Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering 24

Editorial Board

Ozgur Akan
Middle East Technical University, Ankara, Turkey

Paolo Bellavista
University of Bologna, Italy

Jiannong Cao
Hong Kong Polytechnic University, Hong Kong

Falko Dressler
University of Erlangen, Germany

Domenico Ferrari
Università Cattolica Piacenza, Italy

Mario Gerla
UCLA, USA

Hisashi Kobayashi
Princeton University, USA

Sergio Palazzo
University of Catania, Italy

Sartaj Sahni
University of Florida, USA

Xuemin (Sherman) Shen
University of Waterloo, Canada

Mircea Stan
University of Virginia, USA

Jia Xiaohua
City University of Hong Kong, Hong Kong

Albert Zomaya
University of Sydney, Australia

Geoffrey Coulson
Lancaster University, UK

Stephen Hailes Sabrina Sicari
George Roussos (Eds.)

Sensor Systems and Software

First International ICST Conference, S-CUBE 2009
Pisa, Italy, September 7-9, 2009
Revised Selected Papers

Springer

Volume Editors

Stephen Hailes
University College London
Department of Computer Science
London, WC1E 6BT, United Kingkom
E-mail: s.hailes@cs.ucl.ac.uk

Sabrina Sicari
University of Insubria
Dipartimento di Informatica e Comunicazione
21100 Varese, Italy
E-mail: sabrina.sicari@uninsubria.it

George Roussos
University of London
School of Computer Science and Information Systems
London WC1E 7HX, United Kingdom
E-mail: g.roussos@bbk.ac.uk

Library of Congress Control Number: 2009942541

CR Subject Classification (1998): C.2, J.3, K.4.2, K.6, C.2.1, C.3

ISSN 1867-8211
ISBN-10 3-642-11527-6 Springer Berlin Heidelberg New York
ISBN-13 978-3-642-11527-1 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

springer.com

© ICST Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering 2010
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 12830282 06/3180 5 4 3 2 1 0

Preface

The First International ICST Conference on Sensor Systems and Software (S-cube 2009) was held during 7–8 September in Pisa, Italy. This new international conference was dedicated to addressing the research challenges facing system development and software support for systems based on wireless sensor networks (WSNs) that have the potential to impact society in many ways. Currently, wireless sensor networks introduce innovative and interesting application scenarios that may support a large amount of different applications including environmental monitoring, disaster prevention, building automation, object tracking, nuclear reactor control, fire detection, agriculture, healthcare, and traffic monitoring. The widespread acceptance of these new services can be improved by the definition of frameworks and architectures that have the potential to radically simplify software development for wireless sensor network-based applications. The aim of these new architectures is to support flexible, scalable programming of applications based on adaptive middleware. As a consequence, WSNs require novel programming paradigms and technologies. Moreover, the design of new complex systems, characterized by the interaction of different and heterogeneous resources, will allow the development of innovative applications that meet high-performance goals. Hence, WSNs require contributions from many fields such as embedded systems, distributed systems, data management, system security and applications. The conference places emphasis on layers well above the traditional MAC and routing and transport layer protocols. The aim of the conference is to create a forum in which researchers from academia and industry, practitioners, business leaders, intellectual property experts and venture capitalists may work together in order to compare and debate different innovative solutions.

The technical program of S-cube 2009 well reflected the current priorities in wireless sensor networks. Several papers addressed modeling and performance evaluation; several contributions were related to support sensor programming paradigms and infrastructure properties, such as middleware architectures and security. In addition, a considerable part of the technical program was devoted to consolidated and emerging application areas for wireless sensor network services, such as e-health applications and home applications.

The conference program started with a keynote speech followed by seven technical sessions distributed over a period of two days. There were around 50 registrants for the conference.

The conference received around 45 submissions from different countries. After a thorough review process, 16 papers were accepted from an open call and 3 distinguished researchers were invited to contribute 3 invited papers. The overall paper acceptance rate is around 35%. The keynote speech titled “From Sensor Networks to the Web of Things” was delivered by Kay Römer from the University of Luebeck, Germany.

The social program included a tour of the city and a social dinner held on the first day of the conference. It provided a good opportunity for networking among the attendees.

S-CUBE 2010 is under organization. In addition to the technical sessions, S-CUBE 2010 is also soliciting tutorials and workshop proposals.

Organization

Steering Committee Chair

Imrich Chlamtac	Create-Net, Italy

Conference General Co-chairs

Sabrina Sicari	Universitá degli studi dell'Insubria, Italy
Stephen Hailes	University College of London, UK

Technical Program Chair

George Roussos	Birkbeck College, University of London, UK

Local Chair

Gianluca Dini	Universitá di Pisa, Italy

Publications Chair

Luca Mottola	Swedish Institute of Computer Science, Sweden

Publicity Co-chairs

Matteo Cesana	Politecnico di Milano, Italy
Houda Labiod	Telecom Paris, France

Web Chair

Pietro Colombo	Universitá degli studi dell'Insubria, Italy

Conference Coordinator

Barbara Török	ICST

Technical Program Committee

Marco Benini	Universitá dell'Insubria, Italy
Jan Beutel	ETH Zurich, Switzerland
Alberto Coen Porisini	Universitá dell'Insubria, Italy
Christine Julien	The University of Texas at Austin, USA

Eli Katsiri	Birkbeck College, UK
Gerd Kortuem	Lancaster University, UK
Houda Labiod	Telecom Paris, France
Akos Ledeczi	Vanderbilt University, USA
Luis Lopes	University of Porto, Portugal
Sam Michiels	K.U. Leuven, Belgium
Daniele Miorandi	Create-net, Italy
Mattia Monga	Universitá di Milano, Italy
Mirco Musolesi	University of Cambridge, UK
Tatsuo Nakajima	Waseda University, Japan
Animesh Pathak	INRIA, France
Jochen Schiller	Freie Universität Berlin, Germany
Krishna M. Sivalingam	University of Maryland, USA
Robert Szewczyk	Sentilla Corporation, USA
Andreas Terzis	Johns Hopkins University, USA
Eiko Yoneki	University of Cambridge, UK

Sponsored by ICST

Technically Co-Sponsored by Create-Net, ACM SIGBED, UKRI IEEE, University of Pisa

Table of Contents

Applying Complex Event Processing and Extending Sensor Web Enablement to a Health Care Sensor Network Architecture 1
Gavin E. Churcher and Jeff Foley

Turn-Based Gesture Interaction in Mobile Devices 11
Sanna Kallio, Panu Korpipää, Jukka Linjama, and Juha Kela

A Large-Scale Wireless Network Approach for Intelligent and Automated Meter Reading of Residential Electricity 20
Victor Custodio, Jose Ignacio Moreno, and Juan Pablo Viñuela

Weak Process Models for Attack Detection in a Clustered Sensor Network Using Mobile Agents 33
Marco Pugliese, Annarita Giani, and Fortunato Santucci

Key Establishment Using Group Information for Wireless Sensor Networks 51
William R. Claycomb, Rodrigo Lopes, Dongwan Shin, and Byunggi Kim

A Forward and Backward Secure Key Management in Wireless Sensor Networks for PCS/SCADA 66
Hani Alzaid, DongGook Park, Juan González Nieto, Colin Boyd, and Ernest Foo

Analysis of Channel Access Delay of Slotted CSMA/CA in a WSN 83
Alexandre Guitton and Nassima Hadid

Accurate Analysis of IEEE 802.15.4 Slotted CSMA/CA over a Real-Time Wireless Sensor Network 98
Wen-Tzeng Huang, Jing-Ting Lin, Chin-Hsing Chen, Yuan-Jen Chang, and You-Yin Chen

Physical Characterization of Acoustic Communication Channel Properties in Underwater Mobile Sensor Networks 111
Andrea Caiti, Emanuele Crisostomi, and Andrea Munafò

A Code Generator for Distributing Sensor Data Models 127
Urs Hunkeler and Paolo Scotton

Integer-Based Optimisations for Resource-Constrained Sensor Platforms 144
Michael Zoumboulakis and George Roussos

ProSe: A Programming Tool for Rapid Prototyping of Sensor Networks 158
Mahesh Arumugam and Sandeep S. Kulkarni

Energy-Aware Dynamic Route Management for THAWS 174
Chong Shen, Sean Harte, Emanuel Popovici, Brendan O'Flynn, and John Barton

All Roads Lead to Rome: Data Highways for Dense Wireless Sensor Networks 189
David Lowe and Daniele Miorandi

Sensor Data Fusion for Activity Monitoring in Ambient Assisted Living Environments 206
M. Amoretti, F. Wientapper, F. Furfari, S. Lenzi, and S. Chessa

Trade-off Analysis of a MAC Protocol for Wireless e-Emergency Systems 222
Óscar Gama, Paulo Carvalho, J.A. Afonso, and P.M. Mendes

An Underwater Robotic Network for Monitoring Nuclear Waste Storage Pools 236
Sarfraz Nawaz, Muzammil Hussain, Simon Watson, Niki Trigoni, and Peter N. Green

Evaluation of the Impact of the Topology and Hidden Nodes in the Performance of a ZigBee Network 256
Helena Fernández-López, Pedro Macedo, José A. Afonso, J.H. Correia, and Ricardo Simões

Coordinated Sleeping for Beaconless 802.15.4-Based Multihop Networks 272
A.G. Ruzzelli, A. Schoofs, G.M.P. O'Hare, M. Aoun, and P. van der Stok

Author Index 289