

Results and Evaluation

In this chapter, the results of the registration of the available data using the solution presented in chap:Solution will be presented. The running times presented in table:running\_time were taken on an Intel Core i7 – 1065G7 3.9GHz with 16GB RAM. These running times are obtained with the assumption that the position of the point cloud is not far away from the origin.

Task		CityGML model	PLY model
Projection onto the xy-plane		0.607 s	1.33 s
Detection of line segments		3.198 s	3.662 s
[h!]	Detection of line intersections and their angles	0.226 s	0.229 s
Identification of possible correspondences		0.005 s	0.017 s
Alignment of both projections onto the xy-plane		2.904 s	14.359 s
Alignment on the z-axis		0.421 s	1.859 s

Running time of the registration.

Registration of a CityGML model with a point cloud The initial pose of the CityGML model and the point cloud can be seen in fig:initial\_citygml. After the registration process, the resulting transformation is

$$T_1 = 0.987 - 0.1970.0 - 4.994$$

$$0.1970.9870.0 - 2.636$$

$$0.00.01.0 - 0.207$$

$$0.00.00.01.0$$

and the results after applying this transformation to the point cloud are shown in fig:final\_citygml. In the transformation, one can observe a rotation around the z-axis and a translation across the x-, y-, and z-axis.

In fig:final\_citygml, one can see that the walls are correctly aligned. Unfortunately, the point cloud does not contain any scan of the interior.

The alignment of the CityGML model with the point cloud can be seen in the fire exercise building (the one in the middle) in fig:final\_citygml. Registration of a PLY model with a point cloud

The second available data represents a part of the Technical University of Darmstadt. The 3D model is given in ply format. The initial pose of the PLY model and the point cloud can be seen in fig:initial\_ply. After the registration process, the resulting transformation is

$$T_2 = 0.882 - 0.4550.020.504$$

$$0.4550.8820.0 - 21.645$$

$$0.00.01.0 - 19.254$$

$$0.00.00.01.0$$

and the results after applying this transformation to the point cloud are shown in fig:final\_ply. In the transformation, one can observe a rotation around the z-axis and a translation across the x-, y-, and z-axis. In fig:final\_ply, one can see that the walls are correctly aligned. Unfortunately, the point cloud does not contain any scan of the interior.

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Discussion The results presented in the two past sections highly depend on the step described in sub:Detection of line segments. The different running times presented in table:running\_time could be due to the size of the point clouds. The point cloud corresponding to the fire exercise building is much larger than the one of the Technical University of Darmstadt.

Furthermore, the number of intersections detected in the projections onto the xy-plane, both of the models and the point cloud, is much higher for the fire exercise building than for the Technical University of Darmstadt.