

Improved Energy Efficiency and Throughput Using LEACH Protocol in Wireless Sensor Network: A Review

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Abstract— Wireless sensor network (WSN) is a network consisting of small nodes with sensing, computation and capabilities of wireless communication. It is an emerging technology. Each sensor fetches data from the monitored area like temperature, sound, vibration, pressure etc. In WSN energy constraints makes energy saving and make longer the network lifetime. In this paper we reviewed different approaches of LEACH proposed by different researchers. In this paper, we done the comparison the various protocols of LEACH and its parameters are energy efficiency, Lifetime of networks etc.

Keywords— WSN, LEACH protocols, clustering.

I. INTRODUCTION

Today, time is the technology i.e. a huge number of techniques are introduced in a short span time and start research is on. Many techniques are used to communicate and transmit the information between networks. Wireless sensor network (WSN) made up of hundreds and even thousands of small tiny devices called sensor nodes to monitor environmental or physical conditions, such as sound, vibration, temperature, pressure. Many protocols are used to reduce the energy tuberculosis. Energy plays effective role in wireless sensor network.

A. Architecture of WSN

The architecture of a WSN collections of multiple pervasive sensor nodes, sink, public networks, manager nodes and end user. Many tiny, smart and inexpensive sensor nodes are scattered in the target sensor field to collect data and send the useful information back to the end user. All sensor nodes are cooperating with each other with help of wireless connection to form a network, collect and analyse data coming from the environment. Suppose the data collected by node A is routed within the sensor field by other nodes. Edges of node E received all data and then forwarded to target. The destination works like a gateway with higher processing capacity and communicate with the task manager node. The connection between destination and task manager node is the public networks in the form of satellite. The end users receive the data from the task manager node and perform processing on received data [1], [5], [11].

B. WSN's Applications

WSNs can be used in virtually any environment, even all that places where wired connections are not possible like in vehicles, in hospitable or physical placement of the sensors are difficult. WSN enable unattended monitoring of physical quantities over large areas on a scale. These effective features promote the potential of WSNs for more application areas, monitoring things, monitoring space, monitoring the interactions of things with each other and the encompassing space. The first classification includes structural monitoring, equipment maintenance, medical diagnostics and vehicle safety. The second classification includes environmental monitoring, climate control, military and space surveillance. The applications include in the third classification which involve monitoring complex interactions, wildlife habitats, management of disaster, emergency response and manufacturing process flow. Based on the large number of sensor nodes, WSNs is financial viable solutions for a wide range of applications such as environmental monitoring, collection of scientific data, monitoring of health and operations of military [6].

Many routing protocols have been intending in the literature like LEACH, PAMAS. Leach is the important part of routing protocol which is admired by the people that use cluster based routing to minimize the energy consumption.

C. Cluster Routing

Cluster routing protocol is used to make the network useful and efficient. A cluster based routing protocol collection of sensor nodes where each group of nodes has a channel head. Data is sent to the CH rather than send it to the BS. A number of routing protocols have been intended for WSN. LEACH, PAMAS and PEGASIS are most well-known hierarchical protocols. Both of these show significant minimization in the comprehensive network energy over other non-clustering protocol. Hierarchical routing protocols have mental plan to reduce energy consumption by localizing communication within the cluster and add data to reduce transmissions to the BS.

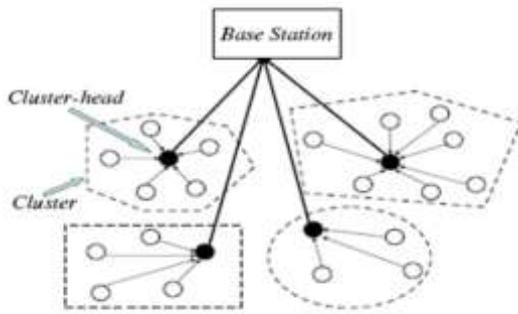


Fig.1 Cluster based mechanism in WSN

D. Leach Protocol

Low Energy Adaptive Clustering Hierarchy (LEACH) is first hierarchical and routing cluster protocol in wireless sensor network which separates the nodes into clusters. In each Cluster, Cluster Head (CH) is responsible for creating and controlling a TDMA (Time division multiple access) and sending data from nodes to the BS, using CDMA (Code division multiple access). Rest nodes are cluster members. LEACH is a self-organizing clustering protocol. LEACH uses clusters for arranging the nodes. This protocol is divided into rounds. Each round consists of two phases namely:

1) *Set-up Phase*: In setup phase decision of one node doesn't depend upon another node either it will CH or not. It will be consider only if nodes served as CH previously. Further, in advertisement phase, CH's give information to own neighbored only that they become CHs, by sending an advertisement packet. Next phase is cluster setup phase, in this cluster is formed by sending information with "join packet" which contain unique number for users with technique used CSMA. Further, in sub cluster phase all information about member nodes and unique numbers for users is provided to CH. On the basis of available information all messages in cluster are received, which is used by CH to create TDMA schedule by taking CSMA code randomly and then give this information to all members. Now proceed for next phase i.e. steady-state phase.

2) *Steady-state phase*: In this phase data is transmitted by nodes. CH have a TDMA slot and energy efforts required for this transmission is very less, this is because until TDMA schedule is busy, radio of every non CH node is turned off. After transmission if data is approved by CH then forward it to the BS. LEACH help to approval of data locally which results in reducing the amount of transmission to base station. But LEACH also suffers from some limitations.

1. There is no particular way for selecting CH.
 2. It is applicable to small area only.
 - 3). CH is not uniformly placed; so it is placed on edges only.
- Though LEACH has number of limitations, still numbers of efforts are made to make better performance of this protocol. [1], [4], [7], [8], [9].

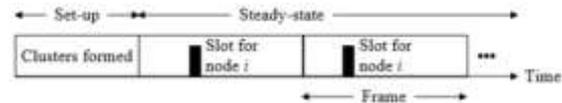


Fig.2 Leach protocol process

II. VARIOUS APPROACHES

A. LEACH

LEACH (Low-Energy Adaptive Clustering Hierarchy), it utilized random based rotations of local cluster. It is uses for distributed the energy for balancing the load. LEACH is used to enable scalability and robustness for non static networks. It is use incorporates data fusion into the routing protocol for reducing the amount of data which is able to transmit to base station [8].

B. Energy-LEACH

Energy-LEACH protocol improves the CH selection procedure. It makes reusable energy of node as the main metric which decides which nodes turn into CH or not after the first rounds. Like LEACH protocol, E-LEACH is divided into rounds, in first round, all node has the same probability to turn into CH, this mean nodes are randomly selected for making CHs, in the next rounds, the residual energy of each node is different after one round communication and taken into account for the selection of the CHs. That mean nodes have more energy to become a CHs rather than nodes with less energy [2].

C. VLEACH

VLEACH is a new version of LEACH protocol, which aims to reduce energy tuberculosis within the wireless network. In this approach, calculate both LEACH and V-LEACH with different type simulations. Using OMNET++ simulator, it shows that VLEACH perform better than LEACH protocol [1].

E. Multi-hop LEACH

Multi-hop LEACH protocol selects sufficient path between the CH and the BS through other CHs and use these CHs as a relay station to transmit data. First, multi-hop communication is adopted among CHs. CH forward data to next CH which is closer to BS as per best path available. CH send data from single hop to multi hop within CH and BS instead LEACH, in which each CH directly communicates with BS without mattering the distance between CH and BS [3].

F. O-LEACH

O-LEACH (optimization Low Energy Adaptive Clustering Hierarchy) to improve existing LEACH and LEACH-C by selecting cluster according to the residual energy of nodes dynamically. The simulation results slow that proposed

algorithm archive longer stability by comparison to original LEACH and LEACH-C [4].

TABLE I

COMPARISON BETWEEN DIFFERENT APPROACHES

Algorithm	Classification	Mobility	Scalability
leach	hierarchical	fixed BS	limited
leach	hierarchical	fixed BS	good
leach	hierarchical	fixed BS	good
m-leach	hierarchical	fixed BS	very good
o-leach	hierarchical	fixed BS	excellent

III. CONCLUSIONS

There are various challenges for deploying wireless sensor network like scalability, programmability maintainability, quality of services, types of service and lifetime of the network. For improving the lifetime of network, the required utilization of energy is very important .The battery energy is the most important resource. In this paper we reviewed various clustering protocols which are used to increase the lifetime of wireless sensor network and all the protocols are used to balance the energy consumption rates in proportion to their remaining energy. In this paper first alive node dead shows on 1060 rounds and energy efficiency quality and redundancy reduction was observed.

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