Efficiency of LEACH Improve by Reducing Cost Complexity of Nodes in WSN

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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. The communication in WSN is made between CH and BS for data transfer. A large a number of sensor is effective for gathering the data in Varity of environment and sensed data is gathered and transfer to the base station for further processing to meet end user queries. 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. 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 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. LEACH use Homogenous or heterogeneous sensor network and find the cost complexity .Simulation result using MATLAB are shows that the proposed Leach heterogeneous system significantly reduce energy consumption and increase total lifetime of wireless sensor network but the cost complexity is increases compared to homogenous LEACH protocol this show using some factors like magnitude, phase response, filter Information, round noise spectrum.

Key words: Wireless Sensor Networks (WSN), LEACH, Homogeneous, Heterogeneous, Magnitude, Phase response, Round Noise Spectrum, Filter Information

I. INTRODUCTION

Wireless sensor network (WSN) consists of small in size sensor nodes, which form an ad-hoc distributed sensing [1] and data propagation network to collect the context information on the physical environment 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. 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]. 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 .A general-purpose computer program which is capable of designing a large class of optimum (in the mini max sense)FIR linear phase digital filters. The program has options for designing such standard filters as low-pass, high-pass, band pass, and band stop filters, as well as multi pas band-stop band filters, differentiators, and Hilbert transformers[4] 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 remote base station, and the extra processing necessary for data aggregation and protocol co-ordination. That the delay is fractional — the discrete-time samples are not exactly reproduced in the output.

The fractional delay can be interpreted in this case as a delay of the underlying continuous-time cosine signal. 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. 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. However fixing the cluster head nodes mean 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. 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.

In this we have define the complexity of LEACH by using some factors and compare that factor in both homogenous and heterogeneous network. 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 we have to be measure complexity by compare there implementation cost in both homogenous or heterogeneous factor like number of multiplier or adder used during data transfer and it can b given in magnitude ,phase response or both nd show there round noise spectrum at there various analysis parameter values. 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. 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.

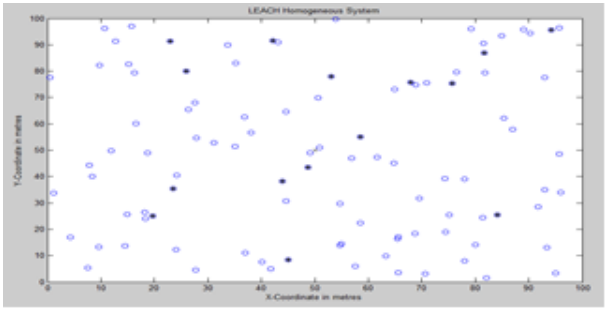

Fig. 1: Initialization of the Wireless Sensor Network

III. SIMULATION RESULT

The plot of frequency response, magnitude and phase of frequency response(sys) creates a plot of the frequency response of a dynamic system model sys. The plot displays the magnitude (in dB) and phase (in degrees) of the system response as a function of frequency. When sys is a multi-input, multi-output (MIMO) model, bode produces an array of Bode plots, each plot showing the frequency response of one I/O pair. bode automatically determines the plot frequency range based on system dynamics. [mag, phase] = (sys,w) returns magnitudes mag in absolute units and phase values phase in degrees. The response values in mag and phase correspond to the frequencies specified by w as follows: Response frequencies, returned as a row vector of frequency points. Frequency values are in radians per Time Unit, where Time Unit is the value of the Time Unit property of system. In the homogeneous LEACH When the number of rounds is 2 that mean value of rmax=2 then all nodes are in live state and their magnitude and phase response gives filter information is the terms of filter structure , filter Length ,linear phase or their implementation cost like number of multipliers ,number of adder, number of states is low in case of homogenous Leach .Similarly as rounds value also taken as 2 in case of heterogeneous but the equivalent result or cost complexity is different in heterogeneous .In heterogeneous implementation cost in the terms of multiplier ,adder or states uses is high .So both case the filter information is calculated as various analysis it can b calculated from magnitude only are from phase response or from both .here we have taken result simulation from Magnitude and Phase Response show result in pulses and simulation result show for both Homogenous or Heterogeneous Protocol. And there filter information and round spectrum noise response result also show that help in define cost factor for Homogenous or Heterogeneous LEACH. In LEACH various type of clustering routing algorithim is uses for calculation during data transfer between CH and BS[6].

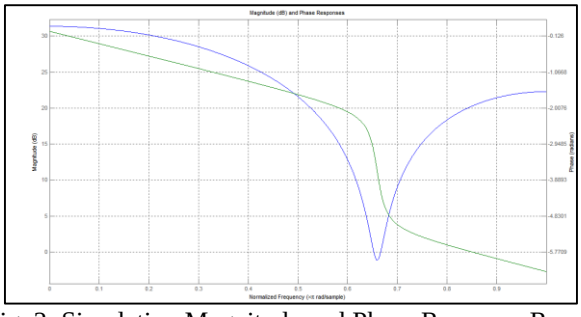

Fig. 2: Simulation Magnitude and Phase Response Result when Rmax=2 in Homogenous LEACH


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Discrete-Time FIR Filter (real)
-------------------------------
Filter Structure  : Direct-Form FIR
Filter Length     : 3
Stable            : Yes
Linear Phase      : No

Implementation Cost
Number of Multipliers            : 3
Number of Adders                 : 2
Number of States                 : 2
Multiplications per Input Sample : 3
Additions per Input Sample       : 2
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Fig. 3: Filter information of magnitude and phase response Define cost complexity in Homogenous LEACH

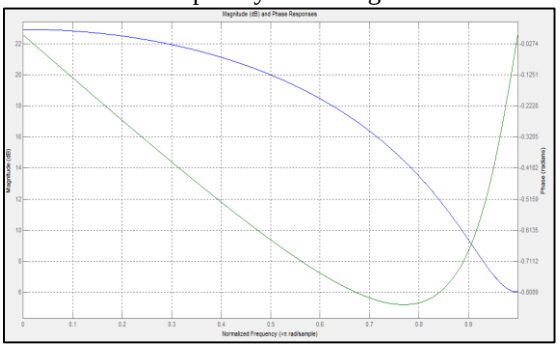

Fig. 4: Simulation Magnitude and Phase Response Result when Rmax=2 in Heterogenous LEACH

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Discrete-Time FIR Filter (real)
-------------------------------
Filter Structure  : Direct-Form FIR
Filter Length     : 2
Stable            : Yes
Linear Phase      : No

Implementation Cost
Number of Multipliers            : 2
Number of Adders                 : 1
Number of States                 : 1
Multiplications per Input Sample : 2
Additions per Input Sample       : 1
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Fig. 5: Filter information of Magnitude and Phase Response Define Cost Complexity in Heterogenous LEACH

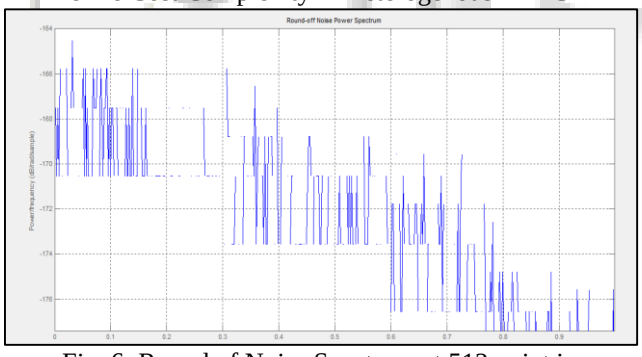

Fig. 6: Round of Noise Spectrum at 512 point in Homogenous LEACH

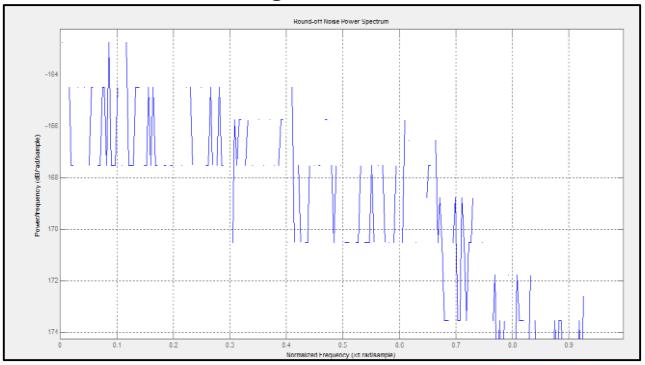

Fig. 7: Round of Noise Spectrum at 256 point in Homogenous LEACH

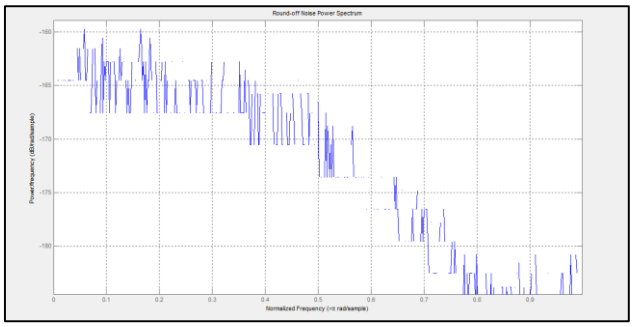

Fig. 8: Round of Noise Spectrum at 512 point in Heterogeneous LEACH

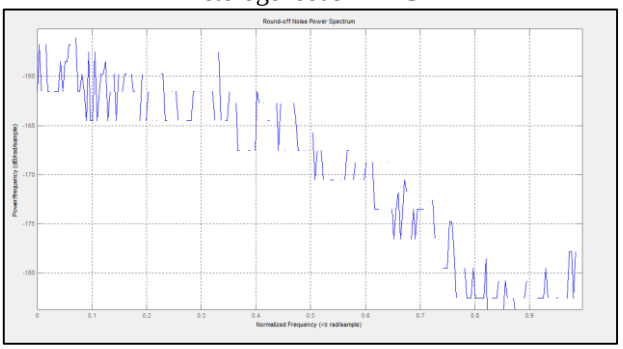

Fig. 9: Round of Noise Spectrum at 256 point in Heterogenous LEACH

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 but this factor also effect cost complexity which should be increases and decreases. We classified cost factor in both Homogenous and Heterogeneous LEACH by there implementation cost of both is compare for define among these two which one have higher complexity. Homogenous have a less implementation cost compare to Heterogeneous but the better lifetime of sensor nodes efficiently given by Heterogeneous LEACH. 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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