Identification of different design alternatives through a performance guided process is hampered by the complexity of the problem, a consequence of the large number of variables and options involved (e.g., financial, environmental, technical, and legal factors). "Manual" approaches toward identification of optimal solutions (mainly by trial and error) are time-consuming, expensive, and inconclusive. Hence, more effective approaches to optimization operations are being pursued, involving optimization platforms and associated automated procedures (Coffey 2008). SEMERGY explores developmental opportunities toward effective evaluation environments for comparative assessment of alternative design and retrofit options (Mahdavi et al. 2012a).

The missing link between users' simplified component representations (e.g., "external wall", "window") and complex specifications of real world products makes the efficient generation of building performance assessment models very difficult. In other words, it remains the task of end-users to map such simple notions of building components to appropriate real-world products that meet calculation procedures' informational requirements. The key contribution of the SEMERGY project is the demonstration of the potential of semantic web technologies toward populating the input data for building performance simulation models via the navigation of the extensive but currently ill-structured web-based information space. Currently, SEMERGY is focused (as proof of concept) on the scattered pool of building product and material data. However, data pertaining to building systems (e.g. heating and cooling systems, active solar components), as well as resources and documents concerning procedural, climatic, and financial (e.g. public funding) information that could be of value to designers and decision makers, can be processed and utilized in the same fashion (Mahdavi et al. 2012a, 2012b).

To accomplish this task, the SEMERGY system deploys two main strategies. First, information regarding building materials, elements, and components are obtained from various resources of the web environment. This information is preprocessed, restructured and augmented to meet the informational requirements of the integrated performance evaluation procedures. Using this reorganized and enriched repository, SEMERGY identifies design alternatives through a rule-based procedure. These potential alternatives are checked against building codes (pertaining, for example, to maximum allowed U-values). Thus, the corpus of possible permutations of the initial design could be efficiently reduced to a computationally reasonable size. Once the ordered set of feasible alternatives is constructed, it is made subject to a comprehensive evaluation process. Thereby, normative demand calculations, environmental impact assessment and cost estimation procedures are deployed. Upon completion of the assessment of the alternative designs, a collection of the best performing solutions is generated and presented to the user.

In summary, the SEMERGY system has links for i) user interaction (user interface), ii) applications and computational engines (reasoning interface), and iii) sources of information (semantic interface). The user interaction link is intended to involve both simple web-based templates for novice users and advanced building information models for professionals. The beta version of the web-based interface has been released and is openly accessible (SEMERGY 2014). The application link supports data exchange between the system and multiple analysis tools pertaining to energy calculation, lifecycle analysis, financial payback assessment, and optimization. The information link, which is the critical ingredient of the proposed architecture, is supported by Semantic Web Technology (Mahdavi et al. 2012a).

Previous publications presented and discussed fundamental features of the technologies embedded in the SEMERGY environment (Mahdavi et al. 2012a, 2012b, Ghiassi et al. 2012, 2013, Shayeganfar et al. 2013, Pont et al. 2013, Heurix et al. 2013, Hammerberg et al. 2013, Wolosiuk et al. 2014)

The present contribution focuses on the SEMERGY's beta release. Specifically, User Interface and workflow patterns are discussed in detail.

SEMERGY BETA FOR NOVICE USERS

Purpose and Structure

The current SEMERGY environment addresses the requirements of novice or professional users interested in a quick estimation of the thermal and environmental performance of their intended design and the alternative design possibilities within the limits of their financial means. The proposed alternatives include sets of construction options, for various building elements, entailing real world products available on the market. SEMERGY beta addresses at present optimization of retrofit projects.

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