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DISTRIBUTED ENERGY EFFICIENT CLUSTERING BASED PERFORMANCE MEASURE IN WIRELESS SENSOR NETWORKS

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Abstract: ***The*** **WSN is a battery operated network with energy consumption as main constraint. The sensing information must be obtained in an efficient manner for the long lifetime of sensor network. This paper evaluates the performance of DEEC clustering algorithms on the basis of stability period, network life time and throughput for different level of heterogeneous wireless sensor networks. We analysis the performance of protocol on the basis of prolonging stability period, network life time of nodes alive during rounds for numerous three level heterogeneous networks. Information from sensor nodes is forwarded to cluster heads (CHs) and these CHs are responsible to transmit this information to base station (BS) which is placed far away from the field. In heterogeneous WSN, we use parameters mentioned as Network field, Number of nodes, Message size, initial energy of normal nodes, and threshold distance for different protocols deployed in WSN and estimate the performance for three level heterogeneous WSNs**

Keywords— **Wireless Sensor Network, Clustering, Routing Protocols**

I. INTRODUCTION

Due to recent technological advances, the manufacturing of small and low-cost sensors has become technically and economically feasible. These sensors measure ambient conditions in the environment surrounding them and then transform these measurements into signals that can be processed to reveal some characteristics about phenomena located in the area around these sensors. A large number of these sensors can be networked in many applications that require unattended operations, hence producing a wireless sensor network (WSN) [1]. In fact, the applications of WSNs are quite numerous. For example, WSNs have profound effects on military and civil applications such as target field imaging, intrusion detection, weather monitoring, security and tactical surveillance, distributed computing, detecting ambient conditions such as temperature, movement, sound, light, or the presence of certain objects, inventory control, and disaster management. Deployment of a sensor network in these applications can be in random fashion (e.g., dropped from an airplane in a disaster image of owners' license information and to track illegal copies. management application) or manual (e.g., fire alarm sensors in a facility or sensors planted underground for precision agriculture). Wireless sensor networks consist of individual nodes that are able to interact with the environment by sensing or controlling physical parameters. These nodes have to collaborate to fulfill their tasks. The nodes are interlinked together and by using wireless links each node is able to communicate and collaborate with each other [1].

The cluster formation process eventually leads to a two-level hierarchy where the CH nodes form the higher level and the cluster-member nodes form the lower level. The sensor nodes periodically transmit their data to the corresponding CH nodes. The CH nodes aggregate the data (thus decreasing the total number of relayed packets) and transmit them to the base station (BS) either directly or through the intermediate communication with other CH nodes. However, because the CH nodes send all the time data to higher distances than the common (member) nodes, they naturally spend energy at higher rates. A common solution in order balance the energy consumption among all the network nodes is to periodically re-elect new CHs (thus rotating the CH role among all the nodes over time) in each cluster [4]. The BS is the data processing point for the data received from the sensor nodes, and where the data is accessed by the end user. It is generally considered fixed and at a far distance from the sensor nodes. The CH nodes actually act as gateways between the sensor nodes and the BS. The function of each CH, as already mentioned, is to perform common functions for all the nodes in the cluster, like aggregating the data before sending it to the BS. In some way, the CH is the sink for the cluster nodes, and the BS is the sink for the CHs. Moreover, this structure formed between the sensor nodes, the sink (CH), and the BS can be replicated as many times as it is needed, creating (if desired) multiple layers of the hierarchical WSN [4].

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II. ROUTING IN WSN

Routing in wireless sensor networks differs from conventional routing in fixed networks in various ways. There is no infrastructure, wireless links are unreliable, sensor nodes may fail, and routing protocols have to meet strict energy saving requirements. Many routing algorithms were developed for wireless networks [6]. These protocols have further various classification such as in data centric protocols consists flooding and gossiping, SPIN, direct diffusion; in hierarchical, it contains LEACH, PEGASIS ,TEEN; and in location based: GEAR and GAF etc. Now, hierarchical routing is further explain in this section. A hierarchical approach breaks the network into clustered layers. Nodes are grouped into clusters with a cluster head that has the responsibility of routing from the cluster to the other cluster heads or base stations. Data travel from a lower clustered layer to a higher one. Although, it hops from one node to another, but as it hops from one layer to another it covers larger distances. This moves the data faster to the base station. Clustering provides inherent optimization capabilities at the cluster heads [7].

III. PROPOSED SYSTEM

The Distributed Energy Efficient Clustering (DEEC) in wireless sensor network is present. Simulation is presented using Matlab. We simulate different clustering protocols in heterogeneous WSN using MATLAB and for simulations we use different nodes randomly placed in a field of dimension 50m×50m. For simplicity, we consider all nodes are either fixed or micro-mobile and ignore energy loss due to signal collision and interference between signals of different nodes that are due to dynamic random channel conditions.

a. Performance criteria

Performance parameters used for evaluation of clustering protocols for heterogeneous WSNs are lifetime of heterogeneous WSNs, number of nodes alive during rounds and data packets sent to BS.

1. ***Lifetime*** is a parameter which shows that node of each type has not yet consumed all of its energy.
2. ***Number of nodes alive*** is a parameter that describes number of alive nodes during each round.
3. ***Data packets sent to the BS*** is the measure that how many packets are received by BS for each round.

b. Distributed Energy Efficient Clustering (DEEC) in heterogeneous wireless sensor network wth 5000 number of rounds and 150 nodes

Following Design parameters are chosen to perform the analysis of the Distributed Energy Efficient Clustering (DEEC) in heterogeneous wireless sensor network.

Parameters	Values
Network field (Size)	**50m * 50m**
Initial Energy of normal node (E_o)	**0.8 J**
P_{opt}	**0.1 J**
E_{fs}	**10nJ/bit/m2**
Number of nodes	**150**
message size	**5000 bit**
EDA	**5nJ/bit/ signal**
E_{elec}	**50 nJ/bit**
Transmit amplifier (E_{amp})	**0.0013 pJ/bit/m4**
Threshold distance (d_o)	**70m**

Table: 1 Design parameter

In this example, we analysis the performance of Distributed Energy Efficient Clustering (DEEC) in heterogeneous wireless sensor network along with 5000 number of rounds and 150 nodes.

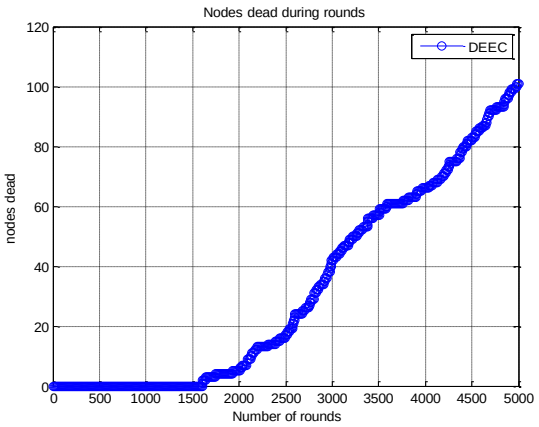

Fig. 1 Dead Nodes during 5000 rounds and 150 nodes

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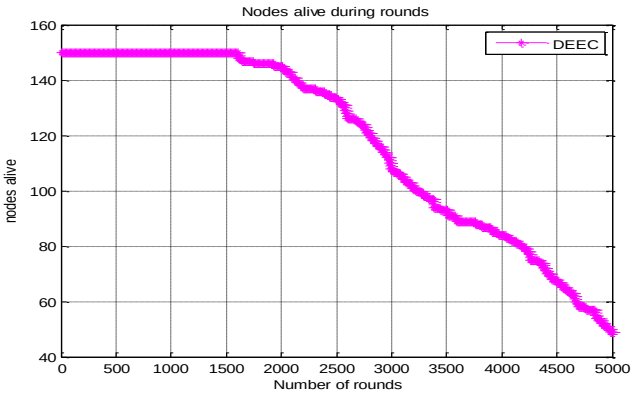

Fig. 2 Alive Nodes during 5000 rounds and 150 nodes

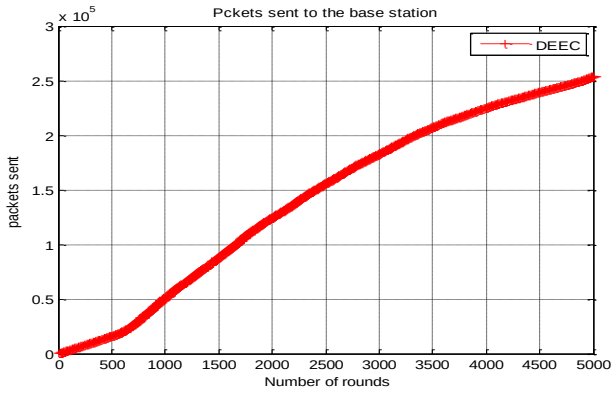

Fig. 3 Packet sends to BS Nodes during 5000 rounds and 150 nodes

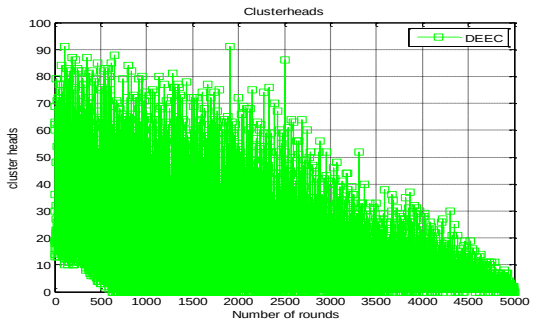

Fig. 4 Count of Cluster Head per round during 5000 rounds and 150 nodes

IV. CONCLUSION

In many critical applications WSNs are very useful such as military surveillance environmental, traffic, temperature, pressure, vibration monitoring and disaster areas. All the nodes have to send their data towards BS often called as sink. Usually nodes in WSN are power constrained due to limited battery, it is also not possible to recharge or replace battery of already deployed nodes and nodes might be placed where they cannot be accessed. Nodes may be present far away from BS so direct communication is not feasible due to limited battery as direct communication requires high energy. Clustering is the key technique for decreasing battery consumption in which members of the cluster select a Cluster Head. It has been evaluated the performance of Distributed Energy Efficient Clustering algorithms on the basis of stability period, network life time and throughput for heterogeneous WSNs. DEEC perform well under three level heterogeneous WSNs containing high energy level difference between normal, advanced and super nodes in terms of stability period.

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