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Energy Efficient Routing Techniques in Wireless Sensor Network: A Review

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ABSTRACT

Wireless sensor networks (WSNs) have captivated substantial attention from both industrial and academic research in the last few years. The major factor behind the research efforts in that field is their vast range of applications which include surveillance systems, military operations, health care, environment event monitoring, and human safety. However, sensor nodes are low potential and energy constrained devices; therefore, energy-efficient routing protocol is the foremost concern.

In this paper we discuss about the congestion control and their effects in sensor networks.

Keywords: Mobile sink, Mobility management, Energy efficiency, Wireless sensor Networks, Routing, Life time.

INTRODUCTION

The progress in modern technologies has motivated the design of small electronic low-powered sensor devices. Ordinarily, a considerable number of these sensors are deployed in remote areas in the form of a wireless network of nodes to measure different physical values. This kind of network scenarios are referred to as wireless sensor networks (WSNs). WSNs are serviceable in numerous industrial applications [3]. Wireless sensor networks (WSNs) consist of small and tiny devices that have been scattered over a distant area to monitor many events such as border surveillance, temperature, and humidity.

These small nodes suffer from many resource constraints such as battery and computation. Therefore, they should be preserved as long as possible to reach the monitoring goals. It is also necessary to design the algorithms that consume low resources from sensor devices [1].

WSNs can be used for improving the gaming experience by enhancing the interactions between the physical world and virtual world using wearable and implantable camera sensors. Medical and health applications from another important set of WSN applications enabling careers to monitor the conditions of patients either in hospital or in elder people’s home. Radiation level control, explosive gas level and leakage detection, as well as restricted area control also form part of the potential security and emergency applications [2].

Wireless Sensor Networks (WSNs) are installed and deployed to carry out different applications, such as Environmental Monitoring, Targeting, Industrial Control, Disaster Recovery, Nuclear, Biological & Chemical attack Detection Reconnaissance and Battlefield Surveillance. This

Wireless Sensor Networks are expected to play more important role in the future generation networks to sense the physical world. It is very well known that the energy is the most serious and critical resource for battery-powered Sensor Networks. To extend the lifetime of this network as long as possible, the energy efficiency becomes the most important parameter during the Protocol design [4].

Fig 1: The taxonomy of the WSN applications [2].

The success of WSN applications is dependent on knowing that information is available, the type of information, its quality, its scope of applicability, limits of use, duration of applicability, likely return, cost to obtain and a host of other essential details. To aid in data collection, the use of mobile nodes has been widely suggested in the literature. Node movement can be controlled and optimized to improve data collection and analysis. For instance, mobile nodes can be used to bridge disconnected parts of the network. Furthermore, node mobility can optimize the energy consumption and lifetime of a WSN. For example, moving the sink to data sources or moving the sensor nodes towards the sink is one way to avoid the communication bottlenecks [11].

WSNs can be classified based on their infrastructure as homogeneous WSNs or heterogeneous WSNs. In homogeneous WSNs, all the SNs have similar hardware components such as the sensing subsystems, processing subsystem, radio subsystem, and power supply unit. On the other hand, the hardware components of two or more SNs are different in heterogeneous WSNs. A major reason for the design of heterogeneous WSNs is to equip some SNs with bigger sensing range and more battery power to attain longer transmission. Although deploying homogeneous WSNs can be quite easy in comparison to heterogeneous WSNs, heterogeneous WSNs are more useful in factual deployments because they are close to practical scenarios. Different energy-efficient and energy-balanced routing protocols have been proposed over the years assuming homogeneous or heterogeneous WSN structures [3]. Due to the broadcast nature of radio propagation, wireless transmissions from a sensor to its sink are open to unauthorized users in WSNs, rendering the sensor-sink transmission extremely vulnerable to both the jamming and eavesdropping attacks [5]. More specifically, a malicious node in IWSNs can readily launch a jamming attack by emitting radio signals to interfere with the desired sensor-sink transmission. Furthermore, any network node within the sensor's transmit coverage is capable of overhearing the sensor-sink transmission and may become an eavesdropping attacker.

Wireless Sensor and Actuator Networks (WSANs) are an extension of WSNs [7]. WSANs are used in various applications such as home automation, battle field surveillance, networked robot, precision agriculture, animal control, and environmental monitoring. The actuator nodes have more communication capability compared to the sensor nodes and are responsible to take decisions and react in the event area according to the received data. To take advantage of the ability of the actuator nodes, an efficient cooperative communication is required. The sensor-sensor coordination is executed to gather information in the surveillance field. The sensor-actuator co-ordination is executed to report the collected data from the sensor to the actuator nodes [7].

The rest of this paper is organized as follows in the first section we describe an introduction of about the routing scheme in wireless sensor networks. In section II we discuss about the jamming attacks in wireless sensor networks, In section III we discuss about the related work. Finally in section IV we conclude and discuss the future scope.

II JAMMING ATTACKS

Jamming attacks deliberately transmit radio signals for disrupting the desired communications between the sensors and sink in IWSNs. A jammer may either block the transmission or interfere with the reception of the desired communications. More specifically, the jammer may selfishly occupy a wireless channel by continuously transmitting a radio signal over the channel. On the other hand, the jammer may emit an interfering signal only when a legitimate sensor is transmitting to the sink. This aims for corrupting the data reception at the sink. There are several different types of wireless jammers, including the constant jammer, intermittent jammer, reactive jammer and adaptive jammer. To be specific, the constant jammer continuously emits a jamming signal over a wireless channel that is shared by all the sensors in wireless sensor networks [5].

III RELATED WORK

From our literature survey, it is noted that numerous literatures focus on energy efficient routing protocols which aim is to find an optimal best path to minimize energy consumption either on local nodes or in the whole wireless sensor networks.

[1] In this paper they model the problem as a multi constrained optimal path problem and propose a distributed learning automaton (DLA) based algorithm to preserve it. The proposed approach leverages the advantage of DLA to find the smallest number of nodes to preserve the desired QoS requirements. It takes several QoS routing constraints like end-to-end reliability and delay into account in path selection. They simulate the proposed algorithm, and the obtained results verify the effectiveness of their solution. [3] In this paper, they provide a clear picture of both the energy-efficient and energy-balanced routing protocols for WSNs. More importantly, this paper presents an extensive survey of the different state-of-the-art energy-efficient and energy-balanced routing protocols. Taxonomy is introduced to classify the surveyed energy-efficient and energy-balanced routing protocols based on their proposed mode of communication towards the base station (BS). In addition, they classified these routing protocols based on the solution types or algorithms, and the input decision variables defined in the routing algorithm. The strengths and weaknesses of the choice of the decision variables used in the design of these energy-efficient and energy-balanced routing protocols are emphasized. [4] They have discussed various energy-efficient routing protocols and discussed their issues. To overcome these major issues, an efficient Energy-Balanced Routing Protocol (EBRP) is designed. In this work, they were analyzed its pros and cons. i.e. from our experimental results, they established that the EBRP fails to achieve Throughput and End-to-End Delay. To achieve these identified issues, they have developed Delay-Aware Energy Balanced Routing Protocol (DA-EBRP). They have thoroughly studied and investigated this proposed routing technique and compared with EBRP in terms of End-to-End Delay, Throughput, Portion of Living Node (PLN) and Network Lifetime. [5] In this paper is author present a review on the challenges and solutions of improving the physical layer security and reliability for IWSNs. They first discuss some wireless reliability enhancement techniques for mitigating the background interference, path loss, multipath fading, and link failure. Then, they provide an overview of wireless jamming and eavesdropping attacks along with their countermeasures, where a jammer attempts to emit an interfering radio signal for disrupting the

desired communications between a wireless sensor and its sink, while an eavesdropper intends to tap the confidential sensor-sink transmissions. Additionally, they evaluate the tradeoff between the security and reliability, called security-reliability tradeoff, in the context of wireless sensor-sink transmissions. [6] In this paper, an energy-efficient routing protocol for wireless sensor networks is proposed. Their protocol consists of a routing algorithm for the transmission of data, cluster head selection algorithm, and a scheme for the formation of clusters. On the basis of energy analysis of the existing routing protocols, a multistage data transmission mechanism is proposed. An efficient cluster head selection algorithm is adopted and unnecessary frequency of re-clustering is exterminated. Static clustering is used for efficient selection of cluster heads. The performance and energy efficiency of our proposed routing protocol are assessed by the comparison of the existing routing protocols on a simulation platform. [7] In this paper, they have proposed an energy efficient and QoS aware routing protocol for WSNs. They have proposed a new clustering mechanism that takes into consideration the accessibility degree of the actuator nodes in the process of CH election. Their approach combines two other important parameters, namely the energy state and the degree of connectivity of the candidate sensor nodes. Their approach reduces the energy consumption as well as the communication delay and balances the energy consumption equally among the actuator nodes. [8] In this paper they propose an energy efficient cluster head selection algorithm which is based on particle swarm optimization (PSO) called PSO-ECHS. The algorithm is developed with an efficient scheme of particle encoding and fitness function. For the energy efficiency of the proposed PSO approach, they consider various parameters such as intra-cluster distance, sink distance and residual energy of sensor nodes. They also present cluster formation in which non-cluster head sensor nodes join their CHs based on derived weight function. The algorithm is tested extensively on various scenarios of WSNs, varying number of sensor nodes and the CHs. [9] In this paper they have presented an adaptive aggregation routing (ARR) scheme with the belief that our proposed scheme is an efficient means to reduce delay and improve the lifetime for WSNs. To address different applications, this scheme can be implemented in all networks with a tree topology. In this scheme, the node assignment algorithm (NAAL) is proposed for dynamically assigning the aggregation queues in the lower layer to the nodes in the upper layer. According to the state of the data queue in the nodes, this algorithm dynamically selects nodes that receive the aggregation queues in this cycle, while other nodes in the same layer can sleep to save energy. [10] They propose a mathematical model for a novel quality-of-service (QoS) routing determination method. The proposed scheme enables determining the optimal path to provide appropriate shared radio satisfying the QoS for a wide range of real-time intensive media. The mathematical model is based on the Lagrangian relaxation method, to control adaptive switching of hop-by-hop QoS routing protocols. The embedded criteria for each objective function are used to decide which path from source to sink will be selected. [11] In this paper, they propose a self-organizing and adaptive Dynamic Clustering (DCMDC) solution to maintain MDC- relay networks. This solution is based on dividing the network into well-delimited clusters called Service Zones (SZs). Localizing mobility management traffic to a SZ reduces signaling overhead, route setup delay and bandwidth utilization. Network clustering also helps to achieve scalability and load balancing. Smaller network clusters make buffer overflows and energy depletion less of a problem. These performance gains are expected to support achieving higher information completeness and availability as well as maximizing the network lifetime. Moreover, maintaining continuous connectivity between the MDC and sensor nodes increases information availability and validity.

IV CONCLUSION AND FUTURE SCOPE

In the last two decades, Wireless Sensor Networks (WSNs) have significantly changed the way we interact with our environment. WSNs appear in several scientific, commercial, health, surveillance, and military applications. The open nature of radio propagation makes wireless transmissions exposed to unauthorized users and become vulnerable to both the jamming and eavesdropping attacks.

REFERENCES:-

[1] Habib Mostafaei, "Energy-Efficient Algorithm for Reliable Routing of Wireless Sensor Networks", IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 66, NO. 7, JULY 2019, pp 5567-5576.

[2] Halil Yetgin, Kent Tsz Kan Cheung, Mohammed El-Hajjar, Lajos Hanzo, "A Survey of Network Lifetime Maximization Techniques in Wireless Sensor Networks", IEEE 2016, pp 1-29.

[3] Olayinka O. Ogundile, Attahiru S. Alfa, "A Survey on an Energy-Efficient and Energy-Balanced Routing Protocol for Wireless Sensor Networks", Mdpi, Sensors, 2017, pp 1-51.

[4] N.Kaleeswari, S.Sangeetha, A. Jerwin Prabu, "Optimization Approach for Energy Consumption in Wireless Sensor Networks using Delay Aware Dynamic Routing Protocol", International Journal of Emerging Trends in Engineering and Development, 2017, pp 54-61.

[5] JIA ZHU, YULONG ZOU, BAOYU ZHENG, "Physical-Layer Security and Reliability Challenges
for Industrial Wireless Sensor Networks", IEEE access 2017, pp 5313-5320.

[6] Muhammad Kamran Khan, Muhammad Shiraz, Kayhan Zrar Ghafoor, Suleman Khan, Ali Safaa Sadiq, Ghufran Ahmed, "EE-MRP: Energy-Efficient Multistage Routing Protocol for Wireless Sensor Networks", Hindawi Wireless Communications and Mobile Computing, 2018, pp 1-13.

[7] Souraya Yahiaoui, Mawloud Omar, Abdelmadjid Bouabdallah, Enrico Natalizio, Yacine Challal, "An
energy efficient and QoS aware routing protocol for wireless sensor and actuator networks", International Journal of Electronics and Communications, Elsevier, 2018, 83, pp 193-203.

[8] P. C. Srinivasa Rao, Prasanta K. Jana, Haider Banka, "A particle swarm optimization based energy efficient cluster head selection algorithm for wireless sensor networks", Springer 2016, pp 1-17.

[9] Xujing Li, Anfeng Liu, Mande Xie, Neal N. Xiong, Zhiwen Zeng, Zhiping Cai, "Adaptive Aggregation Routing to Reduce Delay for Multi-LayerWireless Sensor Networks", Mdpi, Sensors, 2018, pp 1-18.

[10] Mohammed Zaki Hasan, Fadi Al-Turjman, Hussain Al-Rizzo, "Optimized Multi-Constrained Quality-of-Service Multipath Routing Approach for Multimedia Sensor Networks", IEEE SENSORS JOURNAL, VOL. 17, 2017, pp 2298-2309.

[11] Abdelrahman Abuarqoub, Mohammad Hammoudeh, Bamidele Adebisi, Sohail Jabbar, Ahcène Bounceur, Hashem Al-Bashar, " Dynamic Clustering and Management of Mobile Wireless Sensor Networks", Elsevier ltd., 2017, pp 1-17.

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