AI-Based Methods for Improving Scalability and Adaptability of Intelligent Control Algorithms in Smart Buildings

Summary

The research will be conducted in the framework of the research project “Data-driven assessment of the potential and impact of energy saving flexibility technologies in buildings” in cooperation with the company R8 Technologies (https://r8tech.io).

Research field:	Information and communication technology
Supervisors:	Prof. Dr. Eduard Petlenkov Ahmet Köse
Availability:	This position is available.
Offered by:	School of Information Technologies Department of Computer Systems
Application deadline:	Applications are accepted between January 01, 2025 00:00 and January 24, 2025 23:59 (Europe/Zurich)

Description

According to the latest statistics, buildings consume around 40% of the total energy in Europe. In Estonia, this number rises to over 50%, with technical systems consuming almost half of it. Forbes reports that nearly half of all greenhouse gas emissions are generated from real estate, with approximately 27% of annual CO2 emissions coming from building operations.

Thus, optimizing the flexible load of buildings is a highly important and challenging task. Accordingly, technical systems of buildings (HVAC - Heating, Ventilation, and Air Conditioning) can significantly improve buildings' energy performance, reduce energy consumption, and lower the carbon footprint.

An average-sized commercial building has approximately 50,000 data points, with around 3,000 of them being controllable. These points directly influence the building's energy consumption. Such large datasets cannot be analyzed by humans without proper tools to make informed decisions.

At the same time, each building has its characteristics, such as different controllable points, device and automation system variations, dynamic properties, climate zones, user requirements, etc.

The current PhD research aims to:

1. Develop data-driven algorithms for efficient control feasibility of buildings' technical systems, considering the influence of external factors and hidden mutual influences of sub-systems.
2. Develop AI-based methods for scaling control algorithms and facilitating the easier integration of new buildings.

Requirements for the Candidate:

- Good understanding of dynamic processes, their modeling and control methods.
- Proficient programming skills in Python.
- Knowledge of Machine Learning and AI methods.
- Good communication skills

- Knowledge of Heating, Ventilation, and Air Conditioning (HVAC) systems and building automation systems is a benefit.

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