International Journal of Scientific Research in Computer Science, Engineering and Information Technology
 | Volume 2 | Issue 1 | ISSN : 2456-3307

Fast Data Collection in Tree Based Wireless Sensor Network

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ABSTRACT

We investigate the following fundamental question - how fast will data be collected from a wireless device network organized as tree? to deal with this, we explore and evaluate the variety of various techniques using realistic simulation models below many-to-one communication paradigm referred to as converge-cast. we tend to 1st consider time scheduling on one frequency channel with the aim of minimizing the number of time slots needed (schedule length) to finish a converge-cast. Next, we combine scheduling with transmission power control to mitigate the effects of interference and show that whereas power control helps in reducing the schedule length below one frequency, programming transmissions exploitation multiple frequencies are a lot of efficient. we offer lower bounds on the schedule length once interference is totally eliminated, and propose algorithms that deliver the goods these bounds. we tend to conjointly evaluate the performance of varied channel assignment strategies and notice empirically that for moderate size networks regarding 100 nodes, the employment of multi-frequency programming will suffice to eliminate most of the interference. Then, the info collection rate not remains restricted by interference however by the topology of the routing

Keywords: Time division multiple access (TDMA), Wireless Sensor Networks (WSN), Tree based multichannel protocol (TBMP)

I. INTRODUCTION

A Wireless Sensor Network is one kind of wireless network includes a large number of circulating, self-directed, minute, low powered devices named sensor nodes called motes. These networks certainly cover a huge number of spatially distributed, little, battery-operated, embedded devices that are networked to caringly collect, process, and transfer data to the operators, and it has controlled the capabilities of computing & processing. Nodes are the tiny computers, which work jointly to form the networks.

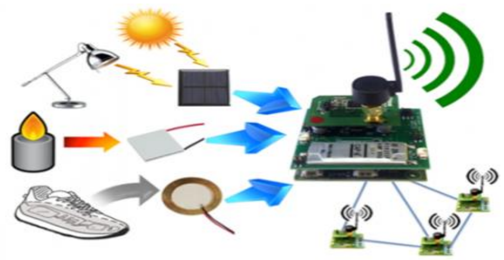

Figure 1 : wireless sensor network Wireless Sensor Network Architecture

The most common WSN architecture follows the OSI architecture Model. The architecture of the WSN includes five layers and three cross layers. Mostly in sensor n/w we require five layers, namely application, transport, n/w, data link & physical layer. The three cross planes are namely power management, mobility management, and task management. These layers of the WSN are used to accomplish the n/w and make the sensors work together in order to raise the complete efficiency of the network.Please follow the below link for:

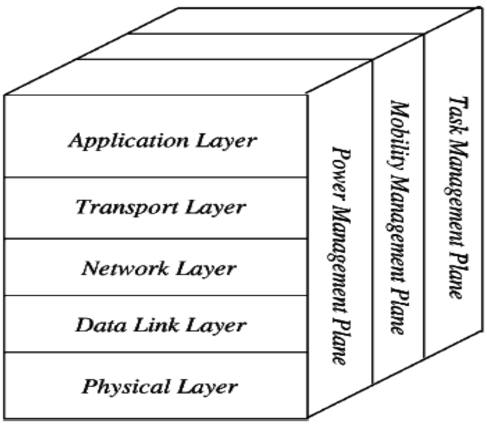

Figure 2 : Wireless Sensor Network Architecture

Application Layer

The application layer is liable for traffic management and offers software for numerous applications that convert the data in a clear form to find positive information. Sensor networks arranged in numerous applications in different fields such as agricultural, military, environment, medical, etc.

Transport Layer

The function of the transport layer is to deliver congestion avoidance and reliability where a lot of protocols intended to offer this function are either practical on the upstream. These protocols use dissimilar mechanisms for loss recognition and loss recovery. The transport layer is exactly needed when a system is planned to contact other networks.

Providing a reliable loss recovery is more energy efficient and that is one of the main reasons why TCP is not fit for WSN. In general, Transport layers can be separated into Packet driven, Event driven. There are some popular protocols in the transport layer namely STCP (Sensor Transmission Control Protocol), PORT (Price-Oriented Reliable Transport Protocol and PSFQ (pump slow fetch quick).

Network Layer

The main function of the network layer is routing, it has a lot of tasks based on the application, but actually, the main tasks are in the power conserving, partial memory, buffers, and sensor don’t have a universal ID and have to be self-organized.

The simple idea of the routing protocol is to explain a reliable lane and redundant lanes, according to a convinced scale called metric, which varies from protocol to protocol. There are a lot of existing protocols for this network layer, they can be separate into; flat routing and hierarchal routing or can be separated into time driven, query-driven & event driven.

Data Link Layer

The data link layer is liable for multiplexing data frame detection, data streams, MAC, & error control, confirm the reliability of point–point (or) point– multipoint.

Physical Layer

The physical layer provides an edge for transferring a stream of bits above physical medium. This layer is responsible for the selection of frequency, generation of a carrier frequency, signal detection, Modulation & data encryption. IEEE 802.15.4 is suggested as typical for low rate particular areas & wireless sensor network with low cost, power consumption, density, the range of communication to improve the battery life. CSMA/CA is used to support star & peer to peer topology. There are several versions of IEEE 802.15.4.V.

Characteristics of Wireless Sensor Network

The characteristics of WSN include the following.

- The consumption of Power limits for nodes with batteries
- Capacity to handle with node failures
- Some mobility of nodes and Heterogeneity of nodes
- Scalability to large scale of distribution
- Capability to ensure strict environmental conditions
- Simple to use
- Cross-layer design

Advantages of Wireless Sensor Networks

The advantages of WSN include the following

- Network arrangements can be carried out without immovable infrastructure.
- Apt for the non-reachable places like mountains, over the sea, rural areas and deep forests.
- Flexible if there is a casual situation when an additional workstation is required.
- Execution pricing is inexpensive.
- It avoids plenty of wiring.
- It might provide accommodations for the new devices at any time.
- It can be opened by using a centralized monitoring.
- We study aggregated converge cast in the context of periodic data collection where each source node generates a packet at the beginning of every frame, and raw data converge cast for one shot data collection

where each node has only one packet to send. We assume that size of each packet is constant. Our goal is to deliver these packets to the sink over the routing tree as fas t as possible .More specifically , we aim to schedule the edges ET of T using a minimum number of time slots while respecting the following constraints :

- Adjacency constraint : Two edges cannot be scheduled in the same time slot if they are adjacent to each other. This constraint is due to the half-duplex transceiver on each node which prevents it from simultaneous transmission and reception.
- Interfering constraint : The interfering constraint depends on the choice of the interference model. In the protocol Model, two edges cannot be scheduled simultaneously if they are at 2-hop distance of each other. In the physical model, an edge cannot be scheduled if the SINR at receiver is not greater than threshold value,

TDMA Scheduling of converge cast

Periodic converge cast:

we consider the scheduling problem wherever packets are aggregated. data aggregation may be an ordinarily used technique in WSN that may eliminate redundancy and minimize the quantity of transmissions, therefore saving energy and up network lifespan We 1st consider aggregate converge solid once all the busy links area unit eliminated by using transmission power management or multiple frequencies. though the matter of minimizing the schedule length is NP-complete on general graphs, we tend to show within the following that when interference is eliminated, the latter reduces to one on a tree, and may be resolved in polynomial time. to the current finish, we tend to 1st provides a sure|boundary|edge|bound} on the schedule length so propose a time interval assignment theme that achieves the bound

One Shot Raw Data Converge cast :

In this section, we consider one-shot data collection where every sensor reading is equally important, and so aggregation may not be desirable or even possible. Thus, each of the packets has to be individually scheduled at each hop en route to the sink. Here the edges could be scheduled multiple times and there is no pipelining.

We now describe a time slot assignment scheme called Local-Time Slot Assignment, which is run locally by each node at every time slot. The key idea is to: 1) schedule transmissions in parallel along multiple branches of the tree, and 2) keep the sink busy in receiving packets for as many time slots as possible. Because the sink can receive from the root of at most one top-sub tree in any time slot, we need to decide which top-sub tree should be made active. We assume that the sink is aware of the number of nodes in each top-sub tree. Each source node maintains a buffer and its associated state, which can be either full or empty depending on whether it contains a packet or not. Our algorithm does not require any of the nodes to store more than one packet in their buffer at any time. We initialize all the buffers as full, and assume that the sink's buffer is always full for the ease of explanation.

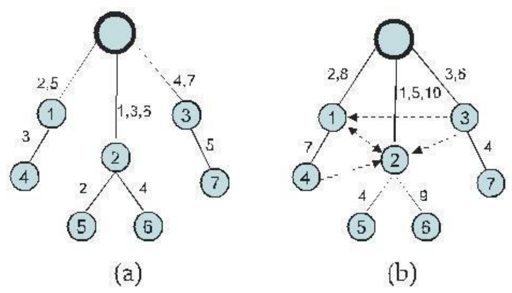

Figure 3. Raw-data converge cast using algorithm Local-Time slot Assignment: (a) Schedule length of 7 when all the interfering links are removed. (b) Schedule length of 10 when the interfering links are present.

Theorem 2: If all the interfering links are eliminated, the schedule length for one-shot raw-data converge-cast is lower bounded by max($2n_k$ -1,N), where n_k is the maximum number of nodes in any top sub-tree of the routing tree, and N is the number of sources in the network

II. EXISTING SYSTEM

One of the most well-known suboptimal scheduling policy is the Greedy Maximal Scheduling (GMS) policy or Longest Queue First (LQF) policy. GMS schedules links in decreasing order of the queue length conforming to interference constraints. It has been known to achieve an efficiency ratio of 1/2 under the 1-hop interference model, where the efficiency ratio is defined as the largest fraction of the optimal capacity region that the scheduling policy can support. GMS is an important scheduling policy because it has a good provable performance bound superior to many distributed scheduling policies and it empirically achieves the same performance as throughput-optimal scheduling in a variety of network settings. For practical implementation in multi hop wireless networks, GMS has been realized as a distributed algorithm. However, these algorithms are quite complex to ensur e the precise queue length ordering

DISADVANTAGES

- Getting delay in packet delivery.
- These algorithms are quite complex to ensure the precise queue length ordering of links. .
- overhead for message exchanges

III. PROPOSED SYSTEM

In proposed system, we have used the distance formula to find minimum distance from source node .By using formula, we get to know which neighbour node is at minimum hop distance from source node ,

DISTANCE FORMULA: Given two points (x1,y1) and (x2 ,y2) distance between the points is given by the formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

First ,we will calculate the distances from source node to all neighbour nodes ,whose distance is minimum , that will be chosen for sending the data. With the help of transmission power control and multichannel scheduling ,data can be sent to destination

node as soon as possible. Fast data collection with the goal to minimize the schedule length for aggregated converge cast has been studied by us in we experimentally investigated the impact of transmission power control and multiple frequency channels on the schedule length Our present work is different from the above in that we evaluate transmission power control under realistic settings and compute lower bounds on the schedule length for tree networks with algorithms to achieve these bounds. We also compare the efficiency of different channel assignment methods and interference models, and propose schemes for constructing specific routing tree topologies that enhance the data collection rate for both aggregated and raw-data converge cast.

ROLE OF CLUSTERS : Naturally ,grouping sensor nodes into clusters has been widely adopted to satisfy the above scalability objective and generally achieve high energy efficiency and prolong network lifetime in large-scale WSN environments. The corresponding hierarchical routing and data gathering protocols imply cluster-based organization of the sensor nodes in order that data fusion and aggregation are possible, thus leading to significant energy savings. In the hierarchical network structure each cluster has a leader, which is also called the cluster head (CH) and usually performs the special tasks referred above (fusion and aggregation), and several common sensor nodes(SN)as members. The cluster formation process eventually leads to a two-level hierarchy where the CH nodes form the higher level and the cluster-member nodes form the lower level. The sensor nodes periodically transmit their data to the corresponding CH nodes.

Impact of Transmission Power Control:

In wireless networks, excessive interference can be eliminated by using transmission power control i.e., by transmitting signals with just enough power instead of maximum power. To this end, we evaluate the impact of transmission power control on fast data collection using discrete power levels. The goal is to find a TDMA schedule that can support as many transmissions as possible in every time slot. It has two phases: 1) scheduling and 2) power control that are executed at every time slot. First, the scheduling phase searches for a valid transmission schedule, i.e., largest subset of nodes, where no node is to transmit and receive simultaneously, or to receive from multiple nodes simultaneously. Then, in the given valid schedule, the power control phase iteratively searches for an admissible schedule with power levels chosen to satisfy all the interfering constraints. In each iteration, the scheduler adjusts the power levels depending on the current RSSI at the receiver and the SINR threshold. According to this rule, if a node transmits with a power level higher than what is required by the threshold value, it should decrease its power and if it is below the threshold, it should increase its transmission power, within the available range of power levels on t he radio. If all the nodes meet the interfering constraint, the algorithm proceeds with the schedule calculation for the next time slot. On the other hand, if the maximum number of iterations is reached and there are nodes which cannot meet the interfering constraint, the algorithm excludes the link with minimum SINR from the schedule and restarts the iterations with the new subset of nodes. The power control phase is repeated until an admissible transmission scenario is found.

Multichannel Scheduling :

Multichannel communication is an efficient method to eliminate interference by enabling concurrent transmissions over different frequencies.
1.Tree Based Multichannel Protocol(TBMP)
2.Joint Frequency Time Slot Scheduling(JFTSS)
3.Receiver Based Channel Assignment(RBCA)

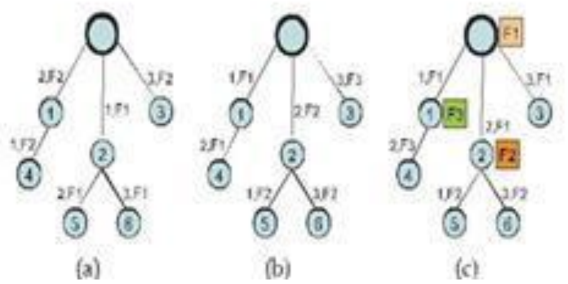

Figure 4. Scheduling with multi channels for aggregated converge-cast (a)Schedule generated with JFTSS (b) Schedule generated with TMBP (C)Schedule generated with RBCA

JFTSS offers a greedy joint solution for constructing a maximal schedule, such that a schedule is said to be maximal if it meets the adjacency and interfering constraints, and no more links can be scheduled for concurrent transmissions on any time slot a nd channel without violating the constraints.

TMCP is a greedy, tree-based multichannel protocol for data collection applications. It partitions the network into multiple sub-trees and minimizes the intra tree interference by assigning different channels to the nodes residing on different branches starting from the top to the bottom of the tree.

RBCA . In this type, the children of a common parent transmit on the same channel. Every node in the tree, therefore, operates on at most two channels, thus avoiding pair wise, per-packet channel negotiation over-heads.

IV. CONCLUSION

In this paper, we studied fast converge cast in WSN wherever nodes communicate using a TDMA protocol to reduce the schedule length. we addressed the basic limitations due to interference and half-duplex transceivers on the nodes and explored techniques to beat an equivalent. we found that whereas transmission power management helps in reducing the schedule length, multiple channels are more effective.We also observed that node-based (RBCA) and link-based (JFTSS) channel assignment schemes ar a lot of economical in terms of eliminating interference as compared to assigning different|completely different} channels on different branches of the tree (TMCP). Once interference is totally eliminated, we have a tendency to proven that with half-duplex radios, the doable schedule length is lower delimited by the utmost degree within the routing tree for aggregative converge forged, and for raw-data converge forged. using best converge forged programming algorithms, we have a tendency to showed that the lower bounds ar doable once an appropriate routing theme is employed. Through intensive simulations, we have a tendency to demonstrated up to AN order of magnitude reduction within the schedule length for aggregative, and a fifty % reduction for raw-data converge cast.

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