

Preface

Wireless Body Area Network (WBAN) is an emerging networking concept that facilitates data communication using wearable and implantable sensor nodes. Wireless health monitoring is a key area of use for WBAN technology. WBAN communication systems can be easily incorporated into health care and home environments providing various advantages, such as avoiding the requirement to visit healthcare facilities for health monitoring, providing patients with an opportunity to keep a personal health record, and possibility of monitoring health information when the patient is involved in daily activities. Wearable and implantable communication devices involved in a WBAN require having small form factor, low power consumption, and scalable data rates ranging from Kbps to Mbps. Low cost, simple hardware implementation, and low processing power are also key requirements for sensor nodes in a WBAN. Impulse Radio-Ultra-Wideband (IR-UWB) can be considered as an attractive wireless technology for WBAN applications due to its inherent features, such as low power consuming transmitter design, low complexity hardware implementation, possibility of developing sensor nodes with small form factors, and high data rate capability.

This book discusses the current state of the art in the IR-UWB technology for WBAN applications. The book systematically introduces some of the existing IR-UWB-based WBAN design techniques. It provides a comprehensive review of the current MAC protocol designs for UWB-based WBAN applications. It also presents a detailed discussion on various hardware designs used in UWB transceiver design. An IR-UWB-based communication system has to be designed in a manner such that it enhances the advantages provided by IR-UWB transmitters while avoiding the complexities introduced by IR-UWB receivers. This book presents a comprehensive description on implementation of a dual-band communication system that uses IR-UWB for data transmission from sensor nodes while using narrowband technology for data reception.

The initial chapters of the book describe the design and evaluation of a dual-band MAC protocol for WBAN sensor nodes. A simulation-based performance analysis of this MAC protocol is presented in terms of critical parameters, such as packet error rate, throughput, packet delay, and power consumption. The latter half of the book describes the implementation and evaluation of a complete communication platform for WBAN applications that includes sensor nodes, coordinator

nodes, and interfacing computer software. Wireless communication for implantable devices is another potential area for the use of the IR-UWB technology in WBAN applications. The last chapter of the book is dedicated to describe a feasibility study on the suitability of IR-UWB technology for implant applications. This study is focused on electromagnetic and thermal power absorption of human tissue that is exposed to IR-UWB signals. The outcomes of this study can be used as a guide in designing IR-UWB systems for implant applications.

We believe that this book will assist students and researchers who work in the area of UWB-based wireless communication. Especially, the hardware design of the UWB system in this book is presented in a manner such that the readers will be able to reproduce the hardware following the information given in the book. We firmly believe that it will assist in developing experimental UWB systems using off-the-shelf components for research purposes. Finally, we would like to thank all the parties who assisted us in producing this book. Our especial gratitude extends to Dr. Tharaka Dissanayake for his assistance with the UWB antennas. We are grateful to the Department of Electrical and Computer Systems Engineering, Monash University, Australia for providing us with the research facilities. We would also like to thank the publisher for providing us with the opportunity of delivering this book to a broad audience.

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