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Cyber Physical Systems Approach to Smart Homes

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Today, the advanced sense-control-actuate technologies allow us to live more comfortable, cost-effective, more convenient, more secure and safe, and more assisted caring and watching in the smart home environment[1]. In the meantime, the demands such as control loads, anticipating home appliance and equipment failures, efficient energy consumption, and so on increase dramatically. In particular, to control the home thermal comfort at the desired level while optimizing the energy consumption at the same time is a challenging issue. This is because (*i*) the dynamic change of outside environment that can be used as one of the thermal resources for controlling the home thermal comfort level; and (*ii*) the preference of thermal comfort level for each occupant is different. Therefore, an energy efficient thermal comfort control (EETCC) system[2] that based on the concept of Cyber-Physical Systems (CPS) is proposed to address the aforementioned issues in the smart home environment. The proposed EETCC system enables to monitor and maintain the desired thermal comfort level dynamically with three actuators: air-conditioner, window and curtain. Although the proposed EETCC system has achieved its goals, it consists of a few shortcomings to be tackled, e.g., the control strategy of proposed EETCC system may suffer a non-estimated and future change and this would lead to a high deviation in estimating the thermal comfort level. Here, we present the concepts from a model predictive control (MPC) and multi-objective optimization (MOO), which are incorporated with to compute the optimal control strategies to compromise between the thermal comfort level and energy efficiency in the CPS-based smart home environment.

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References

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