OC 19. Towards Machine-Learning-Based Digital Twins to Enhance Operation and Energy Management in Smart Buildings

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Abstract

There is a growing installation of sensors in buildings. Moreover, Artificial Intelligence has been applied in several fields. Those trends can provide more data and information in real-time, paving the way to developing Smart Buildings. In this context, this work aims to devise a methodology to improve building energy management, with better data monitoring and visualization to support decision-making. The goal is to provide mechanisms to deal with the increasing amount of data generated by building systems. The objective is to develop models to forecast energy consumption in a specific Smart Building and to gain a deeper understanding of its load profile. The methodology focuses on the potential impact of improved monitoring and visualization of energy management in Smart Buildings, utilizing techniques such as Machine Learning, Deep Learning, Data Visualization, and Digital Twins. Furthermore, this study presents a significant challenge in integrating technologies, concepts, and tools to demonstrate a real-world application in an operational building. This study proposes an alternative to white-box approaches, especially where BIM models are unavailable or impractical to develop. The methodology is based on gray-box and black-box approaches, taking advantage of the increasing availability of sensor data in buildings. Additionally, this project seeks to address a gap identified in the literature by contributing to the development of Machine Learning and Deep Learning models that improve the performance of Digital Twins for energy management. The study also envisages a future platform that presents results through an explainable and coherent decision-support dashboard, providing reliable and relevant information for decision-makers. Finally, this work aims to highlight opportunities for applying similar methodologies to other tasks within the construction industry.

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