

ABSTRACT

The future energy system will have fluctuating energy production due to energy production from wind and solar. One solution for the future energy system, will be to integrate buildings as thermal buffers. This promotes applications among others for energy optimization, Demand Response (DR) and intelligent control strategies for HVAC systems. To enable such applications, the challenge is to create an infrastructure where applications are easy to port between buildings. Software Defined Buildings (SDBs) which facilitate a semantic representation (metadata) for buildings, can provide an infrastructure for Portable Building Applications (PBAs). The challenge is to facilitate a semantic representation for buildings, which is simple and powerful. Therefore the overall research question for this thesis is: How to transform energy and sensor data from buildings to knowledge that support Software Defined Buildings?

This thesis has a constructive research approach. The approach combines analysis of existing solutions, prototyping software tools and data processing methods on real data from buildings. The software tool Metafier has been developed to support the task of annotating and structuring metadata from sensors in buildings. Metafier has been evaluated by three subjects with relevant backgrounds within the topic of energy and buildings. Metafier includes data processing methods for semi-automated metadata generation.

Besides Metafier, a study of data processing methods for Non-Intrusive Load Monitoring (NILM) in an industrial has been performed. The data processing methods disaggregate one sensor into a semantic representation of the equipment connected to the sensor. In addition to the semantic representation the data processing methods estimate the power draw for the connected equipment. This research provides preliminary concepts for applications, to provide disaggregated energy consumption with a minimal sensor infrastructure. Such applications could be part of SDB and developed as PBAs.

The task of annotating and structuring metadata for sensors in buildings, brings value to corresponding data stream of the sensor. The metadata provides context for the sensor and data stream. Metadata for sensors provides the semantic representation which can combine a physical environment to a SDB.

Based on the contributions of the thesis future research will include development of software tools as PBAs. Refinement of data processing methods for automated metadata generation.