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LOAD BALANCING AND CLUSTERING WAY TO IMPROVE ENERGY EFFICIENCY IN SENSOR NETWORKS

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Abstract: Wireless Sensor Network (WSN) has a significant contribution in the field of emerging. A sensor network is a network defined with energy nodes. Each node of sensor network is defined under the energy constraints. The nodes are defined with some initial energy with each communication over the network some amount of energy is lost because of this energy criticality and balancing is one of the major challenges in sensor network. While forming the clusters over the network, a balance will be maintained between the numbers of high and low priority nodes in a cluster. Now to perform the effective communication, each cluster head will be defined with two cluster head. One cluster head will handle the communication with high priority nodes and other will handle the communication with low energy nodes. Sensor nodes in wireless sensor network are depends on battery power they have limited transmission range that's why energy efficiency plays a vital role to minimize the overhead through which the network Lifetime can be achieved. The lifetime of network, depends on number of nodes, strength, range of area and connectivity of nodes in the network.
Keywords: Energy efficiency; wireless sensor network; cluster head selection; LEACH.

I. INTRODUCTION

Wireless sensor network is a complex system consists of a number of small wireless sensor nodes and a base station (BS). Sensor node consists of sensor, processor, memory, RF transceiver (radio), peripherals, and power supply unit (battery) [1]. These sensor nodes are spread over an area of interest and connected in an ad-hoc manner for event detection and collect data for various ambient conditions. The WSN has many applications like disaster management such as earthquake monitoring, tsunami warning, pipeline monitoring systems and flood forecasting. The self - organization, rapid deployment and fault tolerance characteristics of wireless sensor networks make them a very promising sensing technique for military applications [2]. Since WSN has limited resources due to the limited size of the node, either changing or recharging batteries are not feasible. The failure of a single node can prostrate the entire system hence system become unreliable. This problem imposes many challenges to the researchers for developing energy-efficient protocols. The routing protocols in sensor networks are classified into three categories: data centric protocols, location based protocols, and hierarchical protocols. This paper considers the hierarchical protocols which deal with organizing network into a set of tiers. In each tier, sensor nodes are categorized as a cluster head (CH), gateway nodes (GN) and cluster nodes (CN). The role of each CH is to gather sensed data from the cluster nodes periodically and aggregates the received data by removing redundancy among correlated data. Division Multiple Access (TDMA) schedules for cluster nodes through which sensor nodes transmit sense data in fixed slot. The aggregated data is transmitted by cluster head via gateway nodes. Hence, the lifetime of CH and GN would be a very short span of time if the fixed node performs all the tasks and it becomes essential to rotate the cluster head operation periodically in a well-structured manner. In this paper a new CH and GN selection process is proposed for the multi-tiered WSN architecture based on residual energy and RSSI.

II. RELATED WORK

Lot of research has been carried out in the area of energy-efficient clustering technique in sensor networks, which are mainly focused on enhancing the network lifetime. Low Energy Adaptive Clustering Hierarchy (LEACH) proposed in [4] is the first and most popular hierarchical routing protocols designed to aggregate and disseminate data to the base station for network lifetime enhancement. LEACH obtains energy efficiency by partitioning the nodes into clusters. The LEACH operation time is subdivided into rounds where each round comprised of setup phase and steady state phase. In setup phase sensor nodes selects a random number between 0 and 1. If this selected random number is lower the threshold value T (i), then the corresponding sensor node act as a cluster head during the given period, called round. LEACH distributes the role of cluster head among the member nodes in the cluster based on random number and threshold value. After a particular period of time clustering operation return to the setup phase to select new CH. This approach selects the cluster head based on a predetermined probability for cluster heads and does not follow any energy efficient mechanism while choosing T (n) as illustrated in fig1.

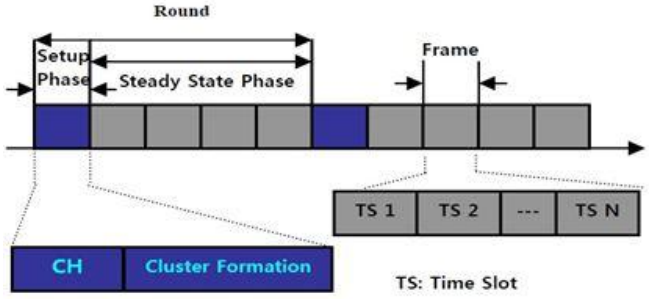

Figure 1: LEACH Protocol Phases

III. SYSTEM MODEL ON PROPOSED WORK

The proposed work defined an effective clustering architecture with effective election algorithm and the effective multi-hop communication within cluster and between the clusters. According to this presented model complete network is divided in small network area segments called clusters and each cluster is controlled by a cluster heads. The work is here focused on the selection of effective cluster heads under different constraints. The constraints are defined in terms of limit specification to the number of cluster members, number of clusters over the network and the energy specification. This improved algorithm will reduce the energy consumption and achieve the energy balancing over the network. Once the clusters are defined, the next work is to perform the communication over the cluster. For this communication three level communication is defined. The first level is defined with the lower limit within cluster. The nodes present in this range can perform direct communication with cluster heads. In second level, the multi-hop communication is performed by the cluster distance node. The third level communication is performed between the cluster heads to perform effective multi-hop communication to deliver the information to base station.

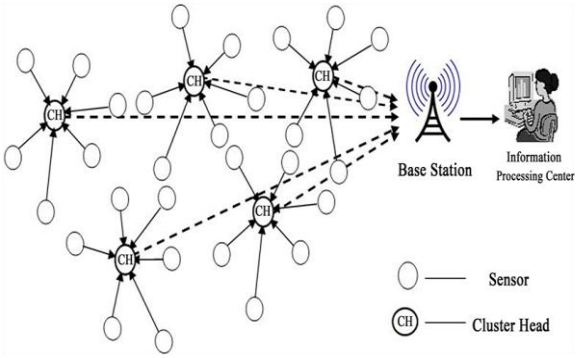

Figure 2: Sensor information forwarding with clustering and aggregation

In this work, a new cluster head specification approach is defined under the following specification

- The minimum and maximum number of clusters over the sensor network so that the uniform distribution will be performed.
- The minimum number of nodes that will be connected to the main cluster head at any instance of time. This is basically to perform the localization in sensor network. So that the chances of node loss will be reduced.
- The cluster head is defined with sensing range.
- The primary cluster head will be selected under the energy and the connectivity constraints.

IV. PROBLEM FORMULATION

A sensor network defines the network nodes under the energy specification. With each Communication over the network some amount of energy is lost because of this energy criticality and balancing is one of the major challenges in sensor network. This challenge becomes more critical when the network is a heterogeneous network. In this presented work, the effective cluster head reelection scheme is defined for clustered heterogeneous sensor network. This work, the heterogeneity of nodes will be defined as the node priority. The nodes will be at first divided in terms of high priority and low priority nodes. Now while forming the clusters over the network, a balance will be maintained between the numbers of high and low priority nodes in a cluster. The clustering will be performed based on the density ratio between the high priority and low priority nodes. Now to perform the effective communication, each cluster head will be defined with two cluster head. One cluster head will handle the communication with high priority nodes and other will handle the communication with low energy nodes. The cluster head selection will be performed based on the energy, distance and residual energy parameters. Each cluster head will be handled separately for the re-election process. While performing the re-election, the balancing between the high and low priority nodes will be maintained. Therefore, the network lifetime in our protocol is measured by following three different metrics.

1) First Node Die (FND): is defined as time elapsed in rounds until the first node has consumed all available energy.
2) Half Nodes Die (HND): is defined as time elapsed in rounds until half of the nodes have consumed all available energy stores.
3) Last Node Dies (LND): is defined as time elapsed in rounds until all the nodes have exhausted their entire energy supply.

The "round" definition in our paper refers to the time interval in seconds before the network start a new cluster process. The clustering will be performed based on the density ratio between the high priority and low priority nodes. Now to perform the effective communication, each cluster head will be defined with two cluster head. One cluster head will handle the communication with high priority nodes and other will handle the communication with low energy nodes. The cluster head selection will be performed based on the energy, distance and residual energy parameters. Each cluster head will be handled separately for the re-election process. While performing the re-election, the balancing between the high and low priority nodes will be maintained. The work will provide the energy balancing over the network so that the network life will be improved.

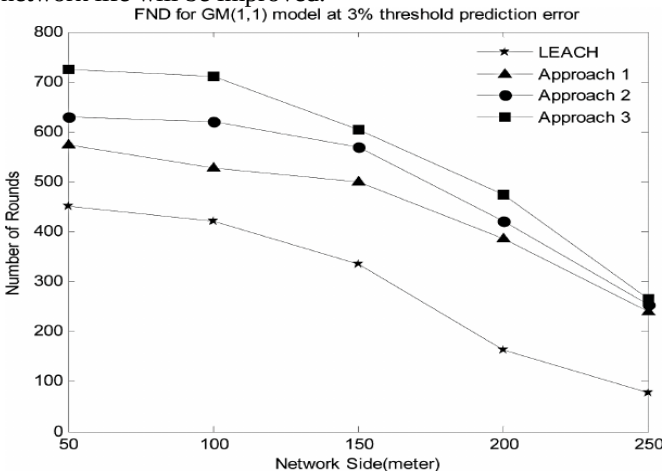

Figure:3 Number of alive sensors VS numbers of rounds for LEACH

V. CONCLUSION

Energy is one of the critical issues of a sensor network. With each communication performed by the network node, some amount of energy is lost in such case there is the requirement to reduce the overall communication over the network and to save the energy. In the general case, each sensor network follows some network architecture. One of such architecture is the clustering architecture in which network is divided in small segments called clusters and each cluster is been controlled by a cluster head. To control and manage the communication over the network the base station is required in a sensor network. In most of the sensor network, the position of the base station is static and generally it is centralized. In this present work, same scenario is considered. In this study about to improve the cluster heads selection algorithm and the route communication over the network. In future my thesis work is improved in terms of network life and packet communication over the network.

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