3D POINT CLOUD REGISTRATION FOR AUTOMATED CONSTRUCTION PROGRESS MONITORING

Project Proposal
AALTO UNIVERSITY
Introduction

The construction industry faces a cost and schedule overrun problem: more than 66% of typical construction projects exceed their budget and 53% fall behind schedule. This is partially due to deficiencies in progress monitoring, which is typically done manually and is prone to errors and oversights. Automating the progress monitoring can improve the speed and accuracy of the process, thus facilitating timely execution of projects and quality control. The advancements in 3D modeling and image processing have made automated progress monitoring possible. We can now build detailed as-built point clouds from site photographs, which can be compared with the as-designed BIM model to automatically infer progress.

A key step in automated progress monitoring is aligning the as-built point cloud with the as-planned BIM model. Registration is normally performed in two steps: first, a coarse registration to perform a rough alignment, followed by fine registration that involves point-to-point or point-to-plane matching.

In this project, students will get exposure to state-of-the-art 3D point clouds built from crane cameras for a large construction site.

Project Goals

The goal of the project is to develop an automated point cloud-BIM model registration system. The system first registers the daily as-built 3D point cloud with the BIM model, then infers the floor number under construction, identifies the boundary of the floor slab and outputs the corresponding 2D crane camera image of the floor slab.

The output of the system will be used by our research team for formwork/rebar detection, which is of interest to our collaborators in the construction industry.

Tools and technology

The as-built 3D point clouds and crane camera images are uploaded daily onto a cloud server. Once these files are downloaded, the registration techniques can be implemented in MATLAB or Python. Autodesk Revit can be used for preliminary analysis and viewing.
Requirements

Good skills in MATLAB or Python are required. Some knowledge of point cloud processing is a plus.

Previous experience with construction is not required.

Legal Issues

The client (Aalto) gets all IPRs to the results.

Signing the NDA included in the Aalto’s contract template is not required.

Client

Aalto University, School of Engineering, Department of Civil Engineering. The research operations of the Aalto University Department of Civil Engineering are mainly focused on the following three areas of Sustainable Built Environment:

- Building Information Modeling and Construction Management
- Building Physics and Environmental Microbiology
- Computational Structural Engineering and Building Materials

This project is related to Construction Management.

Client representative
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Other

All work and related documentation will be in English.