

Design & Simulation of Zigbee Transceiver System Using Matlab

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Abstract— ZigBee technology was developed for special wireless networks where Bluetooth & wi-fi technologies are not showing better results. In wireless personal area networks (PAN) where we need to transmit low data rate information in comparatively large area (10-100 m) [1]. We can use Zigbee transceiver system instead of other technologies. As the functionality of Simpliciti and Zigbee Technology is similar still we are preferring Zigbee system. So this paper will show that how Zigbee technology is different from Simpliciti and other wireless networking technologies and what are basic advantages of Zigbee technology over other systems. To design the Zigbee transceiver system different modulation techniques can be used. In this paper, the design methodology and simulation results of ZigBee transceiver at physical layer are presented using MSK modulation technique [6].

Keywords- IEEE 802.15.4, Simpliciti, MSK, Zigbee.

I. INTRODUCTION

ZigBee is a home-area network designed specifically to replace the proliferation of individual remote controls. ZigBee was created to satisfy the market need for a cost-efficient, standards-based wireless network that supports low data rates, low power consumption, security, and reliability. To address this need, the ZigBee Alliance, an industry working group is developing standardized application software on top of the IEEE 802.15.4 wireless standard. Zigbee standard is basically design for low cost, low power consuming & low data rate required system. Zigbee standard is placed in Physical and Medium Access Layer (MAC). As Zigbee is an standard of Zigbee Alliance. Higher layer specified in the Zigbee standard is for industry alliance. The application of Zigbee Technology can be seen in home monitoring system, climate sensors communication, collection of data in small area in research field & industrial control etc. The major application of Zigbee transceiver is shown in wireless sensor networking and automatic control system such as home controlling, biotelemetry, personal caring (for senior citizens) etc. Home, industry and other organization automation is the major application of Zigbee transmission. Light (Power) control, Light machinery control, SCADA networking etc are some more important application areas of Zigbee technology [2]. Here a comparatively analysis of Zigbee, Bluetooth and Wi-Fi

technology is also present that will help us that how Zigbee is different than other wireless networking technologies [3].

TABLE I: COMPARISON OF ZIGBEE WITH OTHER NETWORKING SYSTEMS

System Application	Zigbee Monitoring & Control	Bluetooth Cable Replacement	Wi-Fi Internet
System Resources	4-32 KB	250KB	1 MB+
Battery Life (Days)	100-1000	1-7	Hours
Nodes in Network	255/65K	7	32
Baseband(Kb/s)	20-250	720	11 Mbps
Distance	1-100 m	1-10m	100 m
Key Characteristics	Stability, low consumption, low cost	Price, Easy use, High Data Rate	Very High Speed, Large network

II. COMPARISON WITH SIMPLICITI

SimpliciTI is Texas Instruments proprietary network protocol for low-power radio frequency wireless communication. Main properties of Simpliciti are, Low cost which means that Simpliciti network protocol can be implemented in systems with small memory capacity. Flexibility is achieved by multiple network topologies namely star and peer-to-peer. The basic Application Programmers Interface (API) makes Simpliciti simple to be used. Wide selection of transceiver chips made to work with Simpliciti operating in sub-1GHz frequencies and in 2.4 GHz band makes this protocol versatile. Finally very low current consumption in sleep state makes Simpliciti very well suited for battery powered applications. Simpliciti and ZigBee modules have slightly different characteristics. ZigBee has greater range but power consumption in sleep state is higher than Simpliciti module. Both modules can be battery powered and both are small in size. However ZigBee has more peripherals, so in complicated personal area network zigbee module is more preferable than any other technology [4].

Simulation Of Zigbee Transceiver System Using Matlab Code

Vasilios Katsikis



Simulation Of Zigbee Transceiver System Using Matlab Code:

Blockchain and Artificial Intelligence Technologies for Smart Energy Systems Hongjian Sun, Weiqi Hua, Minglei

You, 2023-10-04 Present energy systems are undergoing a radical transformation driven by the urgent need to address the climate change crisis. At the same time, we are witnessing the sharp growth of energy data and a revolution of advanced technologies with artificial intelligence (AI) and Blockchain emerging as two of the most transformative technologies of our time. The convergence of these two technologies has the potential to create a paradigm shift in the energy sector, enabling the development of smart energy systems that are more resilient, efficient, and sustainable. This book situates itself at the forefront of this paradigm shift, providing a timely and comprehensive guide to AI and Blockchain technologies in the energy system. Moving from an introduction to the basic concepts of smart energy systems, this book proceeds to examine the key challenges facing the energy system and how AI and Blockchain can be used to address these challenges. Research examples are presented to showcase the role and impact of these new technologies, while the latest developed testbeds are summarised and explained to help researchers accelerate their development of these technologies. This book is an indispensable guide to the current changes in the energy system, being of particular use to industry professionals, from researchers to management, looking to stay ahead of technological developments. *Wireless Personal Communications* Mohsen A. M.

El-Bendary, 2018-03-24 This book introduces wireless personal communications from the point of view of wireless communication system researchers. Existing sources on wireless communications put more emphasis on simulation and fundamental principles of how to build a study model. In this volume, the aim is to pass on to readers as much knowledge as is essential for completing model building of wireless communications, focusing on wireless personal area networks (WPANs). This book is the first of its kind that gives step-by-step details on how to build the WPANs simulation model. It is most helpful for readers to get a clear picture of the whole wireless simulation model by being presented with many study models. The book is also the first treatise on wireless communication that gives a comprehensive introduction to data length, complexity, and the computational complexity of the processed data and the error control schemes. This volume is useful for all academic and technical staff in the fields of telecommunications and wireless communications, as it presents many scenarios for enhancing techniques for weak error control performance and other scenarios for complexity reduction of the wireless data and image transmission. Many examples are given to help readers to understand the material covered in the book. Additional resources, such as the MATLAB codes for some of the examples, also are presented. **Cognitive Radio Technology Applications for**

Wireless and Mobile Ad Hoc Networks Meghanathan, Natarajan, Reddy, Yenumula B., 2013-06-30 Radio interference is a problem that has plagued air communication since its inception. Advances in cognitive radio science help to mitigate these concerns. *Cognitive Radio Technology Applications for Wireless and Mobile Ad Hoc Networks* provides an in-depth exploration of cognitive radio and its applications in mobile and/or wireless network settings. The book combines a discussion

of existing literature with current and future research to create an integrated approach that is useful both as a textbook for students of computer science and as a reference book for researchers and practitioners engaged in solving the complex problems and future challenges of cognitive radio technologies

MATLAB Vasilios Katsikis, 2012-09-26 This excellent book represents the second part of three volumes regarding MATLAB based applications in almost every branch of science The present textbook contains a collection of 13 exceptional articles In particular the book consists of three sections the first one is devoted to electronic engineering and computer science the second is devoted to MATLAB SIMULINK as a tool for engineering applications the third one is about Telecommunication and communication systems and the last one discusses MATLAB toolboxes

Machine Tool Technology, Mechatronics and Information Engineering Zhong Min Wang, Dong Fang Yang, Kun Yang, Liang Yu Guo, Jian Ming Tan, 2014-09-22 Selected peer reviewed papers from the 2014 International Conference on Machine Tool Technology and Mechatronics Engineering ICMTTME 2014 June 22 23 2014 Guilin Guangxi China

LPWAN Technologies for IoT and M2M Applications Bharat S Chaudhari, Marco Zennaro, 2020-03-17 Low power wide area network LPWAN is a promising solution for long range and low power Internet of Things IoT and machine to machine M2M communication applications The LPWANs are resource constrained networks and have critical requirements for long battery life extended coverage high scalability and low device and deployment costs There are several design and deployment challenges such as media access control spectrum management link optimization and adaptability energy harvesting duty cycle restrictions coexistence and interference interoperability and heterogeneity security and privacy and others LPWAN Technologies for IoT and M2M Applications is intended to provide a one stop solution for study of LPWAN technologies as it covers a broad range of topics and multidisciplinary aspects of LPWAN and IoT Primarily the book focuses on design requirements and constraints channel access spectrum management coexistence and interference issues energy efficiency technology candidates use cases of different applications in smart city healthcare and transportation systems security issues hardware software platforms challenges and future directions One stop guide to the technical details of various low power long range technologies such as LoRaWAN Sigfox NB IoT LTE M and others Describes the design aspects network architectures security issues and challenges Discusses the performance interference coexistence issues and energy optimization techniques Includes LPWAN based intelligent applications in diverse areas such as smart city traffic management health and others Presents the different hardware and software platforms for LPWANs Provides guidance on selecting the right technology for an application

[A Novel Non-coherent OQPSK Detection Based on Interactive Kalman Filtering with Applications in ZigBee Receiver](#), 2020 This research proposes a new low cost and less complex methodology endeavoring to optimize the performance of OQPSK using the Interactive Kalman Filter IKF The design method is based on the use of two Linear Kalman Filters LKFs coupled together to be used as a priori phase to an Extended Kalman Filter EKF and as an observer to the 2nd LKF to estimate the phase coefficients We choose to implement the proposed method in the

ZigBee receiver because current numbers indicate that ZigBee sales are growing and are expected to dominate the market by 2023 and become the primary wireless protocol for the Internet of Things IoT ZigBee is a low data rate wireless personal area network LR WPAN used as a short distance communication system Therefore it is a promising technology due to its low cost low power consumption and wireless mesh networking standard There are two types of modulation under the original IEEE 802.15.4 ZigBee standard The first one is the Offset Quadrature Phase Shift Keying OQPSK which is employed in a 2.49 GHz band The other type is the Binary Phase Shift Keying BPSK which is employed in both 868.915 MHz bands ZigBee 2.49 GHz has a higher data rate and number of channels than ZigBee 868.915 MHz The proposed method IKF will be implemented to optimize the OQPSK 2.49 GHz modulated signal The criterion for novelty is the minimization of the Mean Square Error MSE with respect to Signal to Noise Ratio SNR values between the output phase signal and the actual value of the phase signal The proposed phase tracking using the IKF technique reduces the phase deviation error and increases the robustness against Gaussian noise Non Gaussian noise and the Co Channel Interference CCI A MATLAB ZigBee transceiver system model has been created to study the performance of the IKF in the presence of different propagation environments The proposed IKF has been implemented into the ZigBee receiver to illustrate the superiority of the proposed receiver as presented in Chapter 4 Ultimately our motivation for emphasis in this dissertation is twofold First the complexity of coherent communication systems which is based on traditional techniques can be replaced by a simpler receiver Second the introduction of IKF which is a new non coherent detection approach for an OQPSK modulated signal and a novel solution to detect the corrupted received signal and reduce the phase deviation error

MIMO-OFDM Wireless Communications with MATLAB Yong Soo Cho, Jaekwon Kim, Won Y. Yang, Chung G. Kang, 2010-08-20 MIMO OFDM is a key technology for next generation cellular communications 3GPP LTE Mobile WiMAX IMT Advanced as well as wireless LAN IEEE 802.11a IEEE 802.11n wireless PAN MB OFDM and broadcasting DAB DVB DMB In MIMO OFDM Wireless Communications with MATLAB the authors provide a comprehensive introduction to the theory and practice of wireless channel modeling OFDM and MIMO using MATLAB programs to simulate the various techniques on MIMO OFDM systems One of the only books in the area dedicated to explaining simulation aspects Covers implementation to help cement the key concepts Uses materials that have been classroom tested in numerous universities Provides the analytic solutions and practical examples with downloadable MATLAB codes Simulation examples based on actual industry and research projects Presentation slides with key equations and figures for instructor use MIMO OFDM Wireless Communications with MATLAB is a key text for graduate students in wireless communications Professionals and technicians in wireless communication fields graduate students in signal processing as well as senior undergraduates majoring in wireless communications will find this book a practical introduction to the MIMO OFDM techniques Instructor materials and MATLAB code examples available for download at www.wiley.com/go/chomimo N2Z - A NFC to ZigBee® Transceiver Anish Dhanekula, 2012 ZigBee home automation systems

have been around for years They include smart energy efficient wireless systems that connect devices via mesh networking It has always been a problem to connect to these ZigBee nodes with existing technologies we use daily The premise of this project is to provide easy access to these nodes via near field communication which is a technology that is available on a majority of smart phones today The report details the design and implementation of N2Z a device that translates data provided by an Android app through a NFC interface to a ZigBee device and vice versa We first discuss the requirements and use cases for the device and application Then the report goes on to discuss the base technologies behind N2Z which include the Android platform Near Field Communication NFC the ZigBee platform The report then goes on to discuss the design and implementation of the system Consequently we discuss the final results of the system with certain use cases and provide some empirical data that gives us insight into system operation Next we discuss other existing technologies that exist in the market Finally we conclude the report with a discussion on future work and thoughts on the future of ZigBee

Simulation of Optical Communication Systems Using MATLAB Kheng Heng Chew,2000 *Using a Zigbee Wireless Network for Greenhouse Control Over the Internet* Yuriy Vladimirovich Eero, Washington State University. Department of Electrical Engineering and Computer Science,2013

Simulation Studies on ZigBee Communications for Home Automation and Networking Prathamesh Ajgaonkar,2010 ZigBee is a new wireless technology based on the 802.15.4 standard which is extensively used in wireless communication It focuses on standardizing and enabling interoperability of various products It can provide a cost effective and energy efficient means for short range networking Compared with other wireless communication technologies it is seen that ZigBee is not only more reliable but also cheaper and importantly more energy conservative ZigBee communication in the field of Home Automation and Networking will be seen ZigBee is used as a communication medium in home automation and networking In this study simulations on Ad hoc On Demand Distance Vector AODV ZigBee routing protocol with different traffic scenarios like CBR FTP and Poisson and having different network topologies have been performed The trace files generated after the simulations are evaluated to calculate parameters like end to end packet delay and jitter which are key parameters in determining QoS Various types of queue types such as Drop Tail Stochastic Fair Queue SFQ and Random Early Detection RED are used to calculate delay and jitter by taking various traffic scenarios into consideration The results are then evaluated

The Simulation of Teleoperation Systems Using Matlab and MATRIXx Yung Chiang Liu,1996

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