An Energy Efficient Mobility based Clustering in Wireless Sensor Networks

Saranya G, Dr. S J K Jagadeesh kumar

Abstract— In wireless sensor networks, the sink mobility along a constrained path can improve the network lifetime and energy efficiency. Existing method used Weighted Rendezvous Planning (WRP) which an algorithm for controlling the movement of a mobile sinks in WSNs. This method focuses on a single source or sink. This leads to inefficient communication, reducing the network lifetime. Because of this problem, some nodes or parts of WSN are not frequently visited. An enhanced technique is proposed in this paper to overcome the network lifetime reduction problem. The proposed system uses enhancing energy efficiency by using energy based clustering method which uses mobile sink nodes on energy consumption under different scale networks. In this WSN partition into many clusters. Every cluster there is a cluster head (CH) is elected based on their residual energy. Within the communication range of the cluster head the cluster members are joined into the clusters. The cluster members forwarded their data to their CH. The mobile sink can collect the data from the CH and forwarded to base station. The mobile sink only visited the cluster heads this leads to improve the network lifetime compare to other methods. Experimental results also produce better results compare to existing systems.

Index Terms— wireless sensor networks, weighted Rendezvous Planning, cluster head, mobile sink.

1 INTRODUCTION

A wireless sensor network (WSN) is a computer network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations.[1] The development of wireless sensor networks was originally motivated by military applications such as battlefield surveillance. However, wireless sensor networks are now used in many civilian application areas, including environment and habitat monitoring healthcare applications, home automation, and traffic control [1]. Since the nodes are primarily battery powered. It was essential that the power consumption of sensor nodes was kept to the minimum to extend the network lifetime. Many studies have been carried out to develop protocol and algorithms that are energy efficient. Sinks are used to collect the data from the nodes in the networks.

In WSNs with a mobile sink, one fundamental problem is to determine how the mobile sink goes about collecting sensed data. One approach is to visit each sensor node to receive the data directly. This is essentially the well-known traveling salesman problem (TSP) to find the shortest tour for the data collection. The approach is to visit only special nodes to reduce the energy consumption and minimal transmission. In this paper, the WSNs are divided into many clusters. Each cluster there is a Cluster Head (CH) and the rest of the nodes are the cluster members. The sink visits only the cluster head; it sends aggregated data to the mobile sink. The authors have done a lot of studies and proved that clustering is an effective scheme in increasing the scalability and lifetime of wireless sensor networks [8-11], [4-5].

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2 RELATED WORKS:

In WSN the data gathering causes more energy consumption. Since the nodes are primarily battery powered devices. They are not rechargeable so we need power consumption was kept to the minimum to get the maximum life time. Many authors proposed several methods and algorithms for energy consumption of sensor nodes to improve the network lifetime In multi-hop transmission, the nodes nearer to the sink run out their energy much faster when compare to sink far away node. Due to this problem the energy hole problem (i.e. non uniform energy depletion) will occurred. This leads to reduce the network lifetime and also inefficient Communication [2].

Several studies are revealed the energy efficiency for the network. Existing method uses on mobile sink can be mainly classified into two categories. First one is direct and the second one is Rendezvous. In the direct method the mobile sink can visit the each and every node to collect the data where as in the Rendezvous the sink visits only the RPs [3]. Xing, Guoliang, et al [6] analysis the problem of data are delivered to the base station before their deadline, hence Mobile Elements (ME) can't sense the data for transfer of the data to the Rendezvous Point (RP) i.e. next nodes and communication

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problem may arise. The mobile elements progress may experience interrupted due to mechanic problems of motion nodes. Furthermore network may endure from communication delays due to congestion or node/link failure.

As a result, data may miss its deadline or the ME and may miss each other at RPs. For these analyzing issues the authors proposed a rendezvous based approach for exploiting ME to collect the data under secular constrains. Here researchers were present two algorithms which is RP-CP and RP-UG is developed for analyzing constrained and not constrained path for data transmissions for mobile element and Rendezvous points. These algorithms were used to facilitate the reliable data transfer from RP to ME were this approach is used to find a set of RP that buffer data from sources and transfer them to MEs when they arrive. By this approach their simulation results shows the reduce energy consumption and well scaled network density and speedup the networks.

In order to avoid the energyhole problem and energy consumption of sensor nodes the authors [3] used a hybrid moving pattern in which mobile sink only visits RPs as opposed to all nodes. To address this problem weighted rendezvous planning method is used. It is a heuristic novel algorithm is used to find the set of RPs and controlling the movement of mobile sink. In WRP preferentially designates sensor nodes with the highest weight as a RP. The weight of the sensor node is calculated by multiplying the number of packets that is forwarded by its hop distance to the closest RP on the tour. Such that the energy expenditure of sensor nodes is minimized and uniform to prevent the formation of energy holes while sensed data are collected on time.

3 PROBLEM STATEMENT:

To minimize the energy consumption of sensor nodes and extending the network lifetime are the two important considerations in the WSN. Since sensor nodes are equipped with battery powered devices it is impossible to replace the battery for all nodes if the network is implemented for a vast area with a several nodes. In the existing method weighted rendezvous planning is proposed to control the movement of mobile sink. Existing method only considers only one mobile sink to gather data from the sensor nodes. Furthermore, if interference around the node is very high, then nodes need more transmission energy for successful transfer of packet.

4 PROPOSED SYSTEM:

In WRP, a part of the network can be visited again and again. Remaining nodes are not visited. Due to this problem inefficient communication occurred. And single mobile sink can be used for the entire network, so the interference of the node is high it will transmission of data packet becomes delay. To address these problems, the proposed system uses mobility based clustering method.

In this technique the network is divided into many clusters and each cluster there is a cluster head (CH) is elected based on their high residual energy. And rest of the nodes within the coverage area is called cluster members (CM). The mobile sink can collect the data packets from the cluster heads and forwarded to the base station. In order to improve the network lifetime, this proposed method, uses clustering algorithm to overcome the energy consumption of sensor nodes, to address this mobile sink only visits the cluster heads of the network. The energy dissipation of nodes equally shared in the network. The mobile sink can visits all the cluster heads of the network. So the inefficient communication will not occur. The algorithm divided into three phases: information collection phase, whose duration is T1; cluster head election phase, whose duration is T2; cluster formation phase, whose duration is T3.

Information collection phase:

```
Begin (information collection algorithm)
    state←candidate
    Broadcast Node_Msg
    While (T1 has not expired) do
          Receive Node_Msg
          Update neighborhood table NT[ ]
    End
 Ti←broadcast delay time for electing a cluster head
End
```

Cluster Head Election:

In cluster head will be elected based on their residual energy. In the network, all the sensor nodes energy will be calculated using the formula given below:

$$Re = Ie-(Et + Er) \ldots\ldots\ldots \quad (1)$$
$$Et = Pt+Tt\ldots\ldots\ldots\ldots \quad (2)$$
$$Er = Pr+Tt\ldots\ldots\ldots\ldots \quad (3)$$

Where the residual energy of the node can be calculated based on their initial and communication energy (sending and receiving).The highest residual energy node is elected as cluster head.

Cluster formation:

After selecting the cluster head selection process, it sends message to all its neighbours. The neighbours after received this message its checks their residual energy. If the energy is less than the cluster head energy means it will elect as a new cluster head. Otherwise it sends join message to cluster head. The cluster will be formed.

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Cluster formation Algorithm:

```
Begin
  While (t3 has not expired) do
      If state=Plain&& has not sent Join_msg do
       Send Join_msg to the nearest cluster head
       Else if state= head do
        Receive join_msg from its neighbor plain nodes
       end
   end
  If state = head do
  Broadcast Schedule_msg
end
End
```

Cluster communication:

In this module the information will be collected from the sensor nodes. After this data collection the nodes sends their data to corresponding cluster head. The mobile silk can visit these cluster head only. After collecting, the mobile sink forwarded the information to base station.

5 SIMULATION RESULTS:

In order to performance evaluation of mobility based clustering algorithm, we developed our simulator in NS2. Our network consists of number of nodes randomly deployed in 500×500 network size.

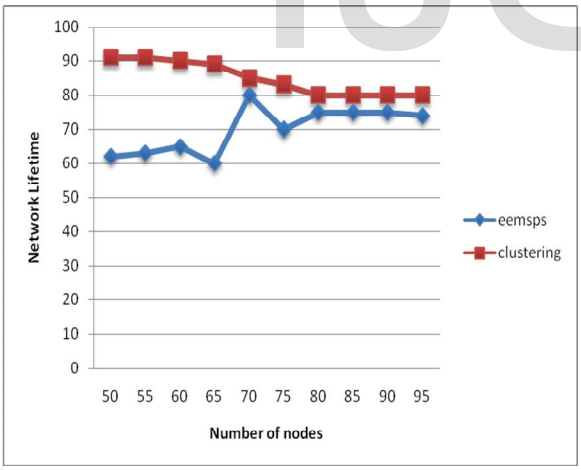

Figure 1. Network lifetime among two schemes

In figure1 the network lifetime compared with existing system. It produced better results, because the network can be divided into many clusters. Each cluster there is a cluster head. The cluster head can monitor the cluster members. The mobile sink only visit these cluster heads.

6 CONCLUSION:

In this paper, we have proposed mobility based clustering method. In this method the sensor network can be partitioned into number of clusters based on their residual energy. The mobile sink can visit only the cluster heads. So the energy consumption of sensor nodes will be reduced and the network lifetime will be improved.

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