

April 15–17, 2014
Berlin, Germany



Association for
Computing Machinery

Advancing Computing as a Science & Profession



IPSN'14

Proceedings of the 13th International Symposium on
Information Processing in Sensor Networks
(part of CPS Week)

Sponsored by:

IEEE, ACM SIGBED and IEEE COMPUTER SOCIETY

Supported by:

**Bosch, Esterel Technologies, Airbus Defense & Space, SafeTRANS,
Acatech, Microsoft Research, ITG, and Carl von Ossietzky Universität**

Table of Contents

IPSN 2014 Conference Organization x

IPSN 2014 Sponsors & Supporters xii

Session: All Things Sensors

- **Fine-Grained Remote Monitoring, Control and Pre-Paid Electrical Service in Rural Microgrids** 1
Maxim Buevich, Dan Schnitzer (*Carnegie Mellon University*),
Tristan Escalada, Arthur Jacquiau-Chamski (*EarthSpark International*),
Anthony Rowe (*Carnegie Mellon University*)
- **Aquatic Debris Monitoring Using Smartphone-Based Robotic Sensors** 13
Yu Wang (*Michigan State University*), Rui Tan (*Advanced Digital Sciences Center, Illinois at Singapore*),
Guoliang Xing, Jianxun Wang, Xiaobo Tan, Xiaoming Liu (*Michigan State University*),
Xiangmao Chang (*Michigan State University & Nanjing University of Aeronautics and Astronautics*)
- **Airplanes Aloft as a Sensor Network for Wind Forecasting** 25
Ashish Kapoor (*Microsoft Research, Redmond*),
Zachary Horvitz, Spencer Laube (*Seattle Academy of Arts and Sciences*),
Eric Horvitz (*Microsoft Research, Redmond*)
- **Using Humans as Sensors: An Estimation-Theoretic Perspective** 35
Dong Wang, Md Tanvir Amin, Shen Li, Tarek Abdelzaher (*University of Illinois at Urbana Champaign*),
Lance Kaplan (*US Army Research Labs*), Siyu Gu, Chenji Pan (*University of Illinois at Urbana Champaign*),
Hengchang Liu (*University of Science and Technology of China*),
Charu C. Aggarwal, Raghu Ganti (*IBM Research*),
Xinlei Wang, Prasant Mohapatra (*University of California, Davis*),
Boleslaw Szymanski (*Rensselaer Polytechnic Institute*), Hieu Le (*Caterva, Inc.*)

Session: Sensors Can Tell

- **One Meter to Find Them All - Water Network Leak Localization Using a Single Flow Meter** 47
Iswarya Narayanan (*The Pennsylvania State University*),
Arunchandar Vasan, Venkatesh Sarangan (*TATA Consultancy Services*),
Anand Sivasubramaniam (*The Pennsylvania State University*)
- **Non-Invasive Respiration Rate Monitoring Using a Single COTS TX-RX Pair** 59
Ossi Kaltiokallio, Hüseyin Yiğitler, Riku Jäntti (*Aalto University*), Neal Patwari (*University of Utah*)
- **Identifying Drug (Cocaine) Intake Events from Acute Physiological Response in the Presence of Free-Living Physical Activity** 71
Syed Monowar Hossain, Amin Ahsan Ali, Md. Mahbubur Rahman (*University of Memphis*),
Emre Ertin (*The Ohio State University*), David Epstein (*National Institutes of Health*),
Ashley Kennedy, Kenzie Preston (*National Institutes of Health*), Annie Umbricht (*Johns Hopkins University*),
Yixin Chen (*Washington University in St. Louis*), Santosh Kumar (*University of Memphis*)

Session: Testbeds

- **Bringing up OpenSky: A Large-Scale ADS-B Sensor Network for Research** 83
Matthias Schäfer (*TU Kaiserslautern*), Martin Strohmeier (*University of Oxford*), Vincent Lenders (*armasuisse*),
Ivan Martinovic (*University of Oxford*), Matthias Wilhelm (*TU Kaiserslautern*)
- **TempLab: A Testbed Infrastructure to Study the Impact of Temperature on Wireless Sensor Networks** 95
Carlo Alberto Boano (*Graz University of Technology*), Marco Zúñiga (*Delft University of Technology*),
James Brown, Utz Roedig (*Lancaster University*), Chamath Keppitiyagama (*SICS Swedish ICT*),
Kay Römer (*Graz University of Technology*)

• RESONATE: Reverberation Environment Simulation for Improved Classification of Speech Models	107
Robert F. Dickerson (<i>College of William and Mary</i>), Enamul Hoque, Philip Asare, Shahriar Nirjon, John A. Stankovic (<i>University of Virginia</i>)	
• CSense: A Stream-Processing Toolkit for Robust and High-Rate Mobile Sensing Applications	119
Farley Lai, Syed Shabih Hasan, Austin Laugesen, Octav Chipara (<i>University of Iowa</i>)	

Session: Location, Location, Location

• Lightweight Map Matching for Indoor Localisation Using Conditional Random Fields	131
Zhuoling Xiao, Hongkai Wen, Andrew Markham, Niki Trigoni (<i>University of Oxford</i>)	
• PiLoc: A Self-Calibrating Participatory Indoor Localization System	143
Chengwen Luo, Hande Hong, Mun Choon Chan (<i>National University of Singapore</i>)	
• Energy Efficient GPS Acquisition with Sparse-GPS	155
Prasant Misra (<i>Indian Institute of Science</i>), Wen Hu (<i>CSIRO Computational Informatics</i>), Yuzhe Jin, Jie Liu (<i>Microsoft Research</i>), Amanda Souza de Paula (<i>University of Sao Paulo</i>), Niklas Wirström (<i>SICS Swedish ICT</i>), Thiembo Voigt (<i>SICS Swedish ICT and Uppsala Universitet</i>)	
• Optimal Sensor Placement and Measurement of Wind for Water Quality Studies in Urban Reservoirs	177
Wan Du, Zikun Xing, Mo Li, Bingsheng He, Lloyd Hock Chye Chua (<i>Nanyang Technological University</i>), Haiyan Miao (<i>Institute of High Performance Computing, A*Star</i>)	

Session: Networks

• Lightweight Neighborhood Cardinality Estimation in Dynamic Wireless Networks	189
Marco Cattani, Marco Zuniga, Andreas Loukas, Koen Langendoen (<i>Delft University of Technology</i>)	
• Fast and Fine-Grained Counting and Identification Via Constructive Interference in Wsns	191
Dingming Wu (<i>Nanjing University</i>), Chao Dong (<i>PLA University of Science and Technology</i>), Shaojie Tang (<i>Temple University</i>), Haipeng Dai (<i>Nanjing University</i>), Guanghai Chen (<i>Nanjing University & Shanghai Jiao Tong University</i>)	
• P3: A Practical Packet Pipeline Using Synchronous Transmissions for Wireless Sensor Networks	213
Manjunath Doddavenkatappa, Mun Choon Chan (<i>National University of Singapore</i>)	
• Cyclic Network Automata and Cohomological Waves	167
Yiqing Cai (<i>Institute for Mathematics and its Applications</i>), Robert Ghrist (<i>University of Pennsylvania</i>)	

Session: Let There Be Light

• SIPs: Solar Irradiance Prediction System	225
Stefan Achleitner (<i>The Pennsylvania State University</i>), Ankur Kamthe, Tao Liu, Alberto E. Cerpa (<i>University of California, Merced</i>)	
• Face Recognition on Smartphones Via Optimised Sparse Representation Classification	237
Yiran Shen (<i>University of New South Wales & CSIRO Computational Informatics</i>), Wen Hu, Mingrui Yang (<i>CSIRO Computational Informatics</i>), Bo Wei (<i>University of New South Wales & CSIRO Computational Informatics</i>), Simon Lucey (<i>CSIRO Computational Informatics</i>), Chun Tung Chou (<i>University of New South Wales</i>)	
• Visual Light Landmarks for Mobile Devices	249
Niranjini Rajagopal, Patrick Lazik, Anthony Rowe (<i>Carnegie Mellon University</i>)	
• Sensors with Lasers: Building a WSN Power Grid	261
Naveed Anwar Bhatti, Affan Ahmed Syed (<i>National University of Computer and Emerging Sciences</i>), Muhammad Hamad Alizai (<i>University of Engineering and Technology</i>)	

Session: Poster Session

- **Poster Abstract: Practical Limits of WiFi Time-of-Flight Echo Techniques** 273
Theodoros Bourchas, Maciej Bednarek (*ETH Zürich*), Domenico Giustiniano (*Institute IMDEA Networks*), Vincent Lenders (*armasuisse*)
- **Poster Abstract: MaWi: A Hybrid Magnetic and Wi-Fi System for Scalable Indoor Localization** 275
Chi Zhang, Jun Lou (*Nanyang Technological University*), Jianxin Wu (*Nanjing University*)
- **Poster Abstract: Water Level Estimation in Urban Ultrasonic/Passive Infrared Flash Flood Sensor Networks Using Supervised Learning** 277
Mustafa Mousa, Christian Claudel (*King Abdulla University of Science and Technology*),
- **Poster Abstract: Implications of Target Diversity for Organic Device-Free Localization** 279
Ju Wang, Xiaojiang Chen, Dingyi Fang (*Northwest University*), Chase Qishi Wu (*Northwest University & The University of Memphis*), Tianzhang Xing, Weike Nie (*Northwest University*)
- **Poster Abstract: eNav — A Smartphone-Based Energy Efficient Vehicular Navigation System** 281
Shaohan Hu (*University of Illinois at Urbana-Champaign*), Lu Su (*State University of New York at Buffalo*), Shen Li, Shiguang Wang, Chenji Pan, Siyu Gu, Tanvir Al Amin (*University of Illinois at Urbana-Champaign*), Hengchang Liu (*University of Science and Technology of China*), Suman Nath (*Microsoft Research, Redmond*), Romit Roy Choudhury, Tarek F. Abdelzaher (*University of Illinois at Urbana-Champaign*)
- **Poster Abstract: PiMi Air Community: Getting Fresher Indoor Air by Sharing Data and Know-hows** 283
Yixin Zheng, Linglong Li, Lin Zhang (*Tsinghua University*)
- **Poster Abstract: A Decentralized Routing Scheme Based on a Zero-Sum Game to Optimize Energy in Solar Powered Sensor Networks** 285
Ahmad H. Dehwah, Hamidou Tembine, Christian Claudel (*King Abdulla University of Science and Technology*)
- **Poster Abstract: A MAC Protocol for Medical Applications** 287
Waltenebus Dargie, Jianjun Wen (*Technische Universität Dresden*)
- **Poster Abstract: Supporting Heterogeneous LCD/Camera Links** 289
Frederik Hermans (*Uppsala Universitet*), Liam McNamara (*SICS*), Thimo Voigt (*Uppsala Universitet & SICS*), Christian Rohner, Edith Ngai, Per Gunningberg (*Uppsala Universitet*)
- **Poster Abstract: EIL – An Environment-Independent Device-Free Passive Localization Approach** 291
Liqiong Chang, Dingyi Fang (*Northwest University*), Zhe Yang (*Northwestern Polytechnical University*), Xiaojiang Chen, Ju Wang, Weike Nie, Tianzhang Xing (*Northwest University*)
- **Poster Abstract: Smartphone Support for Persons Who Stutter** 293
Thimo Voigt (*Uppsala University & SICS*), Kasun Hewage, Per Alm (*Uppsala University*)
- **Poster Abstract — SADSense: Personalized Mobile Sensing for Seasonal Effects on Health** 295
Kamyar Niroomand (*Uppsala University*), Liam McNamara (*Swedish Institute of Computer Science*), Kiril Goguev, Edith Ngai (*Uppsala University*)
- **Poster Abstract: Static Analysis of Device Drivers in TinyOS** 297
Abdelraouf Ouadjaout, Noureddine Lasla, Miloud Bagaa, Nadjib Badache (*CERIST Research Center*)
- **Poster Abstract: A Harmony of Sensors: Achieving Determinism in Multi-Application Sensor Networks** 299
Vikram Gupta, Nuno Pereira, Eduardo Tovar (*Polytechnic Institute of Porto & Carnegie Mellon University*), Ragunathan (Raj) Rajkumar (*Carnegie Mellon University*)
- **Poster Abstract: Precision Improvement of Aircrafts Attitude Estimation Through Gyro Sensors Data Fusion in a Redundant Inertial Measurement Unit** 301
Teodor Lucian Grigorie (*University of Craiova*), Ruxandra Mihaela Botez (*Ecole de Technologie Supérieure*)

• Poster Abstract: Information-Maximizing Data Collection in Social Sensing Using Named-Data	303
Shiguang Wang, Tarek Abdelzaher, Santhosh Gajendran, Ajith Herga, Sachin Kulkarni, Shen Li, Hengchang Liu, Chethan Suresh, Abhishek Sreenath (<i>University of Illinois at Urbana-Champaign</i>), William Dron, Alice Leung (<i>BBN Raytheon Technologies</i>), Ramesh Govindan (<i>University of Southern California</i>), John Hancock (<i>ArtisTech, Inc.</i>)	
• Poster Abstract: NDP – A Novel Device-Free Localization Method with Little Efforts	305
Liqiong Chang, Ju Wang, Dingyi Fang, Xiaojiang Chen, Tianzhang Xing, Weiye Nie (<i>Northwest University</i>)	
• Poster Abstract : Directional Transmissions and Receptions for Burst Forwarding Using Disjoint Paths	307
Ambuj Varshney (<i>Uppsala University</i>), Thimo Voigt (<i>SICS Swedish ICT and Uppsala University</i>), Luca Mottola (<i>SICS Swedish ICT and Politecnico di Milano</i>)	
• Poster Abstract: A Location Aware Personalized Smart Control System	309
Kalyan Pathapati Subbu, Neethu Thomas (<i>Amrita Vishwa Vidhyapeet</i>)	

Session: Demonstration Session

• Demonstration Abstract: Crowdmeter - Predicting Performance of Crowd-Sensing Applications Using Emulations	311
Manoj R. Rege, Vlado Handziski, Adam Wolisz (<i>Technische Universität Berlin</i>)	
• Demonstration Abstract: OpenSky — A Large-Scale ADS-B Sensor Network for Research	313
Matthias Schäfer (<i>TU Kaiserslautern</i>), Martin Strohmeier (<i>University of Oxford</i>), Vincent Lenders (<i>armasuisse</i>), Ivan Martinovic (<i>University of Oxford</i>), Matthias Wilhelm (<i>TU Kaiserslautern</i>)	
• Demonstration Abstract: PyoT, a Macroprogramming Framework for the IoT	315
Andrea Azzarà, Daniele Alessandrelli (<i>Scuola Superiore Sant'Anna</i>), Matteo Petracca, Paolo Pagano (<i>Consorzio Nazionale Interuniversitario per le Telecomunicazioni & Scuola Superiore Sant'Anna</i>)	
• Demonstration Abstract: Automatic Radio Map Construction Exploiting Annotated Walking Trajectories	317
Chengwen Luo, Hande Hong, Mun Choon Chan (<i>National University of Singapore</i>)	
• Demonstration Abstract: Applying Industrial Wireless Sensor Networks to Welder Machine System	319
Dong Yang, Hongchao Wang, Tao Zheng, Hongke Zhang (<i>Beijing Jiaotong University</i>), Mikael Gidlund (<i>ABB AB, Corporate Research</i>), Youzhi Xu (<i>Mid Sweden University</i>)	
• Demonstration Abstract: A MEMS-Based Airflow Sensor Network	321
Hock Beng Lim, Fei Xue, Shuwei Liu, Shanshan Pan, Jianmin Miao (<i>Nanyang Technological University</i>), Les Norford (<i>Massachusetts Institute of Technology</i>),	
• Demonstration Abstract: Automatic Speech Recognition for Resource-Constrained Embedded Systems	323
Felix Sutton, Reto Da Forno, Roman Lim, Marco Zimmerling, Lothar Thiele (<i>ETH Zurich</i>)	
• Demonstration Abstract: Airfeed – Indoor Real Time Interactive Air Quality Monitoring System	325
Kyeong T. Min, Andrzej Forsy, Thomas Schmid (<i>University of Utah</i>)	
• Demonstration Abstract: PiMi Air Box — A Cost-Effective Sensor for Participatory Indoor Quality Monitoring	327
Linglong Li, Yixin Zheng, Lin Zhang (<i>Tsinghua University</i>)	
• Demonstration Abstract: Simply RIOT — Teaching and Experimental Research in the Internet of Things	329
Oliver Hahn, Emmanuel Baccelli (<i>INRIA</i>), Hauke Petersen, Matthias Wählisch (<i>Freie Universität Berlin</i>), Thomas C. Schmidt (<i>HAW Hamburg</i>)	
• Demonstration Abstract: Crowdsourced Indoor Localization and Navigation with Anyplace	331
Lambros Petrou, George Larkou, Christos Laoudias, Demetrios Zeinalipour-Yazti, Christos G. Panayiotou (<i>University of Cyprus</i>)	

• Demonstration Abstract: A Lightweight, Portable Device with Integrated USB-Host Support for Reprogramming Wireless Sensor Nodes	333
Hugues Smeets, Chia-Yen Shih, Tim Meurer, Pedro José Marrón (<i>University of Duisburg-Essen</i>)	
• Demonstration Abstract: Positioning by Synchronized IR Light.....	335
Johan Haake, Peter Björk, Johannes Karlsson (<i>Umeå University</i>)	
• Demonstration Abstract: Participatory Sensing Enabled Environmental Monitoring in Smart Cities	337
Florian Zeiger, Marco F. Huber (<i>AGT International</i>)	
• Demonstration Abstract: Sensor Mockup Experiments with SmartLab.....	339
Georgios Larkou, Marios Mintzis, Stefano Taranto, Andreas Konstantinidis, Panayiotis G. Andreou, Demetrios Zeinalipour-Yazti (<i>University of Cyprus</i>)	
• Demonstration Abstract: An 8x8 MM2 Bluetooth Low Energy Wireless Motion-Sensing Platform.....	341
Tong Kun Lai, Anping Wang, Chun-Min Chang, Hua-Min Tseng, Kailing Huang, Jo-Ping Li (<i>National Tsing Hua University</i>), Wen-Chan Shih (<i>Academia Sinica</i>), Pai H. Chou (<i>National Tsing Hua University & University of California</i>)	
• Demonstration Abstract: Enabling WSN Nodes to Send Data to Smartmobiles by Blinking LEDs	343
Jo-Ping Li, Shin-Yi Chang (<i>National Tsing Hua University</i>), Pai H. Chou (<i>University of California</i>)	
• Demonstration Abstract: Submetering by Synthesizing Side-Channel Sensor Streams .	345
Meghan Clark, Bradford Campbell, Prabal Dutta (<i>University of Michigan</i>)	
• Demonstration Abstract: How Many Lights Do You See?	347
Niranjini Rajagopal, Patrick Lazik, Anthony Rowe (<i>Carnegie Mellon University</i>)	
• Demonstration Abstract: BioWatch — A Wrist Watch Based Physiological Signal Acquisition System.....	349
Simi Susan Thomas, Viswam Nathan, Chengzhi Zong (<i>The University of Texas at Dallas</i>), Praveen Aroul, Lijoy Philipose, Karthikeyan Soundarapandian (<i>Texas Instruments Incorporated</i>), Xiangrong Shi (<i>University of North Texas Health Science Center</i>), Roozbeh Jafari (<i>The University of Texas at Dallas</i>)	
• Demonstration Abstract: Upper Body Motion Capture System Using Inertial Sensors ...	351
Jian Wu, Zhanyu Wang, Suraj Raghuraman, Balakrishnan Prabhakaran, Roozbeh Jafari (<i>The University of Texas at Dallas</i>)	
Author Index.....	353