Smart scheduling with parallel Data Aggregation protocol (SPDA) For Wireless Sensor Networks

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Abstract—Wireless sensor networks are plays in wide range of application in now days. All the sensor nodes equipped with non replaceable batteries for monitoring the desired region by fixed topology. Energy is an ultimate problem facing in Wireless sensor network. Hierarchical routing protocols and smart data aggregation methods are the best solution for energy efficiency. In this proposed system, a Smart scheduling with parallel Data Aggregation protocol (SPDA) method is designed by scheduling mechanism to transmit the data in parallel path. Data transmission carried out by alternatively corresponding parallel path which avoids the unnecessary of receiving and computational processing of data packets from the sensor node. Life time of the network is prolonged through this novel approach rather than existing methods like PEGASIS, APTEEN and etc., In addition, we analyze the factors such as cycle numbers, energy consumed by entire network, number of nodes with time slots is compared with the existing protocols.

Keywords— SPDA, Scheduling mechanism, Data Aggregation

1. INTRODUCTION

Wireless sensor network consists of many self-organizing sensor nodes which perform sensing, processing, storing and communication. Its aim is to collect the data, process and transmit the sensed data to Base station with low power consumption [1]. WSN Routing is very challengeable due to limited resources such as battery backup, low data rate, less transmission range and self configurable. In some scenarios, Sensor node is equipped with battery that is difficult to replace in harsh environment. Thus the network’s lifetime depends upon available charge in the battery of sensor nodes.

To increase the lifetime of the sensor network, clustering among the nodes may takes place. The hierarchical routing protocols provide the maximum energy efficiency. Instead of creating cluster, sensor network environment should be separated into many regions. In each region the sensor nodes transmit the data packet in parallel path. Therefore much number of packets is transmitted without collision and easy way to aggregate the packets with minimal energy consumption. Data aggregation is computing a smaller representation for some of data that definitely represents the large group. The method of data aggregation is performed by a processing entity called aggregator and is broadly speaking executed at Base Station (BS). To reduce the data traffic, thereby to conserve energy, the method of aggregation may be distributed and in-network processing can be executed at all nodes or at specified nodes.

Lattice topology is deployed predominantly at the same time as the location of the nodes are constant in applications such as agricultural monitoring, wildfire monitoring. In this lattice topology i.e., fixed grid topology the data may be routed by means of various routes. Tree topology is some other topology typically used for information aggregation in multi hop WSNs. Multi hop transmission is any other method used to preserve energy expenditure for the duration of transmission. The tradeoff among the latency and power conserved in multi hop transmission is another important factor to be taken for attention within the WSN. In WSN applications like wildfire monitoring used for data collection, sensor data is accumulated at every scheduled period within the BS. The BS initiates appropriate action like communicating to different actor nodes to govern temperature. It is performed at regular periods to make sure that the sensed values are under control and to keep track of the changes. If the control mechanism is in vicinity to verify that the values above threshold are notified right now, then the time between the information collections can be extensive. The goal of this
method is to suggest an allotted scheduling to increase the lifetime of the WSN for data aggregation through proposing a new method SPDA with grid topology by transmitting in parallel path.

II. RIBBON STRUCTURE FOR DATA AGGREGATION

For wild monitoring, all the sensor nodes sensed the information and make computation and transmit the data if it’s reached the threshold value. For multi hop data aggregation, a new structure called ribbon structure is proposed. Along the data path in multi hop communication, a node is designated parallel node if it is connected with the given node, its previous and next hop nodes. If parallel node is present for the current and the next hop node and if there exists communication link between the parallel nodes, the structure is called ribbon structure. The ribbon structure contains parallel paths for communication and can be extended to any number of hops, provided the connectivity is maintained as shown in figure 1.

Communication takes place in parallel from node 0 to node 8, node 1 to node 9, node 10 to node 18 and node 11 to node 19. As far as SPDA concern, the sensor network is separated into different regions. Each region has active and inactive path and it has common aggregator node to collect the sensed information and forward towards the sink node. This ribbon structured based data transmission reduces the energy consumption in each node which leads to enhance the life time of the network. It also reduces the collision between the packets in each entity. The individual nodes may invoke to active state when the path gets disconnected due to failure of intermediate

![Figure 1. Ribbon structured network](image)

III. SPDA APPROACH

3.1 Data aggregation using Ribbon structure network

The data aggregation is performed over a parallel path around continuously. The data forwarding takes place from top to bottom level. The sink node will send discovery packets to one hop neighbor which will again exchange the packets to its neighbor send to the next hop node. From the discovery packets like ribbon structure to be established and then data transmission. The distribution of sensor nodes in a field with irregular pattern with the sink node located at the Centre. It also show two possible multi-hop paths with parallel routes along the ribbon like structure for the nodes reach the sink node in which the proposed algorithm can be implemented.
The ribbon structure can be used with clusters of equal size or unequal size clusters, when the end nodes of the structure are one hop away from the sink with minimum distance separation. The data transmission between the source and the sink node, the multi-path routing every source sensor finds the first K shortest paths to the sink node and separates its load evenly among these paths. If the data transmits the data from one-hop to the next hop this process run in parallel. When then parallel method due to the reduction in the number of transmission, the aggregated data reach the sink in less number of hops. The QoS for the data aggregation is number of hops for the delivery of the aggregated data from the farthest node to the sink. Along the data path multi-hop communication, node is designated parallel node if it is connected with the given node, its previous and next hop nodes. If parallel node is present for the current and the next hop node and if there exists communication link between the parallel nodes, the structure is called ribbon structure.

IV. ROUTING METHODOLOGY

Sensor nodes are placed in a two dimensional field in fixed pattern. The nodes sense data and report data to a sink through wireless multi hop transmission. The sink node verifies if the value reported from the sensor nodes is above threshold value and records the maximum of the sensed value reported at each round of data collection. The nodes report data periodically to the sink. The periodicity of the report is based on the minimum time before which the data threshold is to be detected by the sink for taking further action. The time interval between each round of data collection is higher than the data collection time. The problem is to enhance the lifetime of the sensor nodes and thereby the sensor network. The nodes after initialization remain in sleep or inactive state to conserve power unless they wake up to sense, transmit or receive data. The sensor nodes are low duty cycled in which they stay most of the time in the sleep state.

![Figure 2. Routing methodology](image)

All the sensor nodes are homogeneous except the sink nodes are equipped with fixed battery with same initial energy. The role of each sensor node is divided into main functionalities such as sensing, receiving, in-network processing and transmitting.
Fixed grid topology is used in this method. In this connection, the various regions are assigned which consist of two parallel paths. First path is active in transmission when second parallel path is inactive. Inactive node in the second path performs that will never transmit and aggregation of packets take place. When the data is forwarded from the sensor node, it replies with the Negative acknowledgement after collision occurs in particular intermediate nodes. If the inactive nodes received NACK in multiple times, it switched to active state to complete the data forwarding process to sink. After sending the discovery message from the Sink node, all the sensor node sends the sensed information.

Simultaneously, next region active nodes send the sensed information to the aggregator nodes. Finally all the aggregator nodes send the aggregated information to sink with minimal energy. Therefore the life time of network can be increased.

4.1 Path Initialization

Each node knows how to reach any other node and the cost, distance between itself and its immediate neighbor those are directly connected to it. After that all parallel path are estimated to its nodes then the only selected to the shortest path to identify the route formation. Each node maintains a cost as well as distance can be maintained. Routing due to the find least cost path between the two parallel nodes.

4.2 Parallel Path Estimation

Each core identifies its closest node to the source node. And perform a parallel prefix to select the globally closest node then Broadcast the result to the entire core and each core updates its cluster list.

V. RESULTS AND DISCUSSION

The proposed system is analyzed with the parameters such as energy consumption by the nodes and time slot carried out in active state. As shown in the figure 3. SPDA protocol is consuming low energy through parallel data gathering in fixed topology. As shown in figure 2. The total time slot in the active path is high. The comparison is shown in table.1 for easy analysis between the parameters.

![Figure 3: Total energy consumed (mJ) by the entire network](image-url)
V. CONCLUSION

In this project, we have proposed a distributed scheduling method for wireless sensor network. The result in terms of routing scheme and to identify the routing framework can be estimated, and find the short path for SPDA. Scheduling method due to the data aggregation is done path for estimation of networking model. As the future work, we will establish a distributed scheduling mechanism for WSN involving ribbon structure method. Using distributed scheduling the number of time slots for the aggregated data reach the sink will be decreased. Also life time of a sensor can be increased by saving the energy.

References