Ontology based Fault Detection and Diagnosis system Querying and Reasoning examples

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Abstract : One of the strongholds in the ubiquitous efforts related to the energy conservation and energy efficiency improvement is represented by the retrofit of high energy consumers in buildings. In general, HVAC systems represent the highest energy consumers in buildings. However they usually suffer from mal-operation and/or malfunction, causing even higher energy consumption than necessary. Various Fault Detection and Diagnosis (FDD) systems can be successfully employed for this purpose, especially when it comes to the application at a single device/unit level. In the case of more complex systems, where multiple devices are operating in the context of the same building, significant energy efficiency improvements can only be achieved through application of comprehensive FDD systems relying on additional higher level knowledge, such as their geographical location, served area, their intra- and inter- system dependencies etc. This paper presents a comprehensive FDD system that relies on the utilization of common knowledge repository that stores all critical information. The discussed system is deployed as a test-bed platform at the two at Fiumicino and Malpensa airports in Italy. This paper aims at presenting advantages of implementation of the knowledge base through the utilization of ontology and offers improved functionalities of such system through examples of typical queries and reasoning that enable derivation of high level energy conservation measures (ECM). Therefore, key SPARQL queries and SWRL rules, based on the two instantiated airport ontologies, are elaborated. The detection of high level irregularities in the operation of airport heating/cooling plants is discussed and estimation of energy savings is reported.
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