INTELLIGENT CONTROL OF NETWORKED BUILDINGS – A CONCEPTUAL FRAMEWORK

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OVERVIEW

Buildings are the biggest consumers of electrical energy in the USA - according to the US Energy Information Administration (EIA), buildings account for 40% of total electricity consumed during the year 2020; out of which commercial and residential buildings account for 18% and 22% electricity consumption respectively. As a result, buildings become a potential asset for energy usage optimization from the point of view of electric grids. However, energy usage optimization is not the only problem that buildings lead to, the coupled problems of providing Quality of Service (QoS) to the occupants and supporting the grid with ancillary services also need to be dealt with for the complete utilization of buildings as an asset to the electric grid. The solution strategies for these problems arise from the confluence of diverse fields of Power Systems, Thermal systems, Control Systems, and Machine learning. Where power systems provide the bedrock for electrical modeling, thermal systems provide for HVAC modeling, control systems provide the mathematical framework for designing intelligent optimal controllers based on Model Predictive Control and Reinforcement Learning, and machine learning provides a framework to integrate the availability of big data in aiding data-driven control synthesis and model estimation. This talk will provide a conceptual framework to come up with solutions for utilizing buildings as a grid-edge resource at scale.

BIO

Ninad Kiran Gaikwad is from Mumbai, India. He is currently pursuing a PhD in Electrical Engineering and a MS in Computer Science from Washington State University (WSU); where he is expected to graduate in the Fall 2025. In addition, he holds a MS in Mechanical Engineering from the University of Florida (Fall 2021, UFL), an MTech in Power Electronics and Power Systems from Sardar Patel College of Engineering (Spring 2016, SPCE), a BTech in Electrical Engineering from Veermata Jijabai Technological Institute (Spring 2012, VJTI). As a Research Assistant at the SCALE lab, his research focus lies in developing efficient building thermal models for intelligent control of networked buildings. His other research interests are in Physics-Informed Machine Learning, Model Predictive Control, and Reinforcement Learning for energy systems optimization. He plans to work at a National Lab post his PhD and return to Academia when the time is right.