Wireless Networks

Jiannong Cao
Yanni Yang

Wireless Sensing

Principles, Techniques and Applications

Springer

Wireless Networks

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Jiannong Cao
Hong Kong Polytechnic University
Hong Kong, China

Yanni Yang
Hong Kong Polytechnic University
Kowloon, China

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Preface

Motivation of This Book

Wireless signals play a crucial role in communication for people's daily lives. Without wireless signals, for example, Wi-Fi, Bluetooth, and radio-frequency identification (RFID) signals, people may not enjoy those convenient and joyful services. In the last decade, apart from the communication function, researchers have shown that wireless signals provide a new paradigm for sensing human activities and objects. Wireless sensing has many benefits and advantages over traditional sensing approaches. First, wireless devices are prevalent almost everywhere. Using existing wireless infrastructures can provide a ubiquitous and cost-effective way for sensing. Second, wireless sensing can be non-intrusive. People can get rid of the traditional bulky sensors and avoid being monitored by the camera.

The primary motivation of this book is to provide a comprehensive summary of common principles of wireless sensing, a systematic study about challenging issues in complex and practical scenarios, and critical solutions to tackle these challenges. In particular, we first present a systematic introduction for the development and the vision of wireless sensing technology. Second, we provide a comprehensive study about wireless signals, sensing principles, and applications. Third, we discuss the challenges of putting wireless sensing into tangible and practical use. Then, we introduce methods to tackle the challenging issues in wireless sensing. Finally, we share our experiences in designing wireless sensing systems for several essential applications.

What This Book Is About

This book provides comprehensive reviews of the wireless sensing technology, including the types of wireless signals used for sensing, the general principles and approaches for wireless sensing, the information that wireless signals can sense, and the key applications. This book presents an investigation of the critical challenges that need to be alleviated to achieve wireless sensing in complex and practical scenarios and how to tackle these challenges with concrete case studies

and examples. The book can be seen as a textbook and a practical guide for the reader.

How This Book Is Organized

This book is divided into six chapters:

Chapter 1: "Introduction". This chapter introduces motivations, basics, applications, and the framework of wireless sensing.

Chapter 2: "Wireless Signals and Signal Processing". This chapter introduces different kinds of wireless signals and signal processing methods utilized for wireless sensing.

Chapter 3: "Wireless Sensing System Configurations". This chapter introduces and compares different configurations of wireless devices in wireless sensing systems.

Chapter 4: "Wireless Sensing Methodologies". This chapter introduces and discusses representative methodologies to obtain sensing information from wireless signals.

Chapter 5: "Case Studies". This chapter showcases representative case studies of applying wireless sensing for different applications, including human respiration monitoring, exercise monitoring, and liquid sensing.

Chapter 6: "Conclusion". This chapter provides the summary and future directions of wireless sensing.

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Kowloon, China — Yanni Yang
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Contents

1 Introduction 1
1.1 Wireless Sensing and Applications 1
1.1.1 Applications in Healthcare and Assisted Living 3
1.1.2 Applications in Security and Surveillance 4
1.1.3 Human-Computer Interaction 5
1.1.4 Indoor Navigation 6
1.1.5 Industrial Automation 7
1.2 Wireless Sensing Framework 8
1.3 Organization of the Book 10
References 10

2 Wireless Signals and Signal Processing 13
2.1 Preliminaries of Wireless Signals 13
2.2 Common Types of Wireless Signals 20
2.2.1 Acoustic Signal 20
2.2.2 RFID Signal 22
2.2.3 WiFi Signal 23
2.2.4 LoRa Signal 25
2.2.5 Radar Signal 26
2.2.6 Light Signal 28
2.3 Wireless Signal Processing Solutions 29
2.3.1 Signal Processing to Remove Signal Noises 29
2.3.2 Signal Processing to Release Signal Constraints 34
References 43

3 Wireless Sensing System Configurations 45
3.1 Single-Transceiver vs. Multi-Transceiver Configurations 45
3.2 Device-Based vs. Device-Free Configurations 46
References 47

4 Wireless Sensing Methodologies 49
4.1 Sensed Information from Wireless Signals 49

4.2 Model-Based Methodologies 51
4.2.1 Wireless Signal Propagation Models for Sensing 52
4.2.2 Pros and Cons of Model-Based Methodologies 60
4.3 Data-Driven Methodologies 60
4.3.1 Data Analytics and Machine Learning Algorithms for Wireless Sensing 61
4.3.2 Pros and Cons of Data-Driven Methodologies 65
References 66

5 Case Studies 67
5.1 Human Respiration Monitoring 67
5.1.1 WiFi-Based Respiration Monitoring During Sleep 67
5.1.2 RFID-Based Respiration Monitoring in Dynamic Environments 79
5.1.3 RFID-Based Concurrent Exercise and Respiration Monitoring 94
5.1.4 UWB Radar-Based Multi-Person Respiration Monitoring ... 109
5.2 Human and Object Indoor Localization 120
5.2.1 Bluetooth-Based Human Indoor Localization 121
5.2.2 RFID-Based Object Indoor Localization 130
5.3 Liquid Sensing 141
5.3.1 Acoustic-Based Liquid Fraud Detection 142
References 160

6 Conclusion 163
6.1 Research Summary 163
6.2 The Future 164