TO WHOM IT MAY CONCERN

EXTERNAL EVALUATION OF PhD thesis

TITLE: Semantic BMS: Semantics-Driven Middleware Layer for Building Operation Analysis in Large-Scale Environments

CANDIDATE: Adam Kučera – PhD thesis

The thesis brings innovative approach in challenging multidisciplinary areas. Approach is based on decision support that incorporates facility management, building automation systems, smart environments, and semantic sensor network ontology.

An important contemporary research area in modern science and society are smart environments and buildings. Modern smart buildings are equipped with numerous sensors (forming reach sensor networks) and wide range of controllable devices (like Security systems, Heating, Ventilation, Air Conditioning and so on).

The devices are usually integrated into Building Management System (BMS) and can be remotely monitored, controlled, and queried. Collected sensor data has specific characteristics comparing to other kinds of data as they are more detailed, less delayed, and more accurate. However, as a new and still immature area, Building Management Systems lack convenient tools for data inspection and analysis. It limits their wider and reliable use in building operation optimization. Moreover Facility management, benchmarking and evaluation of facility performance are recently become crucial tasks for effective, efficient, and economical operations in modern buildings.

The main objective of the thesis is to try to reach these requirements and allow facility managers to use data collected from devices in smart buildings more efficiently. Data automation for facility benchmarking has to be used with minimal efforts.

To achieve more intelligent processing of sensor data, an ontology model enriching automation data with additional semantic information is proposed and presented. The proposed semantic model is created using the Web Ontology Language. Also the Semantic Sensor Network (SSN) ontology has been extended and adapted for this particular problem i.e. building operation analysis.

The model is protocol independent and describes available data in such a way that can be easily utilized during decision support activities necessary for building performance analysis, evaluation, and improvement.

Additional quality of the thesis is oriented towards providing specific tools and services comprehensible for facility managers. These tools and services are realized to be flexible, user-friendly, and to obtain dynamic querying over the building automation data. The convenient interface of Semantic BMS provides gathering semantic data without the need to fully understand essential characteristics of the building automation systems or the ontology languages.

Practical contribution of the thesis is that the proposed system allows facility managers to conveniently use BAS data for benchmarking and decision support.

The research presented in this thesis properly justifies strong motivation to improve services and decision support in facility management area, using multidisciplinary approach. The candidate seriously and
maturely analyzed contemporary literature. He presented high-quality State-of-the-Art and related his motivation and research questions adequately and highly convincingly.

In my opinion the thesis is of the highest quality and excellent (grade A) and makes an original and significant contribution to the knowledge and understanding of the field of study. Also methodology applied in the candidate's research is effective and appropriate for the thesis topic. Generally the thesis is well structured, well written from technical and graphical point of view, and easy to read and follow and contains contributions for the PhD level. Candidate demonstrated the ability to work independently and creatively in the field of thesis but also raised new research questions that are attractive for future work.

Based on all mentioned above, in my opinion, thesis merits award of the degree and can be published without modification.

I congratulate the candidate and supervisor.

Novi Sad, 20.4.2018

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