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An Efficient Tree based Topology for Data Collection and Aggregation in Wireless Sensor Network

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Abstract: One of the most important applications of wireless sensor networks is data collection. In Wireless sensor networks (WSNs), users may want to continuously extract data from the networks. But energy efficient data collection and aggregation in wireless sensor network is always a challenging issue. The network topology and interferences also causes significant effects on data collection and aggregation. In this paper, we propose to use multi-frequency in channel assignment because scheduling a transmission using multiple numbers of frequencies is more efficient when compared with single frequency. In proposed system, power control helps in reducing the schedule length and multi-frequency scheduling can also suffice to eliminate most of the interference. Our proposed system achieve improvised performance in scheduling e over different utilization densities, determine the impact of different interference and channel models on the schedule length, is to increase the efficiency of data collection using in wireless sensor network.

I INTRODUCTION

Wireless sensor networks (WSNs) have a broad range of applications, such as battlefield surveillance, environmental monitoring, and disaster relief. A sensor network consists of a set of autonomous sensor nodes which spontaneously create Communication link and perform tasks without help from any central servers. In sensor networks, accurate data extraction is difficult it is often too costly to obtain all sensor readings.

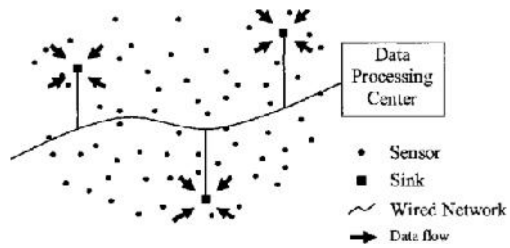

Fig 1: Data processing

In tree base sensor network, network contains set of sensors nodes, such as sink is the root of tree and leaves are the nodes as shown in fig 1. Data in such topology flows from sensor nodes (leaves) to the sink (root) of the tree. Collection of data from a set of sensors to an intermediate parent (sink) in a tree is known as converge-casting. CONVERGECAST, namely the collection of data from a set of sensors toward a common sink over a tree based Routing topology is a fundamental operation in wireless sensor networks (WSN)[1]. In many applications, it is crucial to provide a guarantee on the delivery time as well as increase the rate of such data collection.

In this paper, we propose to use multi-frequency in channel assignment because scheduling a transmission using multiple numbers of frequencies is more efficient when compared with single frequency. In proposed system, power control helps in reducing the schedule length and multi-frequency scheduling can also suffice to eliminate most of the interference. We consider a TDMA framework and design polynomial-time heuristics to minimize the schedule length for both types of convergences and cast. Our proposed system achieve improvised performance in scheduling over different utilization densities, determine the impact of different interference and channel models on the schedule length, is to increase the efficiency of data collection using in wireless sensor network.

II RELATED WORK

Song et al.[2] described a time- optimal energy efficient packet scheduling algorithm for raw-data convergecast with periodic traffic. They assumed a simple interference model in which every node has a circular transmission range and interferences from concurrent multiple senders is neglected and further extended their work and proposed a TDMA- based MAC protocol for high-data-rate [3].

Gandham et al. [4] proposed a distributed time slot assignment scheme, for a single channel in TDMA schedule length. Fast data collection with minimum schedule length for aggregated convergecast is discussed by Chen et al. in [5].

Choi et al. [6] shows that for a single channel the minimum schedule length for raw-data convergecast is NP complete on general graphs. Lai et al. [7] uses a greedy graph coloring approach to find the shortest path to the senders for throughput optimization. They also focused on impact of routing trees on schedule length and devised a new approach called disjoint strips to transmit data over different shortest paths.

Pan and Tseng [8] described a beacon period, assigned to every sensor node in Zigbee network, scheme to reduce latency. A node can receive data only in the allotted beacon period.

Annamalai et al. [9] uses the concept of orthogonal codes to remove interferences, where each node has been assigned time slots from bottom to the top of the tree such that a parent has to wait till it receives all the data packet from its children.

III MULTIPLE FREQUENCY CHANNELS

Multiple frequencies channels are used to enable more consistent transmissions and further improvements like in order to find top-k. Once the multiple frequencies are deployed, the data collection rate are no longer remains limited by the interferences when the multiple senders attempts to send the message to the same receiver at the same time, receiver gets all the data at the same time, but in the present scenario/ days the queues are formed and data is received and sent one after another but not in a single click. To get message at the same time from multiple senders, we add the additional frequency to the original frequency in the receiver side, whenever the receiver moves out our assumed time limit, additionally of extra frequency always vary with place.

IV PROPOSED SYSTEM

Major steps in proposed system are: Periodic Aggregated & Evaluated Converge cast, Transmission Power Control, Aggregated & collective Data Collection, Data aggregation, Tree Based Multi-channel Protocols.

(i) Periodic Aggregated & Evaluated Converge cast:

Data aggregations are commonly used technique in WSN that eliminates redundancy and minimize the number of transmissions, thus saving energy and time in improving network lifetime. Aggregations are performed in many ways, by suppressing duplicate messages; using data compressions and packet merging techniques; or taking advantage of the correlation in the sensor readings. We consider continuous monitoring and testing the applications gives perfect aggregation values, i.e., each node is capable of aggregating all the packets received from its children as well as that generated by itself into a single packet before transmitting to its parent. The size of aggregated data released and transmitted by each node is constant and does not depend on the size of the raw sensor readings.

(ii) Transmission Power Control:

Although the techniques of transmitting power control and multi-channel schedules have been well evaluated & studied for eliminating interference/channels in general wireless networks and their performances for bounding the completion of data collections in WSNs have not been explored in details in the previous cases. The fundamental novelty of our approach lies in the extensive approach of the efficiency of transmission power control and multichannel communication on achieving fast converge cast operations in WSNs.

(iii) Aggregated & collective Data Collection:

Top K products are listed down in these session/modules. We are using to “find Optimal Incremental Property” algorithms are to identify the Top K Products. Along with the top K products, had been listed under the suppressed products in the list. Additionally, the number of top products can be dynamically provided by the user. Internal grooving technique is applied to protect the dynamic and changing market. The database is updated periodically with the dynamically and periodically changing attributes and their products.

(iv) Raw Data Collection (aggregated)

The data collection rate often no longer remains limited to the interference but by the topology/measures of the network. Thus, leading to final step, we have evaluated and constructed network topologies with specific properties that help in further enhancing the rate. Our primary conclusion is that, combining these different techniques can provide an order and magnitude to improvement of aggregated converge cast, and a factors of two improvement for raw-data converge cast, compared to single-channel TDMA scheduling on minimum-hop routing trees/techniques.

(v) Tree (flows) Based Multi-channel Protocols:

Tree Multi-Channel Protocol (TMCP) is a greedy tree-based multichannel protocol. It divides a complete tree into number of sub-trees and reduces intra tree interference by using different channels to the nodes. The advantage of TMCP is that it is designed to support convergecast traffic and does not require channel switching. Since all the nodes communicate on same channel, the contention inside branches is not resolved.

V IMPACT OF NETWORK TOPOLOGY

Besides multiple channels, the network topology and the degree of connectivity makes impact on scheduling performance. Network trees that have more parallel transmissions do not necessarily result in small schedule lengths. As an example in star topology network with N nodes the schedule length is N, whereas it is (2N-1) for a bus topology once interference is eliminated. In this section, we construct a spanning tree with constraint nk< (N+1)/2, where nk are number of branches and N is the number of nodes. A balanced tree satisfying this constraint is a variant of a capacitated minimal spanning tree (CMST).

```
1. Given G(V, E) with sink node S
2. Let P is roots of top subtrees and T={s} U P;
   k=2;
    RS(i)=unconnected neighbors of i; S(i)=0;
3. while k != Maximum_hop_count do Nh= all
   unconnected nodes at hop distance h;
    Connect node N'h having single parent: T=T
   U N'h ;
4. Update Nh = Nh\ N'h;
5. Sort Nh;
6. for all i in Nh
     do
     For all j in P to which i can connect do
     Link (i, j);
     End for
     T=T U {i} U Link(i, j);
     Update RS(i);
     End for
7. k=k+1;
8. End while
```

Fig 2: Pseudo code for CMST algorithm

The CMST algorithm can determine a minimum-hop spanning tree in a vertex weighted graph, such that the weight of every sub tree linked to the root does not exceed a prescribed capacity. Here we have taken weight of each link as 1, and prescribed capacity is (N+1)/2. Here, we propose a method, described in Algorithm 3, based on greedy scheme, a variant of the CMST problem. By using it, searches for routing trees with an equal number of nodes on each branch. It is assumed that every node know their minimum-hop counts to sink node.

VI CONCLUSION

In this paper, we propose to use multi-frequency in channel assignment because scheduling a transmission using multiple numbers of frequencies is more efficient when compared with single frequency. In proposed system, power control helps in reducing the schedule length and multi-frequency scheduling can also suffice to eliminate most of the interference. We consider a TDMA framework and design polynomial-time heuristics to minimize the schedule length for both types of convergences and cast. Our proposed system achieve improvised performance in scheduling over different utilization densities, determine the impact of different interference and channel models on the schedule length, is to increase the efficiency of data collection using in wireless sensor network.

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