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Validation of multiple mobile elements based data gathering protocols for dynamic and static scenarios in Wireless Sensor Networks

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Abstract

WSNs consist of sensors with communication and sensing capabilities. Here authors have focused on data gathering techniques in energy constrained sensor network. This paper contains two data gathering techniques which uses multiple mobile elements meant for collecting data from sensor nodes. One is Mobile Element based Energy-Efficient Data Gathering with Tour Length-Constrained in WSNs (EEDG).Another is an Intelligent Agent-based Routing Structure for Mobile Sinks in WSNs (IAR). Both protocols performance is compared by taking statistics based on performance metrics. Through this paper authors have made an endeavour to validate these protocols in static and dynamic scenarios based on the performance metrics. Analysis is the clear evidence of the fact that protocols are exclusively designed for static WSN and not for the dynamic. With this comparative analysis authors have proved EEDG is superior to IAR as per as efficiency is concerned, at the same time it has some limitations like Idle listening of sensor nodes and also redundancy removal aspects are not considered. Based on this comparative analytical study authors are going to work on elimination of limitation of EEDG protocol to boost up its efficiency in future by increasing the lifespan of sensor network.

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1. Introduction

WSNs consist of many small, low cost nodes equipped with sensor, microprocessors, memory, wireless transceivers, and battery. They monitor the physical, environmental condition and gathers and transmits data to one or more base station. During data collection energy is consumed in WSN. Due to this it has wide range of applications in different field of interest.[1].In WSN Energy consumption is the major limitation and overcoming this drawback is the big challenge. One way to reduce energy consumption is incorporation of mobile elements in sensor networks. Data gathering is one of the basic distributed data processing procedures in WSNs for conserving energy and reducing MAC contention [2]. This mechanism does network aggregation of data essential for energy-efficient data flow [3]. These protocols can reduce the communication cost and improves the lifetime of WSN. The redundant data sensed from the sensors can be eliminated by data gathering [4]. Data gathering increase data accuracy, reduces the number of redundant packets transmitted intern increasing data collection efficiency.

2. Related Work

Fang-Jing Wu and Yu-Chee Tseng [5] has proposed the data gathering concept by mobile mules which uses Traveling Salesman Problem in spatially separated WSN by proving better solution to balance lifetime of WSN and collection of data.

Min Xiang et al [6] proposed energy-efficient intra-cluster data gathering. This system is implemented for saving the energy of sensor network. In this every cluster head will be substituted by the candidate cluster head only when its active time equal to its optimum value. This will help in improving the energy utilization ratio of data gathered to broadcasted message. But this techniques has not considered the idle listening of sensor nodes.

Deepak Puthal [7] has proposed Mobile Sink Wireless Sensor Network (MSWSN) model to collect the data. In this model the sink is mobile in the network and covers the entire network. But with the drawback that is visiting schedule of the mobile sink is unaddressed.

Xi Xu [8] has proposed one technique which dynamically selects sparsity values using signal variations in local regions. Conclusion was A-HDACS enables maximum sensor nodes which helps in improvement in energy efficiency as well as accuracy in signal recovery.

Metin Koç [9] has proposed two algorithms, distributed and centralized which do not consider sink-site combinations to determine migration points which causes higher complexities. When compared both,. authors have concluded by revealing the fact that lifespan of the network with centralized algorithm is more than the distributed.

Authors have also done extensive survey on the existing protocols and came up with the conclusion that in the existing data gathering techniques metrics like visiting schedule and the buffer overflow are not much considered [10]. To address these issues it is important to know which is the efficient protocol, based on which in future work authors can concentrate on eliminating above issues. Apart from this authors have made an attempt to validate and prove the efficiency of the protocol by comparing latest energy efficient protocols. Here concepts are implemented which are common to both (EEDG and IAR) like deployment of mobile sinks, generating visiting schedule, collecting data from cluster members.

In the following section authors have compared two latest data gathering protocols, one is “Energy-Efficient Data Gathering with Tour Length-Constrained Mobile Elements in Wireless Sensor Networks (EEDG) [11]” and another is ” An Intelligent Agent-based Routing Structure for Mobile Sinks in WSNs (IAR)[12]”. Comparative analysis proves which is efficient protocol. Authors have also tried to validate both the protocols in static and dynamic scenario by recognizing the limitation of the efficient protocol. Authors have decided to take the existing limitations as further research topic in the perspective of improvising the existing protocols efficiency.