X-Reality for Intuitive BIM-Based As-Built Documentation

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SUMMARY

Building Information Modeling (BIM) is increasingly being used in the construction industry for planning new buildings, while existing buildings are hardly considered at present, even though digital methods can lead to significant added value, especially for operation and maintenance. For applying BIM to existing buildings, these usually must be surveyed first. Typically, the as-built state is captured by geodetic means as a point cloud using laser scanning or photogrammetry, from which in a subsequent step a BIM model is derived (Scan-to-BIM) in a tedious and cost-intensive manual process. This is mainly because automation is still scarce. Moreover, current workflows require expert software and only use 2D screens, often with a mouse and a keyboard, for modeling.

The project "Building Inspector XR" aims at improving the Scan-to-BIM process for as-built documentation by employing X-Reality (XR), including Virtual Reality (VR) and Mixed Reality (MR) with incorporated automations, to aid the user. Core benefits of XR environments are that users can perceive and interact with 3D objects much more intuitively in comparison to modeling software running on 2D desktop screens, for example because it corresponds more to natural vision and object scale is conveyed better. VR and MR have technology-specific advantages and disadvantages. While VR offers the possibility to sketch 3D BIM models of buildings easily and quickly independent of the user's location, it requires data for context, for instance a point cloud of the built situation. The quality of the point cloud heavily influences the visual appearance of the virtual environment. MR on the other side relies on reality for context, thus, has much more detail, but is restricted to on-location workflows and physically correct user interactions. Therefore, in the project we combine the benefits of both technologies. The initial BIM model is created in VR from a point cloud and completion of it is possible in MR by displaying the model georeferenced on-site, so elements that are hidden or unavailable in the point cloud or semantic object properties can be added. An accurate registration of the model to reality, i.e., accurate georeferencing, is crucial for

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this. The output of the workflow is a standardized Industry Foundation Classes (IFC) model, which can be opened in any IFC-compliant software.

The paper addresses key-aspects of the project "Building Inspector XR", as for example transferring BIM to VR and MR, and highlights core components of our XR solution such as supporting automations, modeling schemes according to BIM standards and model registration for MR to realize an efficient Scan-to-BIM workflow.