Leach Protocol & Its Improvement on Leach-RE (Residual Energy Protocol) In Wireless Sensor Network

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***Abstract*: In few applications, for example military, natural and household Wireless sensor Networks are employed. In the execution of wireless sensor Network, energy usage is the deciding factor in all these applications. The energy accessible for sensor is limited. Enhancing network life period is the key challenge in designing an efficient protocol for wireless sensor Network. The main focus of this work lies on increasing network lifetime so that battery need not to be replenished soon. An efficient method for achieving this objective is Clustering Sensor node. Within this work, an energy proficient clustering algorithm on behalf of sensor network based on the LEACH (Low Energy Adaptive Clustering Hierarchy) protocol is introduced. The one of the most well-liked cluster-build structure is LEACH, in wireless sensor network. The proposed protocol LEACH-RE (Residual Energy Protocol) have aided the facility that it reduces the consumption of network resources as compare to LEACH algorithm in each round. The projected protocol will be simulated and the outcome will demonstrate a significant drop in network energy consumption the same as in contrast to LEACH. LEACH-RE will be suitable to boost the throughput & life span of network.**

***Keywords*: WSN, LEACH, LEACH-RE**

(I) INTRODUCTION

An assortment of recent devices and equipments like living organisms, relies on the sensory records from the existing world around it. Wireless Sensor Networks (WSN) provides sensory data, which comprises of a few minute sensor nodes to observe physical or environmental circumstances, for instance vibration, temperature, pressure, movement or sound and at that moment in a group send these particulars to a central computing system, called base station or sink. The movement of this information is governed by different routing protocols. The most dynamic research territory in the present computer science and media transmission is Wireless Sensor Networks (WSN).

A device which identifies the existence & react quickly several types of input either from environmental or physical condition is called as Sensor. An electrical signal with the intend of further processing is transmitted to a controller is the output of sensor. A type of wireless community that includes a massive quantity of circulating, self-directed, tiny, devices of low powered named sensor nodes called motes is Wireless sensor network. These networks definitely cover a massive number of spatially distributed, minute, battery-operated, embedded devices that are networked to considerately gather, process, and pass on information toward the operators moreover it also controls the potential of computing & processing.Nodes of sensor network which works equally to structure the network are tiny computers. It can be in order of hundreds or in thousands .Smart sensor nodes are low power devices.WSN, are like remote ad-hoc network as they depend on remote availability & spontaneous formation of network so that sensor information can be transported remotely.

(a.) Application Area of Wireless Sensor Network:-

i. WSN have been effectively applied in different application domains as they have adaptability in taking care of issues in different application areas and they can possibly change our lives. It can be used for examination along with focusing on systems in military applications.

ii. To examine various phenomena sensor nodes are placed over an area. To monitor movement within the buildings & infrastructures such as bridges, flyovers tunnels etc. wireless sensor Network can be utilized.

iii. In monitoring doctors or patients in a hospital, sensor nodes can be used with several of the applications are supporting interfaces for disabled, integrated patient monitoring, drug supervision in hospitals.[4]

(b.) LEACH Protocol

LEACH stands for Low-Energy Adaptive Clustering Hierarchy. A TDMA based MAC protocol which is coordinated with basic routing protocol & clustering in remote sensor systems (WSNs) is LEACH [7]. To get better the duration of a Wireless Sensor network, LEACH is used to lesser the energy consumption, required to form & maintain the clusters. [1]

(c.) Variants of LEACH

i. **LEACH-C** The selection of cluster head criteria uses LEACH protocol. At the time of the selection of the cluster head, energy consumption of nodes is considered. It utilizes area data of nodes using global positioning system or spot tracking system. It isn't vigorous because location information of nodes in the cluster it needs. It does not support energy balancing of nodes. [2]

ii. **EDRLEACH** Base station selects the cluster heads at each round. In EDRLEACH, decision of cluster head choice in first round is not quite the same as alternate rounds. In first round, base station utilizes table to store data of nodes for example, number of neighbours, residual energy and distance. This supports direct correspondence amongst nodes and Base station. EDRLEACH enhances LEACH by utilizing uniformly circulated cluster and diminishing the imbalanced topology of the clusters. Balancing of network load increases network lifetime.

iii. **RECHS (Redundant and Energy-Efficient Cluster head Selection Protocol)** there are two cluster heads in each cycle, one cluster head is beginning cluster head and another is initial redundant cluster head. Base station chooses the cluster head take off of these two cluster heads rely on residual energy of the nodes and average hops from customary nodes to these cluster heads. RECHS protocol utilizes multi-hop routing inside clusters [6]. RECHS protocol enhances the security and unwavering quality of the network. RECHS protocol adjusts the network load and also enhances the network lifetime.

(II) Materials & Methods used

Research is a methodical study of system to increase the stock of knowledge & to draw new facts from existing facts. An appropriate tool must be used to conduct a good & efficient research work. It is desirable to study & investigate the performance of different WSN protocols under various types of scenarios & to propose efficient LEACH variant protocol [3] .Minimizing energy debauchery and take full advantage of network duration are important issues in the design of applications & protocols for sensor network. This research work seeks an energy-optimal enhancement to the network in such way that maximize network lifetime while ensuring simultaneously full area coverage & sensor connectivity to cluster heads, the approach being used will be independent to the scenario. In this research paper, following objectives will be achieved.

i. Implementation of existing LEACH protocol.

ii. To design the enhancement parameters to choose the cluster head.

iii. Implementation of LEACH-RE protocol.

iv. To increase the life period of each node by using collective techniques and residual energy concept. So, as a result, the network duration will be improved.

v. To analyze the network life span in terms of live nodes & packet transferred.

(III) LEACH-RE

WSN composed of tiny sensor nodes, wherever each sensor node is defined with some energy. As data is transferred over the network each sensor spends some energy in receiving data, sending data & forwarding data. For this reason, network life depends on how to a huge extent energy spends in each one transmission [5]. WSN usually have some degree of transmission range, due to energy constraints. A primary goal of Wireless Sensor Network is to utilize energy efficiently. LEACH-RE protocol will improve the existing LEACH protocol.

Algorithm for LEACH-RE

```
Define a network with N nodes.
For i=1 to N
{
Define Initial Energy, Transmitting Energy, Rev Energy and other parameters for Node(i)
Set Node(i)=”N”
}
for i=1  to Max Rounds
{
if Energy Node(i)>=0 and P(i)>=Random Value
{
if(Node(i)=’N’ and Energy(Node(i))=Max and Residual Energy(Node(i))=Max and Distance(Node(i))=Min
{
Set Node(i)=’C’
}
}
Else
{
```

```
Dead=Dead+1;
Alive=Alive-1
}
}
```

(IV) Results & Discussions:-

Simulation parameters required for LEACH& LEACH-RE protocols by means is displayed in this section.

Network Area	300*300mt.
Maximum Rounds	4500
Network Size	90 nodes
Probability	0.1
Protocol	LEACH & LEACH-RE
Initial Energy	0.5J

Simulation Parameters for evaluating LEACH & LEACH-RE

(a.) Results for LEACH & proposed LEACH-RE

Various performance metrics such as dead nodes, live nodes, packets transmitted to base station, packets transferred to cluster head, throughput and average residual energy used to analyze & compare the performance of LEACH & LEACH-RE protocol.

When node energy happen to be less than zero & it becomes unable to contribute to network then it is declared as DEAD. In LEACH protocol, nodes begin to die more quickly.

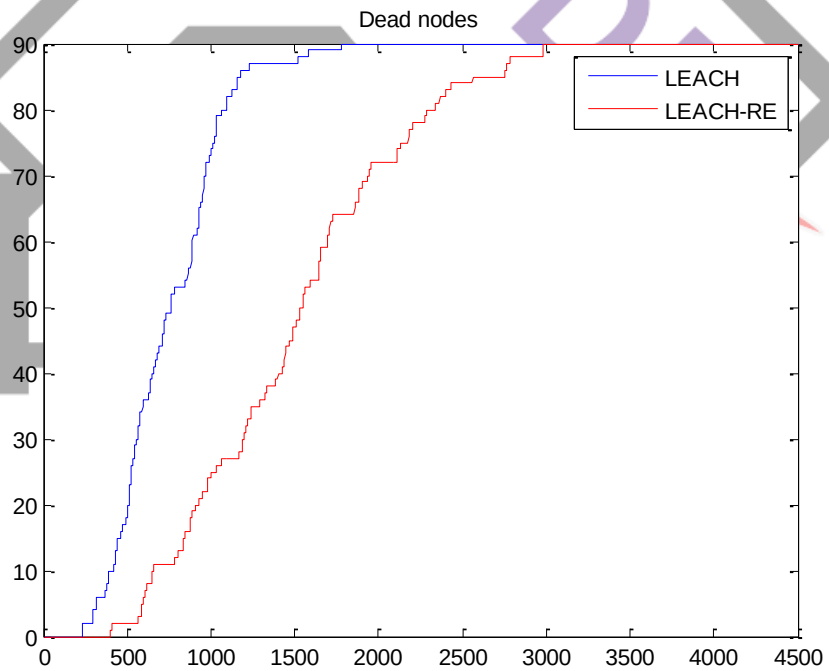

Fig.1 Dead nodes of LEACH & LEACH-RE

As revealed in figure 1, almost 55 nodes dies in 700 rounds and 90 nodes dies in 1750 rounds. But in the case of LEACH-RE, only 50 nodes dies in 1500 rounds and all the available 90 nodes dies in 2950 rounds. The number of rounds before the very last node dies in network using LEACH-RE is higher than the number of rounds before the last node dies in network using LEACH protocol.

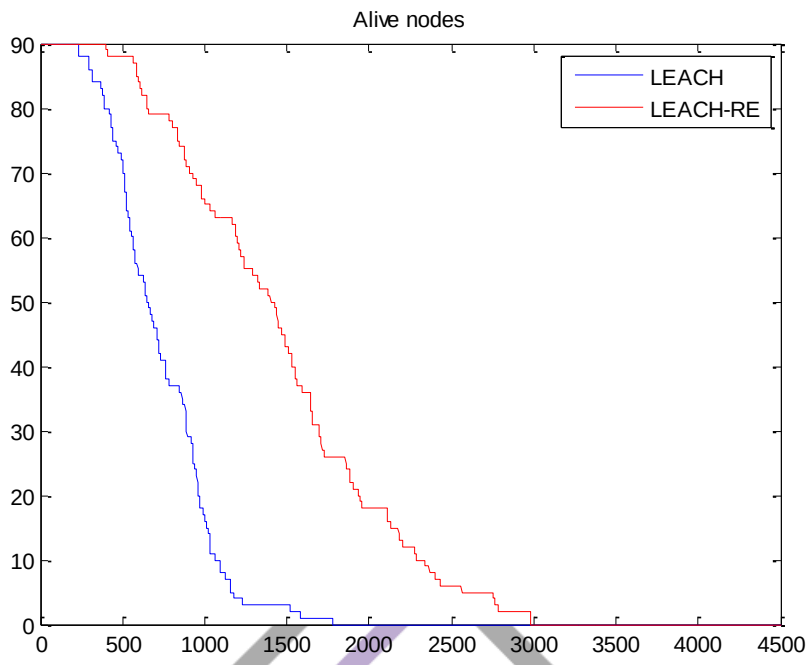

Fig.2 Alive nodes in LEACH & LEACH-RE

Figure 2 depicts the comparison of alive nodes remaining in LEACH & LEACH-RE protocol. It simply shows that remaining number of nodes alive in LEACH-RE are more than LEACH protocol. In 500 Rounds, all nodes alive in LEACH-RE but in LEACH protocol, only 65 nodes alive. In proposed protocol, network lifetime increases.

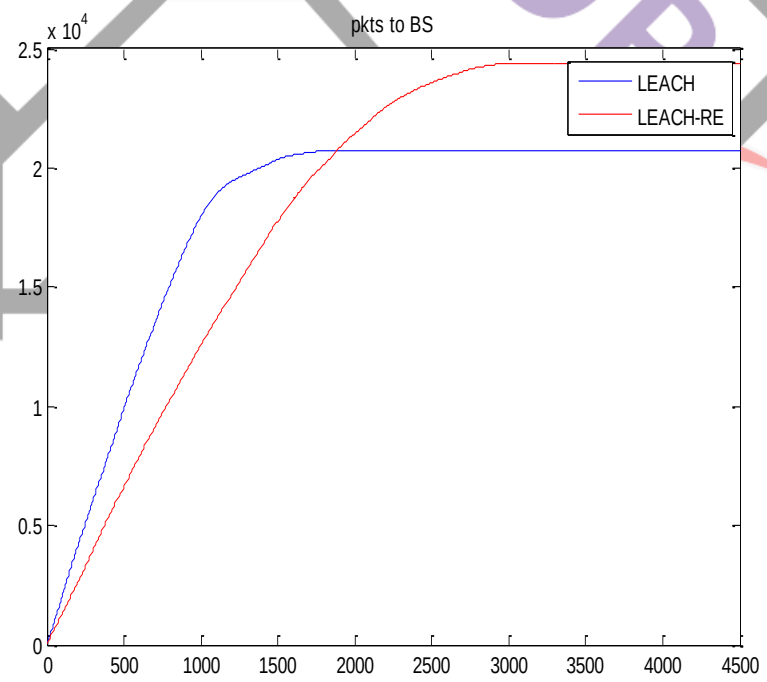

Fig.3 Packets transferred to base station in LEACH & LEACH-RE

Figure3.gives comparative results of packet transferred to base station in LEACH & LEACH-RE .More the number of packets transferred, higher the accuracy of nodes. Almost 1.9*10^4 packets transferred in LEACH in1200 rounds whereas 2.3*10^4 packets transferred in 3000rounds in LEACH-RE.

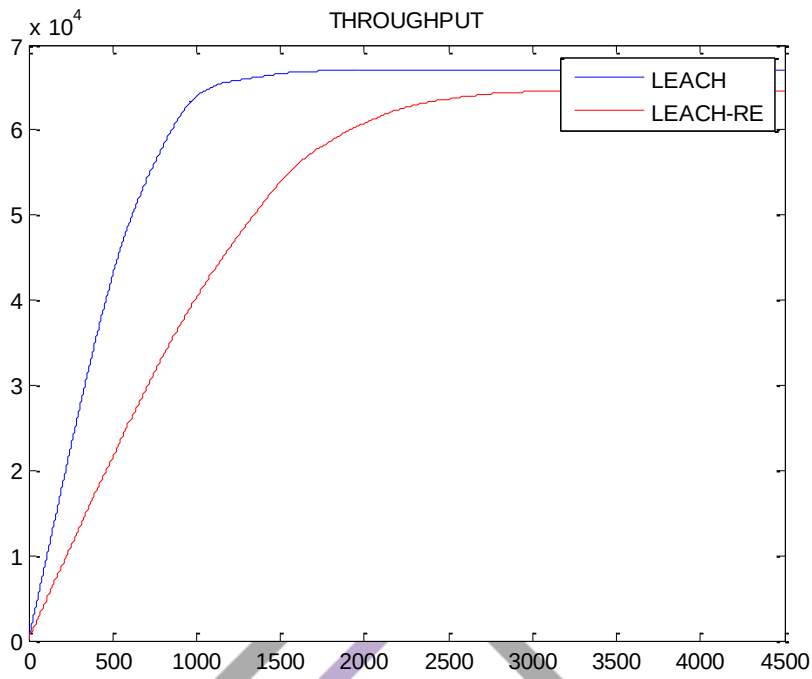

Fig.4 Throughput of LEACH & LEACH-RE protocol

Considering the simulated results in figure 4 of LEACH & LEACH-RE, it is concluded that maximum throughput is achieved by LEACH-RE because of increased network lifetime & better cluster head replacement scheme. The analysis of LEACH-RE performance using MATLAB, illustrate that in particular round, the amount of data packets sent to base station increases than existing algorithm and number of alive nodes also increases, which increases the life period of network.

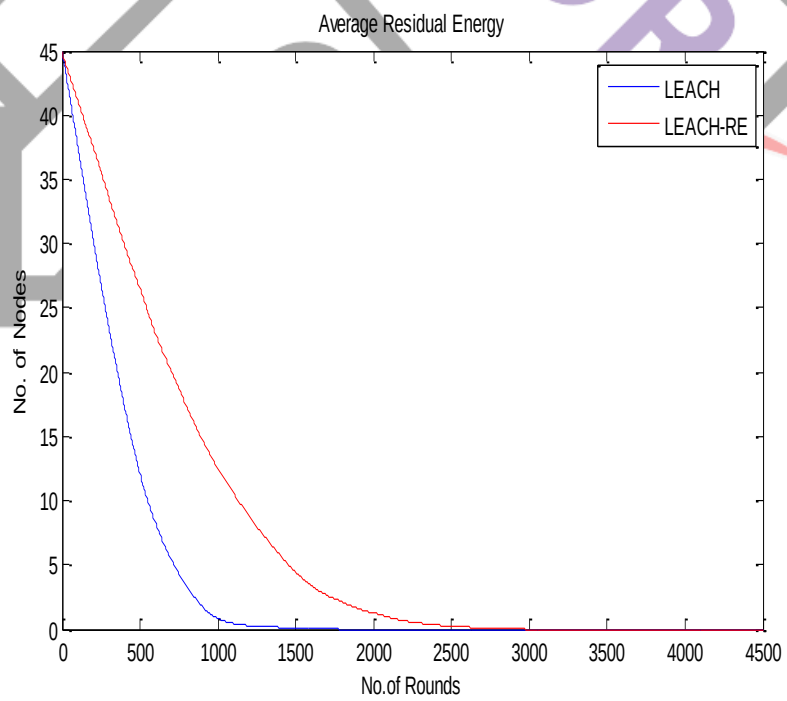

Fig.5 Average Residual Energy of LEACH & LEACH-RE

The figure5 shows that residual energy utilization of nodes in LEACH-RE& LEACH protocol. In the condition of same energy consumption, the numeral of nodes alive remaining in LEACH-RE protocol is greater than the number of alive nodes in LEACH, it reduces about 50% of using up of energy.

(V) CONCLUSION & FUTURE WORK

In this paper, a brief discussion of LEACH along with other clustering techniques for reducing consumption of energy LEACH-RE is presented. It depicts that execution analysis of LEACH-RE is much better than LEACH Protocol in various metrics. The proposed

LEACH-RE protocol is suitable to increase entire lifetime & throughput of network. It gives almost double performance than existing LEACH Protocol.

A further consideration would potentially account for comparing different alternatives of LEACH protocol with this concluded research LEACH-RE. The network range can also be included by increasing quantity of nodes and parameters and their values.The proposed protocol simulated can be further used in physical environment.

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