

GUEST EDITORIAL PREFACE

Special Issue from the Fourth Workshop on *Context-Systems* *Design, Evaluation and* *Optimization (Cosdeo 2013)*

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Today's personal and commercial communication and broadcasting technologies rely extensively on wireless data transmission. Hence, independent of our location, we are constantly exposed to electromagnetic radiation in various frequency spectra originating from a variety of sources. Radio wave propagation depends to a large extent on the surrounding environment in which signals experience typical channel effects such as reflection, diffraction, and attenuation. Therefore, changes in the environment are also reflected in the signal. For example, a human moving in a radio receivers' vicinity may induce specific patterns in the received signal's strength. Depending on the distance to the receiver, the size of the object or individual and the type and intensity of movement, a characteristic fingerprint of the signal

strength fluctuation might be recognizable. The RF-receiver then becomes a sensor to identify situations and events of entities in its proximity.

For instance, time series data of the Received Signal Strength Indicator (RSSI) in typical low-cost consumer radio hardware has been shown to detect human motion, track individuals, and identify objects. This led to the definition of a novel sensing approach termed "Device-Free Localization (DFL)". DFL is defined as the localization or tracking of a person using RF-signals in which the person is not required to carry a radio device. Applications of the DFL concept include intrusion detection, smart homes, border protection, breathing frequency monitoring in a hospital, traffic estimation, human activity recognition, among others.

This special issue presents extended versions of selected papers from the fourth workshop on *Context-Systems Design, Evaluation and Optimization* (CoSDEO 2013) held in conjunction with the *2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing* (UbiComp 2013). The 2013 edition had the theme of Device-Free Radio-based Recognition. The workshop brought together researchers and practitioners working on the design, implementation, and evaluation of systems, algorithms and models for the device-free, radio-based recognition of contexts. Attendees presented papers and discussed the possibility of acquiring context information without instrumenting users or installing special hardware and without the drawbacks of optical or infrared systems. The event provided a discussion venue for this growing community in which fundamental problems as well as sophisticated approaches and actual implementations were presented.

After the meeting, three papers were invited to submit an extended version to the journal special issue. The first paper: “An Analysis of Device-Free and Device-Based WiFi-Localization Systems” by Heba Aly and Moustafa Youssef leverages an automated tool for fingerprint constructions to study novel scenarios for device-based and device-free WiFi-based localization that are difficult to evaluate in a real environment. Scenarios investigated include the effect of changing the mounting location of access points, technology upgrade,

crowd effect on calibration and operation, among others.

The second paper, “Teach your WiFi-Device: Recognise Simultaneous Activities and Gestures from Time-Domain RF-Features”, by Stephan Sigg, Shuyu Shi, and Yusheng Ji considers two untackled problems in RF-based activity recognition: the distinction of simultaneously conducted activities of individuals and the recognition of gestures from purely time-domain-based features. Both are based on a single antenna system, which is important for the application in end-user devices that typically have seldom access to more sophisticated, e.g. frequency-based features.

The third paper, “Device-Free Indoor Localization based on Ambient FM Radio Signals”, by Andrei Popleteev and Thomas Engel presents a system for device-free indoor localization using only ambient FM radio signals. The performance of the proposed system is evaluated as well as its temporal stability and the role of frequency diversity for passive localization.

We hope that you find this special issue interesting and we encourage you to explore this new and exciting area of device-free radio-based recognition.

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Moustafa Youssef is an associate professor at Egypt-Japan University of Science and Technology and Alexandria University. He has more than 10 issued and pending patents, is serving as an associate editor for the ACM TSAS, area editor of the ACM MC2R, served as a Co-Guest Editor of The IEEE Journal on Selected Areas in Communications - Special Issue on Mission-Critical Networking, and served on the organizing and technical committees of numerous prestigious conferences. He has published more than 100 technical papers in the world's top conferences and journals. His research interests include location determination technologies, mobile and pervasive computing, mobile wireless networks, and network security. Prof. Youssef is the recipient of the 2012 Egyptian State Award for Engineering Sciences, the 2010 joint TWAS-AAS-Microsoft Award for Young Scientists, the 2003 University of Maryland Invention of the Year Award, among others. He is a senior member of the IEEE and the IEEE Computer Society, a member of the ACM, and an elected member of the honor society Phi Kappa Phi. He is an ACM Distinguished Speaker.

Markus Scholz received his diploma in computer science from the University of Leipzig, Germany in 2008. Since 2009 he works as a research assistant at the Pervasive Computing Systems Group/ TecO at the Karlsruhe Institute of Technology, Germany. His research interests include novel sensor technologies and algorithms for activity and context recognition for smart environments and rescue workers. Since 2011, he investigates the use of device-free radio based sensing for such scenarios.

Stephan Sigg is with the Georg-August University Goettingen, Germany. Before, he was a Guest researcher at ETH Zurich, Switzerland (2013) and a researcher at the National Institute of Informatics, Japan (2010-2013), the Pervasive Computing Systems group at the Karlsruhe Institute of Technology (2010) and the Distributed and Ubiquitous Systems group at TU Braunschweig (2007-2010; 2013). He obtained his diploma in computer science from University of Dortmund in 2004 and finished his PhD in 2008 at the chair for communication technology at the University of Kassel. His research interests include the design, analysis and optimisation of algorithms for context aware and Ubiquitous systems.