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Application of Building Information Modeling in Energy Management of Individual Departments Occupying University Facilities

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Abstract : To assist individual departments within universities in their energy management tasks, this study explores the application of Building Information Modeling in establishing the 'BIM based Energy Management Support System' (BIM-EMSS). The BIM-EMSS consists of six components: (1) sensors installed for each occupant and each equipment, (2) electricity sub-meters (constantly logging lighting, HVAC, and socket electricity consumptions of each room), (3) BIM models of all rooms within individual departments' facilities, (4) data warehouse (for storing occupancy status and logged electricity consumption data), (5) building energy management system that provides energy managers with various energy management functions, and (6) energy simulation tool (such as eQuest) that generates real time 'standard energy consumptions' data against which 'actual energy consumptions' data are compared and energy efficiency evaluated. Through the building energy management system, the energy manager is able to (a) have 3D visualization (BIM model) of each room, in which the occupancy and equipment status detected by the sensors and the electricity consumptions data logged are displayed constantly; (b) perform real time energy consumption analysis to compare the actual and standard energy consumption profiles of a space; (c) obtain energy consumption anomaly detection warnings on certain rooms so that energy management corrective actions can be further taken (data mining technique is employed to analyze the relation between space occupancy pattern with current space equipment setting to indicate an anomaly, such as when appliances turn on without occupancy); and (d) perform historical energy consumption analysis to review monthly and annually energy consumption profiles and compare them against historical energy profiles. The BIM-EMSS was further implemented in a research lab in the Department of Architecture of NTUST in Taiwan and implementation results presented to illustrate how it can be used to assist individual departments within universities in their energy management tasks.

Keywords : database, electricity sub-meters, energy anomaly detection, sensor
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