

Efficient Data Aggregation and Collection in Tree Based Wireless Sensor Networks

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ABSTRACT: In several wireless sensor network the energy conservation is a major problem .In this WSN once the energy gets lost the sensor moves to die condition and so it cannot possible to replace the battery in sensor. So energy conservation is difficult in sensor network .The node which is closer to the base station has the responsible for collecting data from the entire node and send it to the base station .such node is called as root node or sink node (e.g., tree topology). This paper achieved the fast data collection by keeping the sink node always in the busy state .In this converge cast algorithm is used which contains Aggregated converge cast and Raw-data converge cast algorithm. TDMA (Time Division Multiple Access) are better fit for fast data collection since they can avoid collision and retransmission of data .Fast data collection with the aim of minimize the schedule length for aggregated converge cast.

KEYWORDS: Fast data collection, Energy Efficiency, Aggregated Converge cast, Raw-data Converge cast , TDMA(Time Division Multiple Access).

I. INTRODUCTION

WSN is a wireless network that contains base stations and numbers of nodes (wireless sensors).These networks helps to monitor physical or environmental conditions like sound, pressure, temperature and co-operatively sends data through the network to a main location. Depending on the environment, the types of networks are decided so that those can be deployed in underground, on land, and so on. Typically a wireless sensor network has hundreds of thousands of sensor nodes.

These nodes can communicate among themselves using radio signals. A wireless sensor node is equipped with sensing and computing device, radio transceiver and power components. Energy or Power Consumption of the sensing device should be minimized since their limited energy resource determines their lifetime. To conserve power, sensor nodes normally power off both the radio transmitter and the radio receiver when not in use. Tree topology is also known as cascaded star topology. In tree topologies, each node connects to a node that is located higher in the tree, and then to the gateway. The main advantage of the tree topology is that elaboration of a network can be easily possible, and also error detection becomes easy. The data flows from many nodes to single node is known as converge cast. In Aggregated converge cast where packets are aggregated at each hop and the Raw-data converge cast where packets are individually relayed

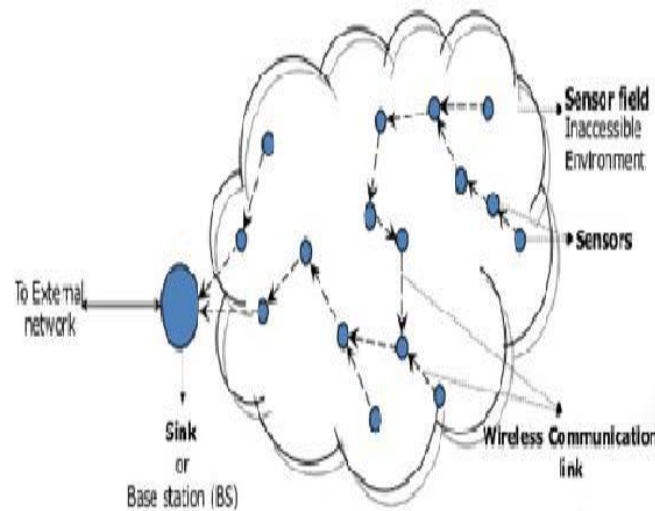
International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Vol. 8, Issue 2, February 2019

toward the base station. Data aggregation is mostly used for energy-conserving technique in WSNs. Half duplex transmission is taken.



II. RELATED WORK

In paper[1], **Maximize the Life time of Sensor Network by Load Balancing Algorithm**[2018] presents an Energy efficient load balanced data collection algorithm for improving the lifetime of wireless sensor network by load balancing scheme. This algorithm find out bottleneck node and balances the path of node having maximum load in the network through randomized changing the path and transforming the tree into a balanced tree. Some sensor nodes are move to die due to heavier load, in that situation this algorithm helps to distribute the load equally on all the nodes and balances the network. If the difference between maximum path load and minimum path load is greater than the threshold value then the given dense tree is not balanced. Then the children's node are inserted to the list for alternating the path.

In paper[2], **Data Aggregation and Principal Component Analysis In WSN**[2017] explains that the data aggregation techniques helps to reduce the energy consumption of sensor nodes and boosts the scalability of the network. In this paper, uses Principal Component Analysis (PCA) techniques which aggregate all the data received at the leaf node into one packet instead of relaying all the incoming packet. so that it reduces the number of transmission bytes in the intermediate nodes and increase the lifetime of intermediate node. It reduces transmissions among the sink and one or more data aggregation nodes in the network.

In paper[3], **Energy Conservation In Wireless Sensor Networks: A Survey**[2016] presents the network is operated by power so that it is very difficult to recharge it. So it is very necessary to save the power of the network by using energy conservation techniques- duty cycling, data reduction and mobility. In duty cycling it uses TDMA techniques to assign time slots to each node and thus it transfers the data only the particular time allotment. In Data Reduction, it reduces the data transmitted to the sink node by encoding the data at source node and decodes the data at sink node. In mobility technique mobilizer is placed on the sensor or the sensor node is placed on the mobile elements like animals, and cars. so that there is no energy loss at the sensor nodes during mobility.

In paper[4], **Extending the Life Time of Wireless Sensor Network through Adaptive Sleep**, [2014] uses Adaptive Staggered Sleep Protocol (ASLEEP) which automatically adjusts the activity of sensor nodes, achieving both low power consumption and low message latency. A node can just wakeup whenever it wants and it can still

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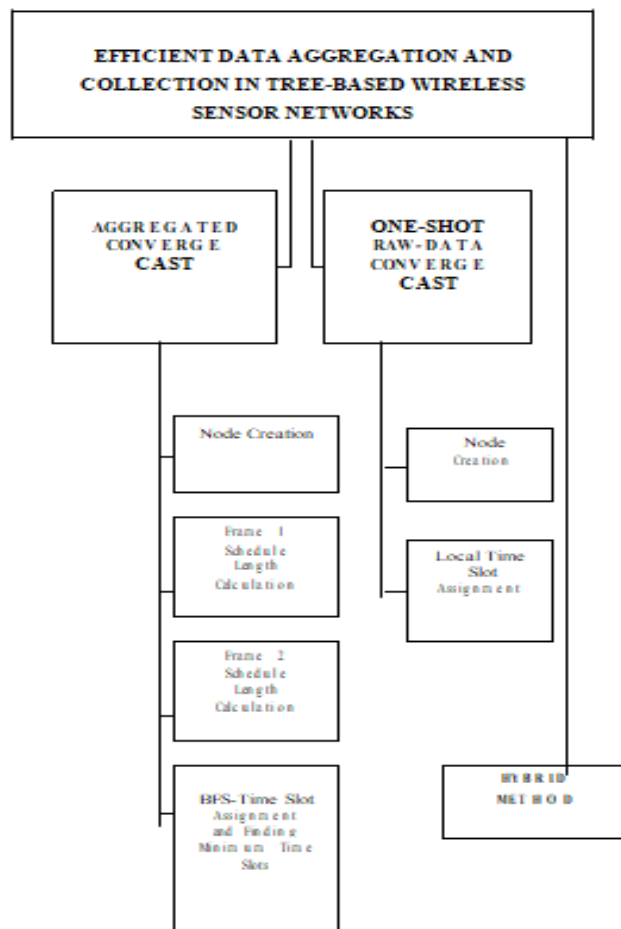
Vol. 8, Issue 2, February 2019

communicate with its neighbours and remaining period of time it moves to sleep state and thus conserve power and improve lifetime of sensor. This protocol helps to transfer data as fast and thus save energy.

In paper[5], **SREE-Tree: Self-Reorganizing**

Energy-Efficient Tree Topology Management in Sensor Networks[2015] a distributed protocol for self-organizing energy-efficient tree management, called SREE-Tree. It can be observed that our proposed SREE-Tree protocol achieves much higher network lifetime compared to Tree-SP, Tree-CTP and Tree-MaxEn, especially when nodes have non-uniform starting energy and non-uniform sensing data generation rates. The performance of Tree-SP is the least because it is not aware of node energy capacity and node data load. Tree-MaxEn performs slightly better than Tree-CTP in the used network scenarios due to local energy awareness in choosing parent node. But the SREE-Tree protocol achieves best performance because of its awareness of load (both in terms of energy capacity and data load) balancing of nodes not in the local neighborhood, but in context of the whole network.

III. ARCHITECTURE AND EXPLANATION



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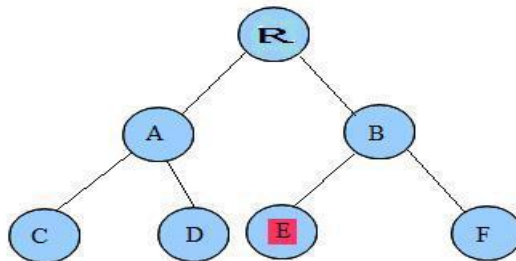
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In the form, a button 'Start creating nodes' is provided which is used to create the tree structures of node as. A button 'Frame 1' is to find the frame 1 schedule lengths. A button 'Frame 2' is to find the frame 2 schedule lengths. A button 'BFS-TIMESLOTASSIGNMENT' is provided to implement the algorithm and calculate the 'Minimum Time Slot' value. In the module, the sink is made to busy always. Other nodes are having buffers and so they receive and hold more number of packets from their children and sends to sink when sink is free. A button 'LOCAL-TIMESLOTASSIGNMENT' is provided to implement the algorithm and calculate the Time slot values to all the nodes. In the hybrid method, all the nodes in the network will collect data using Aggregated converge cast and One-Show Raw-Data Converge cast in the given schedules.

IV. AGGREGATED CONVERGE CAST

Converge cast, 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). In Aggregated converge cast where packets are aggregated at each hop. 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 transfer to its parent. For periodic traffic, it is well known that contention free medium access control (MAC) protocols such as TDMA (Time /data Divisions Multiple Access) are better fit for fast data collection, since they can eliminate collisions and retransmissions and provide guaranteed on the completion time as opposed to contention-based protocols . It introduces polynomial-time heuristics for TDMA scheduling for both types of data collection, i.e., Algorithms (BFS-Time Slot Assignment) and (Local Time Slot Assignment), prove that they do achieve the lower bound of data collection time once interference is removed or eliminated.

4.1 BREATH FIRST TIME SLOTS [BFS]



will search level by level. First it will check if E exists at the root. After that it will check nodes at the second level. Finally it will find 'E' at the third level.

4.2 ADVANTAGES OF BFS

- > Breadth first search will never get trapped exploring the useless path forever.
- > If there is more than one solution then BFS can find the minimal one that requires less number of steps.

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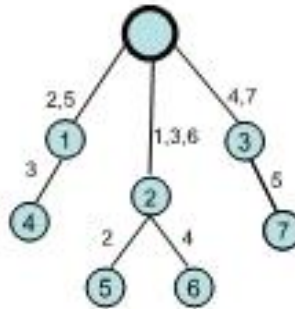
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V. ONE SHOT OR RAW DATA CONVERGE CAST

One-shot data collection in that 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 and send it to the sink. In that it 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) The schedule transmissions in parallel along multiple branches of the tree, and 2) keeping the sink node always busy in receiving packets for as many time slots as possible.

5.1 LOCAL TIME SLOTS



The above figure has the Schedule length of 7 when all the interfering links are removed. It shows the Raw-data converge cast using algorithm LOCAL-TIMESLOT ASSIGNMENT.

VI. HYBRID METHOD

In this , all the nodes in the network will collect data using Aggregated converge cast and One-Show Raw-Data Converge cast in the given schedules. Using a timer, the nodes shifts two algorithms and execute accordingly.

At the above tree with nodes starting from root node, R at the first level, A and B at the second level and C, D, E and F at the third level. If we want to search for node E then BFS

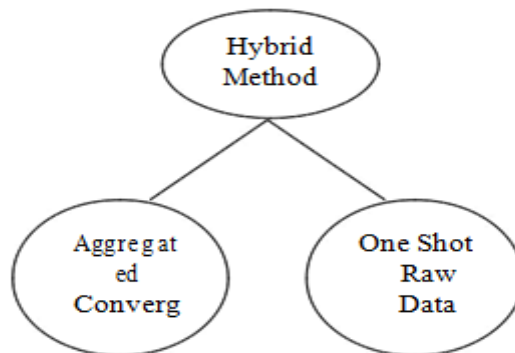


Fig:6.1 Hybrid Method

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VII. ADVANTAGE

The sink node i.e., the root node collects data over different paths in reduced schedule length. So that the number of time slots required to collect data is less. Schedule length is calculated when interference is completely eliminated. Half duplex transmission is taken into account during all data transmissions between any two nodes. By Keeping the sink node always busy and so data collection is fast enough.

VIII. CONCLUSIONS AND FUTURE WORK

In this application, fast converge cast in WSN where nodes communicate using a TDMA protocol to minimize the schedule length is considered. Using converge cast scheduling algorithms, the time slot length is reduced much and also data is fast transferred to the sink node and energy requirements is also less which helps to increase the lifetime of the sensor.



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