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A SURVEY ON LEACH BASED ENERGY AWARE PROTOCOLS FOR WIRELESS SENSOR NETWORK

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ABSTRACT

Wireless sensor network is a wireless network of sensor node and become one of the most interesting area of researches. Routing technique is one of the most challenging issue in the wireless sensor network. In Wireless sensor network routing among various routing techniques energy consumption is one of the most important criteria. LEACH protocol which is one of the most energy efficient clustering protocol. Leach is effective in prolonging the network life time by consuming a small percentage of the total dissipated energy in the system. The paper present survey of LEACH protocol along with mobile sink and various LEACH-Based hierarchal routing protocols like LEACH-C, I-LEACH , V-LEACH.

Keywords: Leach, Wsn, V-Leach, I-Leach, Leach-C

I.INTRODUCTION

Low Energy Adaptive Clustering Hierarchy (LEACH) protocol is widely used for the wireless networks which contain small battery powered devices, for example wireless sensor networks (WSN). When the battery power is drained in these devices/nodes then the network cannot be used and all the nodes spend most of the energy while transmitting the data. Therefore, to increase the lifespan of the network, each node has to do only minimal work for transmitting the data. LEACH protocol is widely used in WSN, because this protocol dissipates the energy in low level.

In LEACH protocol, all the nodes are grouped into the clusters, and in each cluster one of the nodes is assigned as a Cluster Head (CH). CH collects the data from the surrounding nodes and passes it to the base station. Usually, initial assignment of CH is random and the role of CH is rotated for every fixed duration so that each node will act as a CH at least once in its life span. LEACH algorithm has two phases. They are set up phase and steady state phase. Setup phase is used to choose a CH and steady state phase is used to maintain the CH during the transmission of data. A node n is selected as a CH in next round based on applying the following formula. If T(n) is 1 then the node n will be the CH in next round.

$$T(n)=\begin{cases}\dfrac{p}{1-p\times\left(r\times \bmod \dfrac{1}{p}\right)} & \text{if } n\in G\\ 0 & \text{otherwise}\end{cases} \qquad (1)$$

where p is the probability of node n being selected as a CH, r represents the current round number and G is the set of nodes that are not selected as a CH in the last 1/p rounds. Some of the unique features of the LEACH protocol [1] are (1)The coordination and control in the cluster is localized in the set up phase. (2)The role of the CH is rotated and randomized to distribute the energy requirements among the nodes of the network. (3) To reduce the total amount of data transmission, local compression techniques are used in the CH. 4. LEACH is suitable for homogeneous networks. The structure of the cluster of nodes in a wireless network is given in the following Fig.1. In the figure the non cluster nodes are represented in blue color, these nodes send the data to the corresponding cluster head and the cluster head forwards to the base station after performing aggregation or data fusion [2]. Cluster head allots the time intervals to the cluster member nodes so that non cluster nodes can transmit the data to the bases station in the assigned schedule. Time Division Multiple Access (TDMA) schedule is maintained by the CH.

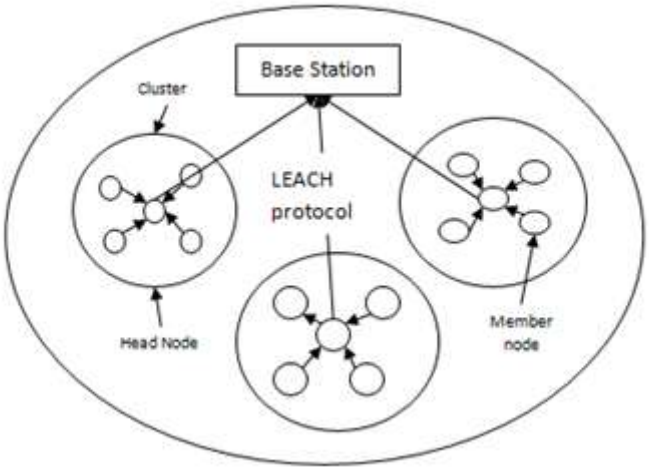

Fig1.General Sensor Network Architecture

Most of the wireless sensor networks use heterogeneous devices and the remaining power of these nodes may differ. Based on simple random rotation, if any node with low remaining energy is selected as a CH, its energy evaporates soon. Therefore, many number of LEACH routing with some enhancements were used by many researchers. Section 2 describes the literature surveyon various protocols and section 3 describes comparison of these algorithms.

II.LITERATURE SURVEY

Fuzhe zhao has proposed LEACH Routing Communication Protocol for a Wireless Sensor Network.Based on the LEACH, LEACH-C also organizes the sensor nodes into clusters with each cluster a cluster head and divides a round into set-up and steady-state phases. It differs from LEACH only in that it uses a high-energy base station to finish the choice of cluster heads. In the set-up phase of each round, every sensor node sends its information about energy to remote BS. Then the BS selects the cluster heads based on the energy information and broadcasts the IDs of cluster heads to other member nodes. This method can make the nodes with more energy and more chance to become the cluster head in the current round. But in this phase, every sensor node

needs to send its ID and energy information to remote BS to compete for the role of cluster heads, which causes energy consumption on the long distance transition [3].

Disadvantages.

(1) CHs' selection is random, which does not take into account the residual energy of every node or need the support of BS.

(2)The high frequency of reclustering wastes a certain amount of energy.

(3)It cannot cover a large area.

(4)CHs are not uniformly distributed, where CHs can be located at the edge of the cluster.

Beiranvand et al. have analyzed and proposed a new enhancement in LEACH named I-LEACH. An Improvement has been done by considering basically three factors; Residual Energy in nodes, Distance from base station and Number of neighboring nodes. A node has been considered as head node if it has optimum value for discussed three factors i.e. have more residual energy as compare to average energy of network, more neighbors than average neighbors for a node calculated in network and node having less distance from base station as comparison to node's average distance from BS in network. Reduction in energy consumption and prolongation in network life time has been observed. The proposed routing algorithm is compared to the previous proposed algorithms e.g., LEACH, DBS, and LEACH-C algorithms. Results of the simulations show that the proposed routing algorithm has been improved the WSN performance at least 65%, reduces the energy consumption of the WSN up to 62%, and improves the successfully delivered packet ratio by at least 56% as compared to the previous routing algorithms[4].

Ahlawat et al. proposed a new version of leach protocol called Improved VLEACH which aims to increase network life time. In this paper we first completely analysed the typical clustering Routing Protocol-LEACH and its deficiencies and proposed improved v-leach. The work to be done in improved v-leach protocol on selection of vice cluster head. The Vice Cluster head is that alternate head that will work only when the cluster head will die. The process of vice cluster head selection on the basis of three factors i.e. Minimum distance, maximum residual energy, and minimum energy. The proposed approach will improve the network life as never the cluster head will die. As a cluster head will die it will be replaced by it's vice Cluster head. After a number of simulations, it was found that the new version of improved v- LEACH outperforms the original version of leach protocol by increasing the network life time 49.37% [5].

S. Mottaghi et al. proposed an algorithm that combines the use of the LEACH clustering algorithm, MS and rendezvous points (RP). Simulation results showed that this method is more efficient than LEACH in terms of energy consumption, particularly in large regions. Wireless sensor networks are composed of a large number of disposable wireless sensors that collect information about their surrounding environment and transmit them to the end user. Because these sensors do not have rechargeable batteries, increasing their lifetime is important and various methods have been proposed to increase the lifetime of the sensor nodes in a network. Most of these methods are based on clustering or routing algorithms. The low energy adaptive clustering hierarchy (LEACH)

algorithm is an efficient clustering algorithm where nodes within a cluster send their data to a local cluster head. Some researchers recommend a mobile sink (MS) as a way to reduce energy consumption and a rendezvous node (RN) to act as a store point for the MS [6].

Disadvantages.

(1)The use of the inter cluster data aggregation has been neglected in the most of existing protocols.

(2)The use of ACO for efficient path selection has also been neglected by the most of researchers.

(3)However the rendezvous nodes based LEACH outperforms over the LEACH in terms of the network lifetime, but has very poor stability period i.e. the first node become dead too early.

III.COMPARISON

Several modification and enhancements are being done on LEACH to examine its existing performance. The following table shows the various enhancements made on LEACH algorithm.

Clustering routing protocol	Classification	Mobility	Scalablity	Hop count	Energy efficiency	Data aggregation	Self organisation	Use of location services
Leach	hierarchical	FixedBS	Limited	Single hop	High	Yes	Yes	No
Leach C	hierarichal	FixedBS	Good	Single hop	Very high	Yes	Yes	Yes
I Leach	hierarichal	FixedBS	Very good	Single hop	Very high	Yes	Yes	Yes
V Leach	hierarichal	FixedBS	Very good	Single hop	Very high	yes	Yes	Yes

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