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Data Aggregation to Improve Energy Efficiency in Wireless Sensor Networks

Shilpy Ghai[1], Prof. V.K.Katiyar[2]
[1]*M.M.Engineering College, Maharishi Markandeshwar University, Mullana, Haryana, India (Research Scholar)*
[2]*M.M.Engineering College, Maharishi Markandeshwar University, Mullana, Haryana, India (Professor, CSE Department)*

Abstract- Wireless Sensor Network is a collection of large number of tiny sensor nodes which are connected to each other wirelessly having limited energy. These nodes are mobile in nature. These sensor nodes sense the same data and forward it to the sink node. In this way, sink node receives redundant data and more energy is consumed in processing this data. Data Aggregation plays a very crucial role in Wireless Sensor Networks. We will use data aggregation to reduce the energy consumption by removing redundancy. Thus, with the help of data aggregation, we can enhance the lifetime of the network. In this paper, we have proposed a hybrid data aggregation technique to remove redundancy.

Keywords- Wireless Sensor Network, Data aggregation, sensor nodes, transmission

I. INTRODUCTION

A Wireless Sensor Network consists of a large number of sensors, each of which are physically small devices, and are equipped with the capability of sensing the physical environment, data processing, and communicating wirelessly with other sensors. Generally, we assume that each sensor in a wireless sensor network has certain constraints with respect to its energy source, power, memory, and computational capabilities.

Wireless Sensor Networks (WSNs) use tiny, inexpensive sensor nodes with several distinguishing characteristics: they have very low processing power and radio ranges, permit very low energy consumption and perform limited and specific monitoring and sensing functions. Several such wireless sensors in a region self-organize and form a WSN. Information based on sensed data can be used in agriculture and livestock, driving or even in providing security at home or in public places. A key requirement from both the technological and commercial point of view is to provide adequate security capabilities. Fulfilling privacy and security requirements in an appropriate architecture for WSNs offering pervasive services is essential for user acceptance. Five key features need to be considered when developing WSN solutions: scalability, security, reliability, self-healing and robustness.

II. DATA AGGREGATION

Data aggregation is the process of collecting and aggregating the useful data. Data aggregation is considered as one of the fundamental processing procedures for saving the energy. In WSN, data aggregation is an effective way to save the limited resources. The main goal of data aggregation algorithm is to gather and aggregate data in an energy efficient manner so that network lifetime is enhanced. Wireless sensor networks have limited computational power, limited memory and battery power, hence increased complexity for application developers which results in applications that are closely coupled with network protocols. In this paper, a data aggregation framework for wireless sensor networks is presented along with a survey on various energy-efficient algorithms for data aggregation [2].

Data Aggregation Strategies: Some of the data aggregation strategies are: Centralized approach, In-network Aggregation, Tree based approach, cluster based approach.

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There are two types of secure data aggregation protocols [3] based on the topology used for aggregation. First is tree-based data aggregation protocols in which the intermediate parent nodes in the path from leaf to base station perform data aggregation. The main issue in this type of protocols is to construct an energy-efficient data aggregation tree. Second is cluster-based data aggregation protocols in which sensor nodes are subdivided into clusters. In each cluster, a cluster head is elected to aggregate the data locally and transmit the aggregation result to the base station.

III. RELATED WORK

In paper [4], author uses Dynamically Balanced Spanning Tree (DBST), which provides dynamic structure of tree to solve hotspot problem and improve energy conservation. DBST is a tree based approach; in this smallest possible weight spanning tree can be formed by using kruskals algorithm.

SVM based Data Redundancy Elimination (SDRE) [5] algorithm makes use of SVM for redundancy elimination. The Support Vector Machine (SVM) is applied on DAT to eliminate redundancy. SVM Performs two functions one is classification and other is correlated data elimination. It uses linear classifier method to represent the classification of redundant data. This method divides the hyper plane in two classes, redundant (no) and not redundant (yes).

Bandwidth efficient Heterogeneity aware Cluster based Data Aggregation (BHCDA) [6] which performs both intra cluster and inter cluster aggregation to eliminate redundancy. Cluster head (CH) is selected from each cluster. Data Aggregation is done at cluster head (CH) for the packets inside the cluster. These cluster heads (CH) will further acts as a nodes and one of the cluster head (CH) from these CH's, will become aggregator node. This aggregator node will forward aggregated data to the sink. The aggregation function used in BHCDA is based on correlation of data packets generated by high energy nodes and low energy nodes. BHCDA performs both intra cluster and inter cluster aggregation which results not only in improving life time of sensor network but also in improving bandwidth utilization.

Redundancy Eliminated Data Dissemination (REDD) [7] algorithm makes use of context aware system for validation and correlation coefficient is used to eliminate redundancy from valid data. In this approach total geographical area is divided into grid based clusters. In each cluster one representative node called header node is elected. This header node is elected based upon battery power. The nodes of WSN are moving so there might be a chance that node may go in other cluster. This is handled by dynamic topology management module of REDD.

Adaptive Energy Efficient Reliable Data Aggregation Technique (AEERDAT)[8]this algorithm changes the size of cluster and allows only valid nodes to be in the cluster in order to maintain reliability. AEERDAT [8] addresses reliability issue of Wireless Sensor Network (WSN) aggregation is that there might be a chance of malicious attack on node which performs aggregation called aggregator node. EERDAT forms a cluster and for each cluster coordinator node (CN) is randomly selected. This CN monitors the function of clusters. Each node inside the cluster maintains Neighbor Information Table (NIT). Each node sends this NIT information to CH. Coordinator Node (CN) selects CH.

Delay Efficient Distributed Data Aggregation (DEDA)[9] scheduling algorithm is proposed to handle the delay and energy tradeoff in the process of aggregation using the timeout concept. This approach first builds aggregation tree, and then distributed aggregation scheduling algorithm is applied to achieve the optimized energy efficiency and delay aware data aggregation. This algorithm makes use of Decision Making Unit (DMU) to handle energy and delay tradeoff. One of the advantage of DEAD is to achieve the ideal energy consumption by limiting a number of redundant and unnecessary responses from the sensor nodes.

Energy Efficient and Balanced Cluster-Based Data Aggregation Algorithm for Wireless Sensor Networks (EEBCDA) remarkably enhance energy efficiency, balance energy dissipation and prolong the network lifetime[10].

IV. PROPOSED WORK

ALGORITHM:

This work deals with the hybridization of the DBST and REDD algorithms for the data aggregation in Wireless sensor networks.

1. First, we have implemented DBST technique, in which cluster formation takes place and this deals with the hierarchical manner in which we will get an ordered manner of our network.

2.Each cluster is having number of nodes and each node will have different energies.

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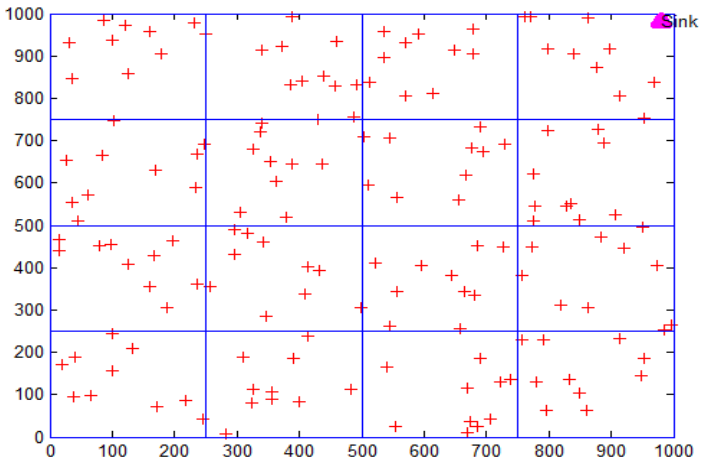
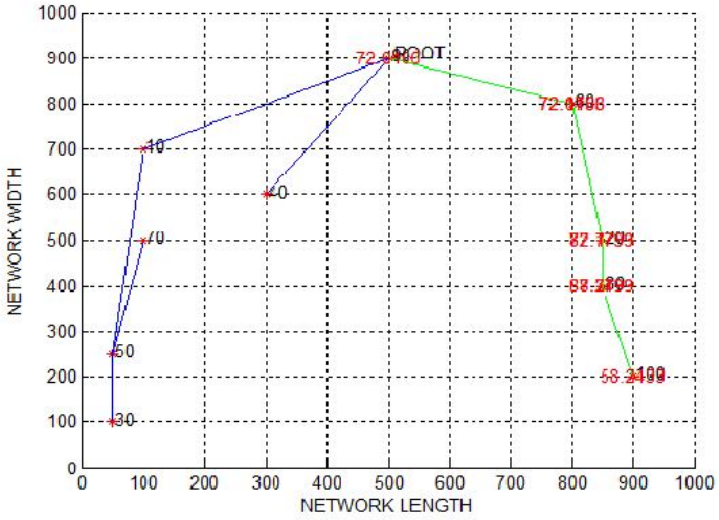


3. Each cluster will have one cluster head because instead of harvesting all energies of the node, Cluster head will communicate on behalf of each cluster for the conservation of energy and it will communicate with the sink node.
4. Then those cluster heads will be having tree structure as mentioned in the REDD structure which deals with the tree data structure.
5. In tree data structure, there is root node and leaf node and route will be performed from leaf node to root node and the root node is that cluster node which is having high residual energy than other cluster head nodes and those contains data in the form of packets which will be transferred to the root node.
6. The route will be performed with the use of the link weight[11].



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V. CONCLUSIONS

This paper provides brief description of various data aggregation protocols in wireless sensor networks. This paper also gives a proposed data aggregation technique to reduce redundancy to reduce energy consumption. This hybrid technique will provide better energy utilization. Further we will work on the various attacks like Sybil attack, Wormhole attack etc. We will detect the victim nodes and will see the effect of the attacks in the sensor network.

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