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Data Aggregation Energy and Probability Effects on the Performance of EDEEC and MODLEACH Protocol in WSN

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Abstract: WSNs are quickly gaining popularity due to they are potentially low cost solutions to a variety of real world challenges. They continue to grow day after day, so it needs the effective protocol mechanisms. There are various areas where research activities are going on in Wireless sensor networks. Data-centric technologies are needed that perform in network aggregation of data to yield energy-ef?cient dissemination. We examine changes of data aggregation energy and probability effects on the performance of Enhanced Distributed Energy Efficient Clustering (EDEEC) and Modified Low Energy Adaptive Clustering Hierarchy (MODLEACH) protocols. Our study uses Dead Nodes, Alive Nodes, Packet sends to BS Nodes and Count of Cluster Heads as a parameters. These parameters have been affected and changed with different data aggregation energy and probability. In this research work the results and observations made from the analyses of results about these protocols are presented.

Keywords: WSN, Data Aggregation Energy, Probability, Dead nodes, Alive nodes, Packet sends_to_BS and Count of _CH

1 Introduction

Progress of work in Wireless sensor Networks (WSNs) has been enabled the designers to create autonomous sensors, which deployed randomly, with no human direction, for the purpose of sensing and communicating worthy data. Different energy-efficient routing protocols are developed for WSNs based on clustering structure. Sensors in WSNs are usually battery operated sensing devices with limited energy resources. So that energy is one of the most important issues and designing power-efficient protocols is vital for prolonging the lifetime and performances of the system. WSNs have been considered for certain applications with limited power, reliable data transfer, short range communication, and reasonably low cost such sensing applications [1]. Data aggregation has been put forward as an essential paradigm for wireless routing in sensor networks [2,3]. The idea is to combine the data coming from different sources en route eliminating redundancy, minimizing the number of transmissions and thus saving energy. This paradigm shifts the focus from the traditional address-centric approaches for networking (Ending short routes between pairs of addressable end-nodes) to a more data-centric approach (Ending routes from multiple sources to a single destination that allows in-network consolidation of redundant data). A routing protocols have originated since the development of this field in which LEACH [4], TEEN [5], M-SEP [6] and PEGASIS [7] are some of them. LEACH, of them, proved to be more promising and became a bench-mark in the designing of other protocols like A-sLEACH [8], Enhanced LEACH [9], LEACH-CC [10], Ad-LEACH [11] and MODLEACH [12] are some of them. The protocol Enhanced Modified LEACH (EMODLEACH) is a reactive protocol which is implemented in homogeneous network model. The concept of Efficient Cluster head Replacement scheme and Dual transmitting power level scheme of MODLEACH along with the concept of Efficient Intra Cluster transmission Scheme of TEEN in LEACH has been implemented. We analyzed their effect on the performances of the network mathematically and verified with the help of simulation. The result clearly indicates that the EMODLEACH protocol outperforms better network lifetime, packet transmitted to the Base Station, less dead nodes at each

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round, less energy loss per round and greater average energy of each node. The analysis helps particular wireless sensor networks applications. The LEACH protocol stand for ? Low Energy Adaptive Clustering Hierarchy [13] is TDMA based MAC protocol with the idea of low energy consumption to maintain cluster and extending the life of the WSN. The MODLEACH is ?Modified Low Energy Adaptive Clustering Hierarchy [14] which is a variant of LEACH while having the efficient head replacement scheme and dual transmission power level which will help in the energy conservation of the wireless sensor network. This paper is organized as follows. Section 2 introduces a related work, section 3 describes the simulation and discussion, section 4 conclusions and section 5 references of the paper.

2 Overview of MODLEACH Protocol

Our work is based on LEACH protocol that can be extended to SEP and DEEC. Basically, we introduce two techniques to raise network life time and throughput. To understand our proposed scheme, we have to understand mechanism given by LEACH. This protocol changes the cluster head at every round and once a cluster head is formed, it will not get another chance for next $\frac{1}{p}$ rounds. For every round, cluster heads are replaced and whole cluster formation process is undertaken. We, in this work, modify LEACH by introducing ?ef?cient cluster head replacement scheme?. It is a threshold in cluster head formation for very next round. If existing cluster has not spent much energy during its tenure and has more energy than required threshold, it will remain cluster head for the next round as well. This is how, energy wasted in routing packets for new cluster head and cluster formation can be saved. If cluster head has less energy than required threshold, it will be replaced according to LEACH algorithm.

3 Overview of EDEEC Protocol.

Enhanced Distributed Energy Efficient Clustering (E-DEEC) scheme is based on DEEC with addition of super nodes. Parul Saini and Ajay.K.Sharma [15] extended the DEEC to three-level heterogeneity. the results of their test show that E-DEEC performs better than SEP which is too extended to three-level scheme.

4 Simulation and Discussion

Simulations are conducted using MATLAB (R2015a) and to get precise plots, con?dence interval is taken. Simulations show that MODLEACH performs better considering metrics of throughput, network life time, and optimized cluster head formation of network. MODLEACH is further improved by using the concept of soft and hard threshold as introduced by TEEN. MODLEACHHT further improve effciency however, MODLEACHST performs best amongst all.

Table 1: Title here

S. No.	Parameters	Values
1	Network Area	300*300
2	Number of Nodes	1000
3	Cluster head Probability	0.01, 0.5, 0.1, 0.2
4	Basestation Location	(150,150)m
5	Transmiter Energy	$50*10^{-8}$
6	Reciever Energy	$50*10^{-8}$
7	Aggregation Energy	$5*10^{-8}, 10*10^{-8}, 20*10^{-8}, 50*10^{-8}, 100*10^{-8}$
8	Amplification Energy	$0.0013*10^{-8}$
9	Number of Rounds	3000
10	Hard Threshold	100
11	Soft Threshold	2

First simulation depicts the effects of Data Aggregation Energy $5 * 0.000000001, 10 * 0.000000001, 20 * 0.000000001, 50 * 0.000000001, 100 * 0.000000001$ changes on Dead Nodes, Alive Nodes, Packet sends to BS Nodes, Count of Cluster Head per round during 3000 rounds and 1000 nodes and 0.1 probability We refer to Data Aggregation Energy in our paper as (DAE).

Table 2: DAE of MODLEACH.

DAE	Dead node	Allive node	Packet-to-CH	Packet-to-BS
$5*10^{-8}$	1000	0	854196	95499
$50*10^{-8}$	1000	0	629636	70573
$100*10^{-8}$	1000	0	491035	55323

Table 3: DAE of EDEEC.

DAE	Dead node	Allive node	Packet-to-CH	Packet-to-BS
$5*10^{-8}$	0	898	408129	751584
$50*10^{-8}$	923	77	353100	680450
$100*10^{-8}$	918	82	319686	678236

Table 4: probability of cluster head in EDEEC.

Probability	Dead node	Allive node	Packet-to-CH	Packet-to-BS
0.01	905	95	767760	536367
0.05	910	90	854084	419357
0.1	898	102	397363	720828
0.2	899	101	125699	972410

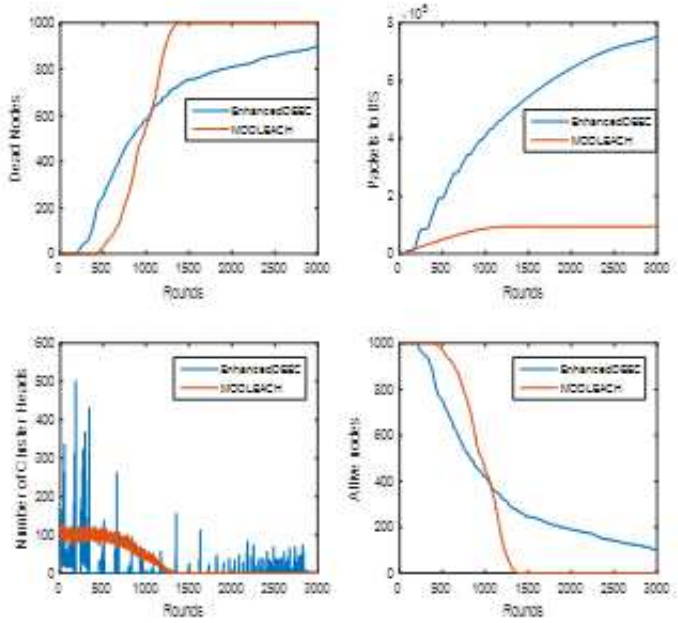

Fig. 1: Data aggregation is 5*0.000000001

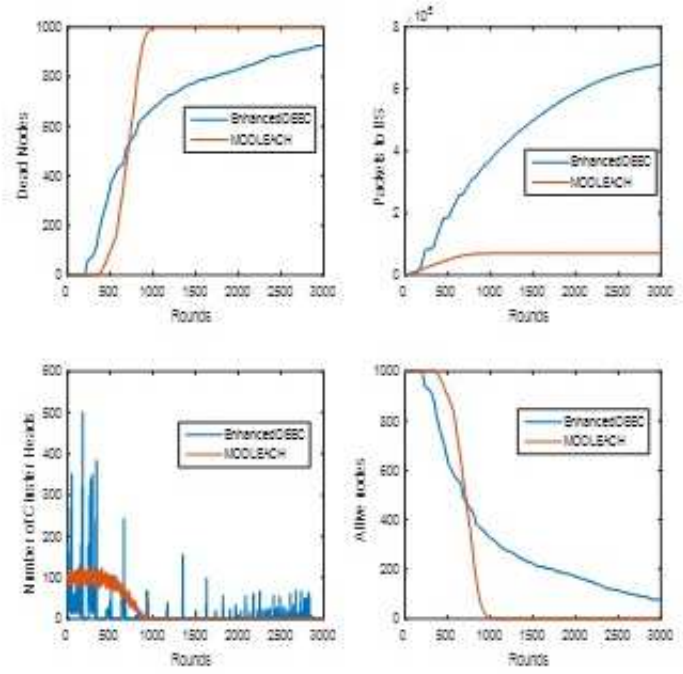

Fig. 2: Data aggregation is 50*0.000000001

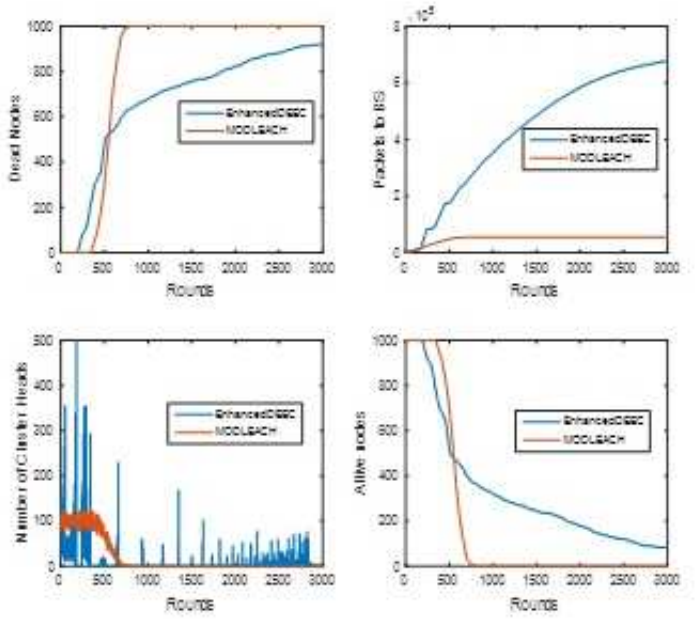

Fig. 3: Data aggregation is 100*0.000000001

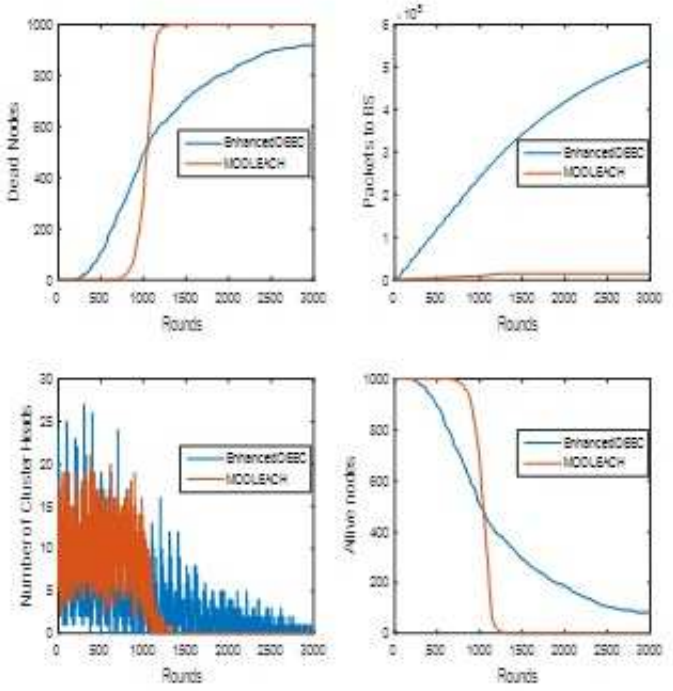

Fig. 4: Probability of cluster head is 0.01

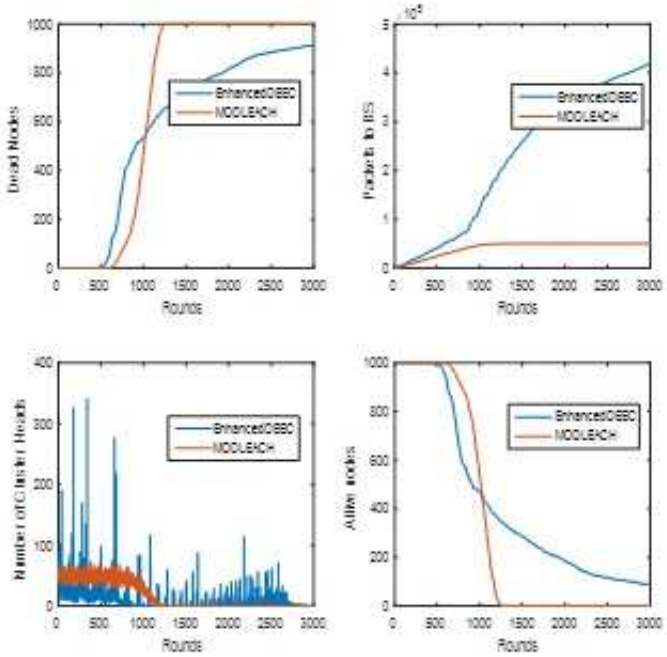

Fig. 5: Probability of cluster head is 0.05

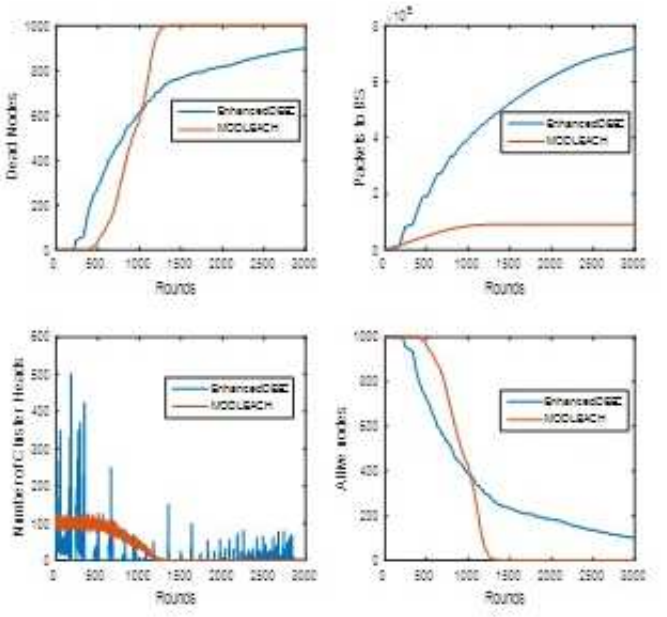

Fig. 6: Probability of cluster head is 0.1

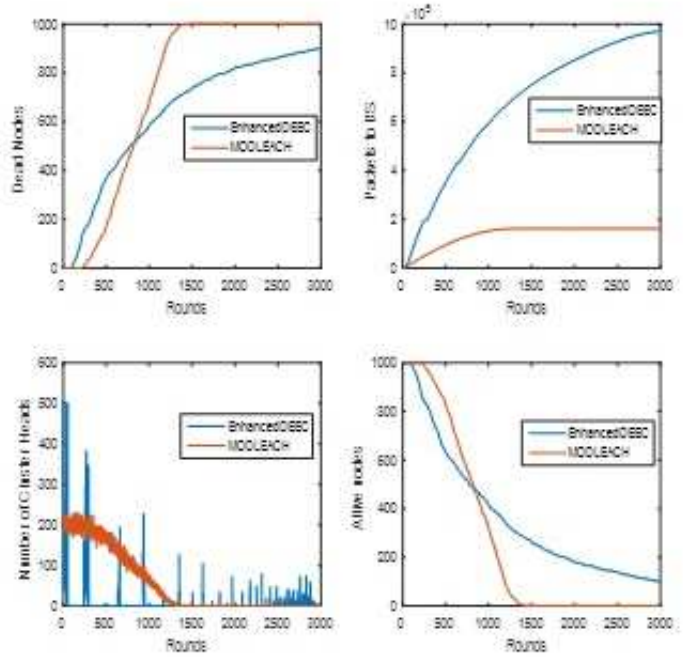

Fig. 7: Probability of cluster head is 0.2

Table 5: probability of cluster head in MODLEACH.

Probability	Dead node	Allive node	Packet-to-CH	Packet-to-BS
0.01	1000	0	1010703	13884
0.05	1000	0	944415	50558
0.1	1000	0	817993	91801
0.2	1000	0	648531	162824

As the result from figures and tables we say that the DAE (Data Aggregation Energy) effects clearly on the performance of EDEEC as a heterogeneous protocol and MODLEACH as homogeneous protocol which by increasing DAE Dead nodes , PACKETS_TO_CH, PACKETS_TO_BS and alive network nodes are decreased.

Second simulation effects of probability of node in cluster head changes P=0.01, p=0.05, P=0.1 , p=0.2 , Data Aggregation Energy 10*0.000000001 this changes on Dead Nodes, Alive Nodes, Packet sends to BS Nodes, Count of Cluster Head per round during 3000 rounds and 1000 nodes. As the result from figures and tables we say that the the probability of node cluster head effects clearly on the performance of EDEEC as a heterogeneous protocol and MODLEACH as homogeneous protocol which by increasing the probability PACKETS_TO_CH is decreased with increasing probability and PACKETS_TO_BS and alive network nodes are increased. Both of probability of node in cluster head and Data Aggregation Energy have clear effects on the performance of EDEEC and MODLEACH protocols and we could say that this effect also on homogeneous and heterogeneous protocols performance. It must be consideration when develop these protocols.

5 Conclusion

Wireless sensor networks are an important type of resource-constrained distributed event-based systems. We have modeled and analyzed the performance of data aggregation in such networks. The modeling tells us that whether the sources are clustered near each other or located randomly, signi?cant energy gains are possible with data aggregation. These gains are greatest when the number of sources is large, and when the sources are located relatively close to each other and far from the sink. The modeling, though, also seems to suggest that aggregation latency could be non-negligible and should be taken into consideration during the design process. The modeling also seems to suggest that the probability of node in cluster head must be taken into consideration during the process design. these protocols will be effective for applications those are time critical by nature.

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