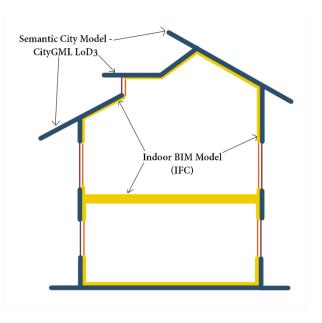**Master's Thesis Proposal:**

Automatic co-registration of Indoor BIM Models and Semantic 3D City Models using geometric and semantic matching and alignment.

In the context of Urban Digital Twins, both BIM models as well as Semantic 3D City Models are being utilized. The buildings in Semantic 3D City Models follow the CityGML Standard and typically only represent the exterior view of the buildings. On the other hand, a BIM/IFC model is a complete model of the building with its interiors and exteriors along with various other information. With the increasing efficiency of laser scanners, it is now also possible to reconstruct partial BIM-IFC models of the as-built environment i.e., only the interiors for specific applications. One challenge with BIM-IFC models is that these kinds of models have rich information but often exist in local coordinate systems. On the other hand, we have the city models which are modelled where buildings are represented in varying levels of geometric and semantic detailing across spatial scales.

"Fitting" an interior BIM model to a CityGML model augments both the models by providing a context for the BIM model and enriching an existing Semantic City model further with interiors information. Since both the models have different origins, there is no guarantee that they will align perfectly with just the georeferencing information. This means that there will be an additional adjustment required to align the models perfectly. Despite georeferencing, the adjustment of the models would require identification of corresponding elements between the BIM Model and the CityGML model that can act as anchor points to align the interiors automatically and perfectly with the exteriors.

In the end, the goal of the thesis is to develop a workflow that can be used to automatically align the interior BIM model with the exterior shell from the CityGML model using anchor points and other alignment parameters (if any) to create a full-fledged, detailed CityGML model with interior information. The Indoor BIM model and the Semantic City Models will be provided to you. Some prior knowledge of 3D Modelling, especially the concepts of IFC and CityGML standards would be required. A familiarity with tools like FME, ArcGIS Pro, MATLAB and python is beneficial to accomplish the goals of this project.

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