

Energy Harmonizing in Wireless Sensor Network with Efficient and Simplified Mobile Sink Wave through Energetic Multicast Communication

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Abstract

An efficient data gathering strategy is presented using mobile sink as data collector with Clustering as sensor organizer in randomly grouped sensors in sensing field for wireless sensor network. The scheme not only extends the network lifetime through clustering process but also increase the data gathering mechanism through efficient and simplified mobile sink waving scheme. The cluster heads selection is based on both energy and data weight, which collecting all the data from the nodes within a cluster and then send it to the sink. Single mobile sink which visits the cluster heads as per defined path collects data periodically. The scheme is systemized through “Mobile Sink based Data Collection Protocol (MSDCP)” which combines energy efficient clustering and data collection method. Accordingly proposed protocol is more suitable for scenarios where sensor nodes generate variable amount of data.

Keywords: Wireless Sensors Network, Mobile Sink, Sensors, Clustering.

I. INTRODUCTION

In the current years, several approaches have been presented for both clustering and sink mobility, which enormously falls into two groups of proactive and reactive methods. In proactive design, the sensed data is stored on the unique central nodes storage, which is after collected by the sink [1]. On the other hand, in reactive approach, the sensed data is collected straightway from the sensing nodes by the mobile sink [2].

This paper presents mobility based reactive protocol named “Mobility of Sink based Data Collection Protocol (MSDCP)”. In this protocol, the sensor nodes with high

energy and highest amount of data are picked as cluster heads which collect data from the common nodes within the cluster. This data is stored unless the mobile sink comes within the transmission region of the cluster heads and request for the aggregated data. One time the request is received the cluster heads move forward the data to the mobile sink. The paper is organized by presenting core related research readings in Section 2 and proposed research protocol in Section 3. The Section 4 details of simulations findings and results whereas paper is concluded in Section 5.

II. RELATED WORK

Younis [5] presents a protocol; (HEED) Hybrid Energy-Efficient Distributed clustering that periodically selects CH based upon their residual energy. The authors do not make any rule about the presence of infrastructure or node capabilities other than the availability of several power levels in sensor nodes.

III. PROPOSED WORK

A wireless sensor network consists of a collection of nodes V where v represents only node single $v \in V$. Every node is identifying by a unique identifier whereas every nodes communicate through full duplex. The cluster is a subgroup of V and other clusters cover the entire network.

a) MSDCP uses three types of nodes are

Normal nodes: Nodes that sense information from the surroundings.

Cluster-heads: The nodes accountable to collect data from the normal nodes.

Sink node: This Node collects data from the cluster heads and provide it to the outer world.

b) MSDCP Proceeding:

All the sensors are randomly deployed in the target sensing field; clustering is achieved where cluster heads are selected through election between sensors on the groundwork of both data stored and residual energy of involved sensors, the cluster heads are selected the normal nodes fellow themselves with the cluster heads and forward their sensed readings to that cluster heads within a cluster. The data is collected cluster heads forward their collected sensed readings to specialized mobile sink whenever it comes within the surround or with in the transmission range.

c) MSDCP Cluster Configuration:

The formation of the clusters for the sensor nodes is mainly based on selection of their cluster heads. Cluster heads must be selected in an optimal way. MSDCP selects the cluster heads by compute residual energy (E) and size of the sensed data (D) of the sensor nodes. Each node calculates a weight (W) being E and D and makes a decision of becoming a cluster head. The weight can be compute as:

$$W = (\alpha \times E) + (\beta \times D) + (\mu \times I) \quad (1)$$

Where, $0 < \mu < \beta < \alpha < 1$.

The weight (W) is a linear combination of E, D, and I, where E has greater proportion in weight computed by D and I, respectively. We have given energy the highest importance followed by size of the sensed data, two nodes have similar energy and data size. Once each node calculates its weight, a timer (T) (delay) is set for the broadcast of a clustering request message as per the following:

$$T = 1 / W \quad (2)$$

d) MSDHP Intra-cluster communication:

Once the clustering is performed and completed the remaining of the nodes combined themselves with the cluster heads and start reporting their sensed data to that respective cluster heads based on saved cluster-head ID. The cluster head on receiving the data performs aggregation and sends that data to available mobile sink normally when cluster head is within the transmission range to that mobile sink.

e) Mobile Sink Data Collection:

In MSDCP, the sink follows rectangular mobility model and cover the entire network crossing the clusters formed. It sends the data requests to cluster heads within the transmission range and collects the aggregated data. In this way the sink collects the aggregated data from the cluster heads. The data collecting phase depends on the speed of the mobile sink and is long enough in which a mobile sink can traverse throughout the network.

f) MSDCP Algorithm:

In aspect 1, clustering is done, which includes selection of cluster head. Aspect 2 carries out data gathering by CH from normal nodes. Aspect 3 is responsible for collecting data from cluster head through movement of mobile sink.

IV. RESULTS AND DISCUSSION

The comprehensive simulations have been organized to evaluate the performance of MSDCP using OMNET++ a simulator that uses INET framework. INET framework consists of simulation modules that are specially designed for wsn. The energy consumed in transmitting a k bit message over a distance d is calculated as:

$$\begin{aligned} ETx(k,d) &= ETx - elec(k) + ETx - amp(k, d) \\ ETx(k,d) &= E_{elec} * k + E_{amp} * k * d \end{aligned} \quad (3)$$

Similarly the energy consumed in receiving the message is calculated as

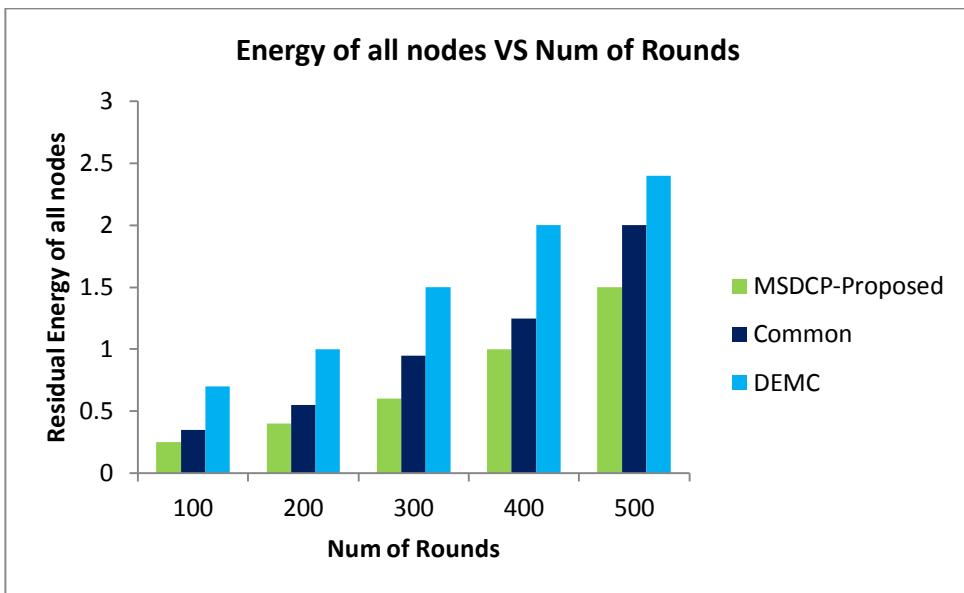
$$\begin{aligned} ERx(K) &= ERx - elec(k) \\ ERx(K) &= E_{elec} * k \end{aligned} \quad (4)$$

$$ERx(K) = E_{elec} * k$$

Where, ETx (k, d) represents, amount of energy that is needed to send k bit message over distance d meters. Similarly, ERx (k) represents the amount of energy that is needed to receive k bit message Moreover, E elec and E amp represents the amount of energy required for using the transceivers and amplifier, respectively.

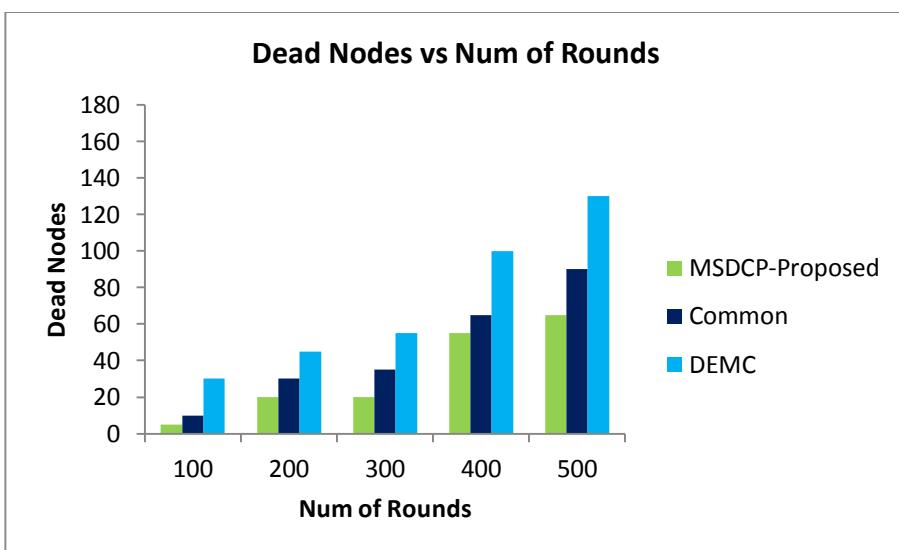
a) Sum of Residual Energy

Figure 3, shows the results for the Sum of residual energy absorb by all the sensor nodes with respect to variable number of rounds. As MSDCP and MSDCP-E are designed for static sensor network with mobile sink, the overall energy consumption is recorded to be low as compared to DEMC as DEMC is designed for static sink or base station.

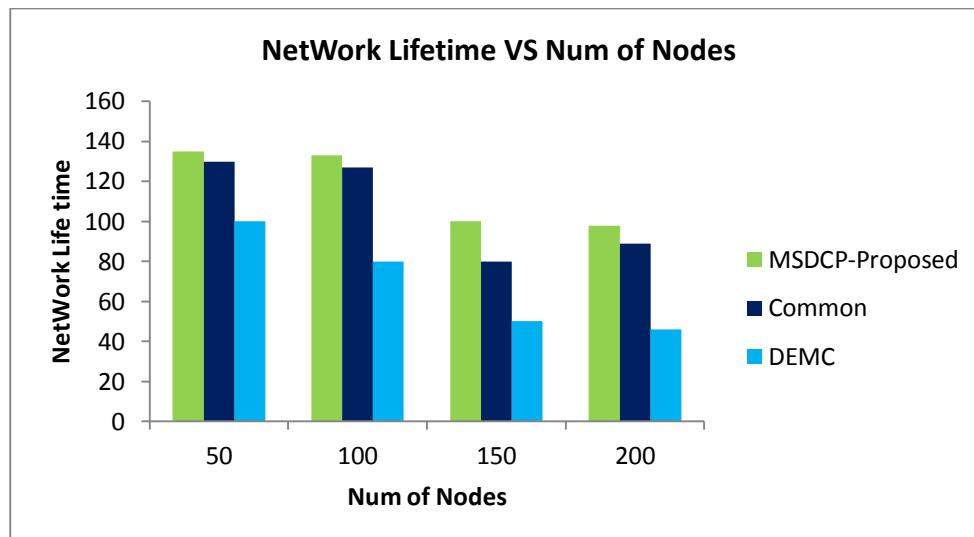


b) Number of Dead Nodes

Figure 4, shows the number of dead nodes with respect to variable number of rounds of the MSDCP, MSDCP-E and DEMC protocols. As projected in result and due to the fact that both MSDCP and MSDCP-E are based on similar sink mobility



MSDCP uses intelligent clustering mechanism that uses a single message for cluster formation. The cluster-head communicates with the sink only. It can be concluded that it also uses optimum number of clustering messages to achieve the required level of packet delivery ratio which does not exceed one. Under high mobility of the mobile sink, the packet loss may increases and the packet delivery ratio is affected.



V. CONCLUSION

This paper presents a novel scheme for wireless sensor networks. It is a fixed mobility based reactive protocol using clustering based on the amount of sensed data and residual energy. The motive behind this cluster formation was to extend network lifetime by reducing the intra-cluster and eliminating inter-cluster communications. Results show that MSDGP achieved less energy consumption and provided extended network lifetime through implementation of single message CH selection process and by introduction of mobile sink instead of static sink.

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