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Optimizing Renewable Energy Consumption in Smart Homes Using Deep Q Networks and Knowledge Graphs

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Electricity production is one of the main sources of greenhouse gas emissions due to its large dependency on fossil fuels. In this context, the electricity required by residential and commercial buildings represents a large proportion of the total electricity demand. Although renewable energy sources have been extensively integrated in the energy grid, the energy is inefficiently used leading to peaks in energy demand and production which may affect the stability of the grid. This paper presents an approach for maximizing the usage of renewable energy in smart homes while minimizing their dependency on the energy provided by the grid. Deep Q Networks (DQN) are used to schedule the electricity load of the smart home for the next day such that the residents'comfort is satisfied. The proposed approach models the energy environment and appliance usage using a knowledge graph, based on which a DQN agent learns optimal energy strategies that balance renewable energy usage, battery storage, and user comfort. Experimental results highlight the system's potential to enhance the efficient usage of renewable energy, while maintaining the comfort of residents.

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