SIMULATION BASED ANALYSIS OF CLUSTER-BASED PROTOCOL IN WIRELESS SENSOR NETWORK

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ABSTRACT

The modern growth in fabricate energy efficient Wireless Sensor Network is liberal a novel way to systematize WSN in applications like surveillance, industrial monitoring, traffic monitoring, habitat monitoring, cropping monitoring, crowd including etc. The rising use of these networks is making engineers evolve novel and efficient ideas in this field. A group of research in data routing, data density and in network aggregation has been proposed in recent years. The energy consumption is the main apprehension in the wireless sensor network. There are many protocols in wireless sensor network to diminish the energy consumption and to put in to the network lifetime. Among a range of types of techniques, clustering is the most efficient technique to diminish the energy expenditure of network. In this effort, LEACH protocol has been second-hand for clustering in which cluster heads are nominated on the basis of distance and energy. The LEACH protocol is been implemented in a simulated environment and analyze their performance graphically.

KEYWORDS

Wireless sensor networks, energy efficiency, Clustering, LEACH protocol

1. INTRODUCTION

A wireless sensor network is complete up of a huge quantity of sensor nodes and a sink [2]. The WSN is self-confident of sensor nodes from hundreds or thousands and every node is coupled to one sensor nodes. A wireless sensor network entire up of a large number of nodes extend over a precise area. A sensor node self-confident of the sensor, actuators, memory, a mainframe and they do have communication aptitude. All the sensor nodes are permitted to communicate in the course of a wireless intermediary. The wireless standard is of infrared, radio frequency that having no wired tie friendly. So the sensor nodes are deployed in a random conduct and it make ad-hoc network because they can discuss themselves [1]. If the node is unable to converse with other nodes of the network through a direct link, it means the node is out of range. In such kind of networks data broadcast from one node to another is perform via in the middle of nodes. This idea is referred as multi- hoping. All sensors nodes work helpfully to serve the requests [4].

1.1Energy Consumption Issues

The chief complicatedness in WSN, sensor node have classified battery life because the sensor nodes size is small so battery size, processor, storage liberty for data, these all are small as sensor nodes**.** So the main central point on lessening energy expenses in wireless sensor networks. In

DOI : 10.5121/ijngn.2016.8102

WSN a package of sensed information and routing in order has to be send which after have some time constraint so that information can be employable before any disaster occurs e.g. manufacturing monitoring, apparatus Monitoring etc. In WSN the power authority utilization is much better-quality data communication then internal processing. So, Energy preservation in WSN is the need to the address [3]. The Wireless sensor is flat to node stop working due to power hitting. In order to supply a reliable examine through a network, the network should be celebrity adjusting and must have elastic properties as requisite from point in time to time. A classified contact node may meet failure due to imperfect battery subsistence. In such case the network protocol should be logical enough to such collapse to keep the network organized many techniques are proposed for energy concession, clustering is single of them. The cluster heads are voted periodically such that members of a cluster can converse with their cluster heads. These cluster heads send data documented from its members to a base station. The multi-clustering can also be used. The cluster head should have to be rotated for the complementary of energy and then there will be an equal heaviness on every node. The energy expenditure can be strong [3]. Energy plays a vital task in wireless sensor networks because nodes are battery operated. Therefore numerous protocols have been proposed in order to diminish the energy consumption of these nodes such as LEACH [6], PAMAS [5].

LEACH is conscious as the most fashionable routing protocol that exploit cluster based routing in order to weaken the energy consumption, in this paper suggest a development on the LEACH protocol that supplementary recover the power consumption, simulation results express out that our protocol outperforms LEACH protocol in term of energy consumption and overall throughput. LEACH is “Low Energy Adaptive Clustering Protocol” [10]. LEACH form clusters and selects randomly cluster Heads for each cluster. Non- cluster heads sense the data and broadcast this data to cluster head, and then cluster head combined the data and forward this data to sink. The principle of this protocol is that it assigns overall energy consumption of the network uniformly to each node by selecting periodically different nodes as a cluster head. There are two phases of LEACH that are Setup phase and Steady state phase. In set up phase, clusters are shaped and cluster heads are chosen. In steady state phase, data from non-cluster heads is transmitted to sink. The sensor nodes communicate with cluster heads with allotted time using TDMA. Cluster heads are arbitrarily chosen in each round. LEACH operation is divided into several rounds. Each round begins with set-up phase. In this clusters are structured. LEACH set a threshold value T(n) and then sensor node I generate a random number between 0 and 1. If the random number is < T(n), the node will become cluster head for the current round and ordinary nodes link the cluster and become cluster members [6].

$$T(n) = p/1\text{-}p \times (r \bmod p\text{-}1)$$

p is a probability of node to be selected as a cluster head, r is a number of rounds passed, G is a selection of ordinary nodes. Once a node become cluster head never become cluster head once more, only the node which have not become the cluster head and have elevated energy can become cluster head at r+1.When cluster head assigns time slots to the members using TDMA then it shifted to the steady state phase. After a shift in steady-state phase, members sent data to cluster heads; cluster head procedure the data and then send data sequence to the base station. After this round, it turn to next round and begin reconstruction new round. compensation of LEACH are that LEACH is completely distributed. LEACH does not necessitate the control information from the base station and the nodes do not require information of the global network in order for LEACH to work. LEACH reduces communication energy by 8 times as contrast to straight broadcast and smallest amount transmission energy routing. Disadvantages of LEACH are that the cluster heads are chosen arbitrarily. So the distribution of cluster heads cannot be ensured. In this protocol, the nodes with low energy have the same precedence as the nodes having high energy and nodes having low energy can become cluster heads [10].

In section ii presents the connected works, In section iii initiate problem formulation, In section iv Simulation Setup, In section v result and discussion and section vi conclude the paper.

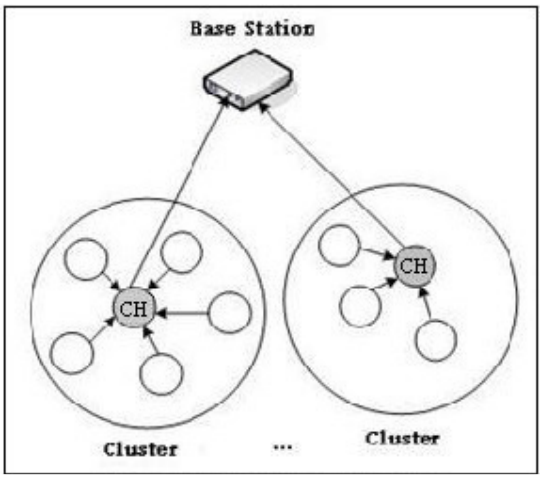

Figure1: LEACH protocol Architecture

2. LITERATURE REVIEW

A majority beneficial energy-saving spare organization, including spare collection and named it LEACH-SM protocol (modified form of prominent LEACH protocol) was deliberate by **Baker B. et al.; (2014).**In this author available a quantitative difference of energy consumption and WSN lifetime for both mentioned protocols [6].

Genetic algorithm and optimization of LEACH protocol that are worn on LEACH protocol and compare both domino effect on the basis of rounds that was discussed by **Yadav S. et al.; (2014)**. This comparison was based on optimal thresholding probability for cluster structure. Finally, after comparison finds LEACH- GA method outperforms MTE, DT and LEACH in terms of network lifetime, use for optimal vigor- efficient clustering [11].

The two significant clustering protocols, namely LEACH and LEACH-C (centralized), using NS2 tool for numerous chosen scenarios, and study of simulation results against chosen performance metrics with latency and network lifetime was planned by Nayak **P.et al.; (2014).** As a conclusion of surveillance from results, it can be mentioned that LEACH can be favored if restricted harmonization of nodes in clustering without involving to BS is of tall priority than other factors like declaration over the desired number of clusters etc.; and LEACH-C can be designated when centralized and deterministic approach jacket complete network is unsurprising still bringing in enlarged network lifetime and desired number of clusters [7].

The tailored version of LEACH protocol called V-LEACH protocol and the contrast of LEACH protocol with V-LEACH protocol was designed by **Alhawat A. et al.;(2013)**. from the simulation results were, first the numeral of busy nodes is more than the unique LEACH. Second the figure of dead nodes is less than the unique LEACH protocol. Network life-time is enlarged by 49.37% then original LEACH [6].

Energy-LEACH protocol improves the CH selection procedure. It makes the lingering energy of nodes as the major metric which decides whether the nodes twist into CH or not after the first round. It same as LEACH protocol was projected by **Xianging F. et al. ;(2007).** E-LEACH is alienated into rounds, in the first round, every node has the alike likelihood to turn into CH, that mean nodes are randomly chosen as CHs, In the next rounds, the left behind energy of each node is dissimilar after one round e-mail and taken into account for the collection of the CHs. That mean nodes have extra energy will develop into a CHs rather than nodes with fewer energy [6].

A novel version of LEACH called two-level LEACH was planned by **Loscri V.** In this protocol, CH collects data from other cluster members as exclusive LEACH, but rather than transport data to the BS openly, it uses one of the CHs that mendacity between the CH and the BS as a transmit station [8].

In LEACH, each CH straight communicates with BS no matter the distances between CH and BS It will guzzle a lot of its energy if the distance is distant. So conquer this drawback multihop-LEACH protocol was proposed by **Zhou H.** It selects a best possible path between the CH and the BS through other CHs and use these CHs as a relay station to televise data over through them [6].

3. PROBLEM FORMULATION

In this work, LEACH protocol has been worn for clustering in which cluster heads are preferred on the basis of distance and energy.

- In LEACH protocol Cluster head straight communiqué with BS no matter the distance between Cluster head and the base station; it will use a group of its energy if the distance is far [13].
- Due to far distance packet does not arrive at the destination because CHs straight communicate with sink there is no inter-cluster communication, and this needs high trans-mission power due to this node dies earlier before transmission.

4. SIMULATION SET UP

In this section, we evaluate the performance of LEACH protocol using NS2 tool. NS2 is used as simulation podium. NS is a distinct event simulator, where the go forward of time depends on the timing of events which are preserve by the scheduler. NS simulator is depending on two languages: C++, and an OTcl (an object-oriented tool command language).

Table 1: NS-2 simulation parameters

Parameter	settings
Simulation Area	500*500 meters
No of nodes	41
Channel Type	Channel/wireless
Antennae model	Antenna/omni antenna
Energy model	battery
Interface queue Type	Queue/Droptail/Priqueue
Link layer type	LL
Initial energy	100
Routing protocol	AODV
Traffic Source	CBR
Type of MAC	IEEE 802.11
Packet size	1000 bytes

The C++ defines the interior instrument of the simulation objects, the OTcL sets up simulation by assembling and configuring the objects and scheduling discrete events. The OTcL are linked together using TclCL [12]. The experiments are performed with a diverse number of nodes placed in a 500m *500m field. Each sensor nodes is assumed to have an initial energy of 100 joules. The general simulation parameters are

To evaluate the performance of LEACH protocol using parameters such as Energy consumption, Packet loss, End to End delay, Throughput and control overhead. Figure 2, shows energy consumption graph, in this graph 100 joules energy is to be addicted in 10 seconds because every cluster heads in LEACH protocol immediately communication with BS no stuff the distance between Cluster head and the base station; it will use a lot of its energy if the remoteness is far [13]. In figure 3, shows the packet loss graph, In this graph 16 number of the packet is lost in 10 seconds because in LEACH protocol CHs minter cluster communication, and this needs high trans-mission power due to this node dies earlier before transmission, packet does not reach the destination [14,15].

In Figure 4, shows End to End Delay graph, in this graph to increase the time delay is high due to high overhead which is a limitation of LEACH protocol [16]. In Figure 5, shows the throughput graph, in this graph 12 packet delivered in 10 seconds because due to high packet loss, delay, and control overhead so that the overall efficiency of the network is decreased [16].
In Figure 6, shows the control overhead. In this graph overhead is giant because in LEACH protocol extra overheads due to cluster head change and calculation leading to energy incompetence for dynamic clustering in large networks [17].

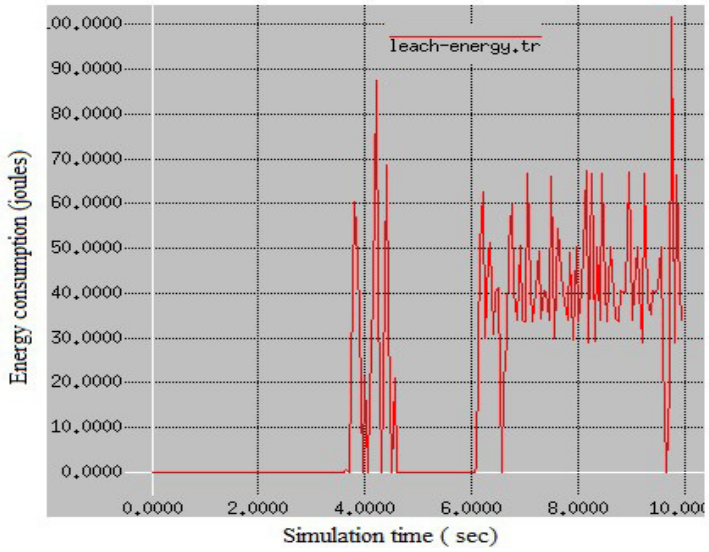

Figure 2: Energy consumption graph of LEACH Protocol

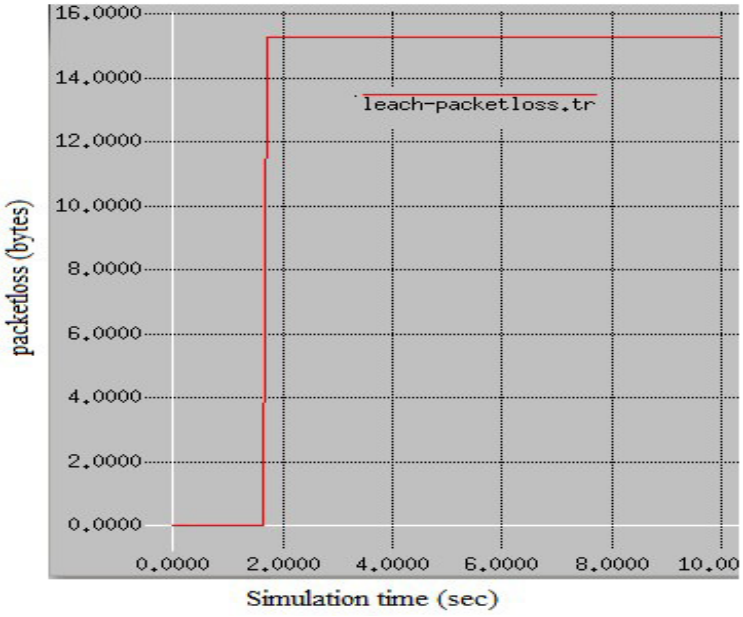

Figure 3: packet losses graph of LEACH protocol

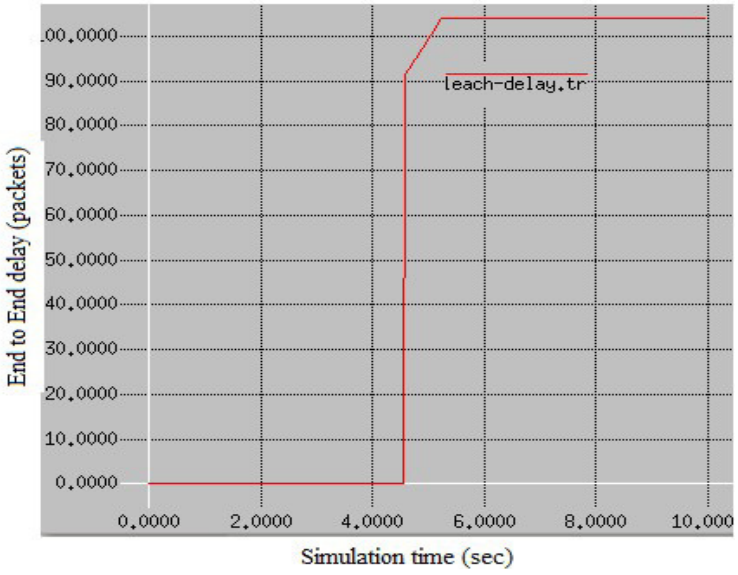

Figure 4 : End to End Delay of LEACH protocol

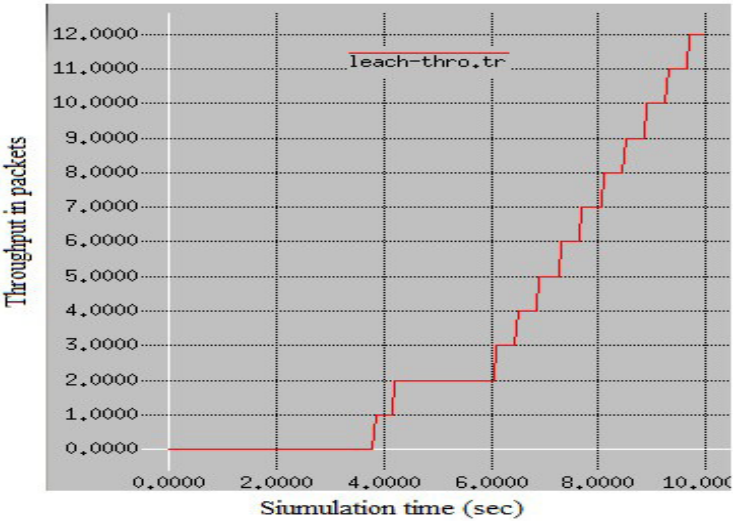

Figure 5:Throughput graph of LEACH protocol

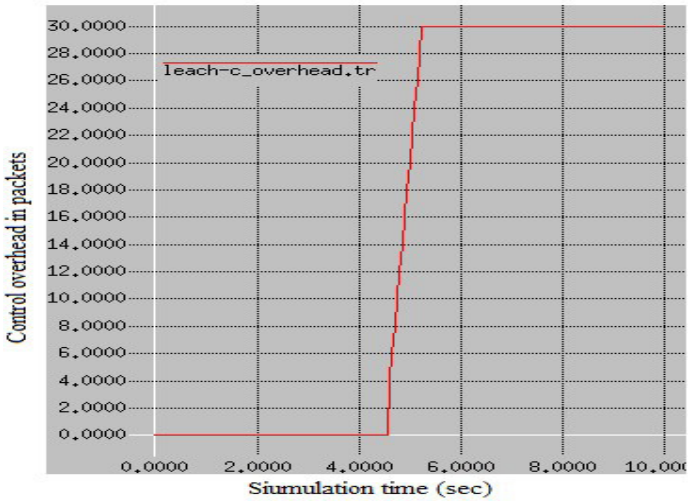

Figure 6: Control overhead in LEACH protocol

6. CONCLUSION AND FUTURE WORK

The conclusion of this paper is to apply and evaluate the performance of LEACH protocol using QoS parameters such as energy consumption, packet loss, End-to End-Delay, Throughput, and Control Overhead. The energy consumption of LEACH is very high because each cluster heads straight communiqué with BS no material the distance between Cluster head and the base station; it will use a group of its energy if the remoteness is far. Due to far distance packet does not arrive at the sink, packet loss problem is occurred so the overall performance of the networks is decreased. With the outcome obtained in this paper, a further issue worthy of consideration with RFID protocol can be done named as R- LEACH protocol. The design system can be extended using R-LEACH protocol; Of course, since we have focused only on LEACH protocol in this paper, the diagnosis can be done using R- LEACH protocol. We would like to consider these issues in subsequent work.

ACKNOWLEDGEMENT

I hereby acknowledge that the above-referred work is my own research work and I am entirely responsible for any kind of misuse of material. I thank my mentor Er. Harsukh Singh to guide and encourage me and for putting all her valuable time for me to get the desired output.

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