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Maximum Connected Load Balancing Cover Tree Algorithm for Wireless Sensor Network

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Abstract

In wireless sensor network the main problem is in the network lifetime, power transmission, energy consumption, speed and bandwidth for transmitting the packets and another problem is that the sink node can connect only with the limited nodes if more number of nodes is connected means then there may be occurrence of traffic and the data information can be eliminated. In order to overcome this problem maximum connected load balancing cover tree (MCLCT) algorithm is used. In various studies it is observed that the MCLCT has more network lifetime, power transmission and energy consumption when compared to the other methods and also to solve the optimization problem simulated annealing algorithm is used to transmit the data which form minimum movement in wireless sensor network and which can achieve both target coverage (TCOV) and network connectivity (NCON).

Keywords: *MCLCT, simulated annealing, TCOV, NCON*

INTRODUCTION

Wireless sensor network (WSN) which is used for monitoring and recording the physical conditions of the environment and systematically arrange the collected data at a base station. WSNs measure environmental conditions. WSN is a wireless network that has base stations and many numbers of nodes. These networks that are wireless sensor network are used to monitor corporal or ecological conditions like sound, pressure, temperature and all the nodes which pass data through the network to a base station. The wireless sensor network which has several topologies for communication between the nodes and they are:

- Star topology
- Tree topology
- Mesh topology

Star topology is a topology that is used for communication, where each node connects directly to a sink node. A single sink node can send or accept a message to a number of remote nodes. The data cannot be sent from one node to another. This allows very high volume of data messages with minimal delay that is low-latency communications between the remote node and the base station (sink node). It depends on a single node to manage the network, so that the base station must be within the transmission range of all the individual nodes. The advantage has the ability to keep the remote nodes to maintain power consumption at minimum level and which is simply under control.

Tree topology is that which connects to the node and also to the neighbour nodes where the node act as a parent child formation and which finally connect to the sink node. The advantage of the this topology is that the network can be expanded easily, and detecting the error in the tree topology is easy The Mesh topologies allow transmission of data from one node to another, which is within its

transmission range. If the node is placed at longer distance if a node wants to send information to the node which is placed at longer distance it uses an intermediate node to send the information. It can also easy detect the fault if it occurs.

SIMULATED ANNELING TECHNIQUE

It is used to solve the optimization problem, it gives connection between the nodes. The example for this is freezing water.it is used to transform the worst solution into the best optimized solution. It has good transmission of packets where we need not to be worried about the output. It is also used to solve the problem of target coverage and network connectivity.

MCLCT TCHNIQUE

It is used to construct a several cover tree when using this several cover tree we can get more network lifetime and good coverage.it decreases the time of transmitting the data.it has two strategies and they are:

- Coverage optimizing recursive (COR) heuristic
- probabilistic load balancing (PLB) strategy.

COMPRESSED DATA GATHERING

In-network compression is an essential technique to reduce the amount of data packets to be sent over the networks. It preserves accurate reconstruction of sensory data at the aggregation point as well. In-network compression techniques can be grouped into three categories conventional compression, distributed source coding, and distributed compressive sensing. Conventional compression techniques require explicit data communication among sensors to eliminate the correlation during the data gathering which need each sensor to perform complex computations and the data compression depends on routing strategy, different routing strategies can obtain different compressed data. Distributed source coding is a distributed compression method without exchanging side information between sensors, and can obtain the same compression performance as the joint entropy coding by applying the Slepian–Wolf coding theory. However, a precondition to implement this method is that the global correlation structure of the sensory data must be known as priori, which is usually difficult to achieve and the sensing environment is often dynamic.

Compressed data gathering method is that the projection matrix Φ is projected on the N number of sensor nodes. In this every node along with the measurement matrix which collect the data and multiply it and send it to the next node. Similarly the next node along with the matrix collects the data and sends it to the next node. Then finally the data's are summed up and passed to the sink node and the received data are reconstructed using the reconstruction algorithm.

RELATED RESEARCH

Jianhua Qiao and Xueyingzhang [1] they proposed compressed data gathering for wireless network based on compressed sensing theory in order to reduce the amount of data transmitted. Two methods were proposed by them and they are:

First method is uniform distribution of nodes which is based on even clustering in wireless sensor network.

Second method is uneven clustering in wireless sensor network which is used to improve the network lifetime and which is also used for energy consumption to balance it.

Darushebrahimi and chadiarsi [2] who implemented random projection using the compressed data gathering where M projection nodes are selected randomly

which is selected to collect the M weighted sums where the projection Node is equivalent to the cluster head. Measurement matrix is assigned to the projection node which is a non-zero element of each row where the measurement matrix transmits the weighted sum to the projection node with spanning tree route algorithm. Like this M projection node collect the M weighted sum and transmit it to the sink.

The disadvantage of this scheme is randomly selecting the projection node. When the projection node is randomly selected then node may die quickly.

Hong shen and Mingxi Li [3] who proposed WSN for large scale. Wireless sensor network with clustered routing data collected which has high performance where in this the cluster heads are uniformly distributed. The purpose of this clustered routing data and to maintain the cluster head uniformly distributed. To solve the challenges they demonstrated energy consumption to maintain the best amount of clusters and to maintain the cluster head uniformly distributed them determined dynamic clustering scheme.

Razzaque and Dobson [4] they supported that the sensing energy consumption in many wireless sensor networks is comparable or even much greater than radio transmission. They present a detail model of an operational energy costs in WSN's with the calculation and comparative study. Mainly they have discussed sensing energy cost, computational energy cost and communication energy cost. In the case of passive sensors sensing energy cost is negligible but for active sensors/ power hunger sensors it is significant. Comparative study of energy saving with and without CS has been done. However, in this paper, we are going to focus on sensing energy cost with measurement time by changing number of the sampling rate.

Darushebrahimi and chadiarsi [5] they found the problem of compressive aggregation in wireless sensor networks. They propose compressive data gathering with compressive sensing by making up the data aggregation tree from the node to the sink. The challenge is to minimize the number of overall transmission and also minimize the number of links. Many algorithms are used to solve this problem. The disadvantage is that data transmission time taken is high.

Xiaofei Xing, Dongqing and Guojunwang [6] who implemented data gathering and processing for large-scale wireless sensor network. If this data are collected in very large scale wireless sensor network due to the collection of more data in wireless sensor network it affect the life of a brilliant network and also the performance of the network. For this they propose an approach to reduce the more collected data using the compressed sensing method. In compressed sensing method both data sampling and compression are done simultaneously. The disadvantage of this is it is non-adaptive and it has high computational complexity and in this paper there is no individual performance of the sensor network.

D. L. Donoho [7] he discussed in detail about mathematical module of a compressive sensing theory along with CS framework. Compressive Sensing which is also known as compressed sensing is used over a traditional Nyquist-Shannon sampling theorem to reduce the energy consumption of wireless sensor network.

Chang Luo, Fengwu, Jun Sun, Chang wen chen [8] they proposed generation of efficient measurements and sparsity for compressive data gathering which purchase compressive sampling to reduce

the cost of communication system in wireless sensor network and also increase the network lifetime in sensor network. In this they have implemented two processes. In first process they have used restricted isometry property which takes multi-hop communication for measurement of sensor reading where the communication cost is reduced. In second process where even though they use sparsity it is complicated to exploit it. In this compressed data gathering have fidelity where the measurement matrix in this paper is based on [I R] matrix. This paper is proposed only for the large scale application it didn't work out for the most challenging network scenarios.

Yuanyuan Liu, Baishan Ci, Wentao Zhao, Lu Zhu, and Aiyun Zhan [9] they proposed the method for compressive data gathering with cluster which is done based on pre-treatment. In order to increase more network life time this paper clusters among the node where cluster head is formed which collect the data from the other node among the clusters and transfer it to the sink node and ascending order is done this is one process and in the another process the sink node which uses the orthogonal matching pursuit algorithm for reconstruction due to this the traffic is reduced and which also reduce communication cost and also increase the network life time Haifeng Zheng, shilin Xiao, Xinhingwang, Xiaohuatian and Mohsen guizani [10] they have studied about the delay and capacity and their requirements for data gathering along with compressed sensing in the wireless sensor network with the randomly scattered nodes. They have taken a sink node and calculated their delay and capacity requirements using the scheduling algorithm and routing based on the compressed sensing algorithm for compressed data gathering method. Also, for a multi-sink network, multisession data gathering scheme with CS is used. However in this paper, we are going to focus on real-valued data gathering by changing sampling rate using CS and going to analyse capacity and delay for data gathering.

Xiao wang, zhifengzhao, Ning Zhao and Honggangzhang [11] has firstly introduced a basic approach of Compressive Sensing and then analysed different applications of CS and then in wireless sensor networks. They apply compressive sensing to the different levels of OSI i.e. Interconnection Reference Model. In a physical layer CS is used for signal detection and channel estimation. Clustering scheme with CS has been discussed in MAC layer of an OSI model. Data gathering in network layer focuses on to achieve high efficiency and to reduce cost. CS is applied to application layer for network monitoring and data fusion. However, we are going to apply compressive sensing for physical signal detection by changing number of sampling rate.

CONCLUSION

In this paper it is addressed the issue of mobile sensor deployment problem and it is observed that the problem is solved by using the maximum connected load balancing cover tree algorithm to minimize the movement of the node and simulated annealing algorithm is used to find the accurate position of the node which helps to prolong the network life time.

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