Extraction of free space for 3D indoor navigation on BIM models

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Abstract:

For several decades, indoor navigation has been exclusively investigated in a 2D perspective, based on floor plans, projection and other 2D representations of buildings. Nevertheless, 3D representations are closer to our reality and offer a more intuitive description of the space configuration. Thanks to recent advances in 3D modelling, 3D navigation is timidly but increasingly gaining in interest through the indoor applications. But, because the structure of indoor environment is often more complex than outdoor, 3D indoor navigation models still lack of precise description and the few available ones rely on very simplified representations, ignoring the obstacles inside the building and leading to limited possibilities in complex buildings.

In this work we introduce a new point of view by considering the entire configuration of the indoor environment in 3D and by representing the actual navigable space as a network of connected 3D objects (volumes). We describe how to extract such 3D free spaces from semantically rich and furnished 3D Building Information Models (BIM). The approach combines the geometric, the topological and the semantic information available in the 3D models to isolate the free space from the rest of the model. Furthermore, the extraction of such navigable spaces in building models lacking of semantic information is also considered. The combinatorial maps data structure is used to support the operations required by the process while preserving the topological and semantic information of the input models.

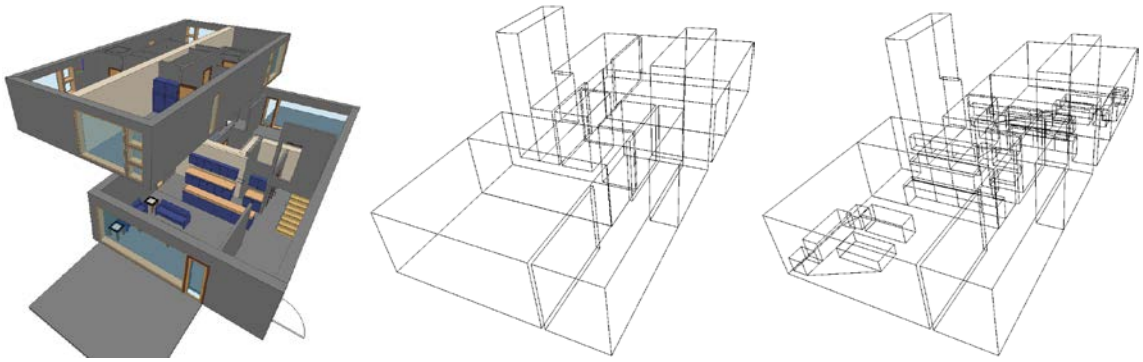

Figure 1: From left to right: BIM model containing furniture; original free space not considering the furniture; actual 3D free space excluding the space occupied by the furniture elements.