Chair of Computing in Civil and Building Engineering
TUM School of Engineering and Design
Technical University of Munich

Master's Thesis:

Comparative Analysis of 3D Scanning Technologies for Construction Progress Monitoring and Digital Twin Integration

Motivation

Construction progress monitoring and the generation of accurate Building Information Models (BIM) from as-built conditions are essential for effective facility management in modern buildings. 3D scanning technologies offer promising solutions for capturing real-world construction data, but their integration into digital twin environments presents significant challenges. Scanned point clouds often suffer from occlusions, noise, and incomplete data, particularly in complex construction environments. Understanding which scanning technologies can most efficiently capture construction progress while maintaining data quality suitable for BIM integration is crucial for organizations like Siemens Real Estate (SRE). This master's thesis will focus on evaluating various 3D scanning technologies and their applicability for construction progress monitoring, with specific emphasis on integration into Siemens-specific digital twin platforms (Building X and DESIGO CC).

Task

- Literature research on current 3D scanning technologies and methodologies for construction progress monitoring and their integration into BIM workflows
- Develop an evaluation criteria catalog considering aspects such as accuracy, capture speed, data volume, user-friendliness, automation potential, and compatibility with BIM software (e.g., IFC export) and Siemens products
- Practical field testing through accompanying data capture on construction sites using selected scanning technologies
- Data analysis and comparison through qualitative and quantitative analysis of captured data against the established criteria catalog
- Derive recommendations for Siemens Real Estate regarding the selection and implementation of suitable 3D scanning technologies and workflows

In the first phase, comprehensive literature research will analyze possible solutions and compare different scanning technologies. In the second phase, a systematic evaluation framework will be developed and applied through practical case studies to assess the efficiency and precision of various scanning solutions for construction progress monitoring and digital twin development.

Expected Outcome

A comprehensive comparative analysis of various 3D scanning technologies that provides Siemens Real Estate with a decision-making foundation for selecting optimal scanning solutions for efficient and precise construction progress monitoring and digital twin development.

Supervisors

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