

# Preface

Sensor systems have been around for quite some time, and their obvious use in thermometer has gone unnoticed until recently. Their unique capability of monitoring a given area has attracted attention, and sensors have been useful in numerous areas. I envisioned the need for this book several years ago when started offering such a course. During the last four years, I collected papers on wireless sensor networks (WSNs) and prepared ppt files from them to deliver lectures. I was fortunate to be invited as a GIAN speaker at the IIT Kharagpur in summer 2015, a premier institute in India. This encouraged me to write two chapters every week when I offered this course again at the University of Cincinnati again during spring 2016. I was invited again to NIT Hamirpur, Himachal Pradesh, India, to deliver lectures under GIAN program and that encouraged me to redraw all pdf-based diagrams in black and white ppts. After that, I also visited Wuxi, China, to get first-hand information about GreenOrbs project and was able to add the newest info on large-scale WSN deployment.

Within engineering and computer science disciplines, wireless sensor network has recently attracted unparalleled interest. In particular, combinations of wireless communication and tiny sensor devices have revolutionized the world of telecommunications. To fully explore and utilize this new technology, universities need to offer new courses and train students in the field so that they could continue their graduate work in this area. However, the students in computer science and engineering (CSE) and electrical engineering (EE) are at best exposed to data communication aspects, while sensor-embedded systems remain untouched, as it is relatively difficult to learn about WSNs without having substantial background in wireless communication technology. On the other hand, EE students learn about the radio frequency (RF) communication aspect only, and the topic of data communication and computing system issues and their correlation in nomadic WSN remains untouched. I put in more efforts in streamlining all the chapters after my return to the USA in July 2016.

Many institutions offer course in WSN area, primarily for graduate students, and then only as special topics. Although there are many edited books related to WSNs, these books can be roughly classified into two groups. The first group focuses on

readers in specific application areas, and the other covers only the general knowledge of environmental monitoring. The books in the first group require a detailed background in RF communication and signal processing and therefore are not suitable for students in CSE. Many recent texts emphasize microwave radar and sensor systems. However, the books in the second group do not provide any depth in the data communication aspects of the technology.

Creating such a unique instructional curriculum requires a great deal of efforts. Planning such a text is a relatively difficult task because of the diverse background requirements. The limitations of most existing books and courses affect the sensor industries in the USA. Companies must train newly hired college graduates for a long time before they can get into WSNs. To the best of our knowledge, such an organized course is not been taught anywhere in the world. Teaching WSN course strictly from research papers is difficult for the professor, which in turn causes students to learn the material inefficiently. Preparing systematic notes in this emerging area will enhance training, increase the availability of well-educated personnel, shorten the new employee training period within industries, and allow nations to continue to advance the research in this technological field.

This book explains how a WSN works in monitoring a given environment. I have selected chapter topics that focus on qualitative descriptions and realistic explanations of relationships between WSNs and performance parameters. Mathematical formulations are needed in engineering and computer science work, and we include some of the important concepts so that students can appreciate their usefulness in numerous WSNs. In all these applications, both security and privacy issues are important. The chapters are organized to provide a great deal of flexibility; emphasis can be given on different chapters, depending on the scope of the course and the instructor's own interests or emphasis.

In this textbook, I have tried to provide an overview of the basic principles behind WSNs and associated support infrastructure. A list of possible group simulation projects is included. The author has tried such projects for several years and has found them highly effective in training students. This book is written both for academic institutions and for working professionals. It can be used as a textbook for a one-semester or a one-quarter course. This book also can be used for training current or new employees of companies and could be adopted for short-term training courses. I hope I have been able to achieve our goal of helping students and others working in this area to have a detailed knowledge about this exciting technology.

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