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From Frescoes to the Cloud: A Digital Twin of the Church of the Holy Trinity for Monitoring and Documenting Conservation-Restoration Processes

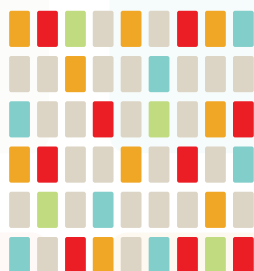
Hrastovlje is among the most important cultural and historical monuments in Slovenia. At the center of the village stands fortified the Romanesque-Gothic Church of the Holy Trinity, built in the 12th century, whose interior is adorned with frescoes by Janez of Kastav dating to around 1490. Due to its artistic, historical, and symbolic significance, the church has been declared a monument of national importance and is included on UNESCO's tentative list of World Heritage Sites.

The documentation of conservation-restoration interventions is essential for the preservation of cultural heritage, as it ensures traceability of the work carried out, enables comparisons of conditions over time, and guarantees transparency in the methods and materials used. It provides a foundation for future research and interventions while strengthening accountability toward heritage. With the integration of modern digital tools such as 3D scanning and digital twins, documentation is becoming increasingly accessible, comprehensive, and valuable for both professionals and the wider public.

The virtual 3D model was created using a combination of scanning and modeling, enabling an accurate digital reproduction of the physical object or space. Textures derived from orthophoto images were applied to the base model, ensuring high visual fidelity and a realistic representation of surfaces. The resulting digital twin was integrated into the company's cloud system, allowing easy access and interaction. The model supports data entry, element mapping, and information storage, with all data georeferenced to maintain precise spatial correlation. Since the conservation-restoration process is currently in the preparatory phase, the entered data reflects the pre-intervention condition. As the restoration work progresses, the data at the same locations will be updated or supplemented. In this way, the digital model provides a comprehensive overview of activities throughout the monument's maintenance process. Its digital format also enables data migration between different systems, facilitating use and analysis in a wide range of other applications.

**3rd Annual Conference
of the Slovenian Node
of the European Research
Infrastructure
for Heritage Science**

*E-RIHS Slovenia
Koper, 18–19 November 2025*



Poster



<https://doi.org/10.26493/978-961-293-546-7.32>

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