

Linked Data Service for Improving Portability of a Model Predictive Controller

Lasitha Chamari ¹, Shalika Walker ², Ekaterina Petrova ¹, Pieter Pauwels ¹

¹Eindhoven University of Technology, The Netherlands

²Kropman Installatietechniek, The Netherlands

Abstract:

In recent years, Model Predictive Control (MPC) has emerged as a potent method for optimizing energy usage in various settings, including commercial buildings. It demonstrated applications in controlling heating, ventilation, air conditioning (HVAC) systems, heat pump systems, and electric vehicle (EV) fleets. However, the challenge lies in porting and deploying MPC applications across different buildings due to the unique configurations required to tailor MPC to specific Building Management System (BMS) settings.

Previous research by the authors proposed leveraging a service-oriented architecture to deploy smart building applications in a modular and scalable manner. A vital component of this architecture is using Linked Data and semantic web technologies to standardize semantic information available in various systems such as HVAC, Building Automation Systems (BAS), Building Information Models (BIM) and IoT devices. Linked Data, facilitated by domain ontologies, improved the generalisability of applications due to standardized metadata representation for smart building applications.

This poster further extends the use of Linked Data to configure an MPC controller to control a small EV fleet in an office building. Utilizing a set of microservices, MPC optimally schedules individual charging sessions for the EV fleet. MPC incorporates machine-learning-based load forecasting, EV user data collection, and scheduling functionalities. The system includes an office building, PV power sources, and four EV charging stations and their system data is accessed through Application Programming Interfaces (APIs) in near-real time. A novel Linked Data service is introduced to configure the MPC. By standardizing and separating configurations from application logic, changes in underlying data sources or formats in a new environment can be accommodated without extensive modifications to MPC models, facilitating rapid deployment in dynamic environments. The poster finally showcases the initial results of reduced peak demand in the building due to the implementation of MPC.