

A Dual Sink Based Bubbling Mechanism for Clusters

Indu¹, Sunita Bhardwaj²

¹M.Tech (CSE), PDM College of Engineering for Women, Bahadurgarh, Haryana

²Assistant Professor, PDM College of Engineering for Women, Bahadurgarh, Haryana

[¹Indusharma.er@gmail.com](mailto:Indusharma.er@gmail.com), [²bhardwajsunita23@gmail.com](mailto:bhardwajsunita23@gmail.com)

Abstract: Sensor network is having its importance in many real time applications to sense different atmospheric, environmental, industrial features. Sensor network is generally a hybrid network with large number of sensor nodes. These sensor nodes are defined with energy parameters and consume some amount of energy with each transmission, receiving and forwarding activity. These sensor networks are present under different network organizing architectures. One of such architecture is the clustered sensor network in which complete network is divided in small segments called clusters. Network is having the multiple sinks that can be defined in any cluster over the network as well as having the randomized node movement. Each cluster also having the static sink as well as having the Cluster head to control the communication. In this paper, a cluster analysis approach respective to the mobile sink node identification is defined to perform the load balancing over the network. The work will check for the presence of the mobile sink in each cluster.

Keywords: WSN, bubbling mechanism, multiple sink, energy distribution.

I. INTRODUCTION

Wireless Sensor Networks (WSNs) are a new technology foreseen to be used increasingly in the future due to their data acquisition and data processing abilities. A sensor network is a collection of communicating sensing devices, or nodes^[1]. All of the nodes are not necessarily communicating at any particular time, and nodes can only communicate with a few nearby nodes. The network has a routing protocol to control the routing of data messages

between nodes. The routing protocol also attempts to get messages to the base station in an energy-efficient manner. The base station is a master node. Data sensed by the network is routed back to a base station. The base station is a larger computer where data from the sensor network will be compiled and processed. The base station can be thought of as a controller for the sensor network. It is the source of instructions concerning the type of phenomena to be sensed, and it collects all results. Human operators controlling the sensor network send commands and receive responses through the base station. The concept of wireless sensor networks is based on a simple equation:

Sensing + CPU + Radio = Thousands of potential applications.

As soon as people understand the capabilities of a wireless sensor network hundreds of applications spring to mind. It seems like a straightforward combination of modern technology.

Lifetime

Critical to any wireless sensor network deployment is the expected lifetime. The goal of both the environmental monitoring and security application scenarios is to have nodes placed out in the field, unattended, for months or years. The primary limiting factor for the lifetime of a sensor network is the energy supply. Each node must be designed to manage its local supply of energy in order to maximize total network lifetime. In many deployments it is not the average node lifetime that is important, but rather the minimum node lifetime. In the case of wireless security systems, every node must last for multiple years. A single node failure would create vulnerability in the security systems. In most application scenarios, a majority of the nodes will have to be self-powered. They will either have to contain enough stored energy to last for years, or they will have to be able to scavenge energy from the environment through devices, such as solar cells or piezoelectric generators. Both of these options demand that the average energy consumption of the nodes be as low as possible.

II. RELATED WORK

The optimal sink placement issue in a network is an NP-complete problem [3,5]. Some works have addressed this

problem and tried to resolve it by different approaches in a polynomial time (using approximation methods) or not [3–5]. In [3], the authors tackled this issue as a flow problem. Several propositions in the literature have focused on the flow problem in a network with a single sink and reached efficient solutions based on energy considerations. The paper [3] extended the study to the case of a multi-sink network. To maximize the network lifetime, the authors consider two questions: how to place the sinks in the network and how to route the data towards these sinks? The produced approach allows finding out among n nodes which would be the p sinks to reach the maximization of the network lifetime. In [4], the authors use the clustering principle. They assume that the number of sinks to place is known prior to the exploitation phase, and this number represents the number of clusters in the network. Therefore, the problem is translated to find an efficient clustering algorithm. Many clustering algorithms exist in the literature (*k-means clustering*, *self organizing maps*, etc. [4]). In [5], the authors have shown that if the transmission power and the capacity of nodes are fixed, the maximization of the network lifetime is comparable to a maximum flow issue. This Base Station Positioning (BSP) problem, as called by the authors, remains NP-complete. To find an approximated solution, the authors have investigated three approximation algorithms: a greedy algorithm and two local search algorithms (Random-restart hill-climbing algorithm and Metropolis -Simulated Annealing- algorithm). Very few research works have focused on the relocation of a unique sink in a sensor network [6–8]. The authors of [6] propose a potential sink moving in order to reduce power dissipation in the nodes nearby the sink serving as last-hop relays. The following questions are addressed: “When?”, “Where”, and “How” to move the sink without affecting data traffic. The proposed solution is based on the substitution of the last-hop nodes serving the sink (substitution operated by the routing algorithm) and the traffic delivered by these nodes. In [6–8], all the proposals focus on the relocation of a single sink in a cluster. The solutions can be extended to a network including several sinks by organizing it in clusters. However, we can observe that relocation of each sink is limited to its cluster and the approaches do not have a global view of the entire network.

III. DUAL SINK BASED BUBBLING MECHANISM

The sensor nodes are defined with energy parameters and consume some amount of energy with each transmission, receiving and forwarding activity. These sensor networks are present under different network organizing architectures. One of such architecture is the clustered sensor network in which complete network is divided in small segments called clusters. The presented technique is defined for a critical challenge in sensor network called mobile multiple sinks communication. In this problem, network is having the multiple sinks that can be defined in any cluster over the

network as well as having the randomized node movement. Each cluster also having the static sink as well as having the Cluster head to control the communication. In this paper, a cluster analysis approach respective to the mobile sink node identification is defined to perform the load balancing over the network. The scheme will check for the presence of the mobile sink in each cluster. If the mobile sinks in the cluster is more than defined limit, then reclustering will be performed to balance the sinks in clustered network. The scheme will also check the average energy analysis in each cluster. If the remaining energy of a cluster is lower than the average energy of the network, than re-clustering will be performed. The re-clustering process will also perform the equalize distribution of the static and mobile sinks. The presented scheme will perform the equalize energy distribution over the clusters as well as over the network so that the network life will be improved. Dual sink based bubbling mechanism is defined in algorithm given below. Nodes seen in red color in fig1 represents cluster head. Black rectangular nodes are the mobile nodes.

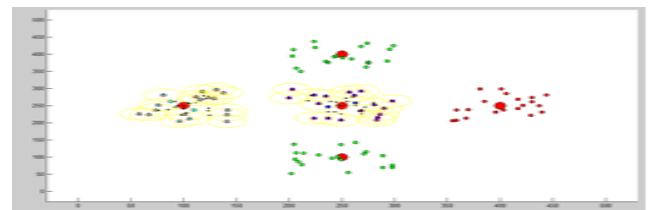


Fig1. Clustered communication

ALGORITHM (DSBBM):

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{
1. Define a Network with N Energy Nodes and
Communication constraints
2. Divide the network in smaller segments with
centroid specification under energy constraint.
3. Define the range limits to distinguish the internal
and external node specification.
4. Send the random mobility on random nodes over
the network.
5. Define Decision Parameters like Probabilistic
Threshold, Cluster Threshold etc.
6. Specify the Energy Limit and Cluster Limit for
Effective Centroid Selection
7. For i=1 to MAX_Iterations
   [Define the Communication over network]
   {
8. For J=1 to Length(Nodes)
   [Process All Nodes]
   {
9. Generate Dynamic Probabilistic Measure on
Nodes(i) for Controller Node Identification
10. if (Probability(Node(i)) > Threshold)
   [If Probabilistic Measure based analysis for
Controller Node Identification]

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Cont....

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{
11.   if(Energy(Node(i))>Threshold And
AreaNodes(Node(i))>Limit)
[If node is having enough energy and connectivity to
set as controller node]
    {
12. Identify the Node as Centroid.
13. Perform Centroid based Node analysis to obtain the
centroid connectivity with each node
14. if(DegreeConnect(CentroidI,CentroidJ)<Threshold)
    [If two centroid having the degree connectivity
lesser than defined Limit]
    {
15. Perform Cluster Merge to re-generate the clusters
with new centroid identification.
    }
    else
    {
16. Perform Cluster Split and re-generate the
clusters with new centroid identification.
    }}
17. For j=1 to Length(Nodes)
    [Perform the Communication]
    {
18. Center=IdentifyCentroid(Nodes(j))
19. PerformCommunication(Nodes(j),Center)
20. if(Nodes(j).Energy=0)
    [Track the network life]
    {
21. Dead=Dead+1
    }
22. Perform Packet Transmission over the Cluster
effective to centroid
}}}

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IV. RESULTS

In this section we present some results obtained through simulation using MATLAB 7.

Figure 2 shows dead nodes in wsn using existing approach and our proposed approach. It shows that there is gradual decrease in no. of dead nodes using proposed algorithm. Figure 3 shows increase in no. of alive nodes using proposed scheme which signifies improvement in network lifetime. Similarly fig 4 shows gradual increase in no. of packets transmitted per round in wireless sensor network.

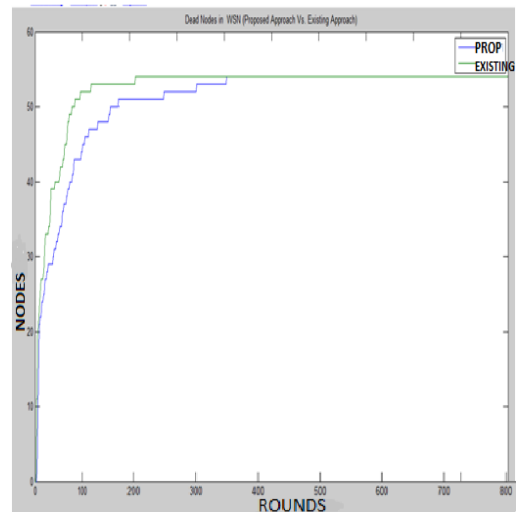


Fig.2 dead nodes in wsn

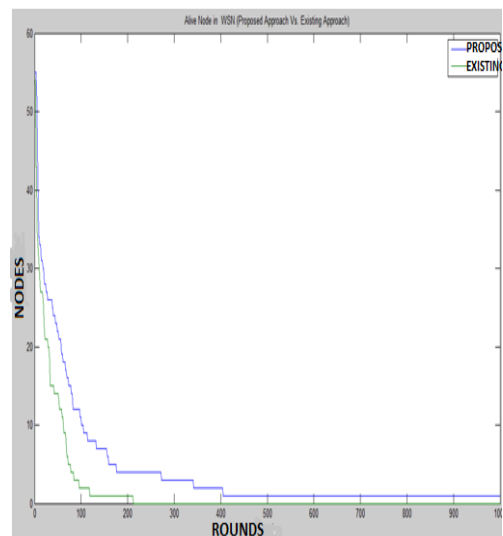


Fig.3 alive nodes in wsn

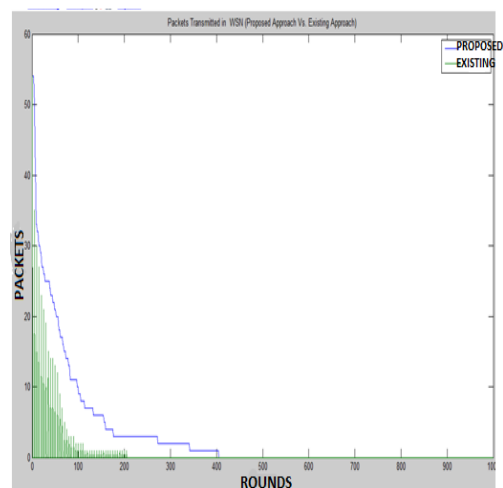


fig.4 Pkts transmitted to wsn

V. CONCLUSION

In this paper we have proposed a new scheme called “Dual Sink Based Bubbling Mechanism for Clusters”. The proposed scheme monitors the mobile sink movement so that the unbalancing over the network is predicted easily. It

uses the reclustering approach so that the energy balancing at cluster and network level is achieved that would gradually reduce the energy consumption over the network. Simulation results shows increase in no. of packets transmission resulting in effective clustered communication.

VI. REFERENCES

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