Energy Efficient Clustering Scheme with Multiple Mobile Base Station for Wireless Sensor Networks

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Abstract
One major challenging issue in wireless sensor networks has been developing energy-efficient protocols. Clustering provides a way to extend the lifetime of a wireless network and at the same time adding multiple mobile base stations may lead to the development of energy-efficient and robust wireless sensor network. In this paper, I propose an energy-efficient and robust hybrid model that use Clustering scheme and deploys multiple base stations.

Keywords
Wireless Sensor Network, Clustering, Multiple Base Stations, Lifetime

I. Introduction

Recent advances in MEMS (Micro-Electro-Mechanical Systems) sensor technology and wireless networks have triggered the deployment of large scale wireless sensor networks. Wireless Sensor Network has thousands to millions of tiny sensors that have low cost and each sensor node is equipped with a sensing device, a low computational capacity processor, a short-range wireless transmitter-receiver and a limited battery-supplied energy. Sensor nodes monitor some surrounding environmental phenomenon, process the data obtained and forward this data towards a base station located on the periphery of the sensor network. Base station(s) collect the data from the sensor nodes and transmit this data to some remote control station.

With an aim to guarantee maximum energy efficiency there are many scheme that suggest organizing sensor node in clusters.

Each Cluster has a cluster head and in order to balance the overhead involved in communication between the cluster head and the base station, each node in the cluster takes turn to become cluster head. This new mechanism is a chain-based power efficient protocol based on LEACH(Low energy adaptive clustering hierarchy) [9]. LEACH uses randomized rotation of the cluster-heads to evenly distribute the energy load among the sensor nodes in a network. Once the clusters are constructed, the cluster heads broadcast TDMA schedules providing the order of transmission for members in the cluster. Each node has its own time slot. It transmits data to the cluster head within its exclusive time slot. When the last node in the schedule has transmitted its data, the cluster head will be randomly elected in the next round. It employs localized coordination to improve the scalability and balance the energy usage of the network among all the nodes. The sensor networks considered by most researchers [5-7] have a single static base station located at the boundary of the sensor network. Past research has focused on developing energy efficient protocols for Medium Access Control (MAC) [8] and routing.

I in this paper, would propose the use of multiple mobile base stations as shown in fig 1.

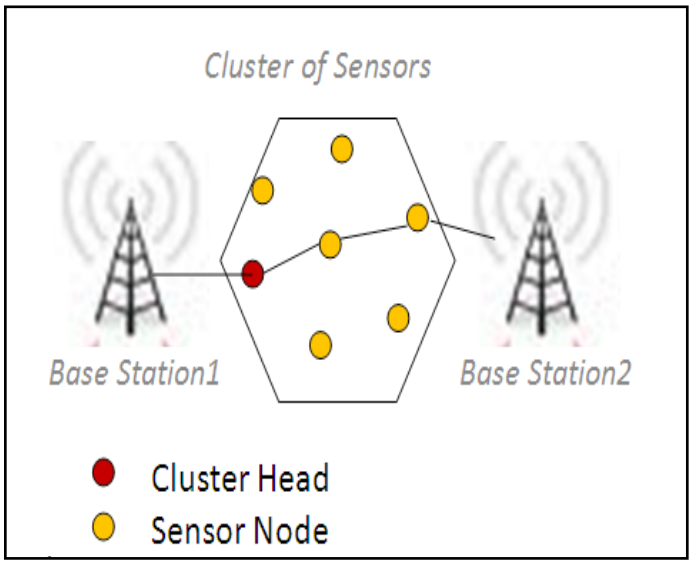

Fig. 1:

It is much cost effective and energy efficient to send data from cluster head to Base Station 1 as compared to Base Station 2 since the energy consumed in routing a message from any sensor node to its nearest base station is proportional to number of hops the message has to travel, employing multiple base stations effectively reduces the energy consumption per message delivered.

In [10], the authors demonstrated through experimental results that the sensor nodes which are one-hop away from a base station drain their energy faster than other nodes in the network. The authors attribute this to the fact that nodes which are one hop away from base station need to forward messages originating from many other nodes, in addition to delivering their own messages. In doing so, these sensor nodes deplete their energy quicker and become inoperational. As a result, many sensor nodes will be unable to communicate with the base stations and the network becomes inoperational. To increase the lifetime of sensor network we propose to use multiple base stations, and periodically change their locations.

II. Related Work

Important issues in designing wireless sensor networks – designing low power signal processing architectures, energy efficient wireless media access control and routing protocols [3,11], low-power security protocols and key management architectures [1,4], have been areas of research in recent years. B Baranidharan and B Shanthi describes the existing routing strategies in WSN and overview of energy efficient routing protocols [2]. All previous research describes either the benefits of using clustering algorithms or making use of multiples mobile base stations. I in this paper propose the use of a hybrid model that will club the benefits of Clustering and Multiple mobile base stations.

III. Proposed Model

The existing models for energy efficiency in wireless sensor network showed considerable improvement in one or more objectives to suite the specific application, but still there needs a lot of work to be done in terms of low clustering overhead, distributed cluster heads, continuous packet data delivery, achieving reduced data fusion cost. In this paper i propose a new hybrid model which considers all these factors in the routing mechanism for the wireless sensor network. The following steps will be involved in the proposed hybrid model.

1. Clustering based on k-means algorithm.
2. Improved cluster head selection mechanism through RSS (Received Signal Strength) value.
3. Alternate CH (Cluster Head) selection for continuous packet data delivery.
4. Shortest path to the super cluster further reduces the power consumption.
5. Compression techniques for reduced data fusion cost.
6. Using multiple base stations instead of single base station.
7. Rotating the base station positions to further reduce the hop count.

By incorporating small changes in each step, we hope this hybrid model may prove to be highly energy efficient model for Wireless sensor networks.

IV. Conclusion

Though the clustering protocols like LEACH, HEED, DECA, etc are proved to be energy efficient than its previous models the main pitfalls in these protocols are that nodes are assumed to be static and stationary. The proposed energy efficiency model is untested while the base stations exhibit mobility. Future works may concentrate on achieving better energy efficiency in routing mechanism for mobile wireless sensor nodes.

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