Preface to the Special Issue: Toward an Efficient and Effective Internet of Things for Cyber-Physical Systems (Part II)

This is Part II of the special issue, entitled “*Internet of Things*,” of the *ACM Transactions on Cyber-Physical Systems*. The special issue is presented to commemorate the 10th anniversary of the CPS research program and the inauguration of *ACM Transactions on Cyber-Physical Systems*.

A total of 14 papers have been accepted for this special issue. Part I contains seven articles and here in Part II we present the remaining seven papers. Given the technical requirements of cyber-physical systems, many mission-critical applications need to perform computations at the edge of Internet of Things (IoT). The papers entitled “*CHARIOT: Goal-Driven Orchestration Middleware for Resilient IoT Systems*” and “*Distributed Trade-Based Edge Device Management in Multi-Gateway IoT*” address how to manage edging computation in IoT systems. Sensing is a critical function for IoT. The paper entitled “*A Survey of Mobile Crowd Sensing Techniques: A Critical Component for the Internet of Things*” reviews the state of this area and discusses its future directions. Given the operational nature of cyber-physical systems, the IoT must meet various stringent requirements of CPS applications (e.g., privacy, security, timing correctness, localization) at all layers. Articles dealing with this aspect at higher layers have been presented in Part I. Here, we present papers that deal with the problems at lower layers. The issues related to localization and time synchronization are addressed by the paper entitled “*SLATS: Simultaneous Localization and Time Synchronization*,” while power for wearable devices is the focus of the paper entitled “*Toward Battery-Free Wearable Devices: The Synergy between Two Feet*.” The security and safety issues are addressed, respectively, by the papers entitled “*Feature-Driven Mediator Synthesis: Supporting Collaborative Security in the Internet of Things*” and “*Systematically Ensuring the Confidence of Real-Time Home Automation IoT Systems*.”

Through the papers we present here and many other scholarly works and industrial developments, we have many good reasons to celebrate the 10+ years of accomplishments made by the CPS (including IoT) community. However, at the same time, we also observe that some critical issues have not been thoroughly addressed. For example, in the call-for-proposal for this special issue [1], one of the topics listed was “Addressing, naming, and search technologies for the IoT.” Unfortunately, almost none of the submitted papers had seriously addressed this issue and none of the papers were accepted for the topic.

In general, Studies on CPS (including IoT) is becoming an academic discipline which is critical for not only industrial technologies but also a new generation of workforce. To achieve this important goal, the community at large must jointly address several important and related issues:

1. Definition of CPS studies. An academic discipline, informally speaking, is a body of organized knowledge on a domain of objects. For CPS studies, the objects are cyber-physical systems. The relevant knowledge usually includes both fundamental concepts and critical rules which govern the domain of objects (e.g., for its development and operations). An academic discipline cannot be formed if this body of knowledge is not well defined.

2. Collaboration on system models and architectures. Cyber-physical systems are man-made objects. Different people (say, from different professions and/or different regions) have a different understanding of these systems. International and inter-disciplinary collaboration is needed to unify different views on system models and architectures in order to provide a sound foundation for the knowledge organization of this emerging new discipline.
3. Development of an educational curriculum and credential recognitions. As mentioned earlier, this academic discipline on CPS studies is important for the new generation of workforce. The community at large must make a special effort to develop an educational curriculum and related mechanism for credential recognition. This should help institutions to properly allocate resources to initiate the educational program and, at the same time, guide the growth of this critical emerging discipline.

Once again, we would like to thank the authors of these papers for their hard and diligent work to produce excellent quality contributions. Our appreciation is extended to the reviewers of the papers for their in-depth reviews and great efforts to improve the quality of the papers. Special thanks are owed to Editor-in-Chief Tei-Wei Kuo for his vision, guidance, and trust. We appreciate Ms. Ada Leong at the University of Macau for her dedicated management of the review process. We are also indebted to the editorial office at Taiwan National University and the publishing and production teams at ACM for their assistance in the preparation and publication of this issue. All the aforementioned efforts were very important in making this special issue a success.

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