bhOWL: BHoM with Semantic Web Technologies

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Abstract

Architecture, Engineering and Construction (AEC) projects require multidisciplinary solutions resulting in several disciplinary representations for one physical asset. However, interoperability issues between software often hinder disciplinary data integration, leading to the late recognition of violated design constraints.

Buildings and Habitats object Model (BHoM) is an open-source framework initiated by Buro Happold, and it provides a unified data model for building design and construction information. Semantic Web technologies can link data effectively, and integrating BHoM and Semantic Web can enhance information exchange efficiency in the building industry.

To achieve this integration, Buro Happold and the Institute for Computational Design and Construction, Chair for Computing in Architecture (ICD/CA) from the University of Stuttgart, have been working on a joint research project. The work includes research on BHoM and its parallels with Semantic Web Technologies; the translation of the terminological and assertional layer from BHoM to OWL/RDF named bhOWL (and vice-versa) and the integration of bhOWL with design software and graph databases. The graph database integrated with the work receives data from multiple design software disciplines, allowing users to perform cross-database queries. Because both BHoM and bhOWL are prominently dedicated to design, the proposed tool is currently geared towards co-design by designers from various disciplines, such as architects or structural designers. Designers can make better decisions by accessing data from various disciplines. For instance, an acoustic designer might need to know the structural model's ceiling deformation values to determine the best location to place acoustic insulation. Although the tool fulfills the requirements of certain case studies, such as describing building parts and materials, it is still unable to utilise an extensive OWL vocabulary, and the process of reusing existing ontologies is rigid.

In future work, we will explore using extensive OWL vocabulary and integrating bhOWL with existing ontologies like BOT, IFC-related ontologies, etc. We will also investigate using Machine Learning approaches to predict links between entities in the same and different domains, inferring new entities from sources beyond BHoM. Future investigation will pivot around combining design tools with Semantic Web standards to improve data interoperability and assist design decisions through inferential reasoning.

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Keywords

Data Integration, Machine Learning, Ontologies and Building Data Standards (e.g. IFC), Knowledge graphs, Idea/vision

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