

# Digitization of cultural heritage buildings for preventive conservation purposes

Suzy Bishara<sup>1,\*</sup>, Maria-Giovanna Masciotta<sup>2</sup>, Luis J. Sánchez-Aparicio<sup>3,4</sup>, Daniel V. Oliveira<sup>1</sup>, Diego González-Aguilera<sup>4</sup> and Joaquín García-Alvarez<sup>5</sup>

<sup>1,\*</sup> Department of Civil Engineering  
ISISE, University of Minho  
Campus de Azurém, 4800-058 Guimarães, Portugal  
E-mail: suz.bishara@gmail.com; danvco@civil.uminho.pt

<sup>2</sup> Department of Engineering and Geology (INGEO)  
“G. d’Annunzio” University of Chieti–Pescara  
Viale Pindaro 42, 65127 Pescara, Italy  
E-mail: g.masciotta@unich.it

<sup>3</sup> Department of Construction and Technology in Architecture (DCTA)  
Escuela Técnica Superior de Arquitectura de Madrid (ETSAM), Universidad Politécnica de Madrid  
Av. Juan de Herrera 4, 28040 Madrid, Spain  
Email: lj.sanchez@upm.es

<sup>4</sup> Department of Cartographic and Land Engineering  
University of Salamanca, Higher Polytechnic School of Ávila  
Hornos Caleros 50, 05003 Avila, Spain  
Email: daguilera@usal.es

<sup>5</sup> Fundación Santa María la Real del Patrimonio Histórico  
Aguilar de Campoo, Palencia, Spain  
Email: j.garcia@santamarialareal.org

## ABSTRACT

In a time where the normal is challenged through crises, destruction and isolation, the need for the digitization of heritage could not be more pressing. The project “*HeritageCare – Monitoring and preventive conservation of historical and cultural heritage*” is an initiative launched in 2016 in Southwestern Europe with the aim of riding the digital revolution and developing a cost-effective integrated documentation system for the preventive conservation of cultural heritage [1]. Through the intelligent use of geomatic approaches, smart technologies and virtualization tools, an interactive walkthrough is curated per each inspected historical building, by generating a 360° virtual environment through a series of panoramic pictures that link adjacent rooms through hotspots, guiding a logical navigation sequence across the structure and allowing to explore georeferenced information about its conservation state. Indeed, besides the hotspots linking the different panoramic spaces, corresponding icons tag the assets, damages and monitoring sensors present in a specific building, showing real-time insights about relevant aspects of the heritage so that to provide the end-user with an enriched digital experience, as well as to warn the building owner/manager in case of problems. In addition to the panoramic sets that capture both the interior and exterior of the heritage ensemble, a 3D dynamic model is produced by exploiting range-based scanning methods for accurate geometrical representation, damage mapping and a more comprehensive visualization of the monitored parts [2].

Since the HeritageCare initiative has involved a large geographical span and included a variety of structures belonging to diverse typologies and featuring different scales, a standardized but flexible protocol with optimized digital workflows was set for the systematic documentation and assessment of the built heritage. To display how this variety was addressed, the implementation of the aforementioned protocol is here demonstrated through two complementary case studies: a small Romanesque church located in Palencia, Spain, and a large Neo-Manueline church situated nearby Guimarães, Portugal. The potentialities offered by the developed WEB-GIS tool are widely discussed in the paper together with its application, showing how heritage information can be wisely stored, managed and accessed from virtually anywhere in the world to support decision-making processes related to its preventive conservation.

## REFERENCES

- [1] Masciotta M.G., Morais M.J., Ramos L.F., Oliveira D.V., Sánchez-Aparicio L., Gonzalez-Aguilera D. A digital-based integrated methodology for the preventive conservation of cultural heritage: the experience of HeritageCare project, *International Journal of Architectural Heritage*, doi: 10.1080/15583058.2019.1668985.
- [2] Sánchez-Aparicio L., Masciotta M.G., García-Alvarez J., Ramos L.F., Oliveira D.V., Martín-Jiménez J.A., González-Aguilera D.A. Monteiro P. Web-GIS approach to preventive conservation of heritage buildings, *Automation in Construction*, 118 (2020) 103304, doi: 10.1016/j.autcon.2020.103304.