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MOBILE DATA GATHERING WITH LOAD BALANCED CLUSTERING AND DUAL DATA UPLOADING IN WIRELESS SENSOR NETWORKS

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Abstract: A Wireless Sensor Network (WSN) is an assemblage of cooperative sensor nodes acting together into an environment to monitor an event of interest. However, a cluster architecture can be a static one that is formed at the time of the network deployment where each cluster has steady characteristics such as a number of members to which they belong and area that is covered. There are several drawbacks apparent on static clustering; for instance, the failure of static membership has an effect on fault-tolerance. The Proposed work implements a dynamic clustering algorithm that achieves reduction in energy consumption based on prediction result of moving objects as well as to avoid redundant data. If the Cluster Head dies (CH), the cluster becomes useless and it also prevents sensors in different clusters. On the contrary, dynamic clustering offers several advantages; for example, clusters are formed dynamically according to particular triggered events. For example if an event has been detected by a node with sufficient power, the node volunteers to act as a CH. The CH invites others nodes to make them members of that cluster. In this capacity, the sensors do not statistically form a cluster and they may be selected on different clusters at different times.

Keywords: dynamic clustering, uploading, cluster head

1. INTRODUCTION

Wireless Sensor Networks have low-cost computation, storage capacity and radio technologies that assemble economical micro-sensor nodes. Micro-sensor nodes are not powerful devices like macro-sensors but they provide fault-tolerant and high quality sensor networks by the deployment of hundreds and thousands of sensors within a network region. What is meant here, is that the electronics of sensing or detecting are capable of calculating the immediate conditions of the environment surrounding the sensor and eventually transforming them into an electronic signal and a message. In reaching the base station, the path by which a message should travel through the sensor node is determined by a mechanism known as routing protocol that will simultaneously and directly influence the energy efficiency of the WSNs.

Wireless Sensor network is a network of devices, indicated as sensor nodes, these nodes sense the environment and converse the data from the monitored field. The data is forwarded to a sink node via single or multiple hops. WSN has come up with an effective solution for many of the applications like military, healthcare, home, etc. Recent advances in wireless communications and electronics have enabled the low cost, low power and multi functional sensor nodes that are distributed densely within a network area.

The unique feature of sensor network is the cooperative effort of sensor nodes. As information technology develops rapidly, volume of the data also increasing concurrently. Big data is a buzzword used to describe a massive amount of both

structured and unstructured data that is so large that it's difficult to process using traditional database and techniques. In most enterprise scenario the data that is too big or it moves too fast or it exceeds current dealing capacity. Big data has the potential to guide the companies improve operations and make faster, more intelligent divisions. Collecting large amount data from sensor nodes is the major concern in the field of information and communication technology. Individual sensor nodes may not provide accurate information. Therefore collecting data from multiple sensor nodes is very essential. In order to gather these data, the WSN is constructed in such a way the sensors relay their data to the "sink". However, in case of widely and densely distributed WSNs, there are two problems in gathering the data sensed by millions of sensors, first, the network is divided to some sub-networks because of the limited wireless communication range. Second, the wireless transmission consumes the energy of the sensors. The data generated by an individual sensor is not significant; each sensor requires a lot of energy to relay the data generated by surrounding sensors. The life time of sensors in dense WSNs will be very short because each sensor node relays a lot of data generated by tremendous number of surrounding sensors.

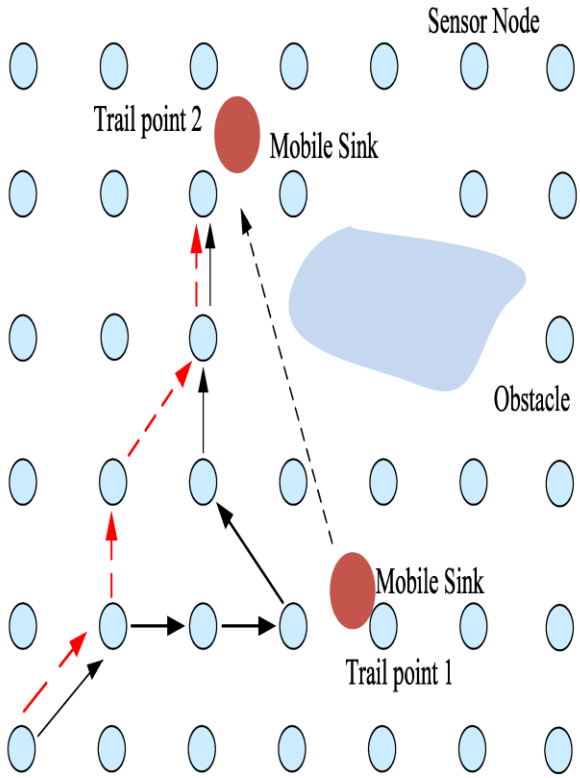

Fig. 1 architecture of Sensor network

The most important phase of cluster-based routing protocols is the cluster head selection (CHS) procedure that ensures uniform distribution of energy among the sensors, and consequently increasing the lifespan of a sensor network. Once the CHs are identified, they form a backbone network to periodically collect, aggregate, and forward data to the BS using the minimum energy (cost) routing. This method significantly enhances the network lifetime compared to other known methods. The major challenges include equal distribution of each cluster over the entire sensor network and the energy dissipation caused by the frequent information exchange between selected cluster head and nodes in the cluster in every setup phase of cluster formation. If CH is selected on the basis of the concept of maximum number of

nodes connected, then it may happen that one or more nodes are not connected to any of the selected cluster heads, even though they are in the transmission range. Such nodes are called the isolated nodes. The proposed algorithm deals with the cluster head selection based on the unique node concept. A unique node is the one which is not connected to any other cluster heads. The current paper describes CHS using two other parameters as well, namely, number of neighboring nodes and the residual energy of the node.

2. SYSTEM DESCRIPTION

2.1 Existing Work

- Wireless sensor nodes distributed in a monitored area collects processes and transmits data acquired from the physical environment.
- The main goal of a WSN is reliably detecting and accurately evaluating the events in the monitored area with the collected data.
- All sensor nodes send the data to Static CH.
- In sensor communication, nodes energy level has to be checked at every route requesting time.
- Static CH consumes more energy to collect data from all sensor nodes thus nodes energy is drained easily.

Disadvantages:

- The Network Life time is reduced by the static CH.
- High Energy Consumption
- High amount of overhead.

2.2 Proposed Work:

- Cluster heads are selected according to the probability of optimal cluster heads determined by the networks.
- After the selection of cluster heads, the clusters are constructed and the cluster heads communicate data with base station.
- To overcome the defects of Static CH and Sencar methodology, a cluster head selection method HEF algorithm has been introduced.
- This method proved that the network lifetime can be efficient.
- Dynamic CH reduces the traffic.

Advantages:

- High amount of data delivery.
- Network life time is increased.
- Reduces Delay and packet loss.
- High energy consumption is reduced.

2.3 Flow Diagram

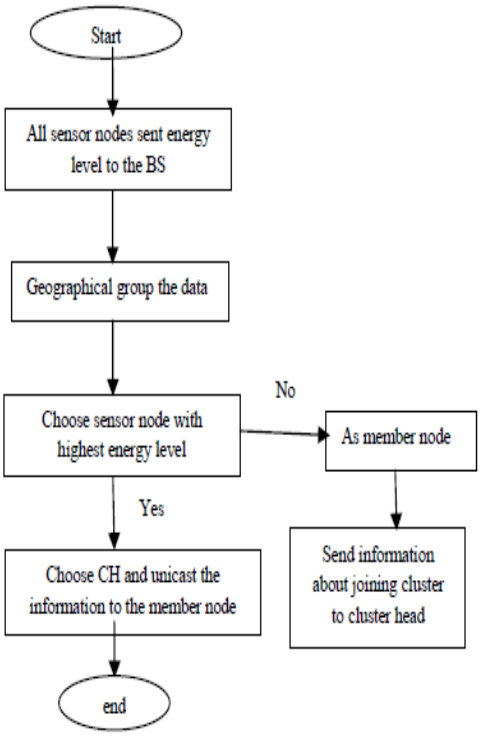

Fig.2 Flow Diagram

3. IMPLEMENTATION AND RESULT ANALYSIS

3.1 Implementation

Initially clusters are created and the corresponding cluster head is selected. After the cluster head receives the data, it can be aggregated and the data can be transmitted to the base station. During the set-up phase each sensor node sends information about its current location to the base station. Sensor nodes sends their energy level to the base station, the base station computes average node energy and determines which nodes has high energy or low energy. The node having higher energy is chose as cluster head. Then it broadcasts an advertisement message to the rest of the nodes. For this "CH advertisement" phase, the CHs use a CSMA MAC protocol. The non CH nodes must keep their receiver on, during the phase of set up to hear the advertisements of all the CH nodes. After this phase is complete, each non-CH node decides the cluster to which it will belong for this round. This decision is based on the received signal strength of the advertisement. After each node has decided to which cluster it belongs, it must inform the CH node that it will be a member of the cluster. Each node transmits this information back to the CH again using a CSMA MAC protocol. During this phase, all CH nodes must keep their receivers on.

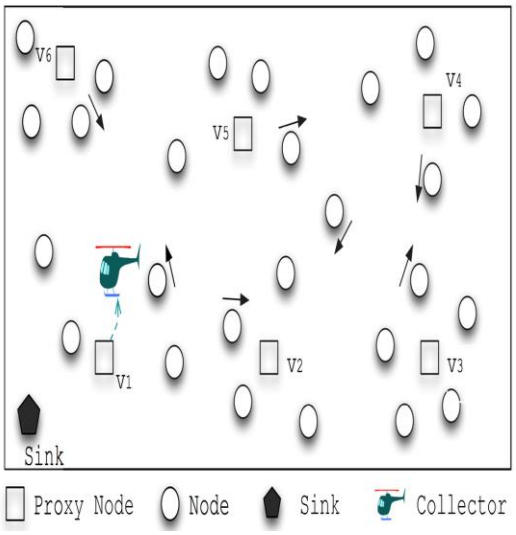

Fig. 3 architecture of network transmission

The CH node receives all the messages for nodes that would like to be included in the cluster. Based on the number of nodes in the cluster, the CH node creates a TDMA schedule telling each node when it can transmit. This schedule is broadcast back to the nodes in the cluster. Once the clusters are created and the TDMA schedule is fixed, data transmission can begin. Nodes send it

during their allocated transmission time to the CH. This transmission uses a minimal amount of energy. The radio of each non-CH nodes can be turned off until the node's allocated transmission time, to minimizing energy dissipation in these nodes. The CH must keep its receiver on to receive all the data from the nodes in the cluster. When all the data has been received, the CH performs data aggregation. This aggregated data is sent to the BS. This transmission takes high energy because BS is far away from CH. After certain period Cluster-head node energy is reduced, because of its operation of receiving, sending and overhearing process. If the energy of CH is below the average energy it is reclustered.

3.2 Modules Description

Network formation with Cluster

- The sensor nodes and sink node are created
- Nodes are placed according to the range of neighbor.
- If sensor nodes want to transfer data, it will send request message to neighbor.
- The node which is near it will send response message.
- Control messages broadcast period should be dynamically adapted to avoid unnecessary message exchanges.

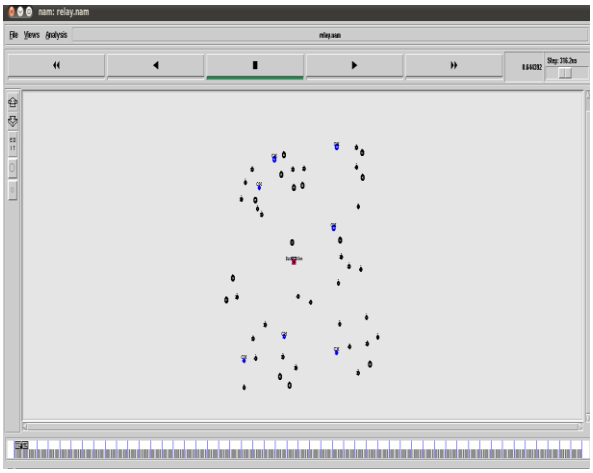

Fig.4. Network Formation

Create Dynamic CH group communication

- A representative of each sub-domain (cluster) is 'elected' as a cluster head (CH) and a node which serves as intermediate for inter-cluster communication is called gateway. Remaining members are called ordinary nodes. The boundaries of a cluster are defined by the transmission area of its CH.
- Cluster architectures do not necessarily include a CH in every cluster. CHs hold routing and topology information, relaxing ordinary node from such requirement; however, they represent network bottleneck points.

Mobile Sink data gathering from Dynamic CH's

- A subset of sensors will be selected as the points, each aggregating the local data from its affiliated sensors within a certain number of relay hops.

- These CHs will temporarily cache the data and upload them to the mobile sink when it arrives.
- Since the mobile sink has the freedom to move to any location in the sensing field, it provides an opportunity to plan an optimal tour for it.
- Our basic idea is to find a set of special nodes referred to as CHs in the network and determine the tour of the mobile sink by visiting each CH in a specific sequence.
- When the mobile sink arrives, it polls each CH to request data uploading and then upload the data to mobile sink.
- If any message is emergency it will directly send the emergency data to base station without waiting the Mobile Sink.

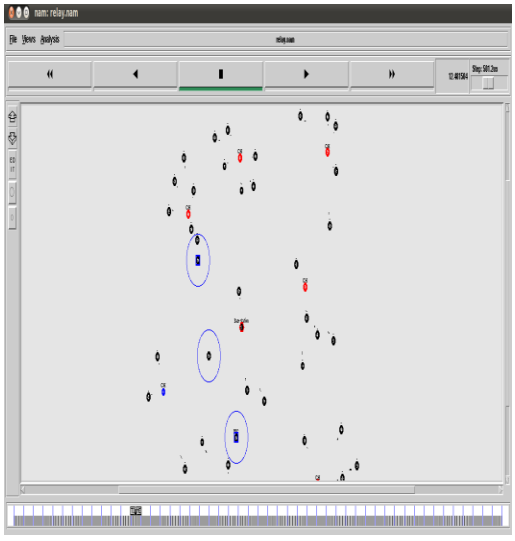

Fig.5. Data Gathering

Handover the data to BS

- A CH uploads data packets to the mobile sink in a single hop.
- The mobile sink starts its tour from the static data sink, which is located either inside or outside the sensing field, collects data packets at the CH and then returns the data to the base station.
- Finally Mobile Sink hand over the data to data sink, such as BS

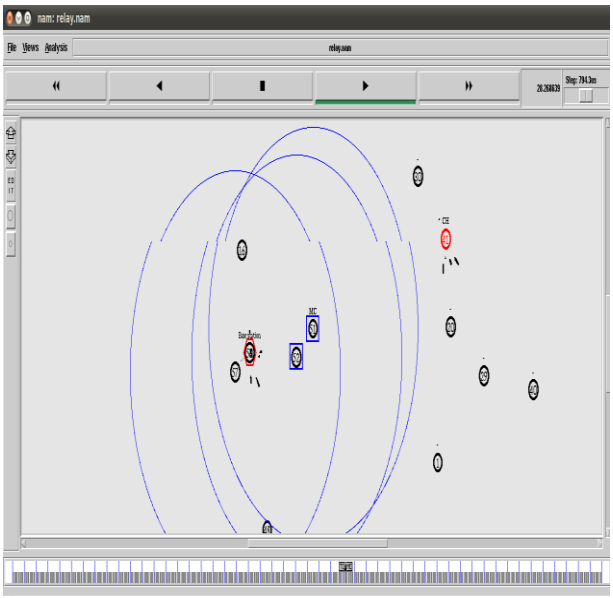

Fig. 6 Handover of data

Performance Measures

Packet Delivery Ratio

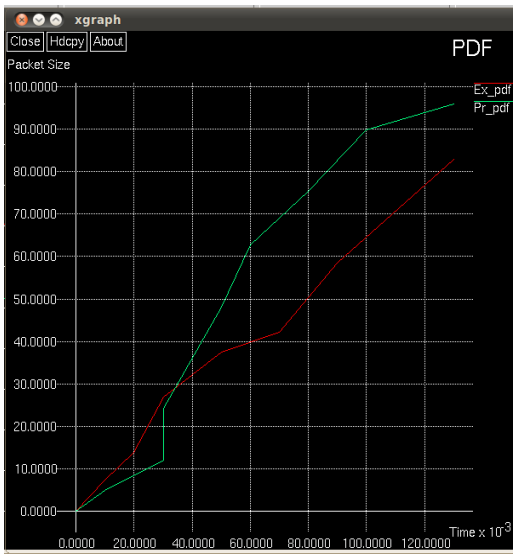

Fig.7. Packet Delivery Ratio

Throughput

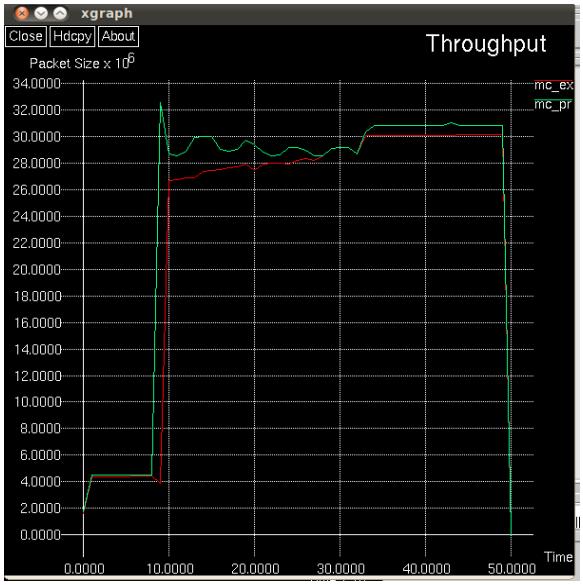

Fig 8 Throughput

Energy

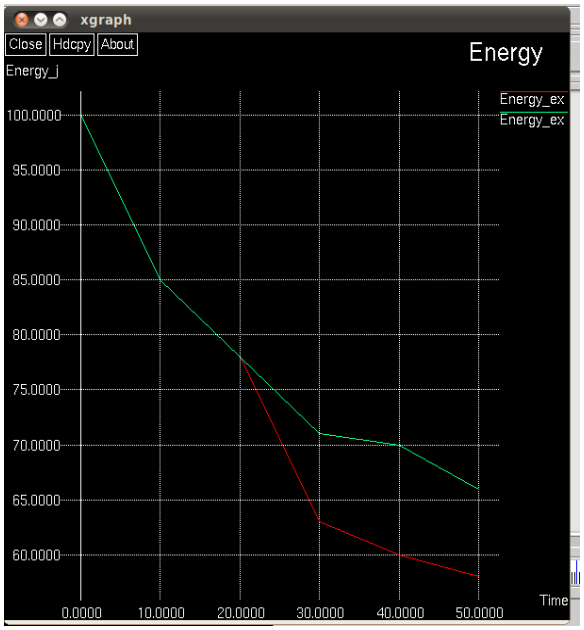

Fig. 9 Energy

4. CONCLUSION

Clustering is a useful topology-management approach to reduce the energy consumption and exploit data aggregation in wireless sensor networks. In this paper we have focused and proposed dynamic clustering where clusters are refreshed periodically and cluster head is selected accordingly. To reduce the energy consumption of sensor nodes, it forwards the data to CH. This is extensively improving the network lifetime, traffic, trade off with the channel access and end-to-end delays. Finally the Mobile Sink moving from Base station gathers data from CH and hand over the data to the Base Station without any delay.

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