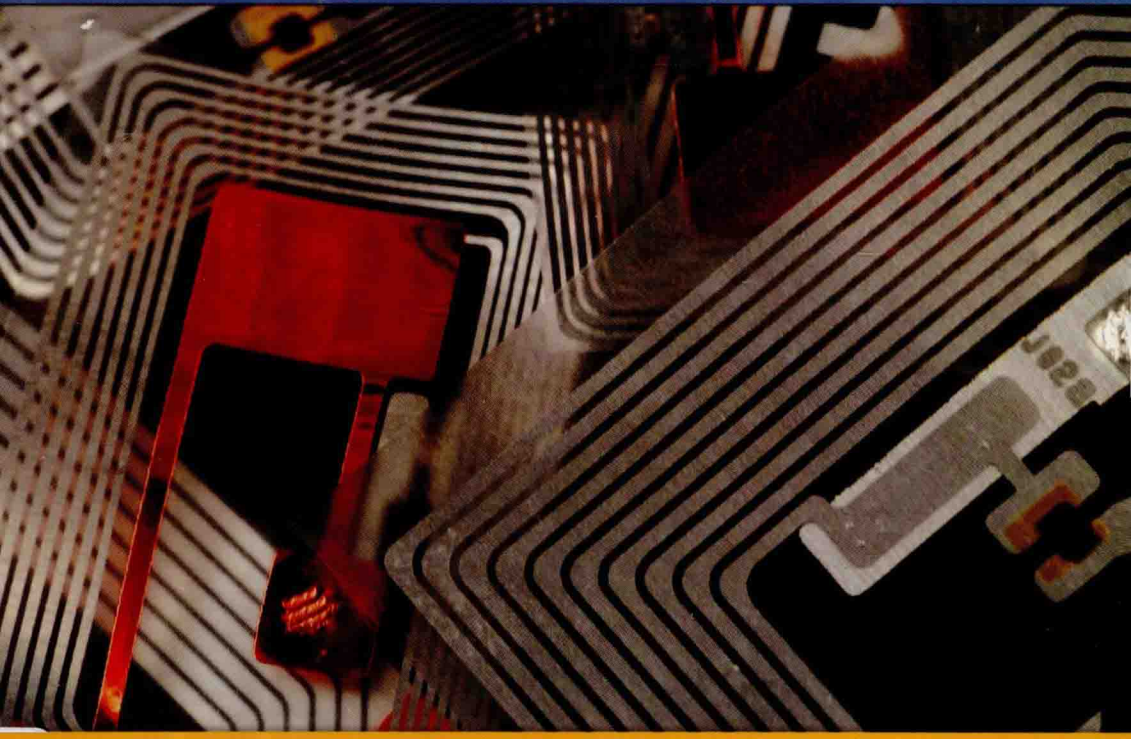
Wireless Networks and Mobile Communications Series

RFID AND SENSOR NETWORKS

Architectures, Protocols, Security, and Integrations

Edited by
Yan Zhang • Laurence T. Yang • Jiming Chen



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Dr. Yan Zhang, Series Editor
Simula Research Laboratory, Norway
E-mail: yanzhang@ieee.org

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Preface

Radio frequency identification (RFID) technology is witnessing a recent explosion of development in both industry and academia. A number of applications include supply chain management, electronic payments, RFID passports, environmental monitoring and control, office access control, intelligent labels, target detection and tracking, port management, food production control, animal identification, and so on. RFID is also an indispensable foundation to realize the pervasive computing paradigm—"Internet of things." It is strongly believed that many more scenarios will be identified when the principles of RFID are thoroughly understood, cheap components available, and when RFID security is guaranteed.

Wireless sensor networks (WSNs) are also attracting significant interest due to recent advances of the enabling technologies, including digital electronics, embedded systems, signal processing, and wireless communications. A WSN consists of a large number of small sensors with sensing, control, data processing, as well as communication and networking capabilities. WSNs are characterized by dense node deployments; unreliable sensors; frequent topology changes; and severe power, computation, and memory constraints. These unique characteristics pose considerable challenges for the design of WSNs. Because sensor networks usually transmit data and operate in hostile, unattended environments, the requirements and design of sensor networks are significantly different from other wireless networks like cellular networks, and ad hoc networks or mesh networks.

In practice, there is an increasing trend in integrating RFID and WSNs due to their complementary natures, and a flexible combination and demand for ubiquitous computing. A variety of applications are under development or in practical usage, e.g., smart homes, surveillance systems, and in personal healthcare. The integration of the two complementary technologies can exponentially enhance the visibility and monitoring capability. However, compared with either RFID or sensor networks alone, integrating RFID and WSNs has more technical, operational, business, and policy challenges.

RFID and Sensor Networks: *Architectures*, *Protocols*, *Security*, *and Integrations* provides a comprehensive technical guide covering introductory concepts; fundamental techniques; recent advances; and open issues in RFID, WSNs, and integrated RFID and

WSNs. This book contains illustrative figures and allows for complete cross-referencing. It also details information on the particular techniques for efficiently improving the performance of a RFID and a sensor network, and their integration.

This book is organized into three parts:

- Part I: RFID
- Part II: Wireless Sensor Networks
- Part III: Integrated RFID and Sensor Networks

Part I introduces the fundamentals and principles of RFID. This part provides readers with a knowledge of RFID, e.g., tags, readers, middleware, security, and services. Part II introduces the fundamentals and principles of WSNs. This part provides readers with a knowledge of WSNs, e.g., routing, medium access control, localization, clustering, mobility, security, and cross-layer optimization. Part III explores the principles and the applications of integrated RFID and WSNs.

This book has the following salient features:

- Serves as a comprehensive and essential reference on RFID, WSNs, and integrated RFID and WSNs
- Covers basics, a broad range of topics, and future development directions
- Introduces architectures, protocols, standards, security, and applications
- Assists professionals, engineers, students, and researchers to understand RFID and WSNs
- Provides a unique content on integrated RFID and WSNs

This book can serve as a useful reference for students, educators, research strategists, scientists, researchers, and engineers in the field of wireless communications and networking. In particular, this book has an instant appeal to students, researchers, developers, and consultants in developing RFID, WSNs, and integrated RFID and WSNs.

We would like to acknowledge the effort and time invested by all contributors for their excellent work. All of them are extremely professional and cooperative. Special thanks go to Richard O'Hanley, Stephanie Morkert, and Joette Lynch of the Taylor & Francis Group for their support, patience, and professionalism from the beginning until the final stage of the book. We are very grateful for Sridharan Sathyanarayanamoorthy for his painstaking efforts during typesetting. Last but not least, a special thank you to our families and friends for their constant encouragement, patience, and understanding throughout this project.

Yan Zhang
Simula Research Laboratory, Norway

Laurence T. Yang
St. Francis Xavier University, Canada

Jiming Chen
Zhejiang University, China

Editors

Yan Zhang received his BS in communication engineering from the Nanjing University of Post and Telecommunications, China; his MS in electrical engineering from the Beijing University of Aeronautics and Astronautics, China; and his PhD from the School of Electrical & Electronics Engineering, Nanyang Technological University, Singapore.

Dr. Zhang is an associate editor and also serves on the editorial boards of the *International Journal of Communication Systems* (*IJCS*, Wiley); the *International Journal of Communication Networks and Distributed Systems* (*IJCNDS*); the *Journal of Ambient Intelligence and Humanized Computing* (*JAIHC*, Springer); the *International Journal of Adaptive, Resilient and Autonomic Systems* (*IJARAS*); *Wireless Communications and Mobile Computing* (*WCMC*, Wiley); *Security and Communication Networks* (Wiley); the *International Journal of Network Security*; the *International Journal of Ubiquitous Computing*; *Transactions on Internet and Information Systems* (*TIIS*); the *International Journal of Autonomous and Adaptive Communications Systems* (*IJAACS*); the *International Journal of Ultra Wideband Communications and Systems* (*IJUWBCS*); and the *International Journal of Smart Home* (*IJSH*).

He is currently serving as the editor for the book series "Wireless Networks and Mobile Communications" (Auerbach Publications, CRC Press, Taylor & Francis Group). He also serves as a guest coeditor for the *WCMC* special issue for best papers in the IWCMC 2009; *Multimedia Systems Journal* (ACM/Springer) special issue on wireless multimedia transmission technology and application; *Journal of Wireless Personal Communications* (Springer) special issue on cognitive radio networks and communications; the *IJAACS* special issue on ubiquitous/pervasive services and applications; the *EURASIP Journal on Wireless Communications and Networking* (*JWCN*) special issue on broadband wireless access; the *IEEE Intelligent Systems* special issue on context-aware middleware and intelligent agents for smart environments; *Security and Communication Networks* (Wiley) special issue on secure multimedia communication; *Wireless Personal Communications* (Springer) special issue on selected papers from ISWCS 2007; *Computer Communications* (Elsevier) special issue on adaptive multicarrier communications and networks; *IJAACS* special issue on cognitive radio systems; the *Journal of Universal Computer Science* (*JUCS*) special issue on multimedia security in communication; the *Journal*

of Cluster Computing (Springer) special issue on algorithm and distributed computing in wireless sensor networks; the *JWCN* special issue on OFDMA architectures, protocols, and applications; and the *Journal of Wireless Personal Communications* (Springer) special issue on security and multimodality in pervasive environments.

He is currently serving as a coeditor for the following books: *Resource, Mobility, and Security Management in Wireless Networks and Mobile Communications*; *Wireless Mesh Networking: Architectures, Protocols and Standards*; *Millimeter-Wave Technology in Wireless PAN, LAN and MAN*; *Distributed Antenna Systems: Open Architecture for Future Wireless Communications*; *Security in Wireless Mesh Networks*; *Mobile WiMAX: Toward Broadband Wireless Metropolitan Area Networks*; *Wireless Quality-of-Service: Techniques, Standards and Applications*; *Broadband Mobile Multimedia: Techniques and Applications*; *Internet of Things: From RFID to the Next-Generation Pervasive Networked Systems*; *Unlicensed Mobile Access Technology: Protocols, Architectures, Security, Standards and Applications*; *Cooperative Wireless Communications*; *WiMAX Network Planning and Optimization*; *RFID Security: Techniques, Protocols and System-On-Chip Design*; *Autonomic Computing and Networking*; *Security in RFID and Sensor Networks*; *Handbook of Research on Wireless Security*; *Handbook of Research on Secure Multimedia Distribution*; *RFID and Sensor Networks*; *Cognitive Radio Networks*; *Wireless Technologies for Intelligent Transportation Systems*; *Vehicular Networks: Techniques, Standards and Applications*; *Orthogonal Frequency Division Multiple Access (OFDMA)*; *Game Theory for Wireless Communications and Networking*; and *Delay Tolerant Networks: Protocols and Applications.*

Dr. Zhang serves as a program cochair for IWCMC 2010, as a program cochair for WICON 2010, as a program vice chair for CloudCom 2009, as a publicity cochair for IEEE MASS 2009, as a publicity cochair for IEEE NSS 2009, as a publication chair for PSATS 2009, as a symposium cochair for ChinaCom 2009, as a program cochair for BROADNETS 2009, as a program cochair for IWCMC 2009, as a workshop cochair for ADHOCNETS 2009, as a general cochair for COGCOM 2009, as a program cochair for UC-Sec 2009, as a journal liasion chair for IEEE BWA 2009, as a track cochair for ITNG 2009, as a publicity cochair for SMPE 2009, as a publicity cochair for COMSWARE 2009, as a publicity cochair for ISA 2009, as a general cochair for WAMSNet 2008, as a publicity cochair for TrustCom 2008, as a general cochair for COGCOM 2008, as a workshop cochair for IEEE APSCC 2008, as a general cochair for WITS-08, as a program cochair for PCAC 2008, as a general cochair for CONET 2008, as a workshop chair for SecTech 2008, as a workshop chair for SEA 2008, as a workshop co-organizer for MUSIC'08, as a workshop co-organizer for 4G-WiMAX 2008, as a publicity cochair for SMPE-08, as an international journals coordinating cochair for FGCN-08, as a publicity cochair for ICCCAS 2008, as a workshop chair for ISA 2008, as a symposium cochair for ChinaCom 2008, as an industrial cochair for MobiHoc 2008, as a program cochair for UIC-08, as a general cochair for CoNET 2007, as a general cochair for WAMSNet 2007, as a workshop cochair for FGCN 2007, as a program vice cochair for IEEE ISM 2007, as a publicity cochair for UIC-07, as a publication chair for IEEE ISWCS 2007, as a program cochair for IEEE PCAC 2007, as a special track cochair for "Mobility and Resource Management in Wireless/Mobile Networks" in ITNG 2007, as a special session co-organizer for "Wireless Mesh Networks" in PDCS

2006, and as a member of the Technical Program Committee for numerous international conferences, including ICC, GLOBECOM, WCNC, PIMRC, VTC, CCNC, AINA, ISWCS, etc. He received the best paper award in the IEEE 21st International Conference on Advanced Information Networking and Applications (AINA-07).

Since August 2006, he has been working with the Simula Research Laboratory, Lysaker, Norway (http://www.simula.no/). His research interests include resource, mobility, spectrum, and data, energy, and security management in wireless networks and mobile computing. He is a member of the IEEE and the IEEE ComSoc.

Laurence T. Yang is a professor at St. Francis Xavier University, Antigonish, Canada. His research interests include high performance, embedded and ubiquitous/pervasive computing. He has published around 300 papers (including around 100 international journal papers such as in *IEEE* and *ACM Transactions*) in refereed journals, conference proceedings, and book chapters in these areas. He has been involved in more than 100 conferences and workshops as a program/general/steering conference chair and more than 300 conference and workshops as a program committee member. He served as the vice chair of the IEEE Technical Committee of Supercomputing Applications (TCSA) until 2004. Currently, he is the chair of the IEEE Technical Committee of Scalable Computing (TCSC) and the chair of the IEEE Task force on Ubiquitous Computing and Intelligence. He is also in the steering committee of the IEEE/ACM supercomputing conference series.

In addition, Dr. Yang is the editor in chief of several international journals and a few book series. He serves as an editor for around 20 international journals. He has been an author/coauthor or an editor/coeditor of 25 books from Kluwer, Springer, Nova Science, American Scientific Publishers, and John Wiley & Sons. He has won five best paper awards (including the IEEE 20th International Conference on Advanced Information Networking and Applications [AINA-06]); two IEEE best paper Awards in 2007 and 2008; two IEEE outstanding paper awards in 2007 and 2008; one best paper nomination in 2007; the Distinguished Achievement Award in 2005; the Canada Foundation for Innovation Award in 2003; and a University Research Award (1999–2002), a University Publication Award (2002–2005), and a University Teaching Award (2005–2008).

Jiming Chen received his PhD in control science and engineering from Zhejiang University, Hangzhou, China in 2005. He was a visiting scholar at the University of Waterloo, the French National Institute for Research in Computer Science and Control, and the National University of Singapore. He is currently an associate professor with the Institute of Industrial Process Control, State Key Lab of Industrial Control Technology, Zhejiang University. He leads the Networked Sensing and Control Group, Zhejiang University. Dr. Chen has published over 50 peer-reviewed papers. He currently serves as an associate editor for the *International Journal of Communication System* (Wiley); *Ad Hoc & Sensor Wireless Networks, an International Journal*; and the *Journal of Computers*, and was a guest editor of *Wireless Communication and Mobile Computing* (Wiley). He also serves as a general symposia cochair of IWCMC 2009, and track cochair of WiCON 2010 MAC.

Contributors

Nadjib Achir
Institut Galilée
University of Paris 13
Villetaneuse, France

Nadjib Aitsaadi
LiP6 Laboratory
University of Pierre and Marie Curie
Paris, France

Ali Hammad Akbar
Al-Khwarizmi Institute of
Computer Science
University of Engineering and
Technology
Lahore, Pakistan

Kashif Ali
School of Computing
Queen's University
Kingston, Ontario, Canada

Ebtisam Amar
LiP6 Laboratory
University of Pierre and Marie Curie
Paris, France

John Attia
Department of Electrical and
Computer Engineering
Prairie View A&M University
Texas A&M University System
Prairie View, Texas

Abdalkarim Awad
Department of Computer Science
University of Erlangen
Erlangen, Germany

LeRoy A. Bailey
Department of Computer Science
and Engineering
Michigan State University
East Lansing, Michigan

Jalel Benothman
PRiSM Laboratory
University of Versailles
Versailles, France

Andrea Boni
Department of Information Engineering
University of Parma
Parma, Italy

Khaled Boussetta
Institut Galilée
University of Paris 13
Villetaneuse, France

Shafique Ahmad Chaudhry
Department of Computer Science
National University of Ireland
Cork, Ireland

Jiming Chen
State Key Laboratory of Industrial Control Technology
Zhejiang University
Hangzhou, China

Paolo Ciampolini
Department of Information Engineering
University of Parma
Parma, Italy

Sebastian Dengler
Department of Computer Science
University of Erlangen
Erlangen, Germany

Christos Douligeris
Department of Informatics
University of Piraeus
Piraeus, Greece

Falko Dressler
Department of Computer Science
University of Erlangen
Erlangen, Germany

Alessio Facen
Department of Information Engineering
University of Parma
Parma, Italy

Damianos Gavalas
Department of Cultural Informatics
University of the Aegean
Mytilene, Greece

Reinhard German
Department of Computer Science
University of Erlangen
Erlangen, Germany

Matteo Grisanti
Department of Information Engineering
University of Parma
Parma, Italy

Hossam S. Hassanein
School of Computing
Queen's University
Kingston, Ontario, Canada

Peter J. Hawrylak
Radio Frequency Identification Center of Excellence
Swanson School of Engineering
Pittsburgh, Pennsylvania

Pekka Jäppinen
Department of Information Technology
Lappeenranta University of Technology
Lappeenranta, Finland

Jehn-Ruey Jiang
Department of Computer Science and Information Engineering
National Central University
Jhongli, Taiwan

Deepak Kataria
HCL America
Florham Park, New Jersey

Ki-Hyung Kim
Department of Information and Communication
Ajou University
Suwon, South Korea

Charalampos Konstantopoulos
Department of Informatics
University of Piraeus
Piraeus, Greece

Lin Li
Department of Computer Science and Engineering
University of Electronic Science and Technology of China
Chengdu, China

Xiangfang Li
Department of Electrical and Computer Engineering
Texas A&M University
College Station, Texas

Alex X. Liu
Department of Computer Science and Engineering
Michigan State University
East Lansing, Michigan

Eugene Lutton
Faculty of Science and Information Technology
The University of Newcastle
Newcastle, New South Wales, Australia

Basilis Mamalis
Department of Informatics
Technological Educational Institution of Athens
Athens, Greece

Di Miao
State Key Laboratory of Industrial Control Technology
Zhejiang University
Hangzhou, China

Marlin H. Mickle
Electrical and Computer Engineering
University of Pittsburgh
Pittsburgh, Pennsylvania

Aikaterini Mitrokotsa
Faculty of Electrical Engineering, Mathematics, and Computer Science
Delft University of Technology
Delft, the Netherlands

Melody Moh
Department of Computer Science
San Jose State University
San Jose, California

Teng-Sheng Moh
Department of Computer Science
San Jose State University
San Jose, California

Carlo Morandi
Department of Information Engineering
University of Parma
Parma, Italy

Hamid Mukhtar
Department of Information and Communication
Ajou University
Suwon, South Korea

Ilaria De Munari
Department of Information Engineering
University of Parma
Parma, Italy

Nidal Nasser
Department of Computing and Information Science
University of Guelph
Guelph, Ontario, Canada

Suat Ozdemir
Computer Engineering Department
Gazi University
Ankara, Turkey

Grammati Pantziou
Department of Informatics
Technological Educational Institution of Athens
Athens, Greece

Santiago Pujol
Department of Civil Engineering
Purdue University
West Lafayette, Indiana

Guy Pujolle
LiP6 Laboratory
University of Pierre and Marie Curie
Paris, France

Lijun Qian
Department of Electrical and Computer Engineering
Prairie View A&M University
Texas A&M University System
Prairie View, Texas

Sk. Md. Mizanur Rahman
Department of Computing and Information Science
University of Guelph
Guelph, Ontario, Canada

Brian Regan
Faculty of Science and Information Technology
The University of Newcastle
Newcastle, New South Wales, Australia

Andrea Ricci
Department of Information Engineering
University of Parma
Parma, Italy

Pedro M. Ruiz
Faculty of Informatica
University of Murcia
Murcia, Spain

Tarek El Salti
Department of Computing and Information Science
University of Guelph
Guelph, Ontario, Canada

Juan A. Sánchez
Faculty of Informatica
University of Murcia
Murcia, Spain

Geoff Skinner
Faculty of Science and Information Technology
The University of Newcastle
Newcastle, New South Wales, Australia

Abd-Elhamid M. Taha
School of Computing
Queen's University
Kingston, Ontario, Canada

Denis Trček
Laboratory of E-Media
Faculty of Computer and Information Science
University of Ljubljana
Ljubljana, Slovenia

Rolland Vida
Department of Telecommunications and Media Informatics
Budapest University of Technology and Economics
Budapest, Hungary

Attila Vidács
Department of Telecommunications and Media Informatics
Budapest University of Technology and Economics
Budapest, Hungary

Zachary Walker
Department of Computer Science
San Jose State University
San Jose, California

Yu Wang
Department of Computer Science
University of North Carolina at Charlotte
Charlotte, North Carolina

Bashir Yahya
PRiSM Laboratory
University of Versailles
Versailles, France

David K. Y. Yau
Department of Civil Engineering
Purdue University
West Lafayette, Indiana

Ming-Kuei Yeh
Department of Information Management
Nanya Institute of Technology
Chungli, Taiwan

Seung-Wha Yoo
Department of Information
and Communication
Ajou University
Suwon, South Korea

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