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Energy Optimized Leach Protocol (EOLP) in Wireless Sensor Network Using O-LEACH

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Abstract: ***Wireless sensor network consists of large no of nodes that can sense each other, which are technically and economically feasible to measure the conditions in the environment around them. Mainly wireless sensor networks are used to reduce the energy consumption. This becomes main problem these days. Hierarchical routing protocol is mainly used for the energy consumption. LEACH protocol is also hierarchical protocol. In this paper we use modified algorithm of O-Leach protocol. This protocol gives best results for prolonging the lifetime of the network. This new technique reduces the energy consumption, delay and also increases the throughput. Modified algorithm is named as EOLP using O-Leach. In this energy radio model is used for energy reduction along with modified algorithm. Both O-LEACH and EOLP are implemented with ns2 then comparison of both shows that EOLP reduces consumption of energy more than O-LEACH.***

Keywords: WSN, Clustering, LEACH, EOLP.

I. INTRODUCTION

After a long term it has been found that there have problem of less battery power of sensor nodes in Wireless sensor networks. It consists no of small tiny nodes which have sensing power. These nodes collect information by interacting with each other. Sensor nodes send information to other nodes in this way all the nodes interact with each other. These sensing nodes are used to monitor physical or environmental conditions such as temperature, sound, pressure, and motion at different locations. Sensor nodes are also used in the applications of battlefield surveillance, seismic detection for the detection of any dangerous gases. These all nodes works on energy,As the battery is finished then working of all the nodes will be stopped. So to reduce energy consumption many protocols have been proposed like LEACH, PEGASIS, SPIN, GEAR etc. But from all of these LEACH is best chosen for less energy consumption because it works on the procedure of clustering. In this clusters are formed as one is the cluster head which gathers information from all the other nodes and then this cluster head send whole gathered data to the base station. For less energy consumption some new techniques are added to this protocol sometimes it is called as its advanced versions or new techniques of LEACH protocol. We also found a new technique for the consumption of less battery power as well as to improve some another factors. This is named as EOLP. It is found by doing some modification in latest version of LEACH protocol. In section 2 we discuss about detail study of LEACH protocol. Then in next section we discuss about related work and then we introduce the proposed work for this. In the end we discuss about conclusion and future scope.

II. DETAIL STUDY OF LEACH PROTOCOL

LEACH is a low energy adaptive clustering Hierarchical protocol. It works on the basis of clustering. In which clusters are formed. From these clusters each have a cluster head which acts as the head of the cluster. Which sends message to all the nodes then these nodes send their data to the cluster head then cluster head send all collected data to the base station. This whole procedure is done on the basis of threshold value. In this clusters are formed by distributed method. Where each node makes its own decision. Firstly a node becomes a cluster head by probability p then broadcasts its decision to all other nodes each non cluster head node chooses its cluster head by least communication. This procedure is done in each round again and again. Each node chooses a random no between 0 and 1. A node becomes cluster head if its random no is less than the threshold value.

$$T(n) = \frac{p}{1-p*(r \bmod 1/p)} \quad : \text{if } n \in G$$

$$T(n) = 0 \quad : \text{otherwise}$$

In this equation p is the desired percentage of CH nodes in the sensor population, r is the current round no, G is the set of nodes that have been cluster heads in last 1/p rounds. So we can say that the decision of cluster head is based on probability. If cluster head dies then whole cluster will ruins. All this working is done with two phases that are:

A. Set up phase
B. Steady state phase

Set up phase:-In set up phase all the sensor nodes group themselves in a network. Then all these nodes send hello message to each other and then cluster head is chosen on the basis of their threshold values. Then cluster head send

messages to all nodes that are under its area. The nodes which are wish to join that cluster send back messages to the cluster head. Cluster head check that the members which are required for the cluster. After this steady state phase works.

Steady state phase:-In this phase after the creation of all clusters. TDMA schedule is created. According to TDMA schedule all the nodes send data to cluster head and then cluster heads send data to the base stations. This procedure is done for the less utilization of energy. This transmission of data is called direct transmission.

After this section related work is done for optimization of energy in LEACH protocol.

III. RELATED WORK

In related work all the work is done with the different techniques to consume less energy. O-LEACH works as LEACH protocol but it uses the Multihop scheme and also works on residual energy, after that it will works as simple LEACH. Cluster head is chosen on the basis of energy greater than 10 per of energy greater than other nodes. It uses the both M-LEACH and LEACH-C. In this Multihop LEACH works in a way that the sensor nodes with high capacity and nodes with lowest capacity are chosen. In this highest capacity nodes acts as cluster heads and lowest capacity nodes works as simple communicable nodes. While LEACH-C works on the basis of centralized approach and O-LEACH also works for the less consumption of energy. It works on the basis of residual energy. In this n-sensors nodes are deployed into M*M region. In this scheme base station is located at the center of square region or on the top of the square region. In this nodes are in static mode. It works in better way than LEACH and multi-hop LEACH protocol.

IV. ENERGY MODEL

Transmitted power, etc.), and nodes behavior during the communication (retransmission, congestion, diffusion of the messages,.).

The consumed power by sensor is that the consumed power by these captures units, treatment units and communication units. So the energy consumption formula is defined follows:

$Ec = Ec/Capture + Ec/Treatment + Ec/Communication$. (2)

Where:

- *Ec*/*Capture*: is the energy consumed by sensor during the capture unit activation. This energy depends primarily on the type of detected event (image) and of the tasks to be realized by this unit.
- *Ec*/*Treatment*: is the energy consumed by the sensor during the activation of its treatment unit.
- *Ec*/*Communication*: is the energy consumed by the sensor the activation of its communication unit.

The consumed energy by sensors during communication is larger those consumed by treatment unit and capture unit.

Indeed, the transmission of a bit of information can consume as much as the execution of a few thousands instructions.

For that, we can neglect the energy of the capture unit, and the treatment unit compared to the energy consumed by the communication unit. In this, case the equation (2) will be thus

$Ec= Ec/Communication$. (3)

The communication energy breaks up into emission energy and reception energy:

$Ec/Communication = ETX + ERX$. (4)

Referring to [14], the transmission energy and reception energy are defined as follows:

$ETX = E_{elec}*K + \varepsilon mp *K *d\lambda$(5)

Where:

- K=message length (bits).
- D=distance between transmitting node and receiving node
- λ= of way loss exhibitor, $\lambda > 2$
- *Eelec*=emission/reception energy, *Eelec*=50 nJ/bit.

V. PROPOSED EOLP

Proposed scheme is named as EOLP. In this M*M square region is used. In this firstly random nodes are chosen that random nodes act as initiators. These random nodes send hello messages to all the nodes in their own clusters. Each node send their energy levels to the initiator node. Then initiator nodes form hierarchy of cluster heads based on their energy levels. As initiator decides cluster heads for subsequent rounds in initial stage only. Highest energy node for 1st round and 2nd highest for next round and so on. Then the entire cluster heads gathers data and send it to the base station. Its work is better than earlier technique.

VI. PROPOSED ALGORITHM

- Chose random nodes from each cluster temporarily.
- Random node acts as initiator node.
- Initiator sends hello messages to the nodes in their own cluster.
- Each node sends their energy level back to the initiator node
- Initiator node forms a hierarchy of clusters based on their energy levels.
- Highest energy node will be selected as CH for round1, second highest energy for round2 and so on.
- CH forward data to base station via multihop.

VII. SIMULATION AND PARAMETERS

In this section we evaluate EOLP using ns2 and its performance is compared with the LEACH-O protocol. Firstly LEACH-O is performed in ns2 then their results are compared. It is taken in area of 1100×1100. Their initial energy is taken as 100.

Performance parameters

Parameters	Value
MAC Type	802.11
Initial energy	100
x-axis distance	1100
y-axis distance	1100
Max packet	500
No of nodes	50
Channel Type	Wireless channel

VIII. COMPARISON STUDY OF BASE AND PROPOSED WORK

Results: - In this paper we evaluate energy efficiency of nodes, delay and throughput. It performs better than O-LEACH. In this 68 joules of energy is used while with earlier protocol it uses 100 joules of energy for all the 4000 rounds. In new scheme less delay occurs as compared to the O-LEACH protocol. Throughput also performs better than earlier protocol. It performs better for all the 4000 rounds while O-LEACH performs lesser than this.

Energy: - With the proposed technique energy is consumed as it remains after the completion of 4000 rounds. But in base paper all energy is used up for 4000 rounds.

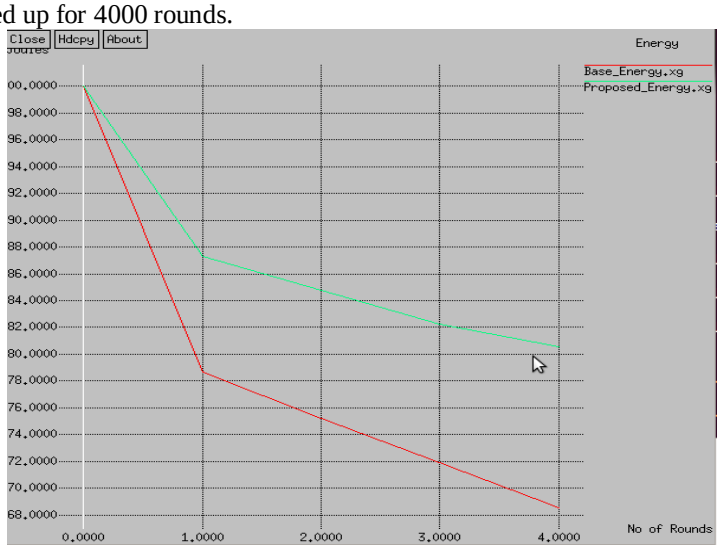

Fig.1 energy is consumed as it remains after the completion of 4000 rounds. But in base paper all energy is used up for 4000 rounds

Delay:- In this result red color signifies delay for proposed technique and green color signifies base delay. Proposed delay is much lesser than base delay for 4000 rounds.

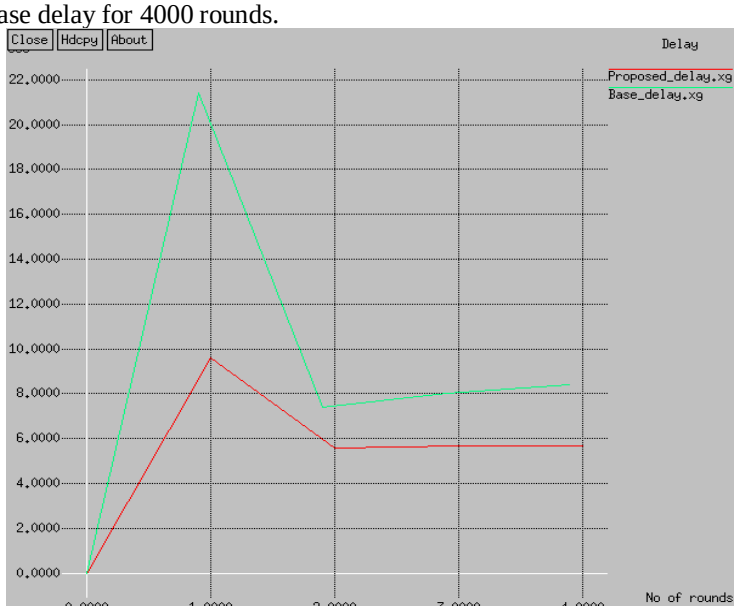

Fig.2 Proposed delay is much lesser than base delay for 4000 rounds.

Throughput:-Throughput of proposed technique is better than base technique for the same no of rounds. Base throughput is shown by red line and proposed throughput is shown by green color.

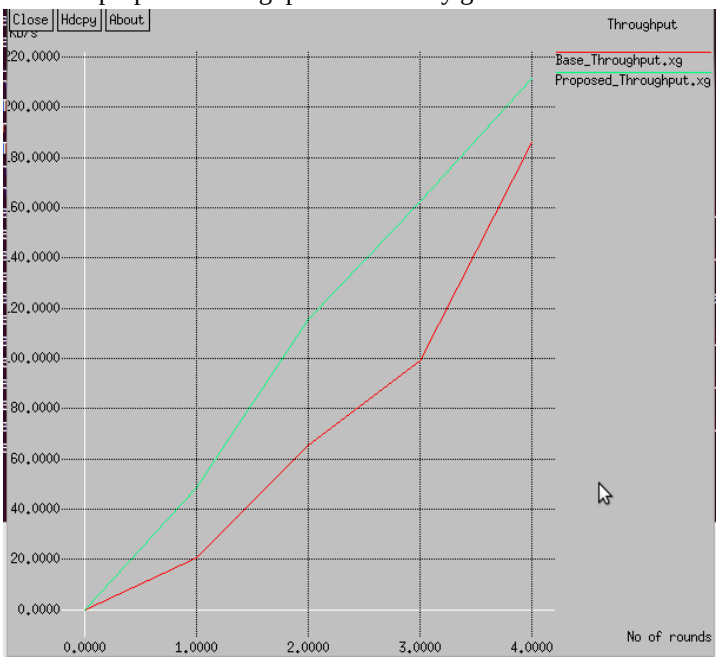

Fig.3 Base throughput is shown by red line and proposed throughput is shown by green color.

IX. CONCLUSION AND FUTURE SCOPE

In this we concluded that energy, delay and throughput are improved than the base approach. It performs in a better way as compared to the base approach. And for future work we can consider some other factors like (distance to base station, or any other genetic algorithm to select cluster head) so that performance of network can be more optimized.

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