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DELAY CONSTRAINT NETWORK STRUCTURE WITH IN-NETWORK DATA FUSION FOR WIRELESS SENSOR NETWORKS

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ABSTRACT - *A wireless sensor network (WSN) comprises a large number of wireless sensor nodes Reduction in energy consumption in WSNs involves effective techniques such as In-Network data fusion and clustering. However, in a data aggregation process clustering introduces bottlenecks to a network which causes extra delay. In this paper, a delay-aware network structure for WSNs with in-network data fusion is proposed. To optimize intra-communication distance an optimization process is also proposed. Simulation results show that, when compared with other existing aggregation structures, the proposed network structure can reduce delays in data aggregation processes and keep the total energy consumption at low levels provided that data are only partially fusible.*

Index Terms - Data aggregation, Data centric routing, DED(Distance energy and degree),Wireless sensor networks

I. INTRODUCTION

Wireless sensor networks is an emerging technology that is gaining a lot of attention for applications such as monitoring and data gathering. A survey Wireless Sensor Networks (WSNs) consist of small nodes with sensing, computation, and wireless communications capabilities. [1]

LEACH-Low energy adaptive clustering hierarchy Networks with LEACH were organized into multiple single-layered clusters LEACH includes a new, distributed cluster formation technique that enables self-organization of large numbers of nodes, algorithms for adapting clusters and rotating cluster head positions to evenly distribute the energy load among all the nodes, and techniques to enable distributed signal processing to save communication resources. In particular, data aggregation techniques can be used to combine several correlated data signals into a smaller set of information that maintains the effective data. [2]

One drawback that occurs in the LEACH protocol is, the election procedure (random) can lead cluster heads to have a weak energy reserve, which can affect the data transmission and can lead to a reconfiguration of the built structure.

The proposed network structure is a tree-based network. In the proposed network structure, wireless sensor nodes are organized into multiple single-layered clusters of different sizes, such that clusters can communicate with the FC in an interleaved manner

- In the proposed system by modifying the network structure the extra delays that is caused in the data aggregation process is highly reduced.
- The sensor nodes are organized into clusters of different sizes by the proposed structure which enhances the communication of every cluster with the fusion center.
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By the proposed structure the size of the outgoing data is made equal or lesser than the size of the incoming data. The delay is constrained by the proposed structure which thereby reduces the power consumption.

Data forwarding takes place only at the cluster heads since the proposed system is organized with multiple single layer clusters.

II. PROPOSED SYSTEM ARCHITECRE

The wireless sensor network architecture consists of sensor nodes where random nodes form a cluster in which one of the node is a cluster head and other nodes in the cluster are cluster members. The process in a wireless sensor network involves communication between the nodes by transmission of data by the cluster heads from its cluster members to the fusion center.

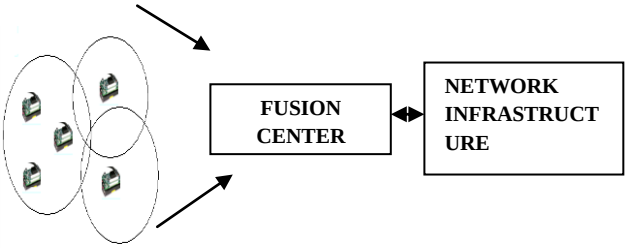
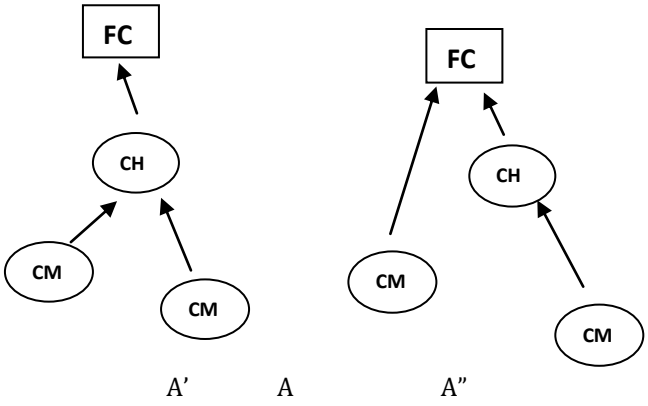


Fig 2.1 Network Model: Infrastructure Construction

1. Cluster head selection- LEACH
2. Data aggregation using the LEACH based CH
3. Cluster head selection- DED(Distance energy and degree)
4. Data aggregation using the DED based CH

In a typical clustering algorithm, a number of nodes in a network will be selected as the cluster heads (CHs). The remaining nodes will be regarded as cluster members (CMs) and form connections with the CHs. A CH will collect information from its CMs. If the data obtained from the CMs are fusible, a CH can perform data fusion on the incoming data and reduce the size of its outgoing data. .



A

Fig 2.2 **Fig 2.3**

In fig 2.2, The amount of delay to receive the data A from both the members is more and hence the power consumption is also more. Therefore, A' > A.

In fig 2.3, The transmission of data from one the CM is done directly with the fusion center. And from the other cm it is done through the cluster through the cluster head. Here the delay and the energy consumption is reduced wherein

A"< A'.

In LEACH there is a self organization of nodes for cluster formation and data aggregation process. And the selection of cluster head is rotated so that there is an even distribution of energy throughout the network. LEACH forms clusters by using a distributed algorithm, where nodes make autonomous decisions without any centralized control.

In LEACH, the nodes organize themselves into local clusters, with one node acting as the cluster head. All non-cluster head nodes transmit their data to the cluster head, while the cluster head node receives data from all the cluster members, performs signal processing functions on the data (e.g., data aggregation), and transmits data to the remote BS. Therefore, being a cluster head node is much more energy intensive than being a non cluster head node.

DED Clustering Algorithm which involves the important features such as degree, energy and distance and transmission range.Using this algorithm a node with higher residual energy, higher degree and closer to the Fusion center is more likely elected as a ClusterHead. The members of each cluster communicate directly with their ClusterHeads (CHs) and each CH aggregates the received messages and transmits them directly to the Fusion center.

Clustering algorithm elects the sensor having high connectivity, closer to destination and reduced power consumption sensor as a cluster head (CH). Through the election of high connectivity CH, the number of hops involved between sensor and cluster head is reduced there by reducing the energy. Through the election of CH closer to destination, number of hops in the data transmission is reduced. When the current CH runs out of energy, re-election of CH is conducted to facilitate the balanced energy consumption among the sensors in the network. Under the condition of this procedure for joining to the new cluster is also proposed. So this algorithm achieves balanced energy consumption in the network by selecting energy efficient and stable CH. Node which is having highest residual Energy and highest degree will be elected as cluster head which implies node having highest weight.

Weight = (Energy * Degree) / Distance - 2.1

III. PERFORMANCE EVALUATION

The proposed structure has an improved performance by overcoming the drawbacks of the existing system. An optimization process is designed to construct the

proposed network structure, which helps maintaining the total energy consumption at a low level. Simulation results show that, when in-network data fusion does not yield any size reduction in outgoing data, the performances of networks with the proposed network structure are higher than those with LEACH. The performance of the proposed network structure can be further improved by knowing the minimum achievable compression ratio between the sizes of the incoming and outgoing data.

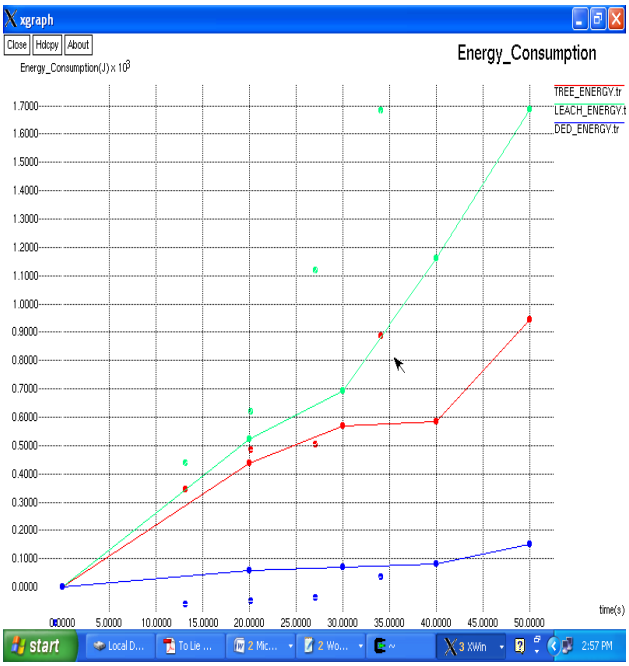


Fig 3.1 Graph comparison for Energy Consumption

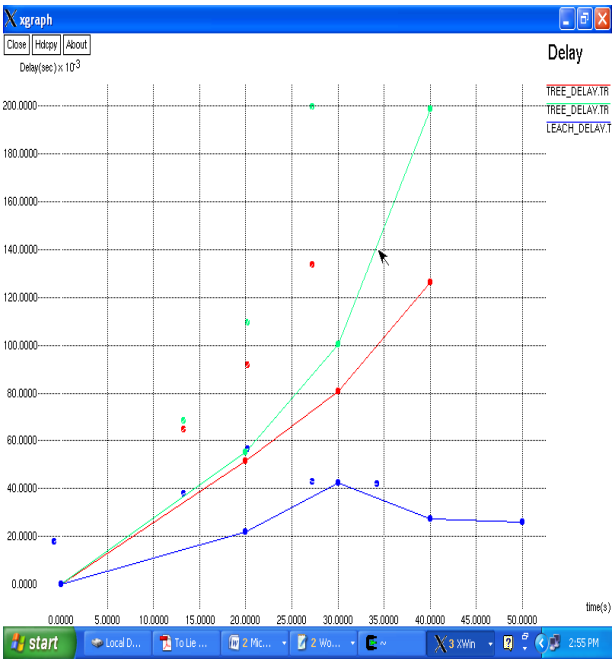


Fig 3.2 Graph comparison for Delay

IV. CONCLUSION

In the proposed network structure the size of the clusters are designed in such a way such that the nodes that are present in the network can communicate with each other. The clusters present are of different size and data aggregation is efficient by the proposed structure only when the data if partially fusible. The results obtained from the simulation show that the delay and energy consumption is greatly reduced by the proposed structure when compared to the LEACH protocol.

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