

Wireless Sensor Networks: Current Status and Future Trends

PREFACE

Human sensing is one way of collecting information, acquiring knowledge and making reliable decisions. Wireless Sensor Networks (WSNs) imitate this human intelligence capability, but on a wider distributed scale, with faster, cheaper and more effective ways that can be used for different applications. Recognizing this fact, we decided to introduce this book on WSNs that documents the current state of these networks, and their future trends.

As the subject is relatively recent and enjoying fast development, we thought that the book should be written by researchers and experts in the field. We called on those experts to contribute to the book by writing chapters in their area of the expertise. Our role was to organize the flow of knowledge through the various sections of the book; and to ensure consistency on the one hand, and clarity on the other. The book would be useful as a reference item to all students, graduates, academics, and researchers of computer science and engineers, whether working in professional organizations, or research institutions.

The book covers the various issues associated with WSNs, including: their structure, activities, and applications. It consists of five main sections divided into 17 chapters. Consequently, this book could be subdivided into five distinct sections.

Wireless Sensor Networks: Storage Issues and Applications

The first group of chapters consists of chapters providing a review of applications of Wireless Sensor Networks, an elaboration on Data-Centric Storage in Wireless Sensor Network and environmental forest monitoring using Wireless Sensor Networks. In addition, a chapter describes fundamentals of Wireless Body Area Networks.

Medium Access Control (MAC) Layer Issues

The second group of chapters includes a chapter emphasizing on mobile Medium Access Control Protocols for Wireless Sensor Network. In addition, chapter 6 on Cooperative Transmission Techniques and Protocols in Wireless Sensor Networks which presents cooperative diversity sensor systems from both the physical layer and the medium access control aspects. Chapter 7 details Wireless Sensor Networks (WSNs) operating in IEEE 802.11 networks while adapting multi-channel assignment in its operation.

Position Estimation, Energy Centric Simulation and QoS Issues

Chapter 8 presents location and position estimation in Wireless Sensor Networks by discussing the basic principles and techniques used in the localization algorithms, categories of these algorithms and also focusing on a few of the representative localization schemes. Moreover, chapter 9 describes energy-centric simulation and design space exploration for Wireless Sensor Networks and chapter 10 presents the fundamentals of MAC protocols and explains the specific requirements and problems these protocols have to withstand for WSN.

Protocols and Data Gathering Issues

Chapters 11 to 13 are devoted to issues related to protocols and data gathering. Chapter 11 covers all layers of WSN protocol stack and presents theoretical aspects, an analytical evaluation and comparison of various major WSN protocols specified in various research literatures under specific classification or category. Chapter 12 explains various phases of data gathering and data management protocols used in sensor networks and details the main features and attribute parameters for each phase. Chapter 13 presents a comprehensive description of two broad categories of data gathering algorithms for wireless sensor networks – the classical algorithms that are not energy-aware and the modern energy-aware data gathering algorithms. In addition, it presents an extensive simulation study that demonstrates the individual as well as the comparative performance of these data gathering algorithms.

Security Issues in Wireless Sensor Networks

Security is a challenging issue in wireless sensor networks (WSNs), therefore, chapters 14 to 17 present privacy and security issues in wireless sensor networks (WSNs). Chapter 14 discusses different techniques and algorithms proposed to address the privacy issues in WSN and investigates two relevant privacy preserving schemes in WSN. Chapter 15 provides a comprehensive discussion on the state-of-the-art in security technologies for WSNs and a brief discussion on the future direction of research in WSN security. Chapter 16 reviews security solutions based on watermarking, which is widely considered to have lower processing and storage requirements in contrast to cryptography based solutions. Finally, chapter 17 surveys recently proposed works on Intrusion Detection Systems in WSNs, and presents a comprehensive classification of various IDS approaches according to their employed detection techniques.

The editors would like to thank all experts who contributed to the book, making it of comprehensive nature. We hope that the book would provide a useful reference to WSNs. We would also like to invite all of its readers to provide comments and suggestions for our future endeavors on the related topics.

Editors

Dr. Shafiullah Khan

Kohat University of Science and Technology (KUST), Pakistan

Dr. Al-Sakib Khan Pathan

International Islamic University Malaysia (IIUM), Malaysia

Dr. Nabil A. Alrajeh

King Saud University, Saudi Arabia