# OVERVIEW

Growth in the renovation sector and strong interest in digital twins have made laser scanning and Point Cloud processing quite popular in recent years. End users increasingly need the ability to obtain accurate models of real-world objects like this location.

ODA Scan-to-Bim is a new SIG project started this year. SIG members provided a wide range of requests including not only the full task of Point Cloud to BIM conversion, but also ability to use intermediate solutions, e.g. Point Cloud to Mesh or Mesh to BRep conversions, as relatively independent tasks.

The project is developed in 3 directions.

The first direction is Point Cloud to Mesh conversion. We're leveraging the open-source PCL library in this area, as it contains several conversion algorithms including Greedy Triangulation, Poisson and Marching Cubes. We're investigating these algorithms and experimenting with the influence of various parameter values on the final results. We also have the ability to make adjustments and customizations to the underlying algorithms as needed.

The second direction is Mesh to B-Rep conversion. Here we've solved several problems, including the calculation of sharp edges, segmentation via sharp edges, calculation of principal curvatures, and segmentation via principal curvatures. Based on these results, we can compute canonical surfaces like planes, spheres, and cylinders within a segment. After that we'll create surfaces for the B-Rep and, finally, perform B-Rep building via surface intersection.

The third direction is the recognition of BIM objects based on a Point Cloud data. This work involves the following:

- Segmentation of the incoming point cloud
- Recognition of planes, and based on that the recognition of walls, floors and ceilings
- Face connection recognition
- And, finally, creation of an IFC file based on the recognized data

# WHAT'S NEW 2022

- **Point Cloud to Mesh conversion**

  - Investigation of Greedy Triangulation, Poisson and Marching Cubes algorithms

  - Experiments with the influence of various algorithms parameter values on the final results

  - Preprocessing of the initial data and postprocessing of the results

- **Mesh to B-rep conversion**

  - Calculation of the sharp edges and principal curvatures

  - Segmentation via sharp edges and principal curvatures

  - Computation of canonical surfaces parameters in segment (plane, sphere, cylinder, cone)

  - Surface creation for the B-Rep and, finally, perform B-Rep building via surface intersection

## Point Cloud to BIM conversion

  - Segmentation of the incoming point cloud

  - Recognition of planes by using RANSAC, and based on that loop (regions) recognition

  - Floors, walls, floors and ceilings recognition

  - Edges generation (faces connections recognition)

  - Creation of an IFC file based on the recognized data