VERIFICATION OF CONSTRUCTION DEVIATIONS USING PARAMETRIC BIM&AR

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INTRODUCTION AND MOTIVATION

This PhD project deals with the detection of constructive deviations between a Building Information Model (BIM) from planning stage and the as-built situation after construction by use of Augmented Reality (AR) directly on the building site. BIM has become a feature in design and planning [1] but with limited investigations how it can be integrated on-site [2]. This work presents an approach for tracking dimensional deviations with BIM&AR.

Reasons for building deviations and the gap between planning model and built model are misinterpreted plans, errors in the building process or deviating decisions of local site management that are not corrected afterwords in the planning database. State of the art in measuring building deviations is surveying with total stations, laser scanners [3] or photogrammetry [4]. Corrections of the planning database by use of measured data are normally made later in the office. This project proposes an approach for integrating AR tracing of existing constructions by comparing as-planned and as-built data in real world on the construction site with the advantage of saving time and costs [5].

REREARCH PROJECT

AR tracing of constructive deviations will only be possible based on a parametric real time model. In this project Unity is used as parametric modeler and Vuforia as implemented AR tool. The individual BIM elements of the database are structured in layers. A scale model with an axis spacing of 12 m by 12 m and a grid of 3 m with standardized industrial components such as truss girders enables to explore simulated deviations in an office environment. The constructive dimensions in the scale model correspond to real-world components.

AR tracking is done by a webcam and a target with additional markers. The AR setup has been optimized by camera calibration and test cases with different viewing angles and lighting conditions. An iPad interface enables wireless remote editing of the parametric BIM&AR database. Measurements can be made directly on-site in AR with a virtual ruler.

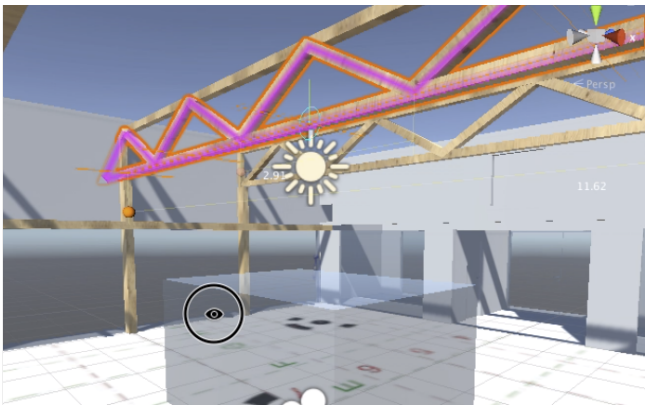

Figure 1: Interior AR view of a parametric truss girder

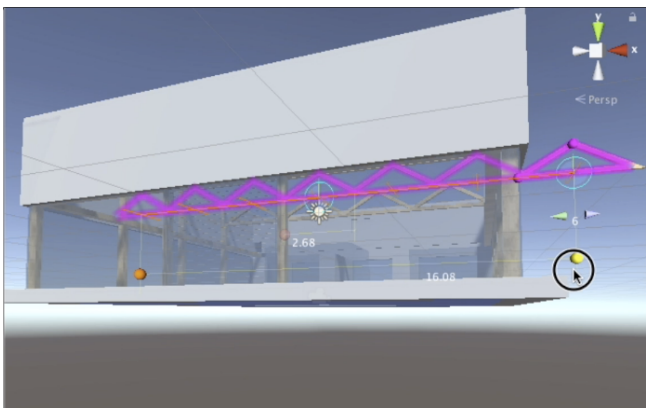

Figure 2: BIM with a scaled truss girder in AR view

RESULTS AND DISCUSSION

Experience shows that the parametric BIM&AR setup is very sensitive to subtile changes of single components. But basically the on-site tracing of construction deviations by comparing as-planned and as-built data with AR works. Technically it is essential to have a calibrated AR setup with AR camera and AR tracking. Lighting conditions and viewing angles also have to be considered. The remote connection to the BIM&AR database via iPad and WiFi enables user independent location on the construction site.

CONCLUSION

Building Information Modeling (BIM) and Augmented Reality (AR) are key technologies for the future. The combination of BIM&AR will enhance the process of as-built information extraction to improve on-site effectiveness [6]. In order to verify the findings of the model stage under real conditions the results of the PhD work will be implemented in an industrial real-world test case in scale 1:1. The planned evaluation in an example environment directly on a construction site will help to derive a robust and reliable method for "Verification of Construction Deviations using Parametric BIM&AR".

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