

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Alfred Kobsa

University of California, Irvine, CA, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

University of Dortmund, Germany

Madhu Sudan

Microsoft Research, Cambridge, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max-Planck Institute of Computer Science, Saarbruecken, Germany

Payam Barnaghi Klaus Moessner
Mirko Presser Stefan Meissner (Eds.)

Smart Sensing and Context

4th European Conference, EuroSSC 2009
Guildford, UK, September 16-18, 2009
Proceedings

Volume Editors

Payam Barnaghi

Klaus Moessner

Mirko Presser

Stefan Meissner

Centre for Communication Systems Research

Faculty of Engineering and Physical Sciences

University of Surrey

Guildford, Surrey, GU2 7XH, UK

E-mail:

{p.barnaghi, k.moessner, m.presser, s.meissner}@surrey.ac.uk

Library of Congress Control Number: 2009934115

CR Subject Classification (1998): I.2.9, C.2.1, C.2.4, D.4.2, D.4.7, H.3.4

LNCS Sublibrary: SL 5 – Computer Communication Networks
and Telecommunications

ISSN 0302-9743

ISBN-10 3-642-04470-0 Springer Berlin Heidelberg New York

ISBN-13 978-3-642-04470-0 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

© Springer-Verlag Berlin Heidelberg 2009

Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper SPIN: 12752102 06/3180 5 4 3 2 1 0

Preface

Welcome to the proceedings of the 4th European Conference on Smart Sensing and Context hosted by the Centre for Communication Systems Research, University of Surrey, in Guildford, UK.

Smart sensing and context are the key enablers for effective autonomous systems, providing transparent technologies to realize the vision of ubiquitous computing, intelligent services and networking. (Wireless) Sensor and actuator networks, tightly integrated into the structure of the Internet provide the underlying manifestation of the physical world into the Internet of Things. Networked sensors can infer context from raw data and capture user and application needs to provide smart adaptive services. Higher-level context can be deducted locally or remotely by combining and abstracting information from smart sensors. The 4th European Conference on Smart Sensing and Context explored new techniques, algorithms and architectures on utilizing context and context-aware services and their applications. The conference builds on the success of the past editions held in Zürich, Switzerland in 2008, in Kendal, UK in 2007 and in Enschede, The Netherlands in 2006. EuroSSC is a forum to exchange ideas and to discuss the most recent developments in smart sensing and context field. It explores the latest findings and state-of-the-art developments in technology, covering human and user aspects. The main topics discussed this year focused on embedded applications, context-aware platforms, context processing, semantic technologies, mobile platforms and real-world deployment and exploitation scenarios. The development of integrating sensor and actuator networks and context-platforms in a wider scale setting has added a new dimension to global networks and has enabled users and applications to interact with the physical world more efficiently. The vision of integrating millions of interconnected resources which are accessible through different services to intermediate interaction between the physical world and the digital world will form the structure of the future Internet and services and will create a platform for networked knowledge. At the conference and also during the poster and demo session research outcomes were presented with this vision in mind. We hope the presented work and demonstrated systems will help researchers and developers in this field to discuss and exchange innovative ideas and plans. A total of 16 full papers were accepted to the conference. Each paper received at least three peer reviews. The Program Co-chairs selected the accepted papers based on their technical merit and the review reports. The conference and proceedings were structured into six main tracks which discussed the key themes addressed by EuroSSC 2009: activity recognition, information aspects of context-aware sensor and actuator systems, context-aware service platforms, Context processing, reasoning and fusion, real-world experiences with deployed systems, and context-aware frameworks in mobile environments.

Amit Sheth from Kno.e.sis Center, Wright State University, and Marimuthu Palaniswami from ARC Research Network on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP), the University of Melbourne, were invited to give keynote speeches. Amit Sheth's keynote was entitled "Computing for Human Experience: Semantics-Empowered Sensors, Services and Social Computing on Ubiquitous Web." He discussed how sensing, semantics, and social computing work in concert to enrich the Web-based interactions; multisensory devices, computing and ubiquitous connectivity involving multimodal information engage transparency in human activities to enrich them in ways not possible before. Marimuthu Palaniswami's talk focused on "Large-Scale Sensor Network Deployment: Research Challenges and Opportunities." Marimuthu Palaniswami presented different issues regarding deployment of large scale sensor networks—making the transition from the lab to the real world—through case studies in environmental monitoring and healthcare.

EuroSSC 2009 was sponsored by the EU FP-7 project SENSEI and also had technical co-sponsorship by the IEEE United Kingdom and Ireland section. We are thankful to the Centre for Communication Systems Research (CCSR) at the University of Surrey, the Springer LNCS staff, the University of Surrey Conference Office and the Wearable Computing Lab at ETH Zürich for their help in organizing this conference.

We owe special thanks to the 90 contributing authors and to the Technical Program Committee members and reviewers of the papers. We would also like to thank Safa Sway, who helped with the local arrangements and who worked hard to make everything run smoothly and pleasantly. Our gratitude also extends to numerous volunteers who helped us during the organization and running of this conference.

September 2009

Payam Barnaghi
Klaus Moessner
Mirko Presser
Stefan Meissner

Organization

EuroSSC 2009 was organized by Centre for Communication Systems Research (CCSR), University of Surrey.

Organizing Committee

General Chair

Payam Barnaghi	CCSR, University of Surrey, UK
----------------	--------------------------------

Program Co-chairs

Klaus Moessner	CCSR, University of Surrey, UK
Mirko Presser	CCSR, University of Surrey, UK
Stefan Meissner	CCSR, University of Surrey, UK
Daniel Roggen	ETH Zürich, Switzerland
Clemens Lombriser	ETH Zürich, Switzerland
Paul Havinga	University of Twente, The Netherlands
Gerd Kortuem	Lancaster University, UK

Poster and Demo Chair

Clemens Lombriser	ETH Zürich, Switzerland
-------------------	-------------------------

Local Co-organizers

Safa Sway	CCSR, University of Surrey, UK
Stefan Meissner	CCSR, University of Surrey, UK
Tarek Elsaleh	CCSR, University of Surrey, UK

Technical Program Committee

Heikki Ailisto	VTT, Finland
Marwan Al-Akaidi	De Montfort University, UK
Nigel Baker	University of the West of England, UK
Martin Bauer	NEC, Germany
Luca Benini	Università di Bologna, Italy
Jesus Bernat Vercher	Telefonica, Spain
Francois Carrez	University of Surrey, UK
Jessie Dedecker	Sirris, Belgium
Simon Dobson	University College Dublin, Ireland
Henk Eertink	Telematica Instituut, The Netherlands
Martin Elixmann	Philips Research, Germany
Elisabetta Farella	Università di Bologna, Italy

Dieter Fensel	DERI, Austria
Daniel Fitton	Lancaster University, UK
Elgar Fleisch	ETH Zürich, Switzerland
Patrik Florèn	Helsinki Institute for Information Technology, Finland
Kaori Fujinami	Tokyo University of Agriculture and Technology, Japan
Elena Gaura	Coventry University, UK
Alexander Gluhak	University of Surrey, UK
Sandeep Gupta	Arizona State University, USA
Manfred Hauswirth	National University of Ireland, Ireland
Alban Hessler	NEC, Germany
Theo Kanter	Ericsson, Sweden
Julia Kantorovitch	VTT, Finland
Ralf Kernchen	University of Surrey, UK
Marc Langheinrich	ETH Zürich, Switzerland
Rodger Lea	University of British Columbia, USA
Peter Leijdekkers	University of Technology Sydney, Australia
Maria Lijding	University of Twente, The Netherlands
Feng Ling	Tsinghua University, China
Paul Lukowicz	University of Passau, Germany
Nirvana Meratnia	University of Twente, The Netherlands
Florian Michahelles	ETH Zürich, Switzerland
Kevin Mills	NIST, USA
Tatsuo Nakajima	Waseda University, Japan
Santosh Pandey	CISCO Systems, USA
Christian Prehofer	Nokia Research Center, Finland
Kay Römer	ETH Zürich, Switzerland
Kurt Rothermel	University of Stuttgart, Germany
Kamran Sayrafian	NIST, USA
Albrecht Schmidt	University of Duisburg-Essen, Germany
Wolfgang Schott	IBM Research Zürich, Switzerland
Mihail Sichitiu	North Carolina State University, USA
Frank Siegemund	European Microsoft Innovation Center, Germany
Tod Sizer	Bell Labs, USA
Vera Stavroulaki	University of Piraeus, Greece
Kristof van Laerhoven	Darmstadt University of Technology, Germany
Roberto Verdone	University of Bologna, Italy
Matthias Wagner	DoCoMo Euro-Labs, Germany
Adrian Waller	Thales Research and Technology, UK
Chen Xiang	Agency for Science, Technology and Research, Singapore
Anna Zhdanova	FTW, Austria
Michele Zorzi	University of Padova, Italy

Additional Reviewers

Majid Ghader

University of Surrey, UK

Wei Wang

University of Nottingham (Malaysia Campus),
Malaysia

Sponsoring Institutions

The EU FP-7 project SENSEI (<http://www.sensei-project.eu/>).

The IEEE United Kingdom and Ireland section co-technical sponsorship.

Table of Contents

Activity Recognition

Episode Segmentation Using Recursive Multiple Eigenspaces	1
<i>Aziah Ali, Surapa Thiemjarus, and Guang-Zhong Yang</i>	
Keep on Moving! Activity Monitoring and Stimulation Using Wireless Sensor Networks	11
<i>Stephan Bosch, Mihai Marin-Perianu, Raluca Marin-Perianu, Paul Havinga, and Hermie Hermens</i>	
Time-Lag as Limiting Factor for Indoor Walking Navigation	24
<i>Andreas Riener, Markus Straub, and Alois Ferscha</i>	

Information Aspects of Context-Aware Sensor and Actuator Systems

A Query Service for Raw Sensor Data	38
<i>Dónall McCann and Mark Roantree</i>	
A Context Lifecycle for Web-Based Context Management Services	51
<i>Gearoid Hynes, Vinny Reynolds, and Manfred Hauswirth</i>	
Semantic Annotation and Reasoning for Sensor Data	66
<i>Wang Wei and Payam Barnaghi</i>	

Context-Aware Service Platforms

Semantic Rules for Context-Aware Geographical Information Retrieval	77
<i>Carsten Keßler, Martin Raubal, and Christoph Wosniok</i>	
A Context Provisioning Framework to Support Pervasive and Ubiquitous Applications	93
<i>Michael Knappmeyer, Nigel Baker, Saad Liaquat, and Ralf Tönjes</i>	
Context-Aware Recommendations on Mobile Services: The m:Ciudad Approach	107
<i>Andreas Emrich, Alexandra Chapko, and Dirk Werth</i>	

Context Processing, Reasoning and Fusion

Context Cells: Towards Lifelong Learning in Activity Recognition Systems	121
<i>Alberto Calatroni, Claudia Villalonga, Daniel Roggen, and Gerhard Tröster</i>	

Automatic Event-Based Synchronization of Multimodal Data Streams from Wearable and Ambient Sensors	135
<i>David Bannach, Oliver Amft, and Paul Lukowicz</i>	

Using Dempster-Shafer Theory of Evidence for Situation Inference	149
<i>Susan McKeever, Juan Ye, Lorcan Coyle, and Simon Dobson</i>	

Real-World Experiences with Deployed Systems

Recognizing the Use-Mode of Kitchen Appliances from Their Current Consumption	163
<i>Gerald Bauer, Karl Stockinger, and Paul Lukowicz</i>	

Wireless Sensor Networks to Enable the Passive House - Deployment Experiences	177
<i>Tessa Daniel, Elena Gaura, and James Brusey</i>	

Context-Aware Frameworks in Mobile Environments

Mobile Context Toolbox: An Extensible Context Framework for S60 Mobile Phones	193
<i>Jakob Eg Larsen and Kristian Jensen</i>	

Statistic-Based Context Recognition in Smart Car	207
<i>Jie Sun and Kejia He</i>	

Author Index	219
---------------------------	-----