

Preface

The idea of this book comes from the observation that sensor networks represent a topic of interest from both theoretical and practical perspectives. The title underlines that sensor networks offer the unique opportunity of clearly linking theory with practice. In fact, owing to their typical low-cost, academic researchers have the opportunity of implementing sensor network testbeds to check the validity of their theories, algorithms, protocols, etc., in reality. Likewise, a practitioner has the opportunity of understanding what are the principles behind the sensor networks under use and, thus, how to properly tune some accessible network parameters to improve the performance.

On the basis of the observations above, the book has been structured in three parts: Part I is denoted as “Theory,” since the topics of its five chapters are apparently “detached” from real scenarios; Part II is denoted as “Theory and Practice,” since the topics of its three chapters, although theoretical, have a clear connection with specific practical scenarios; Part III is denoted as “Practice,” since the topics of its five chapters are clearly related to practical applications.

In Part I, the first chapter, by H. V. Poor, examines ways in which interactions among nodes in wireless networks can lead to greater efficiencies in the use of wireless resources. The second chapter, by S. Sundhar Ram, V. V. Veeravalli, and A. Nedic, develops and analyzes distributed and recursive algorithms for nonlinear regression-based parameter estimation in sensor networks. The third chapter, by A. Prasath, A. Venuturumilli, A. Ranganathan, and A. A. Minai, describes a series of distributed methods for self-organized configuration of heterogeneous sensor networks, and evaluates their performance using optimal configurations obtained through an evolutionary algorithm. The fourth chapter, by A. Scaglione, Y.-W. P. Hong, and B. S. Mergen, discusses cooperative source and channel coding strategies and their performance in very dense sensor networks. The fifth and final chapter of this part, by C. Fragouli, K. Argyraki, and L. Keller, provides an overview of existing and emerging sensor network protocols that enable reliable communication in the presence of node and channel failures under energy constraints.

In Part II, the first chapter, by S. Palazzo, F. Cuomo, and L. Galluccio, introduces a taxonomy of the main approaches for data aggregation recently proposed in wireless sensor networks and presents a comparison between different data aggregation perspectives. The second chapter, by J. Lu, Y. Pan, S. Yamamoto, and T. Suda,

studies data dissemination resilient to large scale sensor failures by replicating data to a set of sensors forming a geographical trajectory. The third and final chapter of this part, by D. Akselrod, T. Lang, M. McDonald, and T. Kirubarajan, focuses on a problem of decision-based control of a network of sensors carrying out surveillance over a region that includes a number of moving targets, with particular application to multisensor multitarget tracking.

In Part III, the first chapter, by J. Beutel, K. Roemer, M. Ringwald, and M. Woehrle, surveys prominent examples of deployment techniques for sensor networks, identifies and classifies causes for errors and pitfalls, and presents a number of wireless sensor network specific techniques and tools for an increased understanding of the causes of such failures. The second chapter, by J.-M. Dricot, G. Bontempi, and P. De Doncker, begins with a survey of state-of-the-art techniques for localization and then proceeds to more elaborate and recent approaches, based on machine learning, automatic data classification, and sensor fusion techniques. In the third chapter, J.-H. Cui, R. Ammar, Z. Shi, Z. Zhou, S. Ibrahim, and H. Yan, investigates how to smartly utilize surface radios to enhance capability-limited underwater acoustic sensor networks. In the fourth chapter, by M. C. Vuran and A. R. Silva, theoretical and practical insights on the problem of communication through soil for wireless underground sensor networks is provided. The fifth and final chapter of this part, by D. McIlwraith and G.-Z. Yang, discusses recent advances in body sensor networks which permit pervasive sensing of detailed physiological signals from implantable, wearable, and ambient sensors.

Finally, I would like to thank those who have made the realization of this book possible. First of all, I am indebted to Dr. Cristoph Bauman, my Springer Engineering Editor, for supporting the idea of this book from the very first discussion at the beginning of 2008. Needless to say, all researchers that have contributed to this book are kindly acknowledged: without them, this would not have been possible – I hope that the fact that they are all from academia will not disprove the very idea of the book. Last, but not least, my sincere gratitude goes to a few members of our little Wireless Ad-hoc and Sensor Networks (WASN) Lab at the University of Parma, namely Marco Martalò, Paolo Medagliani, and Stefano Busanelli, for their help in the editing process and for sharing the interest in sensor networking.

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