International Journal of Electrical, Electronics and Computer Engineering **4**(1): 97-101(2015) **ISSN No. (Online): 2277-2626**

An Improved Cooperative Communication Approach in Clustered sensor Network

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(Received 04 March, 2015 Accepted 04 April, 2015)
(Published by Research Trend, Website: *www.researchtrend.net)*

ABSTRACT: The major optimization required in a sensor network is in terms of energy optimization. One of the common communication type in clustered sensor network a cooperative communication. In this present work, an improvement at the cooperative communication is defined by performing distributing the communication load between the cluster head and the base station. The presented work is defined by setting up an effective range area for base station. The nodes present in this area can perform direct communication with base station using multi-hop flat routing. The rest of the network is divided in clusters and the clusters can perform the communication with base station using multi-hop hierarchical routing. The obtained results shows that the presented work has improved the network communication and improved the network life.

Keywords: Cooperative Communication, Energy Optimization, Effective Coverage, Clustered Network.

I. INTRODUCTION

It is a process in which the network is divided in to clusters and deploying each cluster, a cluster-heads to perform data aggregation. The job of these cluster-heads is aggregating the data received from the sensors and transmitting them to the BS. In most scenarios, they do not perform any sensing. A number of routing protocols have been proposed for WSN. However, few of them are cluster based. LEACH [5], PEGASIS [5] and ESPDA[5] are some of the routing protocols that uses the concept of clustering. This show significant reduction in the overall network energy over other non-clustering protocol. Hierarchical routing protocols designed to reduce energy consumption by localizing reduce transmissions to the BS.

Some researches argue that better connectivity among the cluster-heads is an advantage for application like message broadcasting. The vertices of a connected dominating set induce a connected sub-graph that can be used as a virtual backbone so that broadcast redundancy significantly.

Guha and Khuller proposed two centralized greedy algorithm for finding suboptimal connected dominating sets in arbitrary connected graphs. In one algorithm, vertices are added to a connected set so as to maximize the no of newly dominated vertices. In the other the connectivity of the sub-graph induced by adding each candidate to the current set. Both algorithms have an approximation ratio of 0 (log A). Due to the close similarly between the connected dominating set problem and the set cover problem, It is unlikely that an approximation ratio asymptotically better than 0 (log A) can be found for the connected dominating the problem.

Das and Bharghavan provided distributed implementations of the algorithm of Guhs and Khuller for constructing connected dominating sets in ad-hic networks. These distributed algorithms generate the same connected dominating sets asw their centralized counterparts and, thus, have exactly the same approximation ratio since they utilize central coordinates to oversee the entire execution. To address the issue of non – localized computation on distributed algorithm of Das and Bharghavan, Wu and Li presented a localized distributed algorithm for finding small connecting sets in which each node only needs to know its distance two neighborhoods. The algorithm consists of two marking phases. Initially, each vertex is marked F to indicate that it is not in the connected dominating sets. In phase one, a vertex marks itself T if any two of it neighbors are directly connected. This process marks all vertexes that can be potentially included in a connected dominating set.

In this paper, an effective cooperative communication is suggested over the sensor network. In this section, the description of clustered network is defined along with cluster formation and the communication in clustered network. In section II, the work defined by the earlier researchers is discussed. In section III, the proposed work is defined along with algorithm. In section IV, the results obtained from the work are presented.

II. EXISTING WORK

In this section the work defined by earlier researchers is discussed. In Year 2010, Chirstine Jardak has defined a work to improve the application for sensor network. Author paper explore this space by making careful estimates on the traffic volumes of sensing data in a number of scenarios explored in the literature. Examples of the scenarios covered are patient monitoring, structural monitoring, vehicular applications and environmental monitoring. Author also present rst results from Presented ongoing work towards developing a highly scalable framework for storing and processing data obtained from planet-scale WSN deployments [1]. Zilong Jin presented an Analysis on Adaptive Cluster Ratio in Wireless Sensor Networks". In this paper, Author mathematically analyze Relation between cluster ratio and path loss in a cluster and an optimal cluster ratio is developed to provide promising channel and minimize packet loss. Author examine its performance through a set of simulations. The simulation results show that the proposed optimal cluster ratio effectively guarantees packet reception rate in WSN [2]. Dongyul Lee [3] presented a game theory based approach for cluster formation in sensor network. Author discuss the use of Nash bargaining solution (NBS) for analyzing clustering based sensor network. Author model the energy consumption in the cluster members along with that for data transmission. Author do not consider the energy of cluster heads and sink node because the energy consumption of cluster heads can be solved by a similar scheme with that of cluster members [3]. Vivek Katiyar has defined a work on clustering in heterogeneous network. Author propose an energy efficient multilevel clustering protocol for HWSNs. Author simulate and compare Presented proposed protocol with existing multilevel clustering protocol EEMC for homogeneous WSN. Simulation results demonstrate that Presented proposed protocol outperforms EEMC[4]. Sabbir Mahmud presented a work on the deployment of sensor network with K base station. Author propose a unified heuristic for both problems. In the special case of one static base station, Author propose an optimal, polynomial time algorithm. In the special case of one mobile base station, Author present an efficient heuristic. Author have simulated Presented optimal algorithm, Presented heuristics, and the Mindiff-RE heuristic proposed by Azad and Chockalingam[5]. A work on energy effectiveness in sensor network with node localization and routing is defined by Christian Dominguez Median in year 2011. As the size of the network increases, this problem becomes more complex due the amount of sensor nodes in the network. The meta-heuristic Ant Colony Optimization (ACO) has been proposed to solve this issue. ACO based routing algorithms can add a significant contribution to assist in the maximization of the network lifetime and in the minimization of the latency in data transmission, but this is only possible by means of an adaptable and balanced algorithm that takes into account the WSN main restrictions[6]. HaniaAoudia has defined a work on hierarchical routing in sensor network. Author propose a critical improvement of the LEACH (Low-Energy Adaptive Clustering Hierarchy) routing protocol for the optimization of the energy consumption as well as memory occuptation of Wireless Sensor Network (WSN)[7].

AnandPandya[8] has defined an energy effective routing and clustering approach in sensor network. Author have proposed a novel three phase approach for energy efficient routing using multipath routing and clustering technique. In wireless sensor network (WSN), sensor node has limited battery a supply and transmission range, so it can not directly communicate with sink node. Hence, multi-hop and multi-path communication is essential[8]. Pin Nie has presented clustering algoirhtm under the energy awareness [9]. Milined Pande has defined a hybrid architecture for agriculture sensor network. This paper proposes the novel architecture of WSN which uses existing Radio Frequency/ Free Space Optical (RF/FSO) link model and hybrid energy source for base station for precision agriculture. Win situation to establish WSN for precision agriculture is the objective of this paper [10].

III. PROPOSED WORK

Energy efficiency is the most required quality in a sensor network where each node consumes some energy with each transmission over the network. Energy efficiency is required to improve the network life. The presented work is defined in the same direction to improve the network life. In this work, the energy efficiency is improved for the cooperative communication in dense clustered network. When a clustered is defined by performing the random selection of clustered nodes, there are much chances of non-uniform distribution of these cluster heads.

The base stations communicate to these cluster heads directly and the cluster heads communicate with nodes. But the range of the base station is also fixed, because of this sometimes these cluster heads communicate with base station by the help of other communication over the network.

The presented work is to improve the cooperative communication with the inclusion of relay nodes between the cluster head and the base station, if the cluster head is not in range. The work is about to perform the effective selection of these relay nodes respective to distance and energy. A relay node can be placed between two cluster heads or between cluster heads and base station. As the clustering will be performed, the relay nodes will also identified and placed over the network. As the communication performed over the network and the cluster head die, reclustering over the network will be performed and along with this new relay node selection will be performed. The presented work is about to identify the relay nodes over the network and to improve the network life. The Algorithm defined in this work are given here under

Table 1 : Cooperative Clustered Routing.

1. Define N Number of mobile Nodes in the network with specific parameters in terms of energy, transmission rate etc.
2. For i=1 to N
3. {
4. If (Node Type (Node(i))='N')
5. {
6. Find the Cluster head in Range called CNode
7. Perform Communication between Node(i) and CNode
8. Set CNode as Source and Base as Destination
9. Set CurNode as the current node
10. Find M Neighbor Cluster Nodes of Nodes
11. Set Path=CurNode
12. While (CurNode<>Base)
13. {
14. Find the Minimum Energy, Load and Distance Node among Neighbor List called node)
15. Set j as CurNode
16. Path=Path U j
17. }
18. }
19. Return Path
20. }

Another improvement to the work is defined in terms of flat communicating routing shown here under

Table 2: Flat Base Station Effective Routing.

1. Define N Number of Mobile Nodes in the network with specific parameters in terms of energy, transmission rate etc.
2. Define the Base station and hotspot area range
3. For i=1 to N
4. {
5. If(Dist(Base, Node(i)<=HotSptRange)
6. {
7. Set Node(i) as Source and Base as Destination
8. Set CurNode as the current node
9. Find M Neighbor Nodes of Nodes
10. Set Path=CurNode
11. While (CurNode<>Base)
12. {
    For (j=1 to M)
    {
    Energy(Neighbor(i))
    Distance(Neighbor(i))
    Load(Neighbor(i))
    }
13. Find the Minimum Energy, Load and Distance Node among Neighbor List called node j
14. Set j as CurNode
15. Path=Path Uj
16. }
17. Return Path
18. }

IV. RESULTS

The presented work is implemented in MATLAB environment. The analysis of work is done under four main parameters called Dead Node Analysis, Alive Node Analysis, and Number of Packets Transmitted in each round, Aggregative communication over the network. These results are presented in the form of graphs shown here under

Here the results are defined in terms of dead node analysis. The comparison of presented approach is performed with normal clustering approach. The results obtained from the work are described here under

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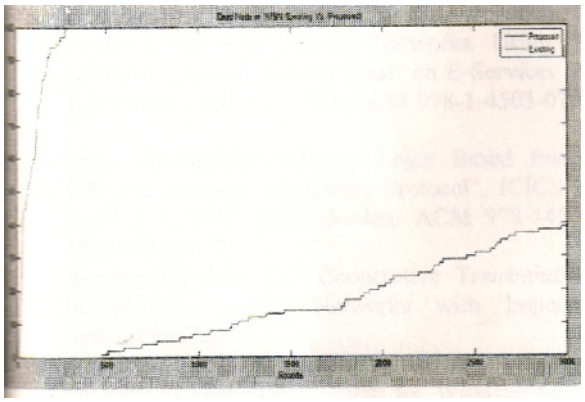

Fig. 1. Dead Node Analysis.

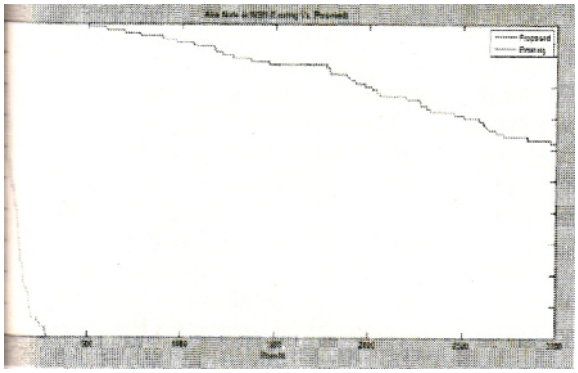

Fig. 2. Alive Node Analysis.

Here the results are defined in terms of dead node analysis. The comparison of presented approach is performe with normal clustering approach.

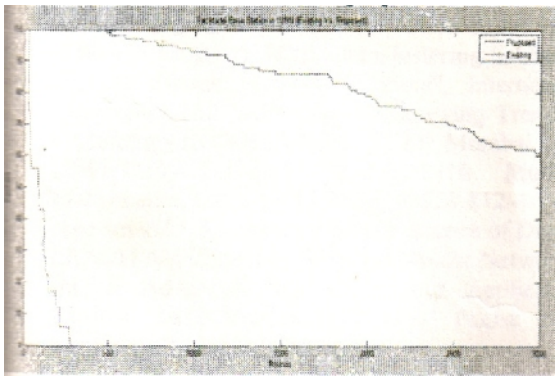

Fig. 3. Packet Communication to base station.

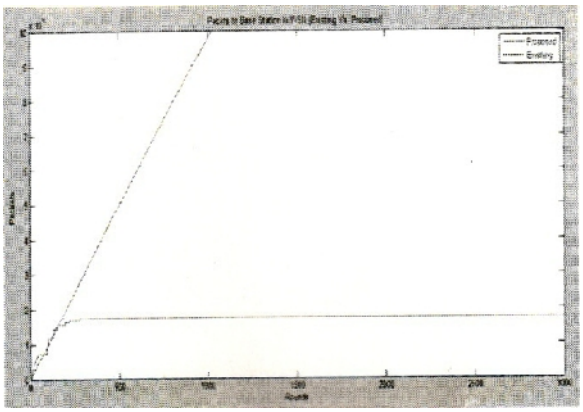

Fig. 4. Packet Communication in Each round.

The results obtained from the work are described here under. Here Fig. 1 has showed the comparison of proposed work under dead node. Here x axis represents the rounds and y axis represents dead node. The results show that the presented work has improved the network life.

Here figure 2 has showed the comparison of proposed work under alive node. Here x axis represents the rounds and y axis represents alive node. The results shows that the network resides for more number of rounds in proposed work.

Here figure 3 is showing the total packet communication over the network. The result shows that the presented work has improved the packet communication upto an extent.

Here figure 4 is showing the packet communication in each round. As then nodes resides for more time in proposed work, the network communication in each round in increased.

V. CONCLUSIONS

In this paper, an effective cooperative communication in clustered sensor network is presented. The work is defined by defining the base station limit to perform direct communication with sensor nodes. The results shows that the presented work has improve the network life and communication.

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