

A Reliable Clustering Based Energy Efficient Path Selection Method with Multiple Mobile Sink

Ajily Rachel Varghese¹, Ann Susan Varghese²

M.G University, Mount Zion College of Engineering, Kadamannitta, Pathanamthitta, Kerala, India

Assistant Professor, Mount Zion College of Engineering, Kadamannitta, Pathanamthitta, Kerala, India

Abstract: *Wireless sensor networks are equipped with tiny, irreplaceable batteries and therefore it is necessary to design energy efficient methods to prolong the network lifetime. In wireless sensor networks (WSNs), the sink mobility along a constrained path can improve the energy efficiency. Sink mobility is an important technique to improve the sensor network performance. Existing method used weighted rendezvous planning (WRP) along with single mobile sink. In this method the mobility of mobile sink is restricted to RPs (the nodes having highest weight). This method focus on single mobile sink. This leads to inefficient communication and reducing the network lifetime. To deal this problems, multiple mobile sink clustering based WRP method is proposed. In this method network region is partitioned into smaller areas and assign CH and mobile sink for each regions and it achieves better reduction in energy consumption and improves the network lifetime. Extensive Simulation are conducted using Network Simulator-2 to verify its efficiency and performance.*

Keywords: WSNs, Cluster head, Multi-sink, Weighted rendezvous planning .

1. Introduction

Wireless sensor network is one of the increasing technology to provide services to the network users. WSN is used to transfer data among the network nodes. To transfer the data network should provide better communication methods among WSNs and should provide efficient energy consumption. WSNs contains enormous amounts of sensor nodes which makeup the networks for monitoring the region of process and feed data about the targets. WSNs can commonly used to achieve military tracking and surveillance. To monitor dangerous environmental explorations and natural disasters etc. In multihop transmission nodes that near to the sink node are congested that they are responsible to forwarding data from nodes that are far away. Therefore the energy of the node near to the base station is exhausted fastly. So the concept of mobile sink is came into being. The mobile sink collects data directly from the sensor nodes and thereby sensor nodes can save energy. The mobile sink that moves throughout the network maximizes the lifetime of the sensor nodes. The travelling route of a mobile sink which depends upon the real-time requirements of data. One of the greatest issue is how the mobile sink goes for collecting the sensed data. It is difficult to visit nodes which having data. It is an active research area now adays.

Clustering is the technique which partitioning the network and making the methods easy. Leach is an hierarchial protocol in which each nodes send data to the cluster head from cluster head to the sink node. It is a TDMA based technique. The advantages of using clustering is CH can communicate directly with sink or user.

2. Existing Techniques

There are so many existing methods on using mobile sink in WSNs. The main aim is to reduce the data collection delays and energy consumption. In large networks there is the

problem with collecting data directly from sensor nodes is became impractical. Visiting each sensor node increases the mobile sink travelling path. There are some existing methods to reduce the problem.

2.1 Rendezvous design for variable tracks

An algorithm called RD-VT is proposed with the objective of identifying a travelling path that is shorter in duration than the packet delivery time. The algorithm first builds a steiner minimum tree. It start from sink's position and traverses in a preorder until the shortest distance between visited nodes is equals to required packet delivery time. A major limitation of RD-VT is it have an unbalanced data forwarding load and energy consumption.

2.2 Rendezvous planning with a constrained path

RD-CP is similar to RD-VT .It first constructs a routing tree rooted at sink and connect to all nodes. Then, each edge of the routing tree assigns a weight. First sorts all the edges according to the weight and selects the edges having highest weight, mobile element only visits the selected edges. The problem with RP-CP is mobile element will visit the sensor nodes on the selected edges twice.

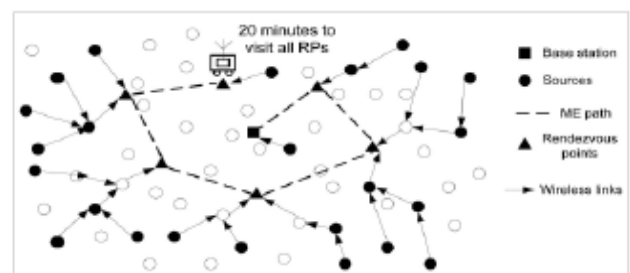


Figure 1: ME Based data collection

2.3 Weighted rendezvous planning method with single Mobile sink

It is a heuristic method, to determine the tour of a mobile sink node. In WRP method weight is given to each nodes sensor node with more connection to other nodes and farther from the computed tour are given a high priority to select as rendezvous points(RP) and mobile sink only visits RPs to collect data. The objective is to minimize the energy consumption by reducing the multihop transmission, But the limitations of these method is it is difficult to find the location of RPs, These nodes run the risk of rapid energy exhaustion and reduces network lifetime.

3. Proposed Technique

For large area applications, the sensor node should be transmits the sensed data to mobile sink within time constraint. In proposed system the whole network region is partitioned into smaller areas and assigns cluster head for each regions, the proposed method is clustering based weighted rendezvous planning method for networks. Within a cluster, nodes transmits data to cluster head(CH) through protocols.CH have responsible for collecting data from each sensor node and transmits data to nearest rendezvous points and mobile sink collect data from RPs..

The algorithm is used to minimizes the energy depletion throughout the network. The travelling path of the mobile sink to visit all rendezvous points is a NP hard problem and solved by WRP algorithm calculating weight for each sensor node which on the basis of hop count and number of packet forwarded by the node and also by using multiple mobile sink reduces the energy consumption of network.

3.1 Clustering

Cluster communication is one of the important one among the cluster nodes. Each and every node in the cluster will act as a both sender and receiver. Through cluster communication selection of cluster head among the cluster nodes can solve better energy problem.

By using a classic clustering algorithm based on Low Energy Adaptive Clustering Hierarchy (LEACH) is a Time division multiple access (TDMA) based MAC protocol which is integrating with clustering and a simple routing protocol in network. LEACH is a hierarchial protocol in which most nodes transmit to cluster heads, and the cluster heads aggregate and compress the data and forward to the sink node. Each node uses a stochastic algorithm(High energy first algorithm) at each round to select cluster head , High energy node is the cluster head in each round. All nodes that are not cluster heads only communicate with the cluster head in a TDMA fashion, according to the schedule created by the cluster head, so minimum energy needed to reach the cluster head. It used for randomized of local cluster heads to uniformly share the energy load between sensors in the network, it reduces the communication energy for transmitting the data. Hence it prolongs the network lifetime.

3.2 Rendezvous points selection method

WRP which is a heuristic method that a near-optimal travelling tour that minimizes the consumption of sensor nodes.WRP assigns weight to each sensor nodes based on the number of data packet forward and hop distance from the tour. The sensor node with highest weight is designed as RPs. Thus the weight of the sensor node i is calculated as

$$W_i = NFD(i) * H(i,M) \quad (1)$$

Where $NFD(i)$ is the number of data packets forwarded by node i and $H(i,M)$ is the hop distance of node i from the closest RP in M (sink tour). Based .Hence sensor nodes that are farther away from the selected RPs or have more than one packet in the buffer have a higher priority to recruited as an RP.WRP algorithm takes as input $G(V,E)$, and its output as a set of RPs.WRP first adds the first node as first RP. Then, it adds the highest weighted sensor node. After that, WRP calls TSP to calculate the cost of the tour. If the tour length is less than the required maximum length of traveled path, the selected node as RP. Otherwise it removed from the tour.

3.3 Multiple Mobile Sink

Wireless sensor network is partitioned into smaller areas where each area is assigned a mobile sink.WRP can run in each region. In clustering all the sensor nodes send its data's to cluster head and cluster head sends the data's to appropriate rendezvous point and mobile sinks node travel along the network and collect the data from the rendezvous points. The multiple mobile sinks in the network effectively saves the energy of network.

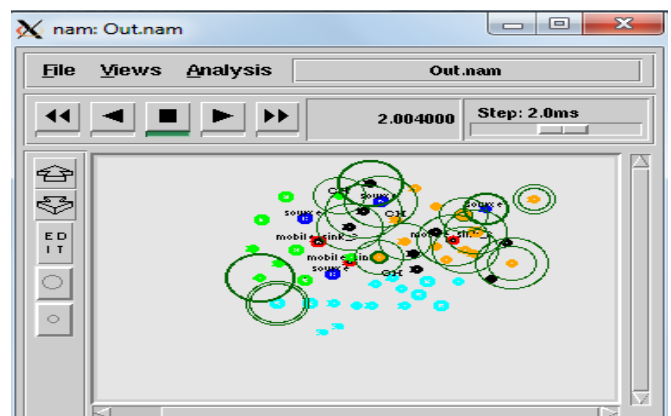


Figure 2: Snapshot of Clustering based communication using multi-mobile sink

4. Simulation Results

The proposed technique is implemented and simulation is done by using Network simulator-2 and evaluate the performance by comparing with existing method(WRP method with single sink node).It uses some parameters average energy consumption and network lifetime to evaluate the performance.



Figure 3: Comparison of average energy consumption level of existing and proposed system

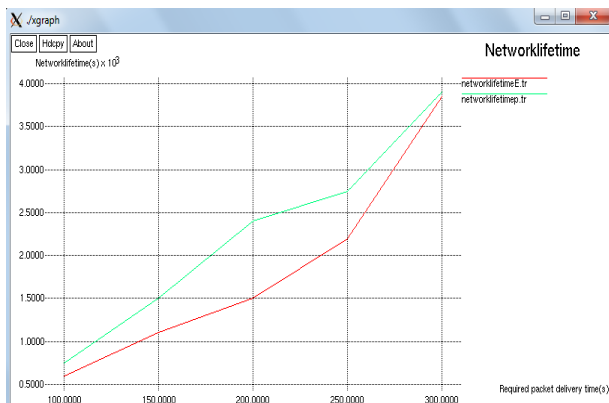


Figure 4: Comparison of network lifetime of existing and proposed system

4.1 Performance Analysis

When compared the proposed technique (clustering based WRP method with multiple mobile sink) with existing method WRP method using single mobile sink, the network energy consumption of proposed method is less than that of existing method because of usage of multiple sink nodes instead of single sink node, reduce the energy consumption level. Clustering technique which clusters the network region, it effectively improves the network lifetime of proposed system.

5. Conclusion

WRP, which is a novel algorithm for controlling the movement of a mobile sink in a WSN. WRP selects the set of RPs such that the energy expenditure of sensor nodes is minimized and prevents the energy hole formation. Clustering based weighted rendezvous planning (CBWRP) with multiple sink is the proposed technique which gives energy efficient path by using more than one mobile sink, it maximizes the network lifetime. The algorithm which prevents energy depletion and reduces the end-end delay. Multi-mobile sink in the network reduces the energy consumption.

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Author Profile

Ajily Rachel Varghese received B.E degree in electronics and communication engineering from Anna university, Tamilnadu, India. Currently She is M. Tech student specialising in communication engineering in Mahatma Gandhi university, Kerala. Her topics of interest are wireless communication system and wireless networks.