

A Review Paper on Leach Based Protocol in WSN

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Abstract— Wireless sensor network have become an active area for researchers now a days. A sensor node carry small amount of resources in terms of processor, battery power, memory and communication range, but when a great number of sensor nodes work together they are able to complete a good volume of task. It is just because of Wireless Sensor Network we are able to interact with physical world directly. Compared with the traditional wireless networks, wireless sensor networks have energy constraints, low-data-rate of high redundant and data flow of high-to-one, and so on. Energy effectiveness is the key performance indicators of wireless sensor networks. Based on the analysis of energy management strategy in the wireless sensor networks, the main factors affecting energy consumption are: perceptual data, data processing and radio communications, the radio communication is the main part of energy consumption. In this paper, we present a recent survey of hierarchical routing protocols which are based on LEACH protocol

Keywords: WSN, Leach, Setup, Steady Phase, ACHTHLECAH.

I. INTRODUCTION

Wireless sensor network is a network consisting of several number of heterogeneous nodes called as sensors nodes which are spatially distributed all over the location and these networks are used to monitor physical or environmental conditions such as temp, pressure, sound, vibration at these locations. Wireless communication enables the co-operation of nodes to fulfill bigger tasks that single nodes cannot. Nodes in WSN are densely deployed and are greater in numbers as compared to mobile ad hoc networks. These nodes communicate with each other and pass data along from one to each other from source to sink. Basically Sensor nodes bridge the gap between physical world and the virtual world. Each node consists of processing capability, may contain many processing units like multiple types of memory, have a RF transceiver, have a power source like battery, and accommodate various sensors and actuators

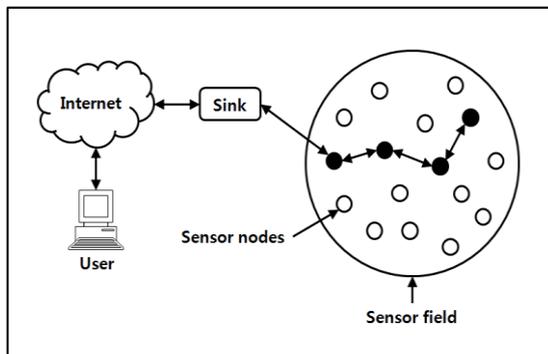


Fig. 1: Network architecture of Wireless Sensor

A sensor network generally consists of several tiny sensor nodes and a few powerful control nodes also called base stations or called as sink. Sensor nodes are usually

densely set up in a large area and communicate with each other in short distances through wireless communication. Although particular sensor nodes have limited number of resources, they are able to achieve worthy task of big volume when they work as a team member. Information gathered by and transmitted on a sensor network of wireless networks describes conditions of physical environments of the area where the sensor network is set up.

The remainder of the paper is organized as follows. Section 2 describes Leach Protocol done so far in this field. Section 3 describes Leach Based Routing Protocol. Finally the paper concludes with a summary.

II. LEACH PROTOCOL

LEACH was proposed by Heinzelman, Chandrakasan and Balakrishnan. It is a hierarchical cluster based routing protocol for wireless sensor networks. This protocol partitions the nodes in to clusters. LEACH randomly selects nodes as cluster-heads (CH) and performs periodic reelection. Cluster Head (CH) is responsible for creating and manipulating a TDMA (Time division multiple access) schedule and sending aggregated data from nodes to the BS where these data is needed using CDMA (Code division multiple access). And the remaining nodes are cluster members. The operation of leach protocol is split into two phases: set up and steady.

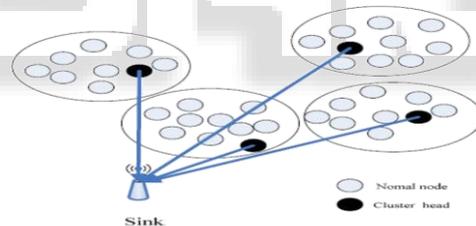


Fig. 2: Architecture of leach

A. Two Phases of Leach:

LEACH is divided into rounds; and each round is of two phase, set-up phase and steady phase

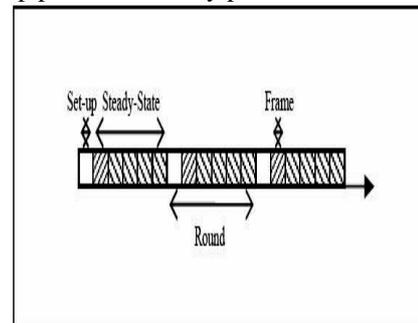


Fig. 3: Leach protocol phases [22]

B. Set-Up Phase

First step is cluster head selection. At the first of each round, each node selects a random number between 0s and 1 and compares it to the threshold shown in formula. If the selected random number is less than the threshold, the node

would be selected as a cluster head for the current round. The threshold $T(n)$ is calculated as

$$T(n) = \begin{cases} \frac{p}{1-p \cdot (r \bmod (1/p))}, & \text{if } n \in G; \\ 0, & \text{else} \end{cases}$$

Here P is the desired percentage of nodes which are cluster head, r is denoted as current round, and G is the set of nodes that has not been selected as cluster-heads in the past $1/P$ rounds. This states that all sensor nodes eventually spend equal energy. After selection of cluster head, it advertises his selection to all remaining nodes. All nodes choose their nearest cluster head when they receive advertisement message based on the received signal strength. Then TDMA schedule is assigned by the CH for their cluster members or nodes.

In order to avoid signal interference near the cluster, cluster head can determine the CDMA codes which all nodes used. The CDMA codes which is used in the current phase and TDMA timing information will be sent together. When nodes within the cluster receive the message, they will send data to the cluster head in their own time slot. Algorithm will enter a stable phase. shows the setup phase by following diagram

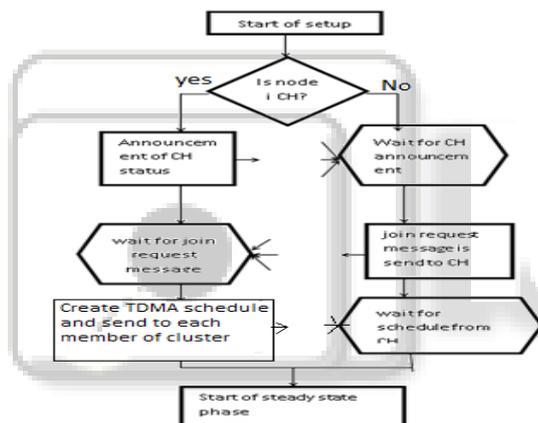


Fig. 4: set up phase in LEACH

C. Steady Phase

The steady state phase is the data transmission step. During this phase, nodes in each cluster send their data based on the allocated transmission time to their local cluster heads. To reduce the energy dissipation, the receiver of all non-cluster head nodes would be turned off until the nodes' defined allocated time. After receiving all the data from the nodes, the cluster head aggregates all the data sent from the member nodes into a single signal and transfers it to the base station

III. LEACH BASED ROUTING PROTOCOL

A. M. Bani Yassein et al. [1] V Leach

A new version of LEACH protocol called VLEACH which aims to reduce energy consumption within the wireless network. In this new version of LEACH protocol, the cluster contains; CH (responsible only for sending data that is received from the cluster members to the BS), vice-CH (the node that will become a CH of the cluster in case of CH dies), cluster nodes (gathering data from environment and send it to the CH). In the original leach, CH will die earlier

than the other nodes in the cluster because of its operation of receiving, sending and overhearing. At the time when the CH die, the cluster will become meaningless because the data gathered by cluster nodes will never reach the base station. In V-LEACH protocol, besides having a CH in the cluster, a vice-CH is present that takes the duty of the CH when the CH dies because the reasons we mentioned above

B. Muhammad Omer Farooq et al [2] MR-Leach

A multi-hop routing with low energy adaptive clustering hierarchy protocol. MR-LEACH follows the fundamental principle of multi-hop routing from cluster-heads to a Base station to conserve energy, unlike the leach protocol. In MR-leach they partition the network into different layers of clusters. Where Cluster heads in each layer collaborates with the adjacent layers to Transmit sensor's data to the base station. Ordinary nodes Join cluster heads based on the received signal strength indicator (RSSI). The transmission of nodes is controlled by a base station (BS) that defines the time division multiple accesses (TDMA) Schedule for each cluster-head. BS choses the upper layers cluster Heads to act as super cluster heads for lower layer cluster heads. By calculating performance evaluation it is shown that MR-LEACH achieves significant improvement in the leach protocol and provides energy efficient routing for WSN.

C. Ajay Jangra et al [4] S-Leach

A novel security S-LEACH mechanism which is the extension of LEACH routing protocol used for detecting the Sybil attack. The mechanism is configured to initiate the Sybil attack whose detection is relayed on RSSI (an indicator of signal strength) when the number of cluster heads in WSN is above the threshold. The security mechanism is canvassed by the safety of the stage and energy consumption through a series of experiments. Accordingly, the simulation results show that the system is an efficacious and robust for guarding the attack Sybil.

D. li-qingguo et al [6] ACHTHLEACH

The Adaptive Cluster Head Election and Two-hop LEACH protocol (ACHTHLEACH) to prolong the life time of network. It improves LEACH with the use of an adaptive algorithm of cluster head election and allowing multi-top transmission among cluster heads and Base Station (BS). They have taken in consideration the distance of nodes as near nodes or far nodes according to the distances to the BS. The near nodes relates to one cluster while the far nodes are divided into different clusters by the Greedy K-means algorithm. The cluster head is turn around and the node with the maximal residual energy in each cluster is elected. During the data transmission phase, the far cluster heads may select the cluster head in the near area as the next hop or communicate directly to the BS. In this paper authors in simulation results have shown that ACHTHLEACH outperforms several existing protocols in terms of network's life period. Specially, ACHTH-LEACH can achieve more than 2 times longer lifespan than LEACH and build a more stable routing environment.

E. JiaXu et al [3] E-Leach

A revised cluster routing algorithm named E-LEACH to enhance the hierarchical routing protocol LEACH. E-LEACH algorithm shows that, the original way of the

selection of the cluster heads is random and the round time for the selection is fixed. In the E-LEACH algorithm, here consider the remnant power of the sensor nodes in order to balance network loads and changes the round time depends on the optimal cluster size. Outcome of simulation results show that our proposed protocol increases network lifetime at least by 40% when compared with the LEACH algorithm.

IV. CONCLUSION:

One of the main challenges in the design of routing protocols for WSNs is how to efficiently consume energy because energy resources are very limited. The ultimate objective behind the routing protocol design is to keep the sensors in operation for as long as possible, thus extending the network's lifetime. Routing algorithm in wireless sensor networks is a very hot research topic, because it has great research significance in saving energy and prolonging network life-cycle. This paper first described the core ideas and analysis model of LEACH algorithm. In this survey we have discussed about different methods and algorithm to Leach Protocol. Due to the drawbacks of LEACH, many protocols have been emerged to solve these problems. However, more work is still needed to find more efficient, scalable and robust clustering scheme to enhance energy consumption and prolonging networks lifetime in small and large WSNs.

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Table Comparisons of Exciting Leach Protocol

Protocol	Assumption	CH Selection	Improvement Over Leach	Disadvantages
V-LEACH	The base station is fixed, all nodes are homogenous and have same energy levels, and all nodes are stationary.	Random	Introducing vice-CH that takes the role of the CH when the CH dies	Extra processing for selecting vice-CH.
Multi-Hop LEACH	Fixed base station. All the sensor nodes are considered static,	Random	Supporting Energy minimizing techniques like Multihop	Problems arise in case one of CHs hops die as result
E-LEACH	The base station is fixed, all nodes are homogenous and have same energy levels, and all nodes are stationary.	Residual Energy Level	It improves the CHs selection process. It determines that the required number of cluster heads has to scale as the Square root of the total number of sensor nodes to minimize the total energy consumption.	The CHs must keep its receiver turned on to receive all the data
Adaptive CH based routing scheme for mobile WSN	Sensor nodes are mobile, All nodes are location unaware and homogeneous with same battery power and Architecture.	Relative direction of the node's neighbors, mobility factor of the node.	Relative direction of node mobility is considered.	Extra overhead on calculating node's movement direction.