Network Lifetime And Energy Efficiency Maximization Using Ant Colony Optimization In WSN

Annu Ghotra, Nitika Soni

Department of ECE, Guru Nanak Dev University Regional Campus, Jalandhar, India
Email: annughotra91@gmail.com

ABSTRACT: Improving network lifetime is the significant challenge of wireless sensor networks. The possible way is to make use of mobile sinks. Sink mobility with a constrained path may improve the energy efficiency in wireless sensor network. Due to the path constrained problem , the communicating speed of mobile sink decreases . So it becomes difficult to improve the routing of data packets and to conserve energy. In this paper, Inter cluster ant colony optimization (ACO) data aggregation is used along with rendezvous points (RP) and mobile sink (MS). This proposed scheme will increase the network throughput and average remaining energy in highly deployed network .

Keywords: WSN; Clustering; ACO; Ant Colony Optimization

1 INTRODUCTION

A WSN consists of a huge number of nodes which may be tightly or arbitrarily deployed in an area in which they have interest. There is Base Stations (BS) situated to sensing area. The base station having major function in WSN as sink send queries to nodes while nodes sense the asked queries and send the sensed information in a joint way reverse to Base station. Base station also serves as an entrance for outer surface system i.e. Internet. So the collection of information and send only relevant data to customer via internet is done by Base station [1].

2 CLUSTERING

Clustering is used in wireless network in order to collect the data from different groups of nodes. These nodes elect the cluster head, if the respected node satisfies the threshold condition. The roles of cluster head are data aggregation and inform it to the base station. This technique is used to reduce the energy consumption by nodes and to improve the routing of data packets which further reduces the cost of system. Recently, there have been lots of other clustering techniques which are mostly variants of LEACH protocol with slight improvement and different application scenarios[2]. While energy efficiency in WSNs remains a function of uniform distribution of energy among sensor nodes, classifying clustering techniques depends on the objectives in mind. The Optimal clustering technique is the technique for the heterogeneity nodes.The clustering algorithms that are made is based on homogeneity and heterogeneity of nodes There are two type of clustering network , first is heterogeneous sensor network and second is homogeneous sensor network.In homogeneous sensor network the entire sensor nodes are same in term of battery energy and hardware complexity while in heterogeneous network two or more different types of nodes with different batteries and functions are used [3]. A mobile sink (MS) is an alternate way to reduce energy consumption. The MS moves inside the environment to collect node data. Sink movement may be controlled or uncontrolled. In controlled methods, the MS trajectory is pre-defined, uncontrolled MS, the sink moves randomly in a predetermined environment. Moving the sink close to normal nodes decreases the transmission distance. MSs have been studied to increase lifetimes WSNs used MS to examine total tour distance, the maximum distance between two consecutive movements, and the minimum sojourn time at each sojourn location. Therefore, one idea has been developed, which is called Rendezvous Points (RPs). The RP is a point near the trajectory of a MS and node (rendezvous node; RN) located nearby. This node transmits data to the MS as it passes nearby. Previous studies have demonstrated the effectiveness of RPs on the performance MSs studied the effect of MS movement (like a bus) on a predetermined trajectory and the use of RN for data collection. The MS sends signals called beacons that notify the RNs of the MS arrival [4].

3 DATA AGGREGATION TECHNIQUES

The purpose of the aggregating the data is to minimize the power consumption by reducing the number of information transmissions. Data aggregation is defined as the method of aggregating the data from multiple sensors to remove redundant transmission and provide fused information to BS (base station). All the aggregation nodes collect data from the leaf nodes and calculate the value of aggregation. Then only the calculated aggregated values are forwarded to the data sink. The aggregate value can be average, maximum (minimum), summation, etc. it is calculated as per requirements of the application. Data generated from neighboring sensors is usually redundant and highly correlated. The amount of data generated in large sensor networks is usually huge for the Sink to process. The data aggregation often involves the fusion of data from multiple numbers of sensors at intermediate nodes and the transmission of the aggregated data to the base station.

The classification of Data Aggregation Mechanisms: According to the WSNs, data aggregation mechanisms can be classified as structure-based, structure-free, and hybrid structure.

Structure-Free Data Aggregation WSNs are as multi-hop Ad-Hoc networks, in which no infrastructure is present to connect the network nodes. The communication architecture for structure-free aggregation of data is termed as basic client/server architecture. To achieve the

scalability, several key points need to be considered such as the high amount of detected data along with communication session needed to forward the data to the server. The sensor nodes are energy constrained, it is inefficient for the sensors to transmit their data directly to the BS (base station). The communication becomes very expensive in terms of energy when compared with local processing [5][6]

Structure-Based Data Aggregation: This scheme can be classified either as based on tree or based on cluster.

A) Tree-Based: In this structure, the sensor nodes are arranged into a tree like structure and data aggregation is performed at the intermediate nodes along with the tree. Aggregation is achieved by constructing an aggregation tree, which can be a minimum spanning tree, rooted at base station and source nodes are considered as leaves. Every sensor node sends its data to its parent node.

b) Cluster-Based: In this, network is divided into sub-groups. Every sub-group is named as “cluster”. Every sub-group constitutes of many nodes from which a node is assigned as a “cluster head” (CH). The CHs are designated to forward their sensor nodes data to the base station. Cluster Head is the master and sensor nodes are the slaves, the master/slave mechanism allows tight traffic control as no node is allowed to send outside their clusters, communication is not allowed between the slaves except through the master [7].

5 PROPOSED ALGORITHM

Figure1 represents the proposed methodology.
The design and flow of implementation and step by step description of the proposed algorithm is detailed as follows.

Step 1 First of all initialize WSN with their respective characteristics.

Step 2 For each node I repeats the following steps

Step 3 If given node has energy more than 0 that means it is alive node only then repeat upcoming steps else move back to step 2.

Step 4 Select node as a CH if it holds the properties of improved node waiting based cluster head selection.

Step 5 Now association of the nodes will be done with their nearest CHs by using ACO.

Step 6 Update the remaining energy of each node I

Step 7 check if there is any dead node, if NO then move to the step 2 else count the no. of dead nodes and show the network lifetime.

Step 8 Evaluate energy dissipation and move to step 2.

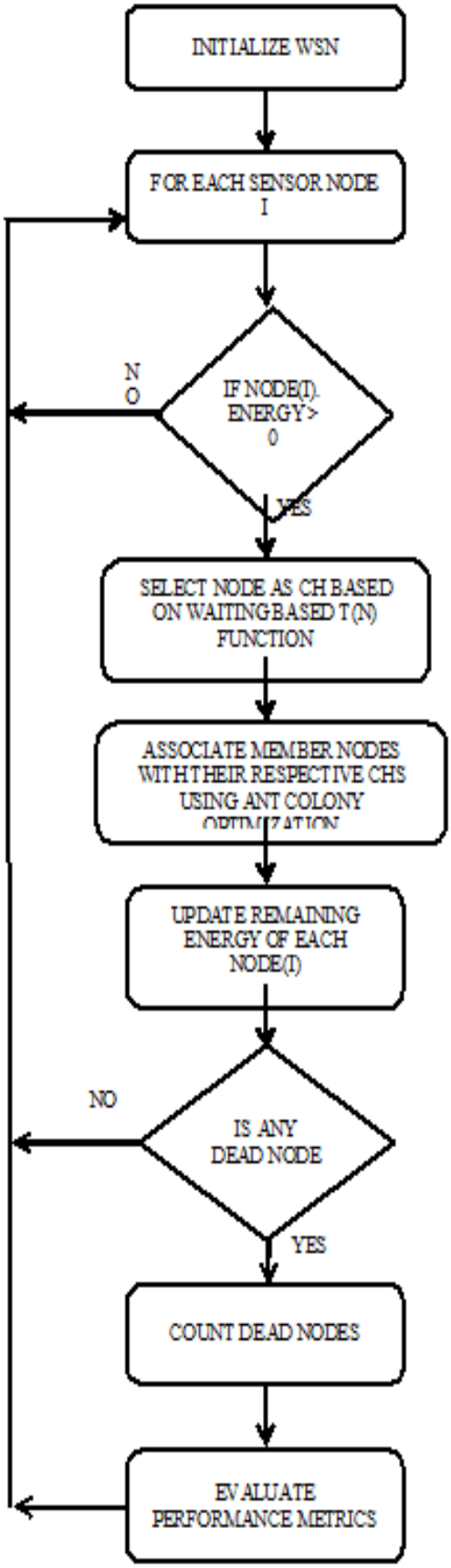

Fig 1: *Proposed Methodology*

7 RESULTS AND DISCUSSIONS

FIRST NODE DEAD: - Figure 2 shows the first node dead evaluation of the existing protocol and the proposed protocol. It is clearly shown that the proposed technique performs better as compared to the existing protocol.

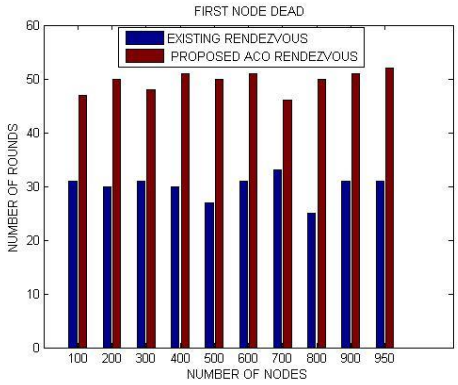

Fig 2: *FIRST NODE DEAD ANALYSIS*

The comparison of existing protocol and the proposed technique is drawn with respect to total number of rounds in case of first dead node when the number of nodes is changed. X-axis is representing number of nodes. Y-axis is representing the number of rounds. It has been clearly shown that the overall number of rounds in case of proposed technique is quite more than that of the existing protocol.

2. HALF NODE DEAD: - Figure 3 shows the half node dead evaluation of the proposed technique and the existing protocol.

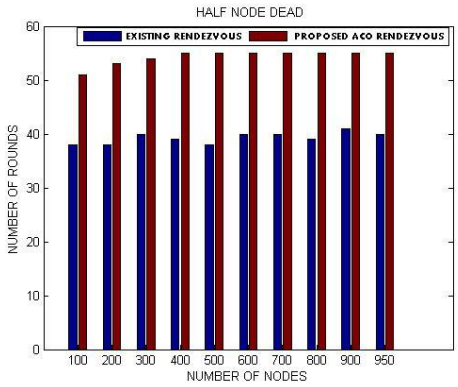

Fig 3: *HALF NODE DEAD ANALYSIS*

It is clearly shown that the proposed technique performs better as compared to the existing protocol. The comparison of proposed technique and the existing protocol is drawn with respect to total number of rounds in case of half dead node when the number of nodes is changed. X-axis is representing number of nodes. Y-axis is representing the number of rounds. It has been clearly shown that the overall number of rounds in case of proposed technique is quite more than that of the existing protocol. Thus proposed technique outperforms over the existing protocol.

3. LAST NODES DEAD: - Figure 4 shows all node dead evaluation of the proposed technique and the existing protocol. It is clearly shown that the proposed technique performs better as compared to the existing protocol. The comparison of proposed technique and the existing protocol is drawn with respect to total number of rounds in case of last dead node when the number of nodes is changed. X-axis is representing number of nodes. Y-axis is representing the number of rounds. It has been clearly shown that the overall number of rounds in case of proposed technique is quite more than that of the existing protocol. Thus proposed technique outperforms over the existing protocol.

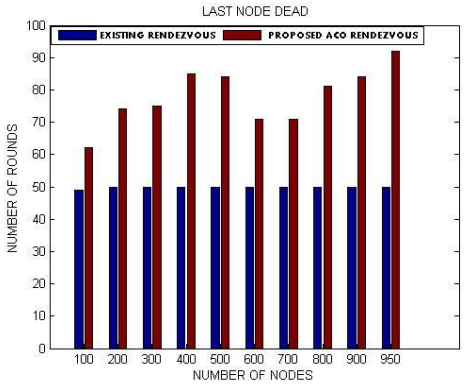

Fig 4: *ALL NODE DEAD ANALYSIS*

2. AVERAGE REMAINING ENERGY

Figure 5 shows the average remaining energy evaluation of the proposed technique and the existing protocol.

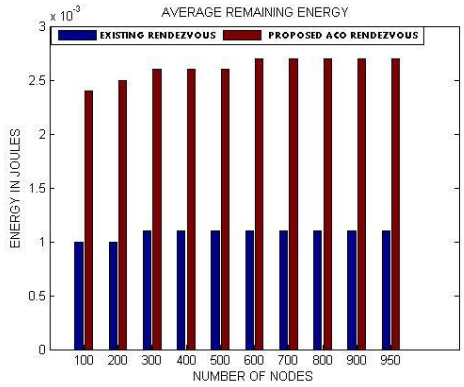

Fig 5: *AVERAGE ENERGY ANALYSIS*

8 CONLCUSION AND FUTURE SCOPE

Inter-cluster Ant Colony Optimization algorithm has been used along with rendezvous nodes for transferring the data packets in the wireless sensor network. The improvement has been made in order to reduce the efforts wasted in routing the data packets sent by the nodes which lies very close to each other in a densely deployed network. The overall goal is to find the effectiveness of the rendezvous nodes based LEACH when ACO inter-cluster data aggregation is applied on it. This work has not considered any compression algorithm to enhance the results further,

so in near future we will use Huffman coding, run length coding, LZW compression etc, algorithms to find best suitable compression technique for WSNs. The proposed technique has been designed and implemented in the MATLAB using data analysis toolbox. The comparative analysis has clearly shown the effectiveness of the proposed technique over the available one.

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