

# From 3D Documentation to XR Representation of Cultural Heritage Buildings – the Case of the Katholikon of St. Stephen, Meteora

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## SUMMARY

Photogrammetric surveying and 3D modelling are of immense value for the diagnosis and conservation of historic and religious buildings. In case they are coupled with eXtended Reality (XR) technologies (i.e., Virtual, Augmented and Mixed Reality), different levels of interpretation, interaction and dissemination can be achieved. This paper presents a holistic approach to the multi-representation of the restoration phases of a Byzantine church. The aim is twofold; the introduction of a low-cost photogrammetric methodology for a detailed and accurate 3D geometric documentation of CH buildings, and the development of a web-based integrated 3D platform with XR functionalities. The proposed methodology is applied to the external and internal 3D reconstruction of the 16th century old church (Katholikon) of St. Stephen's Monastery in Meteora, Greece, at two different periods: prior and after church maintenance work and restoration interventions. Close-range photogrammetry and computer vision are used for the collection of image data and the generation of dense point clouds, surface models and texture mapping. The final 3D models along with their supported metadata are integrated into an online XR viewer for a comparative temporal analysis through an immersive experience. The viewer has the following capabilities: (i) automated virtual tour on the 3D scene, (ii) points of interest, (iii) VR navigation as well as, (iv) marker-less AR based on hand pattern recognition. The 3D rendering and progressive loading, the interactive tools as well as the various visualization modes are built upon Three.js, Tween.js and AR.js libraries. The evaluation of the developed platform regarding performance and usability demonstrates the effectiveness of VR and AR in remote access, monitoring and preservation of tangible Cultural Heritage.

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