US009721046B2

(12) **United States Patent**
Khainson et al.

(10) **Patent No.: US 9,721,046 B2**
(45) **Date of Patent: Aug. 1, 2017**

(54) **SYSTEM AND METHOD FOR REALIZING A BUILDING SYSTEM THAT INVOLVES COMPUTER BASED MATCHING OF FORM TO FUNCTION**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 716 days.

(21) Appl. No.: **14/216,258**

(22) Filed: **Mar. 17, 2014**

(65) **Prior Publication Data**

US 2014/0288890 A1 Sep. 25, 2014

Related U.S. Application Data

(63) Continuation-in-part of application No. 13/833,386, filed on Mar. 15, 2013.
(Continued)

(51) **Int. Cl.**
G06F 17/50 (2006.01)
G06Q 50/22 (2012.01)

(52) **U.S. Cl.**
CPC ***G06F 17/5004*** (2013.01); ***G06Q 50/22*** (2013.01)

(58) **Field of Classification Search**
CPC G06F 17/5004; H02J 3/14
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,529,650 B2 5/2009 Wakelam et al.
2006/0282302 A1 12/2006 Hussain
(Continued)

OTHER PUBLICATIONS

Palonen, M. et al.; "A Genetic Algorithm for Optimization of Building Envelope and HVAC System Parameters"; Eleventh International IBPSA Conference, Glasgow, Scotland; pp. 159-166; Jul. 27-30, 2009.

Manthilake, M.M. Inoka Damayanthi; "Evolutionary building layout optimization"; Doctoral Thesis; Dept. of Civil and Building Engineering, Loughborough University; Mar. 2011.
(Continued)

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(57) **ABSTRACT**

Systems and methods for realizing a complex building system are disclosed. The systems and methods utilize computer-based techniques to rapidly explore large numbers of pattern matching scenarios on a scale which heretofore has not been attempted. In an embodiment, the computer-based technique performs large-scale pattern matching operations to find the best match between functional patterns and spatial patterns. For example, with reference to a particular building system, the technique involves operational modeling to identify the types and volumes of services to provide (functional patterns) and to characterize the physical relationships between the services (e.g., adjacency preferences), along with establishing libraries of three dimensional spaces (spatial patterns), in the form of room and department libraries and building massing configuration libraries. Large numbers of functional patterns and spatial patterns are then matched to each other using cost-based algorithms to find the best match or matches between the form and function.

31 Claims, 60 Drawing Sheets