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Editorial: Sensor Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys 2019)

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Editorial on the Research Topic

Sensor Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys 2019)

It is our great pleasure to publish this Research Topic on Sensor Systems for Energy-Efficient Buildings, Cities, and Transportation. This is a collection of journal papers extended from selected conference papers published in the Sixth ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys 2019), which was held in New York City, NY, United States on November 13–14, 2019. BuildSys is a highly selective, single-track forum for research on systems issues covering all aspects of the buildings, cities, and transportation systems, broadly defined. It has been an interdisciplinary conference that brings together various stakeholders including researchers, practitioners, and policymakers from different disciplines including civil engineering, mechanical engineering, environmental science, electrical and computer engineering, system management and control, and many others.

Advances in the effective integration of networked sensors, building controls, and physical infrastructure are transforming our society, allowing the formation of unprecedented built environments and interlocking physical, social, cyber challenges. Moreover, built environments, including buildings and critical urban infrastructure, account for over half of society's energy consumption and are the mainstay of our nation's economy, security and health. As a result, there is a broad recognition that systems optimizing explicitly for the built environment are particularly important in improving our society, and represent the foundation for emerging "smart cities."

Recognizing the importance of these areas, this Research Topic presents extended studies of high-quality papers presented at BuildSys. The conference proceedings already went through a rigorous double-blind review process by the technical program committee, which consisted of 38 international experts from diverse backgrounds related to built environments in government, industries, and academia. Each paper involved three detailed written reviews from the reviewers, as well as an online discussion and a TPC meeting to reach a consensus on the final acceptance. To the fairness and diversity, the reviewers were categorized (civil/mechanical, electrical/computer science, government/industry) and evenly distributed among the papers. The TPC members discussed each paper in detail over video conference and ultimately accepted 30 full papers and 8 notes papers (29% acceptance rate). We re-invited the TPC members as reviewers for the extended papers in order to ensure the consistency and technical rigor of the reviews while maintaining the timeliness of the publication process.

After the thorough review process, we accepted the following four papers (in alphabetical order):

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Edited and reviewed by:
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1. FAIM: Vision and Weight Sensing Fusion Framework for Autonomous Inventory Monitoring in Convenience Stores

By Falcão et al.

In the U.S. convenience stores make up a large portion of the retail built environment. These stores suffer sales losses due to lack of accurate live inventory monitoring creating out-of-shelf stock-outs. FAIM introduces a novel framework that leverages a network of weight sensors and cameras to accurately monitor the inventory leading to a better economic performance of such spaces. FAIM contributes to the theme of this Research Topic by addressing the challenges present in the integration of networked sensors and its built environment. It further proposes a smart infrastructure system that addresses the economical pains of convenience stores.

2. Fine-Grained Activity of Daily Living (ADL) Recognition Through Heterogeneous Sensing Systems With Complementary Spatiotemporal Characteristics

By Pan et al.

This paper presents a non-intrusive multimodal structural sensing system aiming to achieve in-home long-term activity of daily living (ADL) monitoring. The system utilizes the complementary properties of the structural vibration sensing and non-intrusive load monitoring to enable fine-grained information inference. This paper fits into the topic of Sensing Systems for Energy-Efficient Buildings, Cities, and Transportation by demonstrating the advances in the effective integration of networked sensors and applications of intelligent built environments that impact people's quality of life.

3. Formalizing Tag-Based Metadata With the Brick Ontology

By Fierro et al.

A lack of descriptive, semantic metadata is a limiting factor to the wide-scale adoption of sustainable practices in buildings. This paper establishes a set of metadata design principles to enable the consistent and interpretable usage of emerging standards. These principles are applied to the formal implementation of Brick+, a (now adopted) extension of the Brick metadata schema that subsumes popular tag-based metadata approaches and enables new kinds of metadata-driven interoperability.

4. Gnu-RL: A Practical and Scalable Reinforcement Learning Solution for Building HVAC Control Using a Differentiable MPC Policy

By Chen et al.

This paper introduces Gnu-RL, a novel building control solution that enables real-world deployment of reinforcement learning agents without the need for resource-intensive high-fidelity models. Gnu-RL agents are bootstrapped with domain knowledge and expert demonstration to match the performance of existing controllers prior to any interaction with the environment and continue to improve its policy end-to-end. This paper also shows that Gnu-RL is practical and scalable through additional simulation studies on three DOE commercial reference buildings.

The editors would like to thank the authors for their contributions to this Research Topic. We also greatly appreciate the time and efforts of the reviewers to maintain the high quality of the papers and the high quality of the reviews that are the feature of this research field. We hope these papers will be an inspiration for followup conversations and generating new knowledge in the future.

Thank you and hope you enjoy the Research Topic.

AUTHOR CONTRIBUTIONS

HN, FJ, and PZ contributed to this editorial equally by writing about the research topic, its contribution to the state of the art, and the review process for the papers submitted to the research topic.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.