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Variations in Rounds Keeping Same Density in Homogeneous and Heterogeneous LEACH

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Abstract— In Wireless Sensor network (WSN) the energy consumed by the cluster head and other nodes for communicate to each other. Due to randomness property in cluster head selection, any sensor node can become cluster head and also form uneven sized cluster. In large size cluster, member nodes need more energy for data transmission. More number of clusters in sensing field reduces the cluster size as well as energy consumption of cluster members. It can increase data transmission from cluster head to base station (Inter cluster communication) that consumes lot of energy in the larger area network. The network characteristics of existing classical clustering protocols for wireless sensor network are homogeneous. Clustering protocols fail to maintain the stability of the system, especially when nodes are heterogeneous. A homogeneous sensor network consists of identical nodes, while a heterogeneous sensor network consists of two or more types of nodes (organized into hierarchical clusters).

Index Terms—Wireless Sensor Networks (WSN), LEACH, Homogeneous , Heterogeneous .

I.INTRODUCTION

Wireless sensor network is collection of sensor nodes having limited resources. Sensor nodes are used to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. Sensor nodes communicate the information gathered through wireless links; the data is forwarded, possibly via multiple hops relaying, to a sink (sometimes denoted as controller or monitor) that can use it locally, or is connected to other networks (e.g., the Internet). The nodes are may be stationary or moving. They can be aware of their location or not. They can be homogeneous or not[1].

In this paper Leach- heterogeneous system in the individual clustering of the whole network, which is energy efficient routing method for WSNs and compared it with the normal Leach-Homogeneous system. Results from our simulations using MATLAB shows that Leach Heterogeneous System provides better performance in energy efficiency and increasing level in lifetime of the wireless sensor networks.

Thus we conclude that the heterogeneous wireless sensor networks are more suitable for real life applications as compared to the homogeneous counterpart. WSN is widely used to collect reliable and accurate information in the distance and hazardous environments, and can be used in National Defense, Military Affairs, Industrial Control, Environmental Monitor, Traffic Management, Medical Care, Smart Home [2]-[3]. Also, the network protocol should take care of other issues such as self-configuration, fault tolerance, delay, etc. [4]. In heterogeneous networks more than one and different types of nodes with different battery functionality are used. In heterogeneous network different topologies are used and this makes the network a very complex network. Thus in short, we can say that in case of heterogeneous sensor network there are two or more various types of network nodes along with different functionality and battery energy is used. The real motivation behind the heterogeneous networks is the need of extra battery energy and more complex hardware is embedded in some cluster heads, hence this reducing the overall cost of hardware for the remaining sensor network. But the fixing of cluster head nodes is nothing but the role rotation which is not possible longer [5]. In homogeneous networks all the sensor nodes are identical in terms of battery energy and hardware complexity. With purely static clustering (cluster heads once elected, serve for the entire lifetime of the network) in a homogeneous network, it is evident that the cluster head nodes will be over-loaded with the long range transmissions to the re- mote base station, and the extra processing necessary for data aggregation and protocol co-ordination. As a result the cluster head nodes expire before other nodes. However it is desirable to ensure that all the nodes run out of their battery at about the same time, so that very little residual energy is wasted when the system expires.

One way to ensure this is to rotate the role of a cluster head randomly and periodically over all the nodes as proposed in LEACH [6]. However the downside of using a homogeneous network and role rotation is that all the nodes should be capable of acting as cluster heads, and therefore should possess the necessary hardware capabilities. On the other hand, in a heterogeneous sensor network, two or more different types of nodes with deferent battery energy and functionality are used. The motivation being that the more complex hardware and the extra battery energy can be embedded in few cluster head nodes, thereby reducing the hardware cost of the rest of the network. How- ever fixing the cluster head nodes means that role rotation is no longer possible.

When the sensor nodes use single hop- ping to reach the cluster head, the nodes that are farthest from the cluster heads always spend more energy than the nodes that are closer to the cluster heads. On the other hand when nodes use multi-hopping to reach the cluster head, the nodes that are closest to the cluster head have the highest energy burden due to relaying Consequently there always exists a non-uniform energy drainage pattern in the network. LEACH divides the network into several clusters of sensors, which are constructed by using localized coordination and control not only to reduce the amount of data that are transmitted to the sink, but also to make routing and data dissemination more scalable and robust.

II.RELATED WORK

The WSN is used the two types of networks homogeneous and heterogeneous. The homogeneous mixture is a mixture where the components that make up the mixture are

uniformly distributed throughout the mixture. The heterogeneous mixture is a mixture where the components of the mixture are not uniform or have localized regions with different properties, but heterogeneous networks are more efficient than the homogeneous network in WSN. LEACH (Low-Energy Adaptive Clustering Hierarchy) [5] is a clustering-based protocol and one of the first hierarchical routing approaches for sensor networks that utilizes the randomized rotation of local cluster base stations to evenly distribute the energy load within the network of sensors. In LEACH, the cluster head (CH) nodes reduce the data arriving from nodes that belong to the particular cluster, and send an aggregated data to the base station in order to reduce the amount of information that must be transmitted to the base station. WSN is considered to be a dynamic clustering method. The dynamic is changing the network parameters. In LEACH, a data collection model is described as shown in fig 1. One hundred of homogeneous nodes are uniformly distributed in a 100m * 100m square region. This model is based on the military object tracking and hazards environment monitoring application background, where the base is often far from application area. Some assumptions are made that node can selected its transmission range and every node knows the positions of other nodes and itself. The selectable range assumption is closely based on the function of current sensor devices.

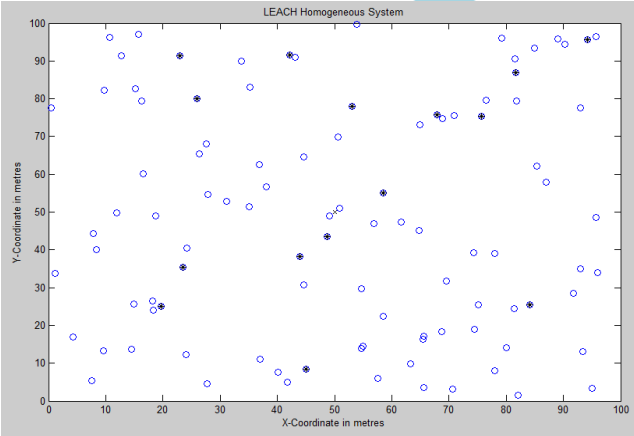

Fig.1: Initialization of the wireless sensor network

The network includes some of the initial setting of energy parameters and the initialization of the sensor nodes. So it is necessary to generate a random distribution of these nodes in the 100 *100 m^2 of the region (X=100, Y=100). Sink is located at (bs_x=50, bs_y=50). o indicates Normal nodes and dark o indicates CHs For homogeneous wireless sensor network system initialization all the available wireless sensor network nodes are having equal amount of initial energy E_o = 0.5J. In the LEACH, the CH is always on receiving data from cluster members, CH dies earlier than the other nodes in the cluster because of its operation of receiving, sending and overhearing.

When the CH die, the cluster will become useless because the data gathered by cluster nodes will never reach the

base station. In our protocol, besides transmitting data directly from CH to base station, CH sends data to the other cluster head which is inside a pre-defined radius, so that transmitting energy is less dissipated.

Table 1: Simulation Parameters

PARAMETER NAME	VALUES
Network area	$100m * 100\ m$
Number of nodes	100
Initial Energy (E_o)	0.5J
BS position	$50\ m * 50\ m$
E_{elec}	50nJ/bit
E_{tx}=E_{rx}	50nJ/bit
ε_{fs}	10pJ/bits/m2
ε_{mp}	0.0013pJ/bit/m^4
D_o	$sqrt(\varepsilon fs\ /\ \varepsilon mp)$
E_{DA}	5nJ/bit
Packet size	4000bits
Total nodes	100

III.SIMULATION RESULT

In the homogeneous LEACH When the number of rounds is 400 then all nodes are in live state Similarly as rounds leads to 800 all nodes are still alive in heterogeneous but 8 nodes dead in homogeneous.

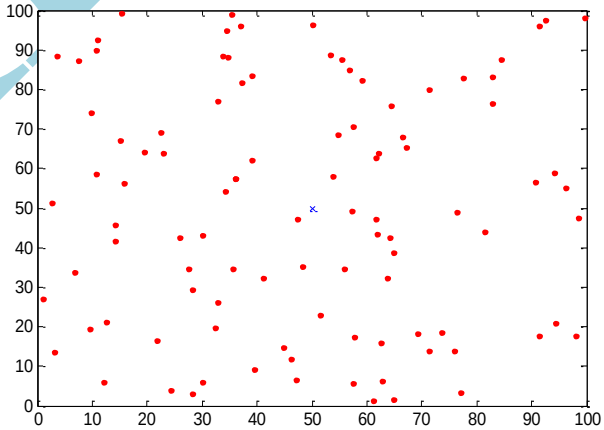

Fig.2. Simulation result after 3400 rounds in LEACH-Heterogeneous System. (All Nodes dead)

As the rounds proceeds up to 1600, 88 nodes start going into dead states in heterogeneous but 99 nodes dead in homogeneous. Up to 2000 rounds dead nodes are only 90 in heterogeneous and 100 nodes dead in homogeneous. At 3200 rounds 100 nodes are dead in heterogeneous. At the last in homogeneous LEACH after 2000 rounds almost all the nodes are dead while in heterogeneous LEACH after 3200 rounds the all nodes are in dead state. Simulation of parameters over the code analyzed shows that heterogeneous protocol performs better than homogeneous type. The graphical representation of the comparison over Number of Rounds and Number of Alive Nodes is shown in graph above.

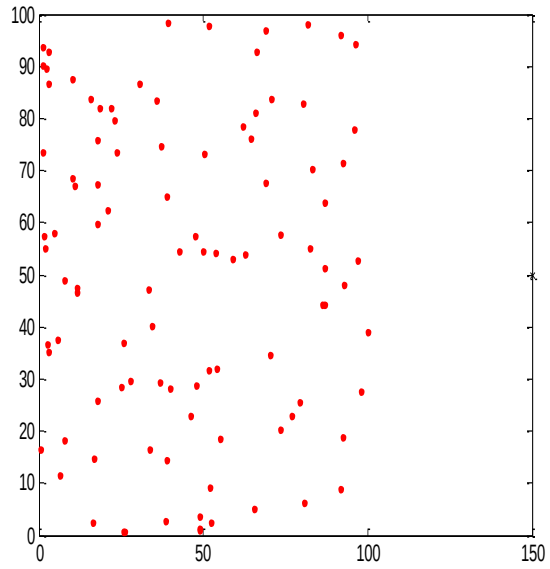

Fig.3. Simulation result after 2200 rounds in LEACH-Homogeneous System. (All Nodes dead)

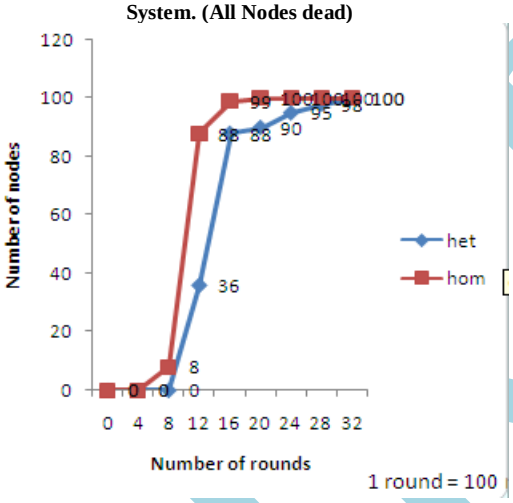

Fig.4.Graph when the number of rounds varies as well as number of dead node also increase

We have the area for the X and Y in meters but number of nodes is same in Heterogeneous and Homogeneous LEACH. In this if we have an area of 100*100 then the total numbers
of nodes are 100.At the last we draw a graph in which we draw. A graph when the number of rounds are increase then the number of node are also increase. In this graph there is a total number of dead node also increase if we increase the number of rounds. Here 1 round = 100 rounds, our rounds start from 0.

IV. CONCLUSIONS

Wireless sensor networks are not always homogeneous, they may be heterogeneous too. Clustering is a good technique to reduce energy consumption and to provide stability in wireless sensor networks. Note that further increasing of the number of nodes in the heterogeneous system and the area does improve the network lifetime considerably. We classified all protocols according to stability and energy efficiency of network. For future work, a model with high density of heterogeneous wireless sensor nodes with its topology is proportionately increased according to the application to have good energy efficient and increasing lifetime network may be investigated. This may try to implement in ns2 and MATLAB with stable and mobile mode of the system. We will increase network lifetime and fault-tolerance with putting high power sensors as a gateway between cluster head and sink.

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