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LEACH Based Method for Prolong the Network Life

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Abstract- In this paper, it focuses at the communication protocols, that can have important effect on the whole energy dissipation of these types of networks. Depend on the observations that the conventional protocols of direct transmission, multi-hop routing, minimum-transmission-energy, and static clustering cannot be better for the sensor networks, it suggest the LEACH (Low-Energy Adaptive Clustering Hierarchy), to equally share the load of energy in the network among the sensors. MANET has a dynamic type of topology because of the movement of portable terminals in the network. These types of mobile terminals are battery operated and need battery resources for the purpose of communication also these types of resources are very limited. This protocol provides help to decrease the power consumption of terminals and also extends the life of battery to enhance the life time of network. This paper, point out on the energy efficient routing protocol that is LEACH (Low Energy Adaptive Clustering Hierarchy) is discovered, by the use of this protocol the performance of network is improved by decreasing the consumption of power of mobile terminals in the network.

Keywords—*Component, formatting, style, styling, insert.*

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I. INTRODUCTION

There is an ad-hoc wireless network which is a group of wireless terminals which are self arrange in a network without any help of a previous infrastructure. Some or probably all of these types of terminals are mobile. As the network can be deployed flexibly and rapidly, it is interested to many potential applications. Commercial applications that are possible of MANET consists of business associates using same information while a meeting, using laptop computers by the students to attend an interactive lecture or emergency disaster relief persons contributing efforts in the natural disasters. Mobile ad hoc networks are also a good substitute in the rural areas or the third world countries in which the traditional communication architecture is not established well.

Currently, the area has been growing with the new concepts in the industrial, health and other controlling applications and so it is needed to make the routing protocols more effective. As the memory is restricted and more power is utilized, programmers required to consider these two issues during creating wireless sensor networks. WSNs are specific to application and terminals are liable to sense, gather and aggregate data and forward it again to the destination.

The main focus for creating a good protocol of routing is: scalability in energy constrained, awareness of energy, and bandwidth limited environment, adaptability in limited memory environment. The Energy efficiency is the main concept in validating the ability to the deployment of the ad-hoc networks. With the hard energy restraint in the ad hoc networks, the energy is for the transmission of data, routes and maintenance establishment must be kept as low as possible. The utilized energy is a significant measure of QoS for ad hoc networks.

There has been important effort in suggesting the energy efficient protocols for example LEACH. In the clustering, the Cluster Heads form he virtual backbone where as the other terminals in the network related with these types of cluster heads to create the virtual clusters. Maximum energy gets drain out by the cluster heads in the wireless ad hoc networks. In this thesis several energy efficient protocols have been analyzed, that can have serious impact on these network's lifetime and suggested an algorithm which deals with the lowering the rate of the dissipation of energy of the cluster heads. The given solution have greatly exceed the standard allocation of the terminals to cluster-heads, depend on the shortest distance criterion. This paper presents, a try has been done to create the deterministic energy-efficient clustering protocol for the packet length, several coverage area, and the terminals to measure the network's performance.

LEACH protocol is organized into rounds. Each round is sub-divided into two phases, set-up phase and steady-state phase. A set-up phase is followed by steady state phase. The **setup phase** starts with the self-election of terminals to cluster-heads. The procedure of self election of terminals as cluster head is followed as a sensor terminal chooses a random number, r, between 0 and 1. LEACH is based on a hierarchical clustering structure model and energy efficient cluster-based routing protocols for sensor networks. In this routing protocol, terminals self organize themselves into several local clusters, each of which has one terminal serving as the cluster-head. In this protocol, terminals elects cluster head terminals for each clusters as randomly chosen maximum energy terminal in the current cluster becomes cluster head terminal and other terminals in that cluster are called as non-cluster head terminal.

The parameters of performance like the number of rounds and the dissipation of energy are analyzed and determined. Terminals absorbs energy during transmitting beacon signals

to the neighboring terminals for the intentions of finding their presence or sending data to another terminal [1]. As when an intermediate terminal has been chosen as a router, it utilizes more energy as compare to an idle terminal as it is involved actively in the communication. Hence, the residual energy of the terminals is important in determining the path for completing the transfer of data successfully without interruption. Therefore, a routing protocol which considers the terminals residual energy will perform better as compare to the protocols which do not.

II. BACKGROUND

1. MANET

Paper [2], A MANET is a self-configuring network consisting of mobile platforms simply referred to as "terminals" which are free to move about arbitrarily. A MANET is an autonomous system of mobile terminals. The system may operate in isolation, or may have gateways to and interface with a fixed network. MANET terminals are equipped with wireless transmitters and receivers using antennas which may be omni directional (broadcast), highly-directional (point-to-point), possibly steerable, or some combination thereof. The ad hoc topology may change with time as the terminals move or adjust their transmission and reception parameters.

Changes in MANET's topology normally found because of the mobility of engaged terminal or disruption of a terminal because of loss of the energy in that terminal [3]. These types of dynamic conditions disturbed the smooth communication in between the requirement in the network. Conceptually, within the MANET, a terminal may either work as an end terminal or as a router for forwarding the data packets in between the end terminals [4]. An efficient routing methods is needed to preserve sufficient services quality while communication in between the terminals.

2. LEACH

LEACH is the first and most popular energy-efficient hierarchical clustering algorithm for WSNs [5], [6], that was proposed for reducing power consumption. In LEACH, the clustering task is rotated among the terminals, based on duration. Direct communication is used by each cluster head (CH) to forward the data to the base station (BS). It uses clusters to prolong the life of the wireless sensor network. LEACH is based on an aggregation (or fusion) technique that combines or aggregates the original data into a smaller size of data that carry only meaningful information to all individual sensors.

LEACH divides the network into several clusters of sensors, which are constructed by using localized **c**oordination and control not only to reduce the amount of data that are transmitted to the sink, but also to make routing and data dissemination more scalable and robust. LEACH uses a randomize rotation of high-energy CH position rather than selecting in static manner, to give a chance to all sensors to act as CHs and avoid the battery depletion of an individual sensor and dying quickly. A current protocol structure which enhance the energy efficiency in the networks is Low Energy Adaptive Clustering Hierarchy (LEACH) [7].

LEACH takes communications between the terminals randomly shared in the constant square area, and an external receiver. It consists of the distributed cluster formation method, that allows self-organization of the huge numbers of terminals, algorithms for rotating cluster head positions and adapting clusters to equally share the load of energy among all the terminals. In the addition, LEACH do the local data fusion to "compress" the volume of the data being transmit from the clusters to base station, again decreasing energy dissipation and improving lifetime of system. Sensors select themselves as the local cluster-heads at any given time with some possibilities. These types of cluster head terminals spread their status to other sensors in network. Every sensor terminal evaluate to which cluster it requires to belong by selecting the cluster-head which needs the minimum energy of communication.

One time if all the terminals are arranged into the clusters, every cluster-head made a schedule for terminals in its cluster. This enables the radio elements of every non-cluster-head terminal to be turned off at all the times except while its time of transmit, hence lowering the energy dissipated in the sensors individually. If the cluster-head has all data from the terminals in its cluster, then the cluster-head terminal collects the data and then sends the compressed data to base station. As the base station is far away in scenario tare analysis, this is a very high transmission of energy. However, since there are only a few cluster-heads, this only affects a small number of terminals.

3. VARIANTS OF LEACH

In this section, Energy Efficient LEACH based protocol MANET with the variants of LEACH will be presented below.

3.1 Energy-LEACH

Energy-LEACH algorithm find maximum of all energy values and determines who the next cluster head to be selected. Here maximum of all energy values is calculated by using list of all energy received by the cluster head

3.2 Mobile LEACH

The LEACH considers all terminals are homogeneous with respect to energy, which is not realistic approach. In particular round uneven terminals are attached to multiple Cluster-head.

3.3 Security LEACH

It is the first modified version of LEACH with cryptographic protection against outsider attacks called Security LEACH(S-LEACH). It suggests that each terminal has two symmetric keys, a pairwise key shared with BS and the last key chain held by BS. S-LEACH is meant to protect only against outsider attacks.

3.4 MODLEACH

Here modification of LEACH is done as modified LEACH (MODLEACH) by introducing a well cluster head replacement scheme and dual transmitting power levels. Our modified LEACH, in comparison with LEACH performs well by using metrics of cluster head formation, through put and network life[8].

3.5 K- LEACH

The K-LEACH protocol improves the clustering and cluster head selection procedure. For the first round of communication, in setup phaseituse the K-medoids algorithm for cluster formation, which ensures uniform clustering.

3.6 LEACH-E

LEACH-E is the enhancement of LEACH. It involves a cluster head selection algorithm which have non-uniform starting energy level among the sensors having global slot..Each cluster has a cluster head terminal [9].

3.7 LEACH-B

It is Balanced Low Energy Adaptive Clustering Hierarchy protocol. LEACH-B uses the decentralized algorithms for cluster formation where each sensor terminal only knows about its own position and the final receiver and does not know about the position of all the sensor terminals.

Table 1. Performance comparison between LEACH protocol variants

Clustering Routing Protocol	**Year**	**Mobility**	**Self organization**	**Distributed/ Centralized**	**Hop Count**	**Homogeneous /Heterogeneous**
LEACH	2002	Fixed BS	Possible	Distributed	Single Hop	Homogeneous
LEACH-C	2002	Fixed BS	Possible	Centralized	Single Hop	Homogeneous
LEACH-B	2003	Fixed BS	Possible	Distributed	Single Hop	Homogeneous
TL-LEACH	2005	Fixed BS	Possible	Distributed	Single Hop	Homogeneous
LEACH-E	2007	Fixed BS	Possible	Distributed	Single Hop	-
LEACH-M	2008	Mobile BS and Terminals	Possible	Distributed	Single Hop	Homogeneous
LEACH-A	2010	Fixed BS	Possible	Distributed	Single Hop	Heterogeneous
Cell-LEACH	2012	Fixed BS	Possible	Distributed	Multi Hop	Homogeneous

4. ENERGY EFFICIENCY

The greatest challenge manifesting itself in the design of wireless ad-hoc networks is the limited availability of the energy resources. These resources are quite significantly restricted in wireless networks as compared in the wired networks. Energy-efficient communication is crucial for raising the life of the power limited wireless ad hoc networks. In current years, multihop wireless ad hoc networks have found extensive use in various fields due to their potential applications in civil and military domains. Some of the applications include mobile computing in areas where other infrastructure is unavailable, law enforcement operations, disaster recovery situations, large sporting events or congresses when it is not economical to build a fixed infrastructure for a short temporary usage, and tactical battlefield communications where the hostility of the environment prevents the application of a fixed backbone network.

Most mobile terminals in a wireless ad hoc network are powered by energy limited batteries, the limited battery lifetime is a hindrance to network performance. Therefore, energy efficiency is of vital importance in the design of protocols for the applications in such networks, and efficient operations are critical to enhance the network lifetime. Since the Terminals are battery-powered; thus energy is a precious resource, that has to be carefully used by the terminals in order to avoid an early termination of their activity, and hence the study and implementation of energy-efficient algorithms for wireless networks, quite constitutes a vast area of research in the field of ad-hoc networks.

III. LITERATURE REVIEW

The LEACH is the most representative routing protocols among hierarchical protocols, whose purpose is to balance the energy consumption of all terminals and thereby to increase the lifetime of network. LEACH randomizes the selection of cluster heads so energy load is balanced among the network and the lifetime is increased. LEACH is more energy efficient than previous flat routing protocols. To make LEACH more energy efficient many solutions have been proposed, among which two base paper has been chosen for further research. Ad hoc networks do not use a constant framework for the communication. To allow effective communication there is a need of to be a wireless backbone.

The backbone must alter to influence the changes in topology of network as the terminals move. The algorithm to select the backbone must be very efficient and fast as they include the mobile terminals powered by the battery. Clustering is the solution for the above issue. Even clustering faces the overhead from the formation of cluster and their maintenance. As the terminals are powered by restricted power supply, the basic aim is to design energy efficient clustering algorithms.

In CTP the terminal with better link quality is selected as parent most of the time and is the one which is involved in most of the communication, which drains out such good link quality terminals and results in network disconnection. In order to avoid this problem, a routing protocol is proposed to balance the traffic load among the possible routes. This is done by having residual energy as a decision factor in the routing tables and this information is exchanged between the neighboring terminals.

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LEACH-Mobile protocol in paper **[**10**]** supports the portability in the wireless sensor networks and is better as compare to LEACH protocol. In the LEACH-Mobile every sensor uses the two way communication method to become a part of a cluster. The cluster head transmits a message to the sensor terminals in its cluster and if it never detect from the sensor terminal it is supposed to have send out of the cluster. If a terminal does not detect from the cluster head, it attempts to link to the other clusters. This protocol can also go through from heavy packet losses and consumption of energy due to its cluster membership method.

IV. PROPOSED WORK

Network life plays very important and critical role in any wireless network. There are various techniques for the making of prolong network. This section discusses about the proposed work which is based on LEACH (Least Energy Adaptive Cluster HEAD) protocol. This proposed work is made workable for heterogeneous network where each and every node is having all to gather different type and energy level of nodes.

Proposed work is again based on two phases:

Phase 1: Set-up Phase

This take cares about the energy level of the each and every node of the network including cluster head are considered and evaluated.

Phase 2: Steady-State

This is again get updated. According to proposed work, energy level of each and every node of the network which wants to take part into transmission of the data are considered and evaluated.

V. SIMULATION AND RESULT ANALYSIS

There are various ways and means to evaluate the performance of any protocol. Here the proposed work is going to evaluate on following parameters:

1. Life-time of nodes
2. Routing Packets

This work is performed in given scenario (as shown in TABLE I).

TABLE I: Simulation Parameters

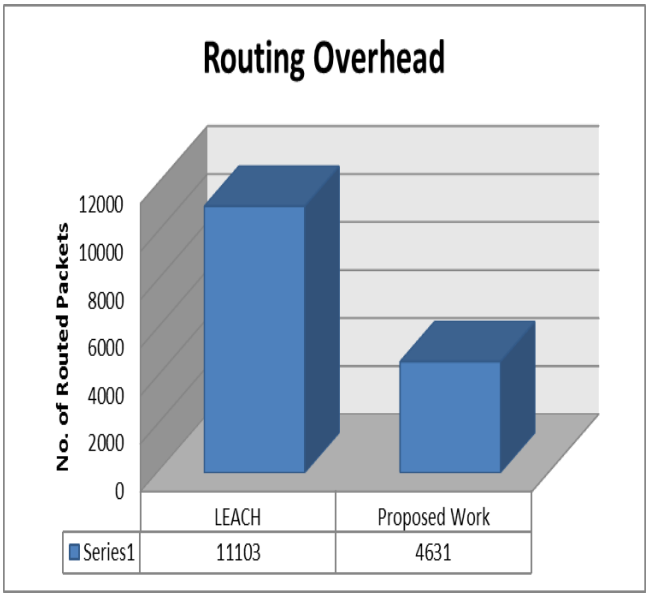
Area	**800 x600**
Traffic	TCP/FTP
Channel	Wireless
Operation mode	MAC_802.11
Mobility	Random waypoint
Antenna	Omni directional
IFQ	Queue/DropTail/PriQueue
Nodes	150
IFQLEN	10
Simulation Time	550 seconds

1. Routing Packets:

Routing packet is a figure which would be responsible for the showing of routing overhead of the network to route the number of packet transmits into the network.

TABLE II: Routing Overheads

LEACH	**Proposed Work**
11103	4631



Graph 1: Routing overhead comparison

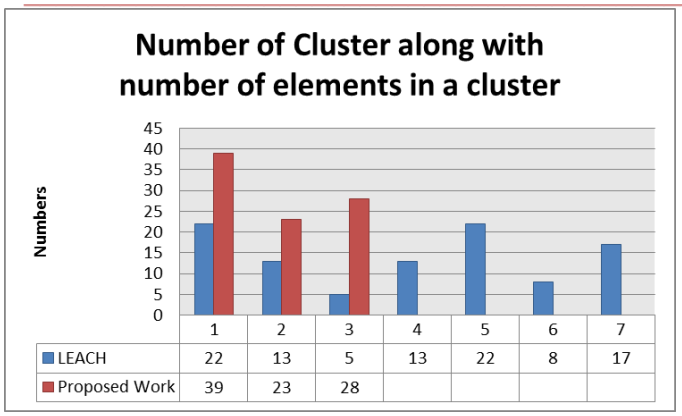
2. Life-time of nodes

It is calculated in terms of number of clusters. As number of clusters grow then energy requirement along with the energy spend in it's synchronization would get increased. And life-time of the network get decreased. And while it get decrease the life-time of the node gets increased and which increases the life-time of the network.

Here, calculation is based on 20th second calculation. But it is very obvious behaviors at other most of the time as well.

TABLE III: Number of Clusters

LEACH	**Proposed Work**
22	39
13	23
5	28
13	-
22	-
8	-
17	-



Graph 2: Number of Clusters at 20th Second.

This graph 2 shows that when there is less number of clusters are needed then energy is less required in number as compare to when there is high requirement of clusters in network. And this less energy requirement increases the life-time of the network.

VI. CONCLUSION

The performance of proposed protocol, LEACH Based Method for Prolong the Network Life, are gives excellent results in given simulation parameters. The packet routing overhead and number f clusters are represents the performance of proposed protocol , LEACH Based Method for Prolong the Network Life , outperforms static clustering algorithms by requiring terminals to volunteer to be high-energy cluster-heads and adapting the corresponding clusters based on the terminals that choose to be cluster-heads at a given time. At different times, each terminal has the burden of acquiring data from the terminals in the cluster, fusing the data to obtain an aggregate signal, and transmitting this aggregate signal to the base station. LEACH is completely distributed, requiring no control information from the base station, and the terminals do not require knowledge of the global network in order for LEACH to operate. Distributing the energy among the terminals in the network is effective in reducing energy dissipation from a global perspective and enhancing system lifetime.

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