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Energy Efficiency Communication Protocol With Mobility in Wireless Sensor Network: A Survey

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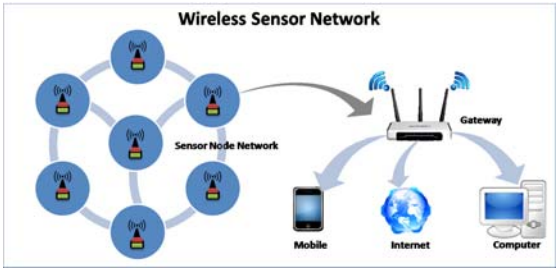
***Abstract*—In wireless sensor network a sensor node collect data from cluster environment and send it to base station. the sensor nodes have limited computation capability, limited power and small memory size. In these network ,sensor node are dependent on low energy. As per energy is a challenging issue in wireless sensor networks, clustering models are used to overcome this problem by using LEACH protocols' cluster is supervise by lead node called cluster head (CH). The main purpose of CH maintain the affiliated node and communicate with other cluster node. Cluster heads collect the data from respective cluster's node and send it to base station. this paper provide a methods for clustering and cluster head election method using various low energy protocol with mobility in wireless sensor environment various technique to improve energy efficiency. Its presents a comparison between the different methods on the basis on the network lifetime. Packet delivery ratio get consider the fix and mobile nodes in each responsible node**

Keywords—wireless sensor network, Energy Consumption, cluster based function, mobility.

1. INTRODUCTION

Wireless sensor network WSN[1] is self organised network proposed by large number of micro sensor that randomly deployed in monitoring regional through wireless communication. this application widely used in military medical logistics management, environmental monitoring agriculture and other commercial area. Since WSNs consist of many sensors with limited energy, an energy-efficient network protocol is an important consideration in WSN applications. Many routing protocols for WSNs have appeared in the literature. In applications using direct transmission (DT) protocols. Wireless sensor Networks [2]can offer unique benefits and versatility with respect to low-power and low-cost rapid development for many applications which do not need human supervision. The nodes in WSNs are usually battery-operated sensing devices with limited energy resources and replacing or replenishing the batteries is usually not an option. Thus energy efficiency is one of the most important issues and designing power-efficient protocols is critical for prolonging the lifetime. Clustering network is an efficient and scalable way to organize[3]. A fundamental challenge for these wireless sensor networks is to meet stringent Quality-of-Service requirements including high target detection probability, low false alarm rate, and bounded detection delay.



- **Sensor Network Architecture**

Design of WSN is influenced by factors such as scalability, fault tolerance and power consumption. The basic kind of sensor network architecture: 1. Layered Architecture: In this type, there is a single base station. Base station acts as access point and it is connected to the wired network. Base station collects all the data from the nodes for further processing .2. Clustered Architecture: In this type, nodes are arranged in clusters and these are governed by a cluster head. Each cluster group exchanges the messages in between their groups only. Cluster heads can communicate with each other and they are responsible to send the data to base station.

- **Issues due to Highly Mobile Environment**

Mobility leads to deterioration in the quality of an established link and, therefore, data transmission is prone to failure, which in turn increases the rate of packet retransmission.2. Mobility leads to frequent route changes, which result in a considerable packet delivery delay.3. A mobile node cannot immediately begin transmitting data upon joining a network, because its neighbours should first discover its presence and decide how to collaborate with it. This requires sometime.4. In contention-based MAC protocols, mobility may increase packet collision while in schedule-based MAC protocols, two-hop neighbourhood information becomes inconsistent once nodes enter or leave, leading to schedule inconsistencies.

2)LITERATURE REVEW

2.1) LEACH PROTOCOLS**:-**LEACH Protocol is the first protocol of hierarchical routings which proposed data fusion, it is of milestone significance in clustering routing protocols. Many hierarchical routing protocols are improved ones based on LEACH protocol [4]. So, when wireless sensor networks gradually go into our lives, it is of great significance to research on LEACH protocol. the benefits of structure wireless sensor network is that some nodes can be deployed with lower energy maintains and

management cost . Wireless sensor network aim is to provide efficient connection among the physical environment condition and internet worlds. basic characteristics of the wireless sensor network are limited energy,dynamis network topology, lower power, node failure and mobility of the node ,short range broadcast communication and multi hop routing and large scale of development

2.1.1) Brief Introduction to LEACH Protocol

LEACH Protocol is a representative of hierarchical routing protocols, its routing in homogeneous sensor networks. LEACH selects randomly the nodes cluster-heads and assigns this role to different nodes according to round-robin management policy to ensure fair energy dissipation between nodes. It is self adaptive and self-organized. LEACH protocol uses round as unit, each round is made up of cluster set-up stage, and steady-state stage, for the purpose of reducing unnecessary energy costs, the steady-state stage must be much longer than the set-up stage.

At the stage of cluster forming, means a node randomly picks a number between 0 to 1, compared this number to the threshold values $t(n)$, if the number is less than $t(n)$, then it become cluster head in this round, else it become common node. Threshold $t(n)$ is determined by the following.

$$T(n) = \begin{cases} \dfrac{p}{1 - p * (r \bmod \frac{1}{p})} & if\ n \in G \\ 0 & if\ n \notin G \end{cases}$$

Where p is the percentage of cluster head nodes in all nodes is the number of round is the collection of nodes that have not yet been head node in the first 1/Prounds .using this threshold ,all nodes will be able to be head nodes after 1/P rounds. this analysis has been follow for each rounds each node becomes CH with probability p when the round begins its not sure which nodes, are head node for this round will not be head node in next round. After 1/P-1 rounds all the nodes which have not head nodes become head nodes with probability 1,when1/P rounds finished, all nodes will return to the same starting line.

2.2) **LEACH-C Protocol-**

LEACH-C is a centralized clustering algorithm in which base node have power to select the clusters on the based on annealing algorithm to find k optimal number of clusters. Based station has been selected as cluster head for particular round. The protocols have guarantees .an optimum number of cluster but its has a drawback that each sensor node provides information about its current position and remaining energy calls residual energy to the sink node during the set up phase which result in an extra overhead in the network.

2.3)Multi hop LEACH-Multi-hop LEACH is an improved version of LEACH. this proposed version requires each sensor must be able to aggregate data, which increases the overhead for all sensors. to improve this strategy focussed on heterogeneous sensor network Multi-Hop LEACH allows two types of communication operations. These are inter-cluster communication and intra-cluster communication. In Multi-hop inter-cluster communication, when whole network is divided into multiple clusters each cluster has one cluster-head. This cluster-head is responsible for communication for all nodes in the cluster. Cluster-head receive data from all nodes at single-hop and aggregate and transmit directly to sink or through intermediate cluster-head. In Multi-hop inter-cluster communication when distance between cluster-head and base station is large then cluster head use intermediate cluster-head to communicate to base station.

2.4)Mobile LEACH(M-LEACH) : The M-LEACH allows mobility of non-cluster-head nodes and cluster-head during the setup and steady state phase. M-LEACH also considers remaining energy of the node in selection of cluster-head. Some assumptions are also assumed in M-LEACH like other clustering routing protocols. Initially all nodes are homogeneous in sense of antenna gain, all nodes have their location information through GPS and Base station is considered fixed in M-LEACH. Distributed setup phase of LEACH is modified by M-LEACH in order to select suitable cluster-head. In M-LEACH cluster-heads are elected on the basis of attenuation model [17]. Optimum cluster-heads are selected to lessen the power of attenuation. Other criteria of cluster-head selection are mobility speed. Node with minimum mobility and lowest attenuation power is selected as cluster head M-LEACH. Then selected cluster-heads broadcast their status to all nodes in transmission range. Non-cluster-head nodes compute their willingness from multiple cluster-heads and select the cluster-head with maximum residual energy. In steady state phase, if nodes move away from cluster-head or cluster-head moves away from its member nodes then other cluster-head becomes suitable for member nodes. It results into inefficient clustering formation. To deal this problem MLEACH provides handover mechanism for nodes to switch on to new cluster-head. When nodes decide to make handoff, send DIS-JOIN message to current cluster-head and also send JOIN -REQ to new cluster-head. After handoff occurring cluster heads re- schedule the transmission pattern.

2.5)Hybrid Energy Efficient Distributed Clustering[HEED]

HEED is an iterative clustering protocol, distributed algorithm used in wireless sensor environment HEED is different from LEACH in the way CHs are elected. Both, electing the CHs and joining to the clusters, its based on the combination of two parameters.1)primary parameter 2)Alternative parameter

The primary parameter depends on the nodes of residual energy. The alternative parameters is the intra cluster communication cost. each node computes communication cost depending on variable power levels ,intra communication are permissible or not. if power is fixed for all nodes, then communication cost can be corresponding to

i. node degree, if load distribution between CHs is required

ii. 1/node degree, if producing dance clusters is required
in this approach HEED periodically selects cluster heads according to a hybrid of their residual energy and secondary parameter, such as node proximity to its neighbours or node degree. using the cluster head probability sensor decide whether its advertise or not that they are a cluster head candidate for this iteration. Based on this advertisement masseges,each sensor node selects the candidate CH with the lowest "communication cost" as its cluster head probability at each iteration until the cluster head probability is one and the sensor declares itself a "final cluster head" for this round.
Advantage of HEED are that nodes only require local information to the cluster ,the algorithm terminates in O(1)iterations, this algorithm show every sensor is part of just one cluster and CHs are well distributed.

2.6)EECS (energy efficient clustering scheme in wireless sensor networks)

The nodes with more residual energy have more probability to be elected as cluster heads. If a given node does not find a node with more residual energy; it becomes a cluster-head. In cluster formation phase, LEACH uses the minimum distance of nodes to their corresponding cluster-head. Different from LEACH, in EECS the dynamic sizing of clusters takes place which is based on cluster distance from the base station. Thus EECS resolves the problem that clusters at a greater distance from the sink requires more energy for transmission than those that are closer. And provides low message overheads and uniform distribution of CHs compared to LEACH.
Advantage-The algorithm constructs multilevel clusters and the nodes in each cluster reach the cluster head by relaying through other nodes.

2.7)Distributed weight-based energy-efficient hierarchical clustering (DWEHC)

Distributed weight based Energy-efficient Hierarchical clustering protocol is a distributed clustering algorithm similar to HEED. It requires no assumptions about network size and density, and considering residual energy in the process of CH election. The main objective of DWEHC is to generate balanced cluster sizes and optimize the intra-cluster topology using location awareness of the nodes. After locating the neighbouring nodes in its area, each node calculates its weight according the sensor's energy reserve and the proximity to the neighbours as following:

$$W_{\text{weight}}(s) = \frac{E_{\text{residual}}(s)}{E_{\text{initial}}(s)} \times \sum_{u} \frac{R-d}{6R}$$

E residual = residual energy at node s
E initial = initial energy at node s
R = distance between CH and a node inside a cluster
d = distance between node s and the neighbouring node u

2.8)TEEN (threshold sensitive energy efficient sensor network protocol)

Threshold sensitive Energy Efficient sensor Network protocol (TEEN) [27], proposed by Anjeshwar and Agrawal, is a hierarchical protocol designed for reactive networks witch respond immediately to sudden changes in the relevant parameters of interest such as temperature. It's very similar to LEACH. In TEEN, a CH will send three parameters: attribute hard threshold (HT) and a soft threshold (ST):

- **Attribute:** it represents the requested task to sensor node.
- **Hard threshold (HT):** it is a threshold (absolute) value for the sensed attribute.
- **Soft threshold (ST):** is a threshold (minimal change) value of the sensed attribute

2.9)PEGASIS (Power Efficient Gathering in Sensor Information Systems)

PEGASIS is that it uses all the nodes to transmit or receive with its closest neighbour nodes. All the nodes which collect the data fuse it with the data received by the neighbour node and transmit it to the next-nearest neighbouring this way all the nodes receive and fuse their data, and pass it to the next neighbour in a chain format till they all reach the base station. Every node in the network takes turns as a leader of the chain and the one responsible to transmit the whole fused data collected by the chain of nodes to the base station In this way the average amount of energy spent by each node is reduced. Greedy algorithms are used to see that all nodes are used during the chain formation. PEGASIS assumes that all the nodes with varying or low energy levels can be compensated in order to to calculate the energy cost of the transmissions with the remaining energy they are left with. It is not necessary that all the nodes need to know its neighbouring nodes, the base station can determine the path or form the chain for all nodes, or all the nodes can determine their neighbouring nodes by sending a signal. Depending upon the signal strength, the nodes adjust their signal such that they hear only the nearest neighbours in the network. This approach will distribute the energy load evenly among the sensor nodes in the network as it uses all the nodes of the network to form the chain and perform simple data forwarding operations. If any node dies in the chain, a new chain is formed, eliminating the dead nodes it is clear that PEGASIS improves on LEACH by saving energy at different stages

CONCLUSION:

In this survey paper we have discuss various low energy routing protocols for wireless sensor network. The main concern of this survey is to examine the energy efficiency and throughput enhancement of these routing protocols. We compare the lifetime and data delivery characteristics with the help of analytical comparison and also from our simulation results. Significant research work has been done in these different clustering routing protocols in order to increase the life time and data delivery features. Certainly further energy improvement is possible in future work especially in optimal guaranteed cluster-heads selection.

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