Modification of Leach Protocol In Wireless Sensor Network

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Abstract- *In wireless sensor networks, leach protocol control is more efficient in terms of channel utilization and energy efficiency. Energy consumption is dominant part in any wireless sensor networks to be work on. These are many low energy consumption routing Protocols designed and tested to save energy of an WSN and ultimately to increase lifetime of network .EIP LEACH is one such protocol in which cluster head is chosen such a way that it should have better energy parameter. This helps increasing lifetime of cluster head and ultimately network. As in EiP -LEACH only one such cluster head is chosen and that cluster head has to communicate with each node of network. Instead this project proposes a method based on ICH-LEACH where, there will be hierarchy which will consist of Master and slave cluster head so as to enhance lifetime of Master cluster head and lifetime of particular network. The packet delivery ratio keeps high i.e. 95% above and link estimated error within 10% for 95% link. The experiments provide optimization of leach protocol length achieves best performances related to the previous experiments.*

Keywords- NS, LEACH Protocol, WSN

I. INTRODUCTION

A fundamental challenge in wireless networks is that radio links are subject to transmission power, fading, and interference, which degrade the data delivery performance. This challenge is exacerbated in wireless sensor networks (WSNs), where severe energy and resource constraints preclude the use of many sophisticated techniques that may be found in other wireless systems. The simple, cost-effective solution based on the technique of dynamic packet length control to improve the performance in these varying conditions. A tradeoff exists between the desire to reduce the header overhead by making packet large, and the need to reduce packet error rates (PER) in the noisy channel by using small packet length. Existing approaches usually require that a set of parameters to be carefully tuned such that it can better match the level of dynamics seen by any particular data trace. However, any fixed set of parameters will not adapt to the changing conditions since one parameter set does not fit all conditions. Furthermore, the update process would require user intervention, further data collection and reprogramming the parameters.The DPLC running the CTP protocol, and compare its performance with a simple aggregation scheme and AIDA. The results show that DPLC achieves the best performance in terms of transmission overhead and energy efficiency. We design and implement a dynamic packet length optimization scheme in the context of WSNs. We incorporate an accurate link estimation method that captures wireless characteristics. We provide two easy-services, i.e., small message aggregation and large message fragmentation, to facilitate upper-layer application programming. The implementation of DPLC is lightweight, with respect to computation, memory, and header overhead. We also evaluate DPLC extensively. We demonstrate the feasibility of dynamic packet length optimization in WSNs, and show its performance improvement by integrating it into CTP, a widely used data collection protocol.Wireless sensor network (WSN) is formed of multiple sensors which transfer the data that they gather to a special node called base station as shown in figure 1. In fact, there are multiple applications for WSN like industrial applications (Monitoring, control of machines), health care analysis, environment, traffic control, agriculture monitoring and home automation. However, routing process between nodes consumes a lot of energy which determines the network's liftime. Furthermore, there are two categories of WSN routing protocol level routing and plane routing. In the last category, we have multiple protocols like DD, SPIN, SAR etc.. .In the first category, there are numerous protocols like TEEN, LEACH etc...[1].

The purpose of this study is to find the optimal packet length for the real time channel conditions. The basic idea is: if thepacket length is too large, the packet retransmission rate willbe high due to packet error; on the other hand, if the packetlength is too small, the effective data throughput will be lowsince much transmission is spent on packet headers. Thereforesome optimal packet length exists to achieve maximal throughput.

A. LEACH protocol in Wireless Sensor Network

1) Theory of LEACH protocol

LEACH protocol refers to Low Energy Adaptive Clustering Hierarchy , which is designed as a routing protocol for Wireless Sensor Network. Generally speaking, there are three steps in cluster routing protocol: the generation of cluster heads, the formation of clusters and the communication among clusters. Hence, LEACH algorithm also includes these three steps, just merging the first two steps into one that is the establishment of clusters and the communication among clusters. Thus, LEACH protocol algorithm contains the set-up of clusters and stable data transmission. As for the selection of cluster heads, LEACH adopts equal probability method, selecting cluster heads in a circle and random manner and distributing the energy of the whole network evenly on each node. Therefore, LEACH algorithm reduces the energy consumption, prolongs the lifetime of the network. The executive process of LEACH is periodical, and each period includes the establishment of clusters and data transmission, and we call a period as a round. In order to conserve the energy, the duration of stable data transmission phrase is much longer than the time required for the establishment.

2) Advantages and Disadvantages of LEACH Protocol

LEACH protocol adopts the method that selects cluster heads at random, which avoids the cluster head to be premature death due to the excessive consumption of energy and form the phenomenon of monitoring blind area. Besides,data fusion efficiently reduces the amount of data communication. Hence, compared with the general routing protocols and static routing protocols, LEACH protocol can prolong the lifetime of Wireless Sensor Network about 15%.Apart from the advantages owned by cluster routing protocols, LEACH also have the following advantages a.LEACH protocol carries out data fusion during data transmission, which reduces the redundant data and conserves the energy.

b. LEACH protocol adopts the mechanism of MAC layer based on CDMA, effectively avoiding signal interference when transmitting data between clusters; while in the cluster, this protocol adopts the mechanism of MAC layer based on TDMA to avoid information conflict sent by nodes, making nodes to sleep when they are not in their own time gaps, so as to save energy.

c. LEACH protocol is proceeding at round. After each round, the protocol will reselect cluster nodes and form new clusters. Thus, each node in the network has the chance to be a cluster head, and the load of the whole network will evenly distribute on each node.

II. LITERATURE REVIEW

1. **EiP-Leach :Energy influenced probability based leach protocol for wireless sensor network ,Anup Kumar M.Bongale ,IEEE 2017.**

In this paper EiP leach protocol is proposed which is an enhanced version of leach protocol that is influenced by the energy parameter for cluster head selection. In leach protocol the node becomes inoperable after 541st round where as for EiP Leach the node dies after 1116 round.There are many hierarchical protocols which focus on electing an optimal CH node and LEACH is one of the well-known cluster based routing protocol. In this paper, EiP-LEACH an enhanced variant of LEACH protocol is proposed; in which CH selection is carried out using probability based threshold value that is influenced by residual energy of candidate CH node and average initial energy of entire network. The choice of CH node is highly dependable on energy parameter.

2. **ICH-LEACH: An Enhanced Leach Protocol for Wireless Sensor Network. M.Bennani Mohamed Taj ,IEEE 2016.**

In this paper , we propose an improved multiparth Leach protocol which uses at most one intermediate cluster head. The aim of our protocol is to extend the lifetime of the network and send more data compared to the original protocol In leach protocol the node dies at round 20, but in our protocol the node dies in round 22. We came up with an improved protocol called ICHLEACH. In fact, this protocol is characterized by the adjustment of the power of transmission, and the distance between the base station and cluster heads. Our new protocol surpassed the original one in term of energy consumption, network lifetime and the number of sand data by avoiding a direct send of data if the distance from the sink is too far. The simulation that we made with initial energy for every node shows that our algorithm is efficient compared to the original one.

3. **Clustering Algorithm for improved network lifetime of mobile wireless sensor network , Jun. Corn, J.W. Bruce ,IEEE 2017.**

In this paper, we propose LEACH-CCH as a clustering algorithm aimed at improving wireless sensor network lifetime in the case of mobile sensor nodes. LEACH-CCH reduces the energy expended during the costliest data transmission. LEACH-CCH increases the lifetime of network .Initial energy given to each node is 0.5J in leach as well as in LEACH-CCH . LEACH-CCH maintained 80% of alive nodes for 8.2% longer than Leach. LEACH-CCH achieves an

improvement of 0.44mJ per data message transmitted to the cluster head.

4. **L.M. Kamarudin, R.B. Ahmad, D.L. Ndzi, A. Zakaria, K. Kamarudin, M.the E.E.S Ahmed, "Simulation and analysis of LEACH for wireless sensor networks in agriculture," IEEE 2017.**

This paper has presented the modeling and evaluation of LEACH protocols in agriculture. LEACH is a cluster based routing protocol which is widely used in WSNs. The protocol achieves energy efficiency through clustering technique with TDMA based MAC layer algorithms and data aggregation method. However, analysis and simulation studies performed on LEACH protocol shows that it uses very simple and unrealistic models, such as simple radio propagation model that do not consider obstacles such as trees in radio propagation channel, simple radio energy models and unlimited transmit power level for protocols evaluation.

5. **Y.Chung and D. Kim, "Self-Organization Routing Protocol Supporting Mobile Nodes for Wireless Sensor Network," in First International Multi-Symposiums on Computer and Computational Sciences, 2006.**

In this paper the main challenge has been the energy efficiency of network. Even while design the routing protocols for WSN, the aim of least energy consumption holds its top priority because energy resources are very limited. The first objective behind the routing protocol design is to keep the sensors in operation for as long as possible, thus extending the network's lifetime. The energy consumption of the sensors is dominated by data transmission and reception. Therefore, routing protocols designed for WSN should be as energy efficient as possible to prolong the lifetime of individual sensors and hence the network's lifetime. In this paper various LEACH-based protocols has been discussed in brief. Furthermore, the timeline and surveyed summary table of LEACH and its descendant routing protocol has been presented. Due to the drawbacks of LEACH, many protocols have been come to solve these problems. However, more work is still needed to find more efficient, scalable and robust clustering scheme to enhance energy consumption and enhance networks lifetime in small and large WSN .

III. METHODOLOGY

- **Study of EiP Based LEACH and ICH protocol :**

First of all EiP Based LEACH Protocol and ICH-LEACH protocol will be studied. EiP Based leach protocol measure power of cluster head to have better energy parameter. Using the concept of ICH-LEACH protocol we proposed modified EiP Based leach protocol. The new algorithm is based on EiP and ICH-LEACH protocol.

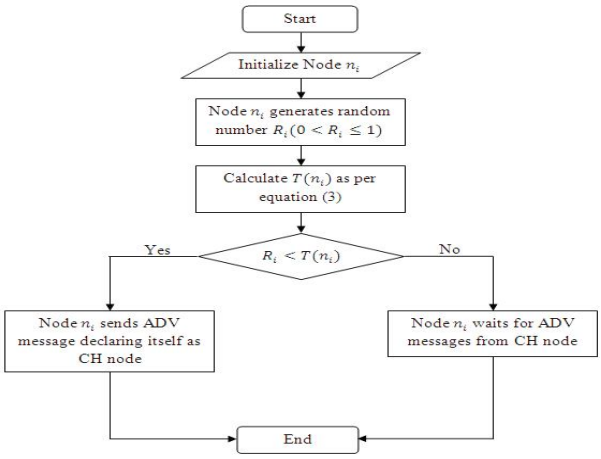

Fig.1. Cluster Election Process of EiP-LEACH

The cluster head election of EiP-LEACH is shown in figure 1. The proposed protocol works similar to LEACH protocol. The major difference between LEACH and proposed protocol is that the CHs are elected based on the parameter influenced by energy. In the proposed method, each node ni generates a random number Ri ($0 < Ri \leq 1$) The modification in calculation of T(ni) .If the random number Ri < T(ni), the node ni is declared as CH node for the current node and CH broadcasts ADV message to all nodes the network indicating that it has become CH node and invites other nodes to join it to further form a cluster. ICH-LEACH protocol aims to reduce the energy consumption in order to extend the network's lifetime and send more data to the sink. Also, our proposition uses the exact phases of LEACH, and use the same number of cluster head as LEACH. Actually, the main problem of LEACH is to send Data from the cluster-Head to the sink directly. Thus, the necessary energy for transmitting Data is high. Even more, if the sink is too far the transmission is impossible and the data is lost. So, by using an intermediate cluster-head if the distance is far, then we make sure that the amount of consumed energy is less during each round and the amount of transmitted.

- **Modification of EiP based LEACH protocol :**

Eip based LEACH protocol helps in deciding the better CH nodes and thereby contributes towards network life prolongation. The modified EiP LEACH protocol contain master and slave cluster head to enhance lifetime of master cluster node and lifetime of network.

- **Defining algorithm for modified LEACH :**

The algorithm is the modification of LEACH protocol in which EiP protocol is modified.

- **Study and Installation of NS :**

The first version of ns, known as ns-1, was developed at Lawrence Berkeley National Laboratory (LBNL) in the 1995-97 timeframe by Steve McCanne, Sally Floyd, Kevin Fall, and other contributors. This was known as the LBNL Network Simulator, and derived in 1989 from an earlier simulator known as REAL by S. Keshav.Ns-2 began as a revision of ns-1. In 1995 ns development was supported by DARPA through the VINT project at LBL, Xerox PARC, UCB, and USC/ISI. In 2000, ns-2 development was support through DARPA with SAMAN and through NSF with CONSER, both at USC/ISI, in collaboration with other researchers including ACIRI.Ns-2 incorporates substantial contributions from third parties, including wireless code from the UCB Daedelus and CMU Monarch projects and Sun Microsystems. For documentation on recent changes, see the version 2 change

NS is a discrete event simulator targeted at networking research. Ns provides substantial support for simulation of TCP, routing and multicast protocols over wired and wireless networks.

Ns has always include substantial contributions from other researchers, including wireless code from the USB daedelus and CMU monarch project and sun
Microsystem.

- **Implementation / simulation of modified algorithm in NS :**

The modified algorithm is implemented on NS software to analyze the algorithm which prolong lifetime of node and network.

- **Analysis of energy parameter:**

Energy parameters will be analyse and compare with EiP LEACH protocol to improve the lifetime of network.

- **Comparison with existing algorithm:**

In the last we will compare modified LEACH protocol
With existing LEACH protocol.

IV. SIMULATION AND RESULT

In this section, we are going to use a simulation to evaluate and analyze our protocol. In order to verify our algorithm, we are going to compare our results with LEACH protocol.

A. Simulation setup:

The parameters that we used in our simulation are ,we used 5j as the initial energy for all nodes . also, we used an application which generates packets every 0,1 second. We also use 20 nodes in surface of 100 m2 . We put the base station at (1,1) coordinates. Finally, we assume that every node can reach the sink.

B. Analysis of results:

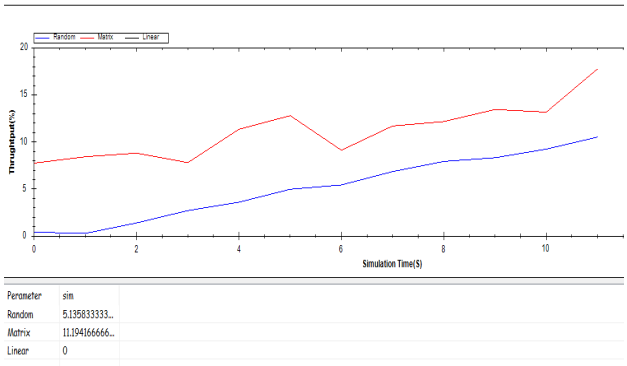

Fig. 1 . Throughput of random and matrix leach.

In fig.1 we observe the LEACH in random and matrix type, in matrix the nodes are live for 11.19s and in random nodes are live for 5.13s time duration.

C. Energy consumption :

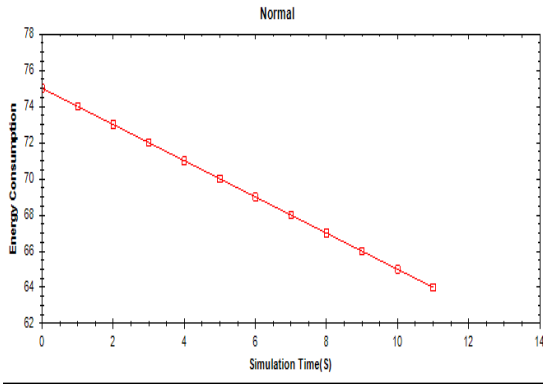

Fig.2 Energy consumption

Fig.2 shows energy consumption of modified LEACH protocol .

D. Network lifetime :

Fig.3 shows network lifetime of modified leach protocol .

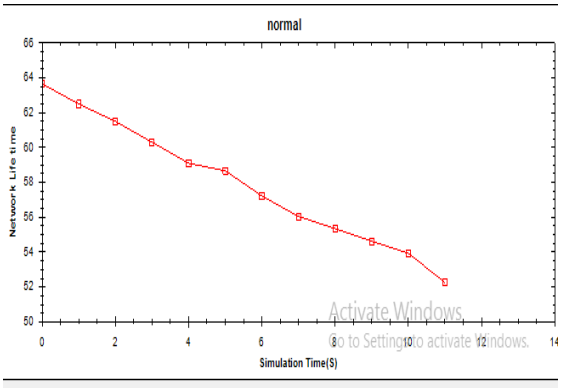

Fig.3 Network lifetime of modified leach

V. CONCLUSION

In this project, modification of LEACH protocol is proposed by defining new algorithm for CH selection. After the modification and implementation of algorithm in NS software expected result should contain the increased lifetime of wireless sensor network. Also comparative analysis between the existing EiP based, ICH based of this modified LEACH will be done. This proposed dynamic packet length optimization approach will provide accuracy in link estimation that capture physical channel condition, increase packet delivery ratio, increase system throughput and efficient energy utilization.

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