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Wireless Body Area Networks and Their Applications – A Review

D.M.G. PREETHICHANDRA¹, (Senior Member, IEEE), LASITHA PIYATHILAKA¹, UMER IZHAR², ROHAN SAMARASINGHE³, (Member, IEEE), AND LIYANAGE C DE SILVA⁴, (Senior Member, IEEE)

¹Central Queensland University, Rockhampton, Australia

²University of the Sunshine Coast,ippy downs, Australia

³Dept of ICE, Faculty of Technology, University of Colombo, Colombo, Sri Lanka

⁴Universiti Brunei Darussalam, Brunei Darussalam

Corresponding author: D.M.G. Preethichandra (e-mail: d.preethichandra@cqu.edu.au).

ABSTRACT In this paper, a comprehensive review of the wireless body area network is provided. A review of the WBAN architectures, standard network topologies, and WBAN communication protocols is discussed in detail. Also, the security requirements of WBAN, security threats and types of attacks, and authentications used in WBAN are discussed. The paper also includes very detailed coverage of antenna types, antenna designs, and flexible antennas used in WBAN with some design considerations and comparisons. Some new energy harvesting technologies, materials used for energy harvesting, and energy management are also discussed. Energy harvesting and power management is an ever-growing area of research. Despite the fact that there are many nanogenerator-based energy harvesting methods, the demand for more efficient energy harvesting mechanisms is ever-increasing. The paper has an extensive discussion of energy harvesting and power management methods. Subsequently, some reviews of recent developments in wearable sensors and novel materials for developing wearable sensors are discussed. Finally, the application areas of WBAN are discussed.

INDEX TERMS Body area network, network security, wireless communication protocols, wearable sensors, energy harvesting, WBAN, flexible sensors, IoT

I. INTRODUCTION

A Wireless Body Area Network (WBAN) is a network of devices comprising sensors, actuators, and transceivers placed on the surface of the body, under the skin, or inside the body as implanted or digested devices. WBANs have become an interesting topic for researchers in many fields due to the rapid developments happening in the internet of things (IoT) research. The applications of WBAN and IoT have wide usages including remote health/fitness monitoring, rehabilitation, military and sports training, active combat operations, livestock farming, interactive gaming, personal information sharing, secure authentication, assisted living, etc. [1], [2]. The number of different types of sensors that are made for IoT applications increases rapidly, making the use of WBAN more cost-effective for many fields. Further, the amount of information that the WBANs provide from people in the field could never be obtained without wireless access. Such information is widely used for monitoring and training people on specific activities. It is obvious that with the increase in WBAN usage, there will be a rise in network issues and these

issues need to be addressed to get the maximum use of future WBAN. Since the WBAN generates and transmits personal biological information, the network security requirement is paramount. Other major issues are the power management of the WBAN, developing different sensors with minimum energy usage, and optimizing the network parameters for the best power management. Energy harvesting from the surrounding environment and through human movements is another crucial area of interest in WBAN where researchers have provided many different solutions [3]. Intra and inter WBAN data transmission consumes a considerable amount of power and choosing the correct antenna for a specific application is also critical. Antenna designs play a great role in reducing power usage, reducing the channel-loss, and increasing throughput [4]. The flexibility of sensors is another critical issue and therefore developing flexible sensors is another demanding research area [5], [6]. To provide comprehensive knowledge on all the above-mentioned areas of interest, this review paper analyses the commonly used and recently proposed WBAN architectures and communication

Wireless Body Area Networks Technology Implementation And Applications

**Chika Sugimoto, Hamed Farhadi, Matti
Hämäläinen**



Wireless Body Area Networks Technology Implementation And Applications:

Wireless Body Area Networks Mehmet R. Yuce, Jamil Khan, 2011-12-06 The book provides a comprehensive overview for the latest WBAN systems technologies and applications The chapters of the book have been written by various specialists who are experts in their areas of research and practice The book starts with the basic techniques involved in designing and building WBAN systems It explains the deployment issue **Ultra Wideband Wireless Body Area Networks** Kasun

Maduranga Silva Thotahewa, Jean-Michel Redouté, Mehmet Rasit Yuce, 2014-04-17 This book explores the design of ultra wideband UWB technology for wireless body area networks WBAN The authors describe a novel implementation of WBAN sensor nodes that use UWB for data transmission and narrow band for data reception enabling low power sensor nodes with high data rate capability The discussion also includes power efficient medium access control MAC protocol design for UWB based WBAN applications and the authors present a MAC protocol in which a guaranteed delivery mechanism is utilized to transfer data with high priority Readers will also benefit from this book s feasibility analysis of the UWB technology for human implant applications through the study of electromagnetic and thermal power absorption of human tissue that is exposed to UWB signals **13th EAI International Conference on Body Area Networks** Chika Sugimoto, Hamed

Farhadi, Matti Hämäläinen, 2020-03-03 The papers in this proceeding discuss current and future trends in wearable communications and personal health management through the use of wireless body area networks WBAN The authors posit new technologies that can provide trustworthy communications mechanisms from the user to medical health databases The authors discuss not only on body devices but also technologies providing information in body Also discussed are dependable communications combined with accurate localization and behavior analysis which will benefit WBAN technology and make the healthcare processes more effective The papers were presented at the 13th EAI International Conference on Body Area Networks BODYNETS 2018 Oulu Finland 02 03 October 2018 *Intelligent Wireless Sensor Networks and the Internet of Things* Bhanu Chander, Anoop Benet Nirmala, Koppala Guravaiah, G. Kumaravelan, 2024-06-12 The edited book Intelligent

Wireless Sensor Networks and Internet of Things Algorithms Methodologies and Applications is intended to discuss the progression of recent as well as future generation technologies for WSNs and IoTs applications through Artificial Intelligence AI Machine Learning ML and Deep Learning DL In general computing time is obviously increased when the massive data is required from sensor nodes in WSN s the novel technologies such as 5G and 6G provides enough bandwidth for large data transmissions however unbalanced links faces the novel constraints on the geographical topology of the sensor networks Above and beyond data transmission congestion and data queue still happen in the WSNs This book Addresses the complete functional framework workflow in WSN and IoT domains using AI ML and DL models Explores basic and high level concepts of WSN security and routing protocols thus serving as a manual for those in the research field as the beginners to understand both basic and advanced aspects sensors IoT with ML DL applications in real world related technology Based on the latest

technologies such as 5G 6G and covering the major challenges issues and advances of protocols and applications in wireless system Explores intelligent route discovering identification of research problems and its implications to the real world Explains concepts of IoT communication protocols intelligent sensors statistics and exploratory data analytics computational intelligence machine learning and Deep learning algorithms for betterment of the smarter humanity Explores intelligent data processing deep learning frameworks and multi agent systems in IoT enabled WSN system This book demonstrates and discovers the objectives goals challenges and related solutions in advanced AI ML and DL approaches This book is for graduate students and academic researchers in the fields of electrical engineering electronics and communication engineering computer engineering and information technology [Autonomous Sensor Networks](#) Daniel Filippini,2012-11-27 This volume surveys recent research on autonomous sensor networks from the perspective of enabling technologies that support medical environmental and military applications State of the art as well as emerging concepts in wireless sensor networks body area networks and ambient assisted living introduce the reader to the field while subsequent chapters deal in depth with established and related technologies which render their implementation possible These range from smart textiles and printed electronic devices to implanted devices and specialized packaging including the most relevant technological features The last four chapters are devoted to customization implementation difficulties and outlook for these technologies in specific applications **Body Sensor Networking, Design and Algorithms** Saeid Sanei,Delaram Jarchi,Anthony G. Constantinides,2020-04-30 A complete guide to the state of the art theoretical and manufacturing developments of body sensor network design and algorithms In Body Sensor Networking Design and Algorithms professionals in the field of Biomedical Engineering and e health get an in depth look at advancements changes and developments When it comes to advances in the industry the text looks at cooperative networks noninvasive and implantable sensor microelectronics wireless sensor networks platforms and optimization to name a few Each chapter provides essential information needed to understand the current landscape of technology and mechanical developments It covers subjects including Physiological Sensors Sleep Stage Classification Contactless Monitoring and much more Among the many topics covered the text also includes additions such as Over 120 figures charts and tables to assist with the understanding of complex topics Design examples and detailed experimental works A companion website featuring MATLAB and selected data sets Additionally readers will learn about wearable and implantable devices invasive and noninvasive monitoring biocompatibility and the tools and platforms for long term low power deployment of wireless communications It s an essential resource for understanding the applications and practical implementation of BSN when it comes to elderly care how to manage patients with chronic illnesses and diseases and use cases for rehabilitation **Applications of Machine intelligence in Engineering** Jyotsna Kumar Mandal,Sanjay Misra,Jyoti Sekhar Banerjee,Somen Nayak,2022-04-21 The Global Conference on Artificial Intelligence and Applications GCAIA 2021 provides a prominent venue for researchers engineers entrepreneurs and scholar students to share their

research ideas in the area of AI Academic researchers would reveal the results and conclusions of laboratory based investigations via the GCAIA 21 platform which bridges the gap between academia industry and government ethics The GCAIA 21 platform will also bring together regional and worldwide issues to explore current advancements in contemporary Computation Intelligence This Conference Proceedings volume contains the written versions of most of the contributions presented during the conference of GCAIA 2021 The conference has provided an excellent chance for researchers from diverse locations to present and debate their work in the field of artificial intelligence and its applications It includes a selection of 62 papers All accepted papers were subjected to strict peer review by 24 expert referees The papers have been selected for this volume because of their quality and their relevance to the theme of the conference *Applied Computing to Support Industry: Innovation and Technology* Mohammed I. Khalaf,Dhiya Al-Jumeily,Alexei Lisitsa,2020-01-07 This book constitutes the refereed proceedings of the First International Conference on Applied Computing to Support Industry Innovation and Technology ACRIT 2019 held in Ramadi Iraq in September 2019 The 38 revised full papers and 1 short paper were carefully reviewed and selected from 159 submissions The papers of this volume are organized in topical sections on theory methods and tools to support computer science computer security and cryptography computer network and communication real world application in information science and technology *Industry 4.0 and People Analytics* Vinod Kumar Shukla,Praveen Kulkarni,Deepika Gaur,Pradeep N,Jean Paolo G. Lacap,Amina Omrane,2024-07-05 Industry 4 0 is revolutionizing the way companies do business by integrating new technologies into workplace practices and into production facilities and throughout their operations This new volume provides an insightful examination of the role of people analytics the data driven and goal focused method of studying people processes functions challenges and opportunities at work to elevate these systems and achieve sustainable business success in the era of Industry 4 0 It explores the use of AI and other technologies in analyzing cognition human potential and talent management for studying workplace diversity and inclusion in performance management and reward analytics to enhance emotional and social intelligence in decision making for employee training programs for employee wellness enhancement for leadership development and more Ultra-Wideband and 60 GHz Communications for Biomedical Applications Mehmet R. Yuce,2013-10-16 This book investigates the design of devices systems and circuits for medical applications using the two recently established frequency bands ultra wideband 3 1 10 6 GHz and 60 GHz ISM band These two bands provide the largest bandwidths available for communication technologies and present many attractive opportunities for medical applications The applications of these bands in healthcare are wireless body area network WBAN medical imaging biomedical sensing wearable and implantable devices fast medical device connectivity video data transmission and vital signs monitoring The recent technological advances and developments proposed or used in medicine based on these two bands are covered The book introduces possible solutions and design techniques to efficiently implement these systems in medical environment All individual chapters are written by leading

experts in their fields Contributions by authors are on various applications of ultra wideband and the 60 GHz ISM band including circuit implementation UWB and 60 GHz signal transmission around and in body antenna design solution hardware implementation of body sensors UWB transceiver design 60 GHz transceiver design UWB radar for contactless respiratory monitoring and ultra wideband based medical Imaging The book will be a key resource for medical professionals bio medical engineers and graduate and senior undergraduate students in computer electrical electronic and biomedical engineering disciplines

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