

Special issue on emerging trends in cyber-physical systems

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The pervasiveness of ever-faster computers and ever-cheaper communication bandwidth, and the integration of physical systems and processes with networked computing, is leading to the emergence of a new generation of engineered systems: cyber-physical systems (CPS). The potential of CPS systems in economics and society, ranging from miniscule (pace makers) to large-scale (the national power-grid), is vastly greater than first realized, and major investments are being made worldwide to develop the technology.

Many of the CPS-related studies and efforts focused on the challenges the physical environment brings to the scientific foundations of networking and information technology. In particular, the physical components of such systems introduce safety and reliability requirements that are qualitatively different from those of general purpose computing. However, the full scope of this change has much more breadth and depth than a restructuring inside networking and information technology; it is a profound

revolution that turns entire industrial sectors into producers of cyber-physical systems.

The aim of this special issue (SI) is to present innovative researchers and technologies as well as developments related to CPS. This SI was organized using papers from the IEEE AINA 2010 International Conference, which was held in Perth, Western Australia from 20th to 23rd of April, 2010. AINA 2010 received 470 papers, of which only 120 were accepted for publication. We encouraged the authors of AINA 2010 to extend their papers and submit them to this SI. Based on their quality and relevance to the SI, we selected five papers.

In the first paper by Vitabile et al., the authors address the issue of the increasing number of car accidents and present a low-intrusive, real-time drivers' drowsiness detection system. The proposed system exploits the "bright pupil" phenomenon by means of an IR source light embedded in the car's dashboard to quantify the drowsiness level in terms of percentage at which the driver's eyes were closed more than 80%. The system is built using FPGA technology capable of processing 720×576 frames in 16.7 ms. The article presents the evaluation and testing of the system conducted in real-operating conditions.

In the second paper, Enokido et al. discuss their previous work based upon a pair of power consumption-based (PCB) and transmission rate-based (TRB) algorithms and propose an extended power consumption-based (EPCB) algorithm. They proposed the PCB and TRB algorithms to select a server with minimum total power consumption in communication-based applications. Additionally, the PCB was found to be more useful in this regard. However, during their previous study, they tried to ascertain only the amount of electric power a server is expected to consume to transmit a file to a new requesting client with the PCB algorithm. The authors have extended their work and

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proposed EPCB to estimate the amount of power that a server would consume to transmit a file to all clients requesting the file. The evaluation results show that the total power consumption of servers can be reduced more by the EPCB algorithm than the PCB and TRB algorithms.

In the third paper, Hiroaki Nishino presents a Japanese calligraphy training system that provides a virtual space for calligraphy learners to intuitively acquire hard-to-inherit skills. The proposed system makes use of a haptic device called PHANTOM to simulate the writing brush on virtual canvas. The system records the instructor's hand motions such as brush-strokes and pen pressure during the writing of characters and reproduces them to train the learners. The author implements a powerful 3D brush model for real-time visualization while maintain the quality and reality of visualized characters. The effectiveness of the system is tested through two experiments for learning calligraphy in a virtual environment.

In the fourth paper by Hsu et al., the authors propose a RFID-based system focusing on home safety for children and the elderly. The proposed system detects the movement of users equipped with a RFID reader. If the user, having a RFID tag, approaches a dangerous location or dangerous object, the system alerts him/her in order to prevent any mishap. The degree of danger is determined through fuzzy

inference based on the user's age and signal strengths which indicate the user's proximity to the dangerous location or object. The system has a feedback mechanism that modifies the default fuzzy membership function of the corresponding location or object. The authors validated the system through experiments and the results are promising.

In the last paper by Herberg et al., the authors critically study and report on advancements in "IPv6 routing protocol for low power and lossy networks (RPL)". The protocol has been under development for a year and this article elaborates on certain aspects such as a broadcast mechanism, where more efforts are needed to make this protocol viable for wireless sensor networks (WSNs). In this regard, the authors have suggested different broadcast mechanisms which exploit existing RPL and require no additional state maintenance. The authors also compare the performance of RPL with those of the suggested mechanisms.

In concluding this overview, we would like to thank all the authors for submitting their papers and the reviewers for their good work in making it possible to publish this SI.

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