An Overview of Energy Consumption Techniques in Wireless Sensor Networks

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Abstract - A Wireless Sensor Network (WSN) could be a wireless network consisting of spatially distributed autonomous devices that use sensors for watching and recording the physical conditions of the surroundings and organizing the collected information at a central location. Energy Consumption is a very difficult problem in a WSN because the batteries of wireless sensor nodes have very restricted capacities. Due to this problem, every solution elaborated for these networks should be aimed at minimizing the energy consumption. This paper provides the short overview of the energy consumption techniques and algorithms for calculating energy-efficient topologies for wireless sensor networks.

Keywords - Wireless Sensor Networks, Energy Consumption, Protocols, Survey

I. INTRODUCTION

Wireless Sensor Networks (WSNs) have been widely considered as one of the most important technologies for the twenty first century. Building sensors area unit created attainable by the recent advances in Micro-Electro Mechanical Systems (MEMS) Technology. Wireless Sensor Networks (WSNs) consist of small nodes with sensing, computation, and wireless communications capabilities. Due to recent technological advances, the producing of small and low price sensors became technically and economically possible.

WSNs are a class of Ad-Hoc network. A WSN is a wireless network consisting of spatially distributed autonomous devices that use sensors for watching and recording the physical conditions of the atmosphere and organizing the collected information at a central location. WSNs measure environmental conditions like temperature, sound, pollution levels, humidity, wind speed and direction, pressure, etc.,

Each node is usually powered by an energy-limited battery, therefore the energy budget is a critical design constraint in WSNs and energy consumption is the key issue in order to increase the network lifetime. Due to this problem, more techniques are available in WSN. This paper performs the review on WSN concept, methods, energy saving techniques and routing schemes.

II. LITERATURE REVIEW

A. Wireless Sensor Network: A Review

I.F. Akyildiz et al. [1] performed a survey on wireless sensor networks in 2002. Previous works concentrate wired sensor network concepts and architecture. But, this paper described the concept of Wireless sensor networks which has been made viable by the convergence of MEMS Technology, wireless communications and digital electronics. Then, the communication architecture for sensor networks is outlined, and the algorithms and protocols developed for each layer in the literature are explored. In the future, this wide range of application areas will make sensor networks an integral part of our lives.

F. L. Lewis [2] conducted a review on wireless sensor networks in 2004. This paper performed a review on wireless sensor network technologies, protocols and applications. In future, conduct a review based on wireless sensor network routing techniques, power consumption techniques, IEEE standards and MAC protocols.

Jennifer Yick et al. [3] performed a survey on wireless sensor network in 2008. The goal of survey is to present a comprehensive review of the recent literature since the publication of [I.F. Akyildiz et al., A survey on sensor networks, IEEE Communications Magazine, 2002]. This paper summarized and compared different proposed designs, algorithms, protocols, and services. Moreover, we have highlighted possible improvements and research in each area.

B. Energy Consumption in Wireless Sensor Network: A Review

Giuseppe Anastasi et al.[4] presented a survey on energy conservation in wireless sensor networks in 2009. Sensor nodes are generally battery-powered devices, the critical aspects to face concern how to reduce the energy consumption of nodes, so that the network lifetime can be extended to reasonable times. In this paper first break down the energy consumption for the components of a typical sensor node, and discuss the main directions to energy conservation in WSNs. Then, present a systematic and comprehensive taxonomy of the energy conservation schemes, which are subsequently discussed in depth.

Sidra Aslam et al. [5] projected power consumption in wireless sensor networks in 2010. Much research has been done to design schemes for power conservation and power management in sensor nodes upon all layers of protocol stack. To increase sensor node's lifetime, integration of harvesting technologies, low power sensor network design, and energy-aware protocols is mandatory. Therefore, generic cross-layer optimization techniques are required to fulfill applications demands. The goal of this study is to present and discuss several strategies such as power-aware protocols, cross-layer optimization, and harvesting technologies used to alleviate power consumption constraint in WSNs.

Zahra Rezaei and Shima Mobininejad [6] performed an energy saving in wireless sensor networks in 2012. Sensors cannot be easily replaced or recharged due to their ad-hoc deployment in hazardous environment. Considering that energy saving act as one of the hottest topics in wireless sensor networks. For this reason, this paper focused primarily on duty cycling schemes which represent the most compatible technique for energy saving and also focus on the data-driven approaches that can be used to improve the energy efficiency. In future, have to analyze the rest of mobility model.

C. Routing Protocols for Wireless Sensor Network: A Review

In the year of 2003 Stefan Dulman et al. [7] introduced the reliability in multipath routing for wireless sensor network**.** In wireless sensor networks (WSN) data produced by one or more sources usually has to be routed through several intermediate nodes to reach the destination. Problems arise when intermediate nodes fail to forward the incoming messages. The reliability of the system can be increased by providing several paths from source to destination and sending the same packet through each of them. Using this technique, the traffic increases significantly. Due to this reason, analyze a new mechanism that enables the tradeoff between the amount of traffic and the reliability. The data packet is split in k sub packets (k = number of disjoined paths from source to destination). If only E_k sub packets ($E_k < k$) are necessary to rebuild the original data packet, then the trade-off between traffic and reliability can be controlled. The future work focuses on finding ways of estimating the failing probabilities of each node.

Kemal Akkaya and Mohamed Younis [8] performed a survey on routing protocols for wireless sensor networks in 2005. Recent advances in wireless sensor networks have led to many new protocols specifically designed for sensor networks where energy awareness is an essential consideration. Most of the routing protocols they might differ depending on the application and network architecture. This paper surveys recent routing protocols for sensor networks and presents a classification for the various approaches pursued. The three main categories explored in this paper are data-centric, hierarchical and location-based. Each routing protocol is described and discussed under the appropriate category. Other possible future research for routing protocols includes the integration of sensor networks with wired networks (i.e. Internet).

R.Vidhyapriya and Dr .P.T. Vanathi [9] proposed an energy efficient adaptive multipath routing for wireless sensor networks in 2007. Routing in wireless sensor networks is a difficult task. Multipath routing schemes distribute traffic among multiple paths instead of routing all the traffic along a single path. Two key questions are arising in multipath routing, how many paths are needed and how to select these paths. This paper utilizes multiple paths between source and the sink, adaptive because they have low routing overhead. This protocol is intended to provide a reliable transmission environment with energy consumption, by efficiently utilizing the energy availability and the received signal strength of the nodes to identify multiple routes to the destination.

Ewa Niewiadomska-Szynkiewicz et al. [10] conducted a comparative study of wireless sensor networks energy-efficient topologies and power save protocols in 2009. In existing survey conducted based on only topologies and protocols for wireless sensor network. Proposed paper provided the short overview of the energy conservation techniques and algorithms for calculating energy-efficient topologies for wireless sensor networks. The energy conservation techniques and algorithms for computing the optimal transmitting ranges in order to generate a network with desired properties while reducing sensors energy consumption are discussed and compared through simulations.

B. Baranidharan and B. Shanthi [11] performed a survey on energy efficient protocols for wireless sensor networks in 2010. The existing energy efficiency model for the sensor network shown considerable improvement in one or more objectives to suite the specific application, still there needed a lot of work to be done on energy efficient model in terms of low clustering overhead, distributed cluster heads, continuous packet delivery, reduced data fusion cost. Due to this reason, proposed a new hybrid protocol model which considers all these factors in the routing mechanism for the wireless sensor network. Future works may concentrate on achieving better energy efficiency in routing mechanism for mobile wireless sensor nodes.

Ahmed Ayadi [12] conducted a survey on reliable transport protocol for wireless sensor networks in 2011. Classical reliable transport protocols like Transmission Control Protocol (TCP) are not well suited for wireless sensor networks due to both the characteristics of the network nodes (low computing power, strong energy constraints) and those of the main applications running on those nodes (low data rates). This paper presented a

new transport protocols for wireless sensor networks providing various type of reliability and using new mechanisms for loss detection and recovery, and congestion control. Future works may concentrate on achieving better energy efficiency in reliable transport mechanism for mobile wireless sensor nodes.

Ali Norouzi et al. [13] proposed a novel energy efficient routing protocol in wireless sensor networks in 2011. A main issue of gossiping is how to assign time slots to nodes for interference-free data transmission. Due to this reason, this paper proposed a new routing protocol based on Gossiping called Fair Efficient Location-based Gossiping (FELGossiping) to improve the problems of Gossiping and its extensions. FELGossiping consists of three phases: Initialization, Information Gathering and Routing. In future, introduce a "Green Wireless Networks" routing protocol that optimizes energy consumption and bandwidth.

Smriti Joshi and Anant Kr. Jayswal [14] projected a review on energy-efficient MAC protocol for wireless sensor networks in 2012. Influencing by the design principles of traditional layered protocol stack, current MAC protocol designing for wireless sensor networks (WSN) seldom takes load balance into consideration, which greatly restricts WSN lifetime. This paper, a novel forwarding election-based MAC protocol is presented to prolong WSN lifetime by means of improving energy efficiency and enhancing load balance. This paper gives the performance analysis of all the protocols that have been proposed for wireless sensor networks till date. Further work will include the issues of these MAC protocols.

Sourabh Jain et al. [15] proposed an energy efficient maximum lifetime routing algorithm for wireless sensor networks in 2012. For maximizing the lifetime of these nodes most routing algorithm in wireless sensor networks uses the energy efficient path. These energy efficient routing algorithms select a best path for data transmission and consume less energy. But a single best path puts extra load to a specific node causing lower lifetime. This paper proposes an energy efficient maximum lifetime routing algorithm. It is based on a greedy heuristic technique to maximize lifetime of the system. For achieving maximum system lifetime proposed algorithm uses the energy cost of links for constructing energy efficient path. In future work, concentrate some security mechanism.

III. CONCLUSION

This paper performs a review on wireless sensor networks. Review is conducted based on following categories: wireless sensor network concepts, energy consumption in wireless sensor networks, routing protocols for wireless sensor networks. This survey concludes with the recommendations to the future direction in the energy efficiency model for the sensor networks.

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