

Sensor Networks and Configuration

Nitaigour P. Mahalik (Ed.)

Sensor Networks and Configuration

Fundamentals, Standards, Platforms,
and Applications

 Springer

Editor

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Dedicated to my

Teachers and family members

Preface

Advances in networking principles may indeed influence many kinds of monitoring and control systems in the most dramatic way. Sensor network and configuration (SNC) falls under the category of modern networking systems. A Wireless Sensor Network (WSN), a sophisticated, compact, and advanced networking method has emerged that caters to the need for real-world applications. Methodology and design of WSNs represent a broad research topic with applications in many sectors such as industry, home, computing, agriculture, environment, and so on, based on the adoption of fundamental principles, specifications characterisations, modeling, simulations, and state-of-the-art technology. Technological research in this field is now expanding; its design phases appear to be highly complex and involve interdisciplinary approaches.

The main objective of this book is to provide information on concepts, principles, characteristics, applications, latest technological developments, and comparisons with regard to sensor networks and configuration. This book incorporates research, development, tutorials, and case studies. Academic and industrial research and developments in networked monitoring and control (e.g., intelligent home, pet management, etc.) are being carried out at many different institutions around the world. The technological trends in this domain (e.g., design, integration, communication schemes, development methodology, current application scenarios, pros and cons, etc.) need to be extensively disseminated so that the sensor network revolution can spread to serve society in a bigger way. In particular, the book is intended to focus on describing the implicit concept of advanced networking, personal area networking, and mobile area networking, as well as application-oriented design tips and hints, as much as the techniques and methodology. This book will enable readers to understand the underlying technology, philosophy, concepts, ideas, and principles, with regard to broader areas of sensor networks. Aspects of sensor network in terms of basics, standardization, design process, practice, techniques, platforms, and experimental results have been presented in a proper order. Fundamental methods, initiatives, significant research results, as well as references for further study have also been provided. Relative merits and demerits are described at the appropriate places so that novices as well as advanced practitioners can use the evaluation to guide their choices. All the contributions have been reviewed, edited, processed and placed in appropriate order to maintain consistency so that irrespective of whether the reader is an advanced practitioner or a newcomer he or she can get most out of it. Since this book covers many aspects of SNC the importance of this order is considered significant. The roadmap of the book is as follows.

Chapter 1 is a general introduction. Chapter 2 presents the backbone of WSNs, the IEEE 802.15.4 protocol. The requirements for service-oriented sensor webs are presented in Chapter 3. Cross-layer design principles are described in Chapter 4. Grid computing has evolved as a standards-based approach for coordinated resource sharing. There are several issues and challenges in the design of sensor

grids. Chapter 5 has been dedicated to the sensor grid architecture for distributed events classification. Chapters 6, 7, and 8 deal with topology controls, routing protocols, and energy aware routing fundamentals, respectively. Chapter 9 discusses the aspects of probabilistic queries and quality assurances. A statistical approach-based resilient aggregation is studied in Chapter 10. The communication performance study is presented in Chapter 11. A sensor network consists of a large number of *nodes* connected through a multi-hop wireless network. Data management is an issue discussed in Chapter 12. Localisation and location estimation are also two important design considerations. Chapters 13 and 14 introduce these. It has been variously proposed that the future of the monitoring and control will be based on sensor networks. A comprehensive description of an application driven design, ZigBee WSN and their applications, MANET versus WSN, etc. can be found in Chapters 15-17. There has been recent confusion on sensor network and industrial Distributed Control Systems (DCS). In fact, sensor networks and DCS are complementary to each other. As such, two chapters have been dedicated to introduce industrial sensor and actuator networks; (the *fieldus*) and the DCS simulation scenario. The book also contains three chapters regarding applications of WSNs. The application domains are pet management systems, agriculture monitoring, and intelligent CCTV. The last supplemental chapter reviews the modulation techniques and topology, an essential topic for novice researchers and readers.

The success story of this book ‘Sensor Network and Configuration’ is due to the direct and indirect involvement of many researchers, technocrats, academicians, developers, integrators, designers, and last but not the least the well-wishers. Therefore, the editor and hence the publisher acknowledge the potential authors and companies whose papers, reports, articles, notes, study materials and websites have been referred to in this book. Further, many of the authors of the respective chapters gracefully acknowledge their funding agencies, without which their research could not have been completed. Every precaution has been taken to credit their work in terms of citing their names and copyright notices under the figures and texts incorporated in this book: but in case of error we would like to receive feedback so that the same can be incorporated in the next phase of printing. In particular, persons such as Abhijit Suprem, Suprava Mishra, M Tubaishat, S Madria, Debasis Saha, M Reichardt, RS Raji, R Murugesan, KK Tan, KZ Tang, P Raja and G Noubir, Jianliang Xu, Chagwen Xie, PR Moore, Jun-Sheng Pu, Saleem Bhatti, AS Hu, SD Servetto, WW Manges, P Meheta, PH Michael and the following agencies, institutes, companies and journals are acknowledged: UiSec&Sens EU Project (contract number 026820) and the Hungarian Scientific Research Fund (contract number T046664), Hungarian Ministry of Education (BÖ 2003/70), HSN Lab., Italian Ministry for University and Research (MIUR) through the PATTERN project, Research Grants Council of the Hong Kong SAR: China (Project No. HKBU 2115/05E), Kumoh National Institute of Technology: South Korea, w3.antd.nist.gov, ZigBee Alliances, Echelon Corporation, Geospatial Solutions, Fuji Press, Maxim/Dallas, and <http://www.cs.ucl.ac.uk>.

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