Smart Living Candidate Seminar

Smart Temperature Control of Multi-Occupant Spaces using Internet-of-Things Architecture

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Abstract: Energy usage in buildings, both residential and commercial, account for nearly 40% of the total energy consumption in US with HVAC systems being at the top. However, even with the existing cost of HVAC systems, the occupant dissatisfaction associated with the prevailing indoor thermal conditions have been highlighted by several studies. This work was motivated by the problem of computing optimal commonly agreeable thermal settings in the spaces with multiple occupants. We start by developing a consensus algorithm (using ADMM) for attaining a commonly agreeable temperature set-point and a game-theoretic (auction) mechanism as an extension of VCG, that requires occupants to "purchase" their individualized comfort levels beyond what is provided by default. We finally present an Internet-of-Things (IoT) framework, with distributed sensors and a central hub, designed for enabling occupant feedback collection and incorporating the feedback data towards energy efficient operation of a building. The sensors perform indoor localization and provide temperature readings in real-time. The central hub, hosting the learning and optimization algorithm, uses this data to automatically adjust thermostat through secure APIs over wireless medium.

Bio: Dr. Santosh K. Gupta received his Ph.D. degree in the department of Electrical, Computer & Systems Engineering from Rensselaer Polytechnic Institute (RPI). He joined RPI as a postdoctoral research associate afterwards and also founded One Comfort Labs – an IoT based smart home product startup. One Comfort Labs received NSF I-corps award and was recognized as one of the Best University Startup 2016. His general research areas include Cyber Physical Systems, Cyber Human Systems, Smart Buildings & Smart Living, Internet of Things Architecture, Machine Learning, Computer Networks, and Wireless Communication systems. Prior to joining RPI Dr. Gupta worked as a Sr. Software Engineer at Apple and Cisco for 5 years. He completed his MS from Georgia Institute of Technology and B.Tech from IIT Kanpur.

Date: April 20, 2017

Time: 11:00 am

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