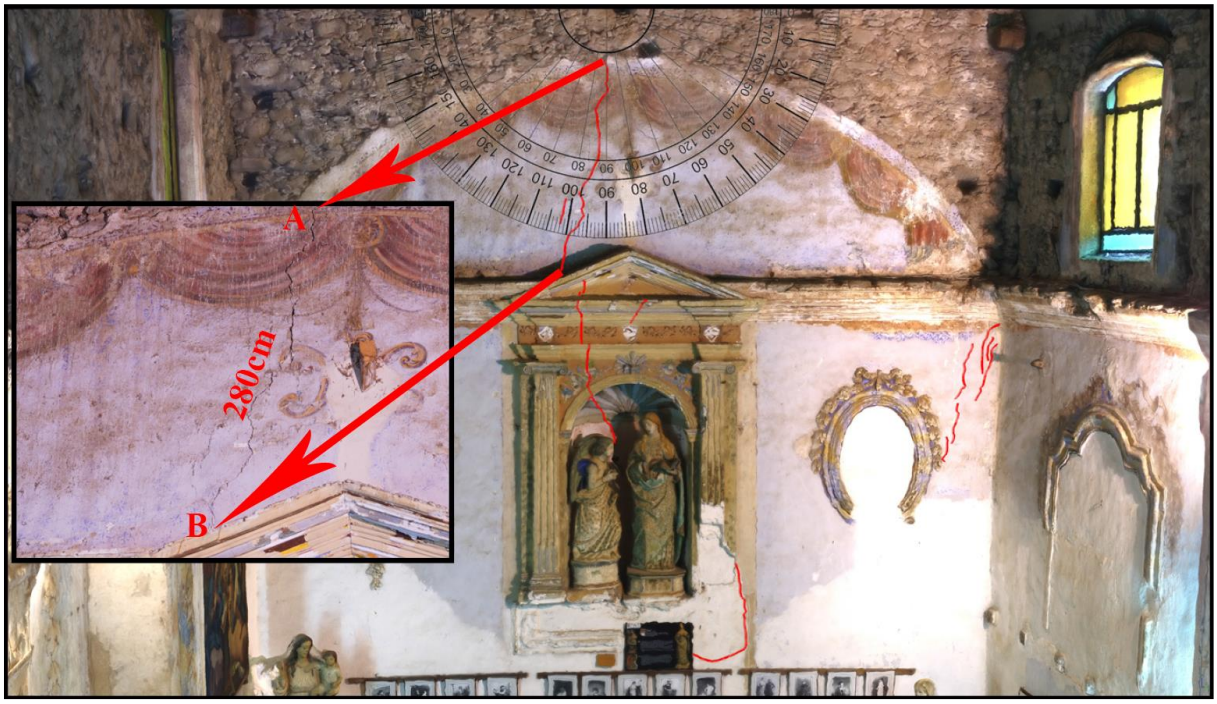

Figure3:. Mapping of the main fractures.

3. Concluding remarks

This approach allowed us to obtain a very good representation of the topographic variations spanning from the millimetric to the metric scale and gave us the possibility to identify "topographic" alignments as well as mapping different "morphologic" features within the structure. An ad-hoc Geographic Information System (GIS) environment was generated and the DEM, and RGB orthophotos were imported. They were used to map the relevant features of the paint as well as fractures and structural damage. Different paints as well as the areas that experienced previous restorations were identified and mapped. Each of these areas have characteristic features, as "geographic" distribution, topographic position, texture, RGB range of colors and response to the UV light.

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References

[1] D'Amico S., Colica C., Persico R., Betti M., Paterniti Barbino M., Galone L., Foti S., 2020. Geophysical investigations, digital reconstruction and numerical modeling at the Batia Church in Tortorici (Messina, Sicily): preliminary results. 2020 IMEKO TC-4 International Conference on Metrology for Archaeology and Cultural Heritage Trento, Italy, October 22-24, 2020

[2] S.D'Amico, M.Saccone, R.Persico, V.Venuti, G.V.Spagnolo, V.Crupi, D.Majolino, "3D survey and GPR for cultural heritage. The case study of SS. Pietro and Paolo Church in Casalvecchio Siculo",Kermes, vol.107, 2017, pp. 11-15.