Evaluation of Point Cloud Data Acquisition Techniques for Scan-to-BIM Workflows in Healthcare

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SUMMARY

The digital transformation is no longer future vision but has already essentially changed social and economic landscape worldwide. However, this is not focused on optimizing profits and increasing efficiency in commercial companies solely. In fact, novel technologies should also improve the lives for people. People in need of care will become a longer independent and more secure live in future due to innovations in the field of assistance systems by for example checking residential space for domestic care even for non-professionals. The study presented here uses a digitalization solution in Architectural, Engineering and Construction (AEC) industry – Building Information Modeling (BIM) – which is becoming popular and is gaining importance, in particular with respect to the modeling of existing buildings (as-built BIM). Based on dense 3D point clouds, virtual as-build modeling is labor intensive and time consuming. Terrestrial laser scanning (TLS) is the most used method to generate point clouds of as-build structures, but is increasinglyfacing competition from innovative developments in consumer industry.

In this paper, several state of the art data acquisition techniques are discussed by using simulated residential space and evaluated with respect to standardized requirements for barrier-free living. Our studies have shown that there is a lack of international standards for accessibility, resulting in the inclusion of the German standard DIN 18040-2 as a detailed reference. The sensor zoo used to generate dense 3D point clouds represents a wide market range and contains established high-end instruments from 3D surveying, classic photogrammetric methods and low-cost hardware from consumer industry and robotics respectively. For the evaluation technical quality parameters, expense factors and usage requirements are taken into account. Finally, the tested sensors are rated according to their suitability for domestic care application. Our study shows that low-cost sensors provide point clouds having sufficient quality and density for BIM modeling and residential space analysis.