Digital Twins of Cultural Heritage by a Web App

Two examples for the integration of 3D models, VR and videos in the documentation of complex monuments

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3D models as digital twins

Three-dimensional virtual tours are currently changing everything. Google Street View, for example, is one of the most popular apps among others. Cultural Heritage, especially Industrial Heritage, is often very complex, with many rooms full of inventory. Spaces are often so small and cramped or so overcrowded that a photograph cannot show everything. With a three-dimensional camera, the heritage can be captured very easily and quickly on site and can be explored by a virtual tour at home.

The decisive factor here is that the technology is easy to use, which is now fulfilled, for example, by the scanner system from Matterport ©. The operation is as simple as with a conventional digital camera and the costs are also moderate. In contrast to a digital photo, however, a real 3D model creates a digital twin with point cloud, floor plan, virtual tour with high-resolution pictures and a 3D view (dollhouse).

To make the 3D model easily and clearly accessible to users, it is integrated into a web app via an API. The process of integration by an API is just as easily as the integration of a photo. The decisive difference is of course the great clarity of the model.

Furthermore, these models can be measured on screen with an accuracy of a few centimetres or used to create CAD files based on the underlaying point cloud of the digital twin.

Large scale example: World Heritage Site Voelklinger Huette

The recording of the inventory and conservation planning at the World Heritage Site Voelklinger Huette is done by 3D models since early 2018. This project includes 81 rooms, 53 buildings and is linked to over 600 individual objects. In addition, 19 central locations have been captured as 3D models and linked to the web app too.

A comparison with similarly large projects from the past shows that the documentation of a project is more accurate, clearer and much faster than with conventional method. In addition, the 3D models

can be presented to all project partners (internally) or to the public around the clock from anywhere.

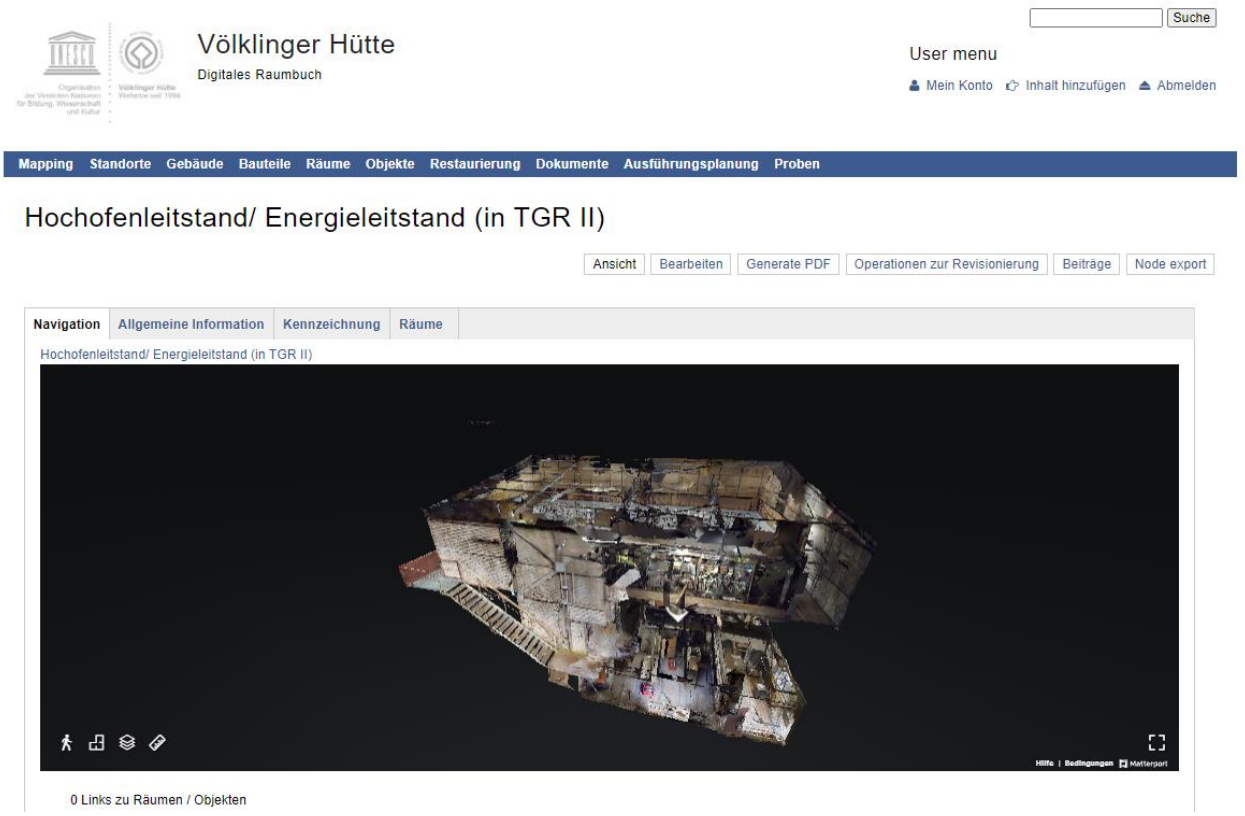

Fig. 1. Screenshot with dollhouse view, blast furnace control room of Voelkinger Huette (© Kornelius Götz).

All 3D models can also be viewed with VR glasses. VR gives visitors a real immersion in the digital twin or, when using a high tripod, the feeling of flying over the monument.

Fig. 2. Screenshot with dollhouse view and button 'Enter VR' (© Kornelius Götz).

Oral History: the example of the transformer station at ERBA, Wangen Germany

In the context of industrial cultural heritage there are very often still experts available on site who used to work here in the past. These experts have invaluable detailed knowledge which should also be documented and preserved for future generations.

This could be done very easy: today every smart phone has an app for recording videos and are available anytime and anywhere. Digital cameras provide the same service in higher quality. That's one reason for us to offer the possibility to insert videos or just sound. Furthermore, the videos can be linked to the 3D model. Ideally the expert stands at his former workplace and explains who he is and what he has done there, pointing to the inventory while the video is being recorded.

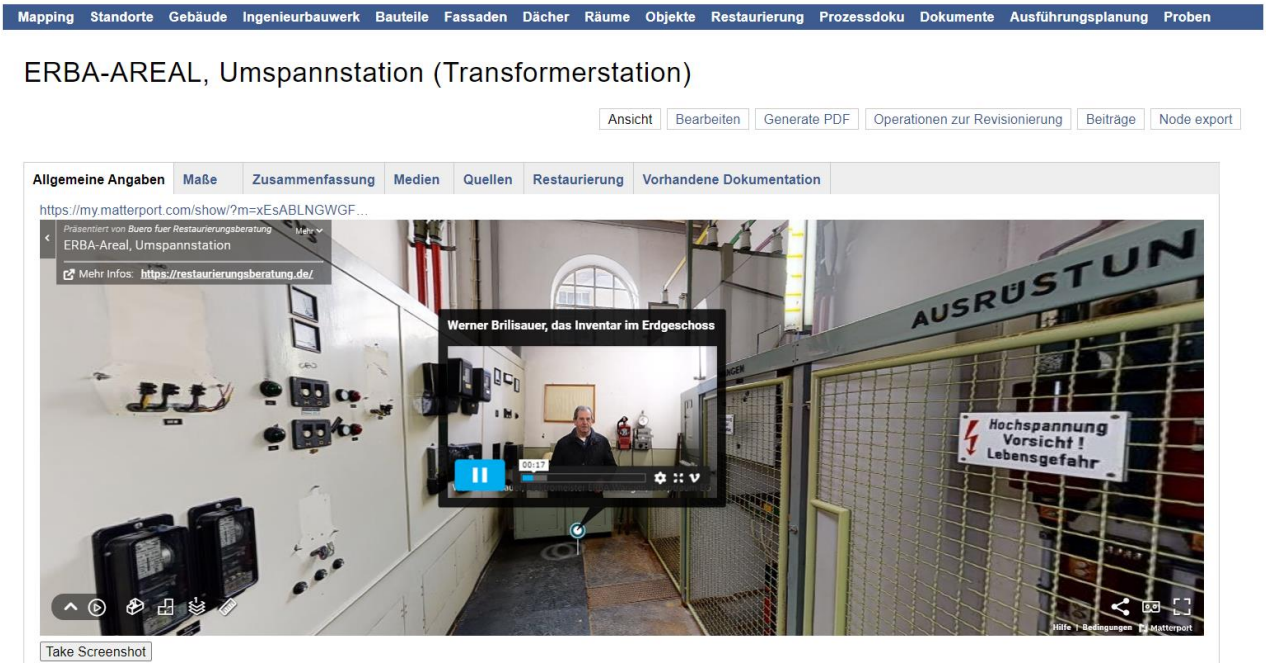

Fig.3. Screenshot 3D model with embedded video (© Kornelius Götz).

Conclusion and Perspective

In conclusion several advantages are clear on hand:

- Very easy recording of any kind of information by anyone without special experience.
- Highly vivid through integration of 3D models, videos, and GIS data.
- Enter VR button for real immersion in the digital twin.
- Data is automatically saved on the web server immediately after uploading.
- Cooperation of different participants at different locations 24/7.
- Runs on mobile devices such as smartphone, tablet, or notebook.

Next step will be the integration of a translation tool for the international use and a monitoring tool for World Heritage sites. Further on the gathered information of digital twins will be developed to fit the need of HBIM offering acknowledged interfaces.

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