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Case Based Reasoning with Expert System and Swarm Intelligence to determine Energy Reduction in Buildings Energy Management

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ABSTRACT

This paper proposes a novel Case Based Reasoning (CBR) application for intelligent management of energy resources in residential buildings. The proposed CBR approach enables analyzing the history of previous cases of energy reduction in buildings, and using them to provide a suggestion on the ideal level of energy reduction that should be applied in the consumption of houses. The innovations of the proposed CBR model are the application of the k -Nearest Neighbors algorithm (k-NN) clustering algorithm to identify similar past cases, the adaptation of Particle Swarm Optimization (PSO) meta-heuristic optimization method to optimize the choice of the variables that characterize each case, and the development of expert systems to adapt and refine the final solution. A case study is presented, which considers a knowledge base containing a set of scenarios obtained from the consumption of a residential building. In order to provide a response for a new case, the proposed CBR application selects the most similar cases and elaborates a response, which is provided to the SCADA House Intelligent Management (SHIM) system as input data. SHIM uses this specification to determine the loads that should be reduced in order to fulfill the reduction suggested by the CBR approach. Results show that the proposed approach is capable of suggesting the most adequate levels of reduction for the considered house, without compromising the comfort of the users.

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