Power Transmission Analysis in Wireless Sensor Networks Using Data Aggregation Techniques

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ABSTRACT
Power consumption mainly takes place in three stages: processing the data, receiving the data, and transmitting the data. Power consumption in data transmitting is one of the most important phenomena in wireless sensor networks (WSNs). In this article, authors analyze the power transmission in three scenarios with 100 and 500 nodes for 100 and 1000 sq. meters of area respectively and design a network which should be more efficient in power saving. Results analysis section presents different data aggregation techniques and their impact on the power transmission in WSNs. Three different scenarios have been used during simulation of network in Matlab. After that, the authors find that the proposed approach has outperformed in the first two scenarios. However, in the third scenario, results are partially better as compared to the existing approaches (tree-based, cluster-based, chain-based, and grid-based). The proposed approach, PLBDA, is 10.30%, 18.55%, 37.11%, and 55.67% better for transmission power save in comparison to tree-based, cluster-based, grid-based, and chain-based approaches respectively.

KEYWORDS
Data Aggregation, Energy Efficiency, Power Transmission, Wireless Sensor Networks (WSNs)

1. INTRODUCTION
Recently a lot of work is going on data aggregation techniques in wireless sensor networks. In this paper, the author considers the different data aggregation approaches with their analysis on power transmission analysis. Basically, there are four categories of data aggregation approaches which areas; Tree-Based, Cluster-based, Chain Based and Grid-Based. Tree-Based data aggregation approach is based on tree architecture. Root node works as a coordinator node in the network. Data aggregation takes place at the intermediate node. Lower level nodes always forward the data to the upper-level node. There are two ways to transfer data in a tree-based approach; the first one is indirect diffusion and the second is aggregated data transmission. It has been found that a lot of energy get wastage by indirect diffusion technique, so aggregation is more suitable and energy efficient way (Ding et al, 2003). The cluster-based approach is based on clustering architecture. The network is divided into clusters and each cluster having own cluster head. Selection of cluster head plays an important role in energy efficiency. So, dynamic cluster head selection is more suitable for energy efficiency.
(Heinzelman et al., 2002). PEGASIS is the most popular approach based on Chain model. Nodes are randomly deployed in the network. All sensor nodes transfer the data to the nearest neighbor and aggregation takes place only the central node only. After that, the central node forwards the data to the coordinator node. Data transmission in Chain model is based on Greedy approach (Lindsey et al., 2004). The grid-based approach is better for the mobile scenario, especially when event occurrence time is small. The whole network divides into a number of areas and every area is responsible for the reporting of event occurrence. Central node of the area is selected for the grid aggregator. All aggregation processes take place at that node only.

Grid aggregator node data forward to the coordinator node after aggregation. The grid-based approach also suitable for event mobile scenario. Grid-based approach increases the throughput of the network and end to end response time (Vaidyanathan et al., 2004). In wireless sensor networks, energy consumption is the main issue. Energy consumption takes place during the three main tasks which areas; (i) transmitting the data, (ii) the reception of data and (iii) processing the data. Out of these three terms, most of the energy is consumed during the transmission of the data in the network. This paper focuses on saving the power in transmitting the data. The main contribution of the paper is to design a system which can save more power for wireless sensor networks in comparison to the existing data aggregation approaches.

1.1. Organization of the Paper

“Section 1” presents the introduction part of the paper. Related work explained in “section 2”. Different data aggregation approaches are discussed in “section 3”. Flowchart of the proposed model is shown in “section 4”. Results with suitable graph have been presented in “section 5”. Finally, conclusions and future scope are presented in “section 6”.

2. RELATED WORK

In order to review the literature, research papers were identified from various repositories like Science Direct, ACM Digital Library, IEEE Journals, Springer and Google Scholar etc. Research papers related to Power transmission in the Wireless Sensor Networks have been considered for detailed analysis. Review of literature in this paper has been carried out in the similar fashion as done previously by authors (Kumar and Singh, 2017).

Zhong et al. (2018) discussed an encrypted scheme for aggregation in WSNs. There are some limitations to homomorphic encryption malleability, aggregation functions, and unauthorized access. Proposed scheme solve these issues from WSNs using the signature method. Scheme complete in three steps: first step scheme filter out data in network aggregation, in second step coordinator node identify the data which is received is original or not and in last step coordinator node performs aggregation functions. Authors achieved better results in terms of delay, energy consumption and computational overhead. Energy consumption is directly proportional to the number of nodes in the networks.

Sasirekhaand Swamynathan, (2017) explained a new approach (CCMAR) for data aggregation in WSNs. CCMAR having an advantage over the LEACH and PEGASIS. CCMAR divides the networks into some regions and again clustered the network. Each cluster region has a bunched leader (cluster head). The mobile agent creates the difference between this scheme and other energy efficiency schemes. CCMAR used cluster chain method instead of a long chain. CCMAR techniques include three steps: the first one is the formation of chain and cluster, the second one is data aggregation and the last one is a collection of data from bunch leaders.

Lu and Sun, (2018) presented a spatiotemporal based scheme for data aggregation for WSNs. This scheme improves the convergence in data accuracy with the help of degree of attaching on every bunch leader. Data classified using the chi-square test. Authors show simulated and theoretical both results and found better as compare to the existing approaches. Mean value works as aggregation function in the networks. Wan et al. discussed tree-based data aggregation in WSNs. The main purpose of data
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Facilitating Biodefense Research with Mobile-Cloud Computing
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