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AN ENHANCED CLUSTER (CH-LEACH) BASED ROUTING SCHEME FOR WIRELESS SENSOR NETWORK

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Abstract - In Past year WSN network is used in many real time applications. The real time applications raise various fundamental problems like limited energy resources, network life time, etc. The growth of the WSN is increase day by day. In WSN has a plenty of sensor nodes. Sensor nodes are deployed to monitor the real worlds which are transmitting the sensed data to Base station. The main problem in WSN is the sensors are having limited lifetime and more energy consumption to transmit the data to Base station. This is the one of the challenge in WSN. To improve the network life time and reduce energy consumption to use clustering technique. Clustering is a process of grouping the sensor nodes into cluster. The objective of clustering is to increase the network scalability, energy efficient, etc. in this paper we propose CH-LEACH we present architecture schemes and evaluate. It's performance using analytical study and simulations. The evaluation is based on the most critical metrics in WSNs such as network lifetime, Energy-Efficient (Energy Consumption). The evaluation and comparison with existing solutions show that our proposed CH-LEACH exhibits a reduction in energy consumption over LEACH and DEEC.

Key Words: WSN, life time, CH-LEACH, Energy Consumption, DEEC

1. INTRODUCTION

In recent years WSN is an emerging area. WSN is an interconnection of devices in wirelessly. The WSN has been used in various areas like military and civilian application. Sensor nodes are randomly deployed in an environment and sense the real world. These sensor nodes are having limited capability such small power unit, small memory, low computation and low processing. The important parameter of sensor is lifetime. The sensor nodes are generates an enormous amount of data. Sensor nodes send the sensed data to base station to further operation. These sensor nodes are grouped often into cluster. Sensors are used to monitor the real world environment and transmit the sensed information to base station.

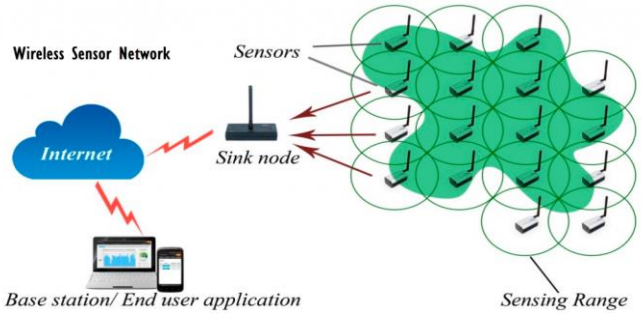

Fig -1: WSN Structure

If each and every sensor starts to communicate and engage in data transmission in the network the great data congestion and collision will be experienced. The clustering is method to overcome these problems. WSN has some algorithms to solve these routing problems. Some of routing algorithms are try to increase the network lifetime and reduce the energy consumption. The routing algorithms are LEACH, HEED, PIHASIS, DEEC, SEP, LCA, TASC, etc. These algorithms have the goals to increase the network energy and provide scalability.

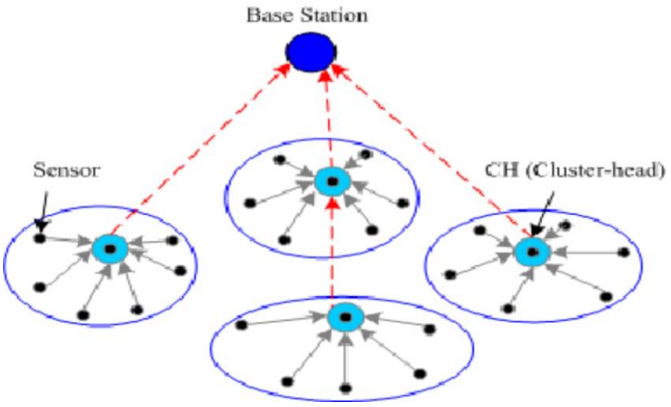

Fig -2: WSN Clustering

In clustering concept each cluster has a coordinator referred to as a cluster head and a number of member nodes. The WSN contain two types of communication such as inter-cluster communication among the nodes in a same cluster and the intra-cluster communication among the nodes in a different cluster. But the intra clustering reduces the battery drainage of a node.

2. RELATED WORK

LEACH is the most popular significant cluster based protocols. In WSN more cluster based protocols are proposed to improve the network lifetime and reduce the energy consumption.

2.1 LEACH (Low Energy Adaptive Clustering Hierarchy)

The main aim of this LEACH protocol is to minimize the global energy consume by the nodes and increase the network lifetime. The loads are distributed to nodes over a period of time. LEACH is one of the hierarchical routing protocols in terms of energy efficient. The LEACH works with various rounds. The functions of LEACH are divided into two types of loop. One is setup phase and another one is steady phase. Setup phase performs a clustering and select cluster head. During the steady phase the sensor nodes are communicate to Cluster head. In setup phase making a cluster and the sensor nodes are distributed onto some cluster dynamically.

The cluster heads are elected as randomly in a cluster node for each cluster. If making cluster an integer in the series of 0 to 1 is elected randomly and same linked with the threshold t(h). This node is make it as a cluster head for the current round. When chosen value <t(h) else the nodes act as a child or cluster member. The threshold t(h) equation is

$$t(h)\begin{cases} \dfrac{p_b}{(1 - p_b * \left[r_n \bmod \left(\frac{1}{p_b}\right)\right])} & if\ h \in G1 \\ 0 & otherwise \end{cases}$$

Where p_b is amount of the CH nodes between all the nodes, r_n is the number of round, G_1 is the group of nodes not yet have been CH node throughout the first $\frac{1}{P_b}$ rounds.

After forming cluster and chosen of cluster head the CH will broadcasting and send advertisement message to all other nodes. In steady phase the nodes are communicate to CH for sending their message. The communication is based on the TDMA Signal. After that the CH will communicate to Base station to send and receive the information.

2.2 DEEC (Distributed Energy Efficient Clustering)

DEEC is one of the heterogeneous wireless sensor network protocols. In DEEC cluster head selection is based upon the probability of remaining energy of each nodes and average energy of the network. The nodes which having high energy has a high probability to become a cluster head. Less energy nodes are referred as a cluster member. The DEEC protocol is based on the LEACH but the cluster head selection is different. As we know the SEP protocol we have two types of node such as normal node and advanced node. Which helps in selection of cluster but it fails in multi-level heterogeneous network environment.

In DEEC uses a probability based ratio between residual energy of the node and the average energy of the system. The DEEC having got limitation that the advanced nodes always get penalize as when the residual energy reduced and become equal to that of the normal nodes. The advanced node will die fast than the other nodes.

3. PROPOSED APPROACH

In this section discussed the proposed work model. In this present explain the concept of proposed network model. Assume the network is formed with randomly deployed a sensor in the environment. All the nodes are having same identical sensing, communication capabilities and same initial energy.

3.1 Energy Efficient Cluster Formation

The basic Idea is to uniformly distribute the load among all sensor nodes. The proposed CH-LEACH routing protocol including optimal number of cluster heads, residual energy, average distance and closer node near to Bas station. Proposed algorithm is used to find the lifetime of sensor nodes in terms of rounds in network. If sensor nodes drops to zero energy ignored for next round of CH election in the network.

In each round the CH-LEACH randomly select certain number of nodes as these nodes are nearest to centroid in their cluster region. The following steps describe the process.

1. Generate n points cluster center the number of cluster required n.
2. Set the data points. In this case the data points will assign to location of the nodes in every cluster area required.
3. The cluster center (centroid) in each area will assign to nearest node by calculating the mean value of the nodes location (data points) in each cluster.
4. This node will become the cluster head if it has enough energy means above the threshold set.
5. Repeat this step when assigning node that is near to the cluster center not able to act as cluster head.

The CH-LEACH randomly selects certain nodes as these nodes are nearest to centroid in the region. For each and every round the CH-LEACH changes the cluster head by choosing another node. As these nodes are already chosen before having energy level under the threshold then the cluster head will updated by chosen another node. The cluster process is done in setup phase. The following architecture shows the overall CH-LEACH function.

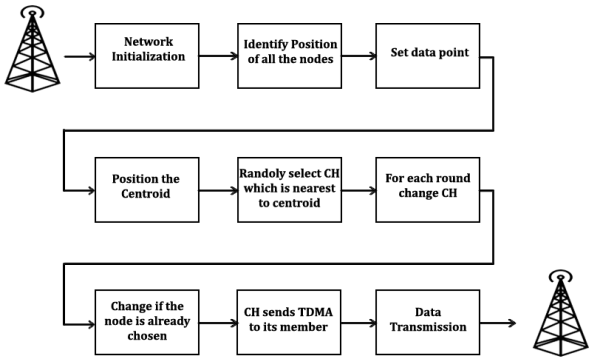

Fig -3: System Architecture

In steady phase the CH's send the TDMA schedule to its entire member node. The cluster members are sending the packet to cluster head according to their TDMA schedule. Cluster head is responsible for transmit the data to base station.

4. SIMULATION RESULT

In this section we evaluate the performance of CH-LEACH and our routing schemes in terms of energy consumption and network lifetime and we compare the obtained results.

4.1 Working Environment

In this section we provide an illustration of proposed protocol algorithm capabilities using Matlab R2007b simulator compare its performance with LEACH and DEEC. The parameters used in the simulation are summarized in the Table1.

Table -1: Simulation Parameter

Parameters	Values
Network Grid	(0,0)x(100,100)
Base Station	(50,50)
εelec	50 nJ/bit
εfriss amp	10pJ/bit/m2
εtwo ray amp	0.0013pJ/bit/m4
d0	87 m
Initial energy per node	0.2 J
Number of nodes	100, 200
P	0.05

4.2 Simulation Result

During a round, each member sends only one data packet to its respective cluster-head. At the end of each round, each cluster-head aggregates all data packets received from its members into one packet and sends it to the base station.

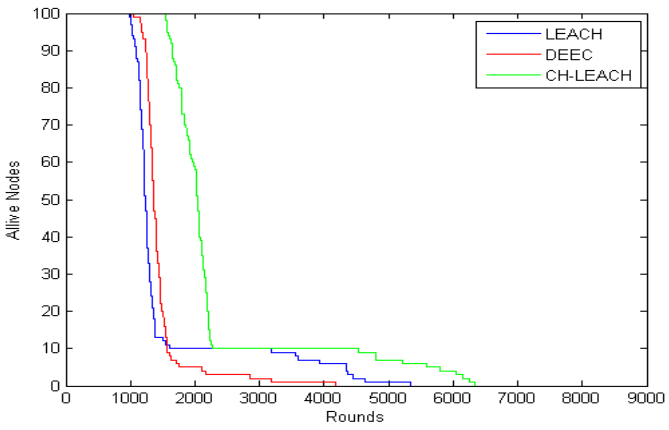

Fig -4: Number of Alive nodes

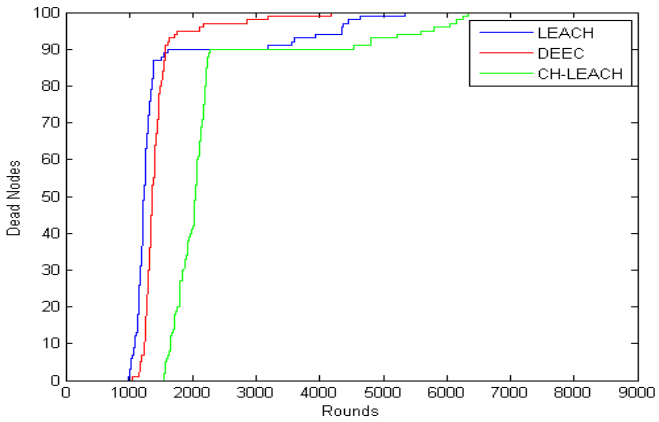

Fig -5: Number of Dead nodes in each round

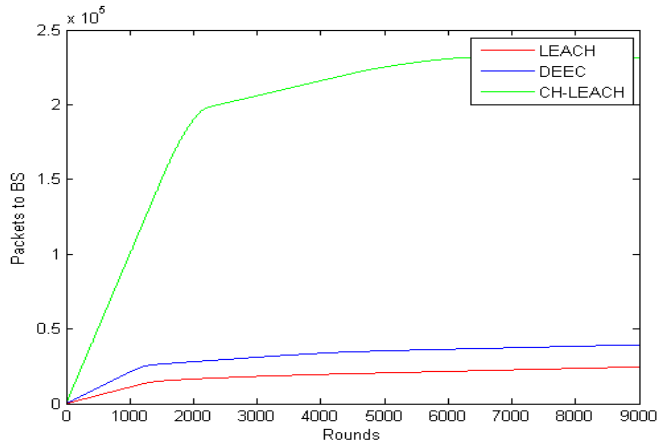

Fig -6: Number of packets to Base Station

In order to evaluate the reliability of CH-Leach protocols the fig 4 shows the comparison alive nodes for various protocols. The fig 5 shows the comparison of number of dead nodes in

each protocol and the fig 6 shows the number of packets send to base station for each protocol.

5. CONCLUSION

In this paper a series of experiments on different scenarios were implemented and tested. The Lifetime of the WSN network in CH-Leach shows major extension compared to LEACH and DEEC protocols. The main aim of this protocol which enhance the existing protocols in order to extend the time of the network.

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