A smart way to predict building energy consumption

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In a time of aging infrastructure and increasingly smart control of buildings, the ability to predict how buildings use energy—and how much energy they use—has remained elusive, until now.

Researchers from Saudi Arabia, China and the United States collaborated to develop a smarter way to predict energy use through a method that involved artificial systems, computational experiments and parallel computing. They published their results in *IEEE/CAA Journal of Automatica Sinica*.

"Generally, it is challenging to predict building energy consumption precisely due to many influential environmental factors correlated to energy-consuming such as outdoor temperature, humidity, the day of the week, and special events," said Abdulaziz Almalaq, paper author and assistant professor in the Department of Electrical Engineering in University of Hail's Engineering College in Saudi Arabia.

"While environmental parameters are useful resources for energy consumption prediction, prediction using a large number of a building's operational parameters, such as room temperature, major appliances and heating, ventilation, and air-conditioning (HVAC) system parameters, is a quite complicated problem, compared with prediction using only historical data."

According to Almalaq, the environmental parameters are useful but limited. For example, two identical buildings in identical settings may have very different energy consumptions based on how the buildings are used. Even if both buildings are maintained at the same temperature, one building's HVAC system will need to use more energy if that building is holding an event with a few hundred people.

"The accurate prediction of energy consumption at a specific time under many outside and inside conditions becomes an essential step to improve energy efficiency and management in a smart building," Almalaq said.

Almalaq and his team used hybrid deep learning algorithms, coupled with artificial systems, computational experiments and parallel computing theory based on complex, but generic, systems. When tested using real building at the University of Colorado Denver, the method significantly helped improve energy management.

"The analysis performed in this paper showed that the hybrid deep learning model is a powerful artificial intelligence tool for modeling multivariable complex systems," Almalaq said. "It has the potential to be applied in different areas, such as the smart office, the smart home and the smart city."

More information: Abdulaziz Almalaq et al. Parallel building: a complex system approach for smart building energy management,*IEEE/CAA Journal of Automatica Sinica*. Volume: 6 , Issue: 6 , November 2019.

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