



(1)

Survey on Energy Consumption Models in Wireless Sensor Networks

Mohammed Abo-Zahhad, Osama Amin, Mohammed Farrag, Abdelhay Ali

Abstract:

Wireless Sensor Network (WSN) is one of the most important areas of research in the twenty- first century. WSN aims to sense a certain natural phenomenon and sends sensed data to sink using a multi - hop network. In order to increase the lifetime of the battery-based sensing nodes, it is essential to minimize the consumed energy in the sensing process. The first step to achieve this goal is to know completely the sources of energy consumption in WSNs. In this paper, sources of energy consumption at various communication layers have been studied and investigated. Furthermore, survey has been provided for existing energy models and the classification of these models into physical layer, MAC layer and cross-layer energy models. Finally, a comparison between existing available energy models has been provided.

Keywords:

Energy Consumption Models; Wireless Sensor Networks; ad hoc Networks; Networking Layer; Data Link Layer; Medium Access Control; Physical Layer; Cross-layer

Published In:

Open Transactions on Wireless Sensor Network , ,



(2)

A Survey on Protocols, Platforms and Simulation Tools for Wireless Sensor Networks

Mohammed Abo-Zahhad*, Osama Amin, Mohammed Farrag and Abdelhay Ali

Abstract:

Wireless Sensor Networks (WSNs) are becoming very common technology which combine sensing, processing, and wireless multi-hop networking. This paper provides a wide review of the present state about WSNs at the time of its writing. Following a top-down approach, WSNs concept, definition and applications is provided. Furthermore, an overview of WSNs constrains and judgment metrics such as lifetime and latency is given. Then, the communication protocol stack for WSNs is described, and protocols developed for each layer are discussed. Finally, this paper provides review and comparisons of current simulation programs All of these features make the paper valuable for an extensive variety of possible readers, researchers in WSNs, students stating research in WSNs, specialists wanting to offer WSN solutions, and WSN application designers.

Keywords:

Wireless sensor networks; communication protocol stack; Platforms; Simulator Tools; Ad hoc networks

Published In:

International Journal of Energy, Information and Communications , ,



(3)

An Energy Consumption Model for Wireless Sensor Network

Mohammed Abo-Zahhad, Mohammed Farrag, Abdelhay Ali, Osama Amin

Abstract:

Energy consumption and energy modeling are important issues in designing and implementing of Wireless Sensor Networks (WSNs), which help the designers to optimize the energy consumption in WSN nodes. Good knowledge of the sources of energy consumption in WSNs is the first step to reduce energy consumption. Therefore, an accurate energy model is required for the evaluation of communication protocols. In this paper, we provide an energy model for WSNs considering the physical layer and MAC layer parameters by determining the energy consumed per payload bit transferred without error over AWGN channel. We show how the transmission power must be chosen in order to achieve energy-efficient communications over AWGN channel. We also find that, for each modulation scheme, there are optimal transmission power at which the energy consumption is minimized. Moreover, we investigated the energy saving gained from optimizing the constellation size.

Keywords:

Wireless Sensor Network, Energy Consumption Model, Optimal Transmit Power, Minimum Energy Consumption

Published In:

IEEE 5th Annual International Conference on Energy Aware Computing Systems and Applications (ICEAC) , ,



(4)

An Energy Consumption Model for Wireless Sensor Networks

Mohammed Abo-Zahhad, Mohammed Farrag, Abdelhay Ali and Osama Amin

Abstract:

Energy consumption and energy modeling are important issues in designing and implementing of Wireless Sensor Networks (WSNs), which help the designers to optimize the energy consumption in WSN nodes. Good knowledge of the sources of energy consumption in WSNs is the first step to reduce energy consumption. Therefore, an accurate energy model is required for the evaluation of communication protocols. In this paper, we provide an energy model for WSNs considering the physical layer and MAC layer parameters by determining the energy consumed per payload bit transferred without error over AWGN channel. We show how the transmission power must be chosen in order to achieve energy-efficient communications over AWGN channel. We also find that, for each modulation scheme, there are optimal transmission power at which the energy consumption is minimized. Moreover, we investigated the energy saving gained from optimizing the constellation size.

Keywords:

Wireless Sensor Network, Energy Consumption Model, Optimal Transmit Power, Minimum Energy Consumption.

Published In:

IEEE 5th Annual International Conference on Energy Aware Computing Systems and Applications (ICEAC 2015), IEEE. ,
NULL , NULL



(5)

Energy Consumption and Lifetime Analysis for Wireless Sensor Networks

Mohammed Abo-Zahhad, Mohammed Farrag, Abdelhay Ali and Osama Amin

Abstract:

Energy consumption and energy modeling are important issues in designing and implementing of Wireless Sensor Networks (WSNs), which help the designers to optimize the energy consumption in WSN nodes. Good knowledge of the sources of energy consumption in WSNs is the first step to reduce energy consumption. Therefore, an accurate energy model is required for the evaluation of communication protocols. In this paper, we present an energy analysis technique for WSNs considering the physical layer parameters by determining the energy consumed per payload bit transferred without error over AWGN channel. We show how the transmission power must be chosen in order to achieve energy-efficient communications over AWGN channel and provide a closed-form expression for optimum transmission power. We also find that, for each modulation scheme, there are optimal transmission power at which the energy consumption is minimized. The proposed model can be used to analyse the WSNs energy consumption, to evaluate communication protocols, and it can also use to estimate energy consumption and network lifetime which used for on-line energy accounting.

Keywords:

Wireless Sensor Network, Optimal Transmit Power, Minimum Energy Consumption, Energy Consumption Model, Lifetime, Physical layer.

Published In:

IEEE 32nd National Radio Science Conference (NRSC), IEEE. , NULL , NULL



(6)

A Comparative Study of Energy Consumption Sources for Wireless Sensor Networks

Mohammed AboZahhad, Mohammed Farrag, and Abdelhay Ali

Abstract:

With the development of MEMS and CMOS technologies, the implementation of a huge number of wireless distributed micro-sensors that can be simply and rapidly deployed to form highly redundant, self-configuring, and ad hoc sensor networks. Sensor nodes are generally battery- devices, the critical facets to face concern are how to minimize energy consumption of nodes, so that the lifetime of sensing nodes can be maximized. The first step to achieve this goal is to know completely the sources of energy consumption in wireless sensor networks. In this paper, sources of energy consumption at various communication layers have been studied and investigated. Moreover, the energy consumption for the components of a typical sensor node and the impact of communication protocols stack on the energy consumption are discussed. In the sequel, the sources of energy consumption in each communication layer individually are studied. Then, a survey has been provided for existing energy models and the classification of these models into physical layer, MAC layer and cross-layer energy models

Keywords:

Wireless sensor networks, energy consumption, energy modeling, physical layer, cross-layer.

Published In:

International Journal of Grid and Distributed Computing , 8 , 65-76



(7)

Modeling and Minimization of Energy Consumption in Wireless Sensor Networks

Mohammed Abo-Zahhad, Mohammed Farrag and Abdelhay Ali

Abstract:

Design of energy-efficient wireless sensor networks (WSNs) has become an important area of scientific research. In this regard, modeling and minimizing of energy consumption are the main objectives for designing WSNs. In this paper, an energy consumption model for WSNs based on physical layer parameters is proposed by calculating the total energy that is required for successfully received one bit over Rayleigh fading channels. The proposed energy consumption model is validated with real measurements. Results show a good agreement between proposed model and experimental measurements with a mean absolute percentage error less than 5.5%. The validated model is used to optimize transmitted power to achieve minimum energy consumption. Finally, a closed-form expression for optimum transmitted power is derived for M-QAM modulation scheme

Keywords:

Wireless Sensor Network, Energy Consumption Model, Optimal Transmit Power, Minimum Energy Consumption, Physical layer

Published In:

International Conference on Electronics, Circuits, and Systems , NULL , NULL



(8)

Design and Implementation of Building Energy Monitoring and Management System based on Wireless Sensor Networks

Mohammed Abo-Zahhad, Sabah M Ahmed, Mohammed Farrag, Mohammed F A Ahmed, Abdelhay Ali

Abstract:

Wireless sensor networks (WSNs) play a key role in extending the smart grid implementation towards residential premises and energy management applications. Efficient supply and demand balance, and consequently reducing the electricity expenses and carbon emissions, is an immediate benefit of implementing smart grids. In this paper, design and implementation of an energy management system (EMS) for efficient load management are proposed. The EMS reduces the consumption of the consumers at the peak load hours and thus reduces the carbon emissions of the household. The proposed system consists of two main parts. The first part is an Energy Management Unit (EMU) which has a graphical user interface for runtime monitoring and control. The second part is sensor nodes which measure the power consumption of the different loads and transfer it to the EMU via multi-hop network. The EMU is implemented using NI LABVIEW software and XBee-PRO ZigBee module to communicate with sensor nodes. Hardware model is implemented using Arduino Uno microcontroller, XBee-PRO ZigBee module and the ACS712 current sensor. The EMS is applied to building of Electrical Engineering Department at Assiut University as a case study

Keywords:

NULL

Published In:

10th IEEE International Conference on Computer Engineering and Systems (ICCES 2015) , NULL , NULL



(9)

Modeling and Optimization of Energy Consumption in Wireless Sensor Networks

Mohammed Abo-Zahhad, Mohammed Farrag, Abdelhay Ali ·

Abstract:

Energy consumption and energy modeling are important issues in designing and implementing of Wireless Sensor Networks (WSNs), which help the designers to optimize the energy consumption in WSN nodes. Good knowledge of the sources of energy consumption in WSNs is the first step to reduce energy consumption. Therefore, an accurate energy model is required for the evaluation of communication protocols. In this paper, an energy model for WSNs is provided considering the physical layer and MAC layer parameters by determining the energy consumed per payload bit transferred without error over AWGN channel. This model has been tested with real data and NS-2 simulator. Results show good agreement between proposed model, experimental measurements and NS-2 simulator with mean absolute percentage error less than 5.18%. Furthermore, the proposed model is exploited to optimize transmitted power to achieve minimum energy consumption. Finally, a closed-form expression for optimum transmitted power is derived for M-QAM modulation scheme

Keywords:

NULL

Published In:

10th IEEE International Conference on Computer Engineering and Systems (ICCES 2015) , NULL , NULL



(10)

A fast accurate method for calculating symbol error probabilities for AWGN and Rayleigh fading channels

Abo-Zahhad, Mohammed; Farrag, Mohammed; Ali, Abdelhay

Abstract:

NULL

Keywords:

NULL

Published In:

National Radio Science Conference, NRSC, Proceedings , v 2016-April , p 241-248