

A Comparative Analysis of LEACH and SEP using NS2

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Abstract— Nowadays, wireless sensor network are generally deployed a sensor nodes to detection an event and transmit the data to the base station (BS). When clustering is an approach to use to minimized the energy consumption of such network. Therefore, in this paper low energy adaptive clustering hierarchy (LEACH) protocol and stable election protocol (SEP) is proposed. The performance analysis show that the comparison of LEACH and SEP protocol on the basis of different factors like as delay, packet loss and throughput.

Keywords—WSN; LEACH; SEP; CH; BS

I. INTRODUCTION

A combination of sensor nodes in a cooperative manner is known as a wireless sensor network. In the wireless sensor networks, no. of sensors are deployed at the different locations. These sensor nodes are operate in the different modes. Wireless sensor networks are used in the different applications like as automation, environmental, area monitoring and air pollution monitoring [5] [13]. Sensor node senses the data and transmits it to user. The some components are used in wireless sensor network are like as sensor node, processor and base station (BS). Otherwise sensor nodes are basic component of wireless sensor network (WSN). These are light weight, small in size and portable. Sensor nodes are used to send the data from base station. Another component base station is used to collect the data from different sensor nodes. Another approach like direct communication are used to transmit the data from sensor nodes to base station (BS) but in the minimum transmission energy nodes are nearest the base station (BS) has more probability to send data than sensor nodes which are located far away from the base station (BS) [10]. So, need to introduce the concept of clustering. Clustering is an approach used to minimize the energy of consumption. In clustering, the no. of nodes are select the cluster head (CH). When the selection of cluster head (CH) on the basis of initial energy or residual energy. Then sensor nodes are transmit data to Cluster head (CH). Cluster head are used to aggregate the data from different sensor nodes and transmit to the base station (BS).

Sensor networks are classified as heterogeneous protocols and homogeneous protocols. LEACH (low energy adaptive clustering hierarchy) protocol is an example of homogeneous protocol. Basically it is called as a proactive routing protocol [11]. In this protocol, the sensor nodes are distributed evenly and the sensor nodes have same energy

levels they form clusters to send energy. The main function of the LEACH protocol is formation of sensor nodes basis on incurred signal intensity [10]. LEACH protocol is working on two phases like as initial phase and stable phase. In the initial phase, the selection of cluster head (CH) on the basis of random number, the sensor nodes generate a random number like as 1 or 0. It is selected each random number on the basis of threshold value so the sensor node selected as a cluster head for the each current round. In the stable phase, the sensor nodes are senses data and broadcasting the data to cluster head, after received the data, cluster head performs the step of aggregation and send data to base station (BS). Finally the duration of stable phase is more as compared to the initial phase [16]. LEACH protocol is not applicable for large areas due to the limitation of energy [10].

Another example of heterogeneous protocol is SEP (stable election protocol). It was an improvement for LEACH protocol. The homogeneous networks considered same amount of energy for all nodes, while in case of heterogeneous network different level of energy nodes are considered. SEP protocol is introduced two types of nodes like as advanced node and normal node [10]. The selection of cluster head in the SEP protocol on the basis of (advanced or normal node) nodes. These nodes are senses the data in network, broadcast it to the desired cluster head (CH) and finally cluster head sends the data to base station (BS) [14]. The energy of the advanced nodes is more as compared to the normal nodes. Advanced nodes have more probability to become cluster head iteration. So the SEP protocol increases lifetime of the network as compared to the LEACH protocol [10]. But the transmission rate is not much improvement [11].

II. RELATED WORK

Some work related to this strategy is described below:

Akyildiz i., et al. [2002] presented a survey on WSN routing protocol. WSN has number of characteristics to satisfied like accuracy, fault tolerance, power consumption, delay, throughput, energy efficiency, lifetime of sensor nodes, packet delivery ratio, packet loss etc. these requirements help in the development in new research ideas [1]. Biradar R., et al. [2010] provided a review of the various fields in which WSNs has been employed, design issues of routing protocols like as LEACH protocol, SEP protocol, M-GEAR protocol and compared them on the basis of parameters like

power consumption, efficiency, delay, data aggregation, scalability [3]. Singh S., et al. [2010] presented a review of the characteristics, applications and design issues in WSNs. Also a different types of protocols like as LEACH protocol, SEP protocol and HEED protocol has been explained. The conclusion obtained is that there is a need for more reliable, more scalability and energy efficient routing protocols [2]. Faisal S., et al. [2011] implemented a Zonel stable election protocol (Z-SEP) protocol and it compared with the LEACH protocol and SEP protocol. Simulation results show that Z-SEP protocol enhanced the stability period, throughput, network lifetime, data aggregation and efficiency that existing protocols like LEACH protocol and SEP protocol [4]. Nadeem Q., et al. [2013] designed a Multi hop- gateway based energy efficient routing protocol (M-GEAR) protocol for the minimum consumption energy. Simulation results show that our proposed gateway based protocol in better in terms of network lifetime, stability period and throughput [6]. Pramanick M., et al. [2014] had compared LEACH protocol, SEP protocol, Hybrid energy efficient distributed protocol (HEED) protocol on the basis of number of alive nodes, number of dead nodes, number of clusters and number of cluster heads (CH). They concluded that SEP protocol is best in selection of cluster heads (CH) [7]. Chawla H., et al. [2014] provided knowledge of the various applications like as area monitoring, environmental monitoring, monitoring of air pollution, detection of land slide, monitoring of water quality etc and the security issues of Wireless sensor network (WSN) [8]. Javaid N., et al. [2014] designed a Application aware threshold based centralized energy efficient cluster protocol (ATCEEC) Protocol and simulation results show that ATCEEC protocol yields maximum network lifetime, throughput and stability period of network as compared to the selected protocols like as LEACH protocol, SEP protocol and M-GEAR protocol [9]. Pramanick M., et al. [2015] introduced an Energy aware sleep scheduling clustered based routing protocol (EASSCR) Protocol. The goals of this scheme are, increase stability period of network and minimize the loss of data and Performance analysis show that EASSCR has significant improvement over existing protocols LEACH protocol, SEP protocol and M-GEAR protocol in terms of lifetime of network and data units gathered at base station (BS) [12]. Dewli N., et al. [2015] analyzed and compared two wireless sensor network (WSN) protocols, Multi hop- gateway based energy efficient routing protocol (M-GEAR) protocol and modify low energy adaptive clustering hierarchy (MODLEACH) protocol on the grounds of network lifetime, throughput and performance of the network [14]. Anisi M., et al. [2015] proposed a data routing scheme which ensures increase lifetime of network by exploiting energy efficiently, supporting reliability, fast delivery of delay-sensitive data and achieving low-cost sensor design. Author's founds that ability to use in both event-driven and query-driven applications, ensuring taking the shortest routing path, transmitting very less number of packets, simplify the implementation, roots are maintained, high probability of completeness of responses while realizing significant power savings and increasing the network lifetime [15].

The prominence in this research paper is concentrated on study and evaluation of a comparative analysis of LEACH

and SEP protocol. The SEP protocol perform better as compared to LEACH protocol because less delay, less packet loss and more throughput in IEEE 802.11 standard using Network Simulator 2.35 (NS2) tool.

III. SIMULATION SETUP

The network is simulated by the network simulator 2.35 (NS 2.35) and IEEE standard 802.11. the simulation network are used two dimensional view. The base station are used in the center of the network at selected region and cluster head transmit the data to base station using multi hopping. Cluster head (CH) will be selected at the minimum distance is followed by the cluster. The base station transmits the message to all sensor nodes with cluster head (CH) and desired route to be followed. The some sensor nodes are react and another discard the message [11]

The desired specifications of network and its other details are shown in the form of table given below:

Table I. Network configuration

Parameter	Specifications
Simulation Tool	Network Simulator 2.35
IEEE Standard	IEEE 802.11
Protocol	LEACH and SEP
Total Number of Nodes	100
Total Number of Cluster Head (CH)	8
Network Size (in meters)	100*100 meter
Node Range	18 meter
Sink	1



Fig. 1. Network Deployment

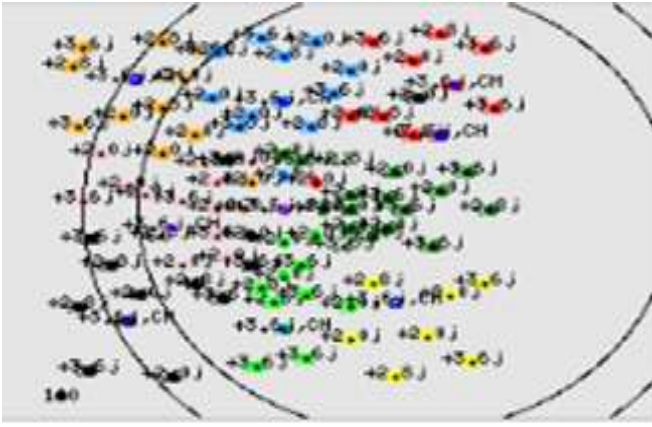


Fig. 2. Data Aggregation and Data Transmission to base station (BS)

The figure 1 shows the network deployment and figure 2 shows the data aggregation as well as data transmission by the use of base station (BS).

IV. RESULTS AND DISCUSSIONS

The sensor nodes are deployed randomly and clustering process is used to minimize the coverage area. Another, x-axis defined number of packets and y-axis are defined simulation time in seconds. Figure 3 shows the result of delay in graphically. The time required through the packets to reach the sink is called as a delay. We compare the LEACH and SEP protocol in this paper and more delay in LEACH protocol because of dynamic clustering. In SEP protocol, delay has less as compared to LEACH protocol. The number of packets are not reach the base station at the time transmission is called as a packet loss. Figure 4 shows packet loss is less in SEP protocol as compared to LEACH protocol because the use of multihopping. Otherwise SEP protocol is multi-level heterogeneous network but LEACH protocol is an example of homogeneous network. Figure 5 shows the result of throughput in graphically. The number of packets are received by the base station per unit time is known as a throughput. Simulation result shows that the SEP protocol performs better as compared to LEACH protocol.

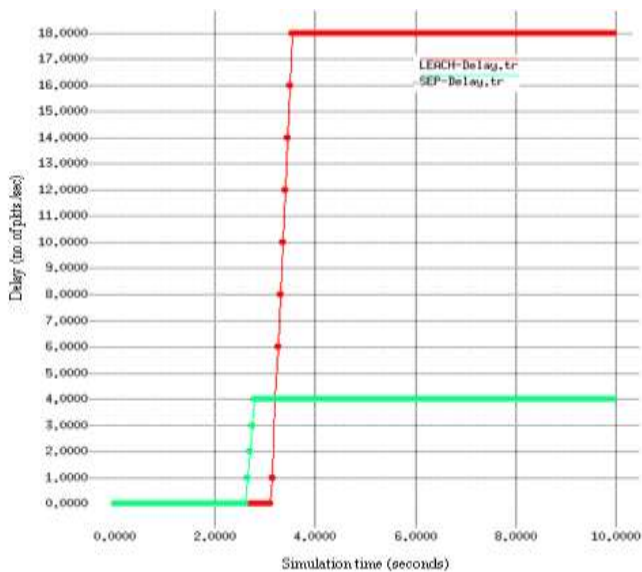


Fig. 3. End to End Delay

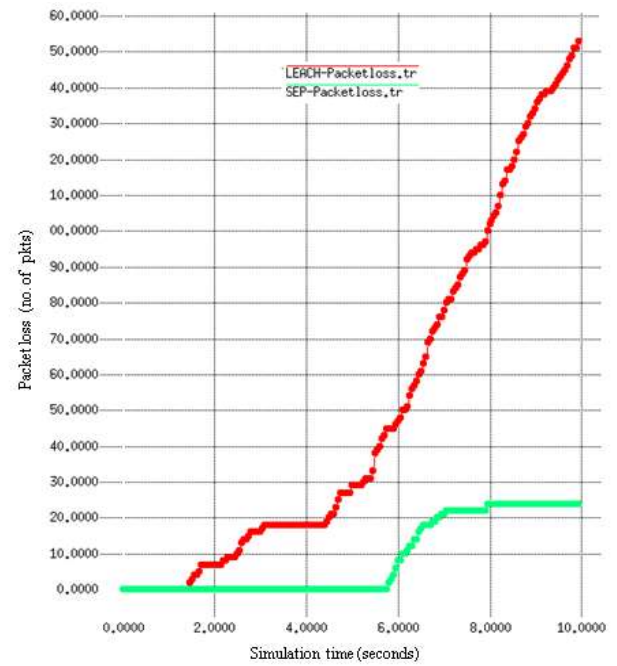


Fig. 4. Packet loss

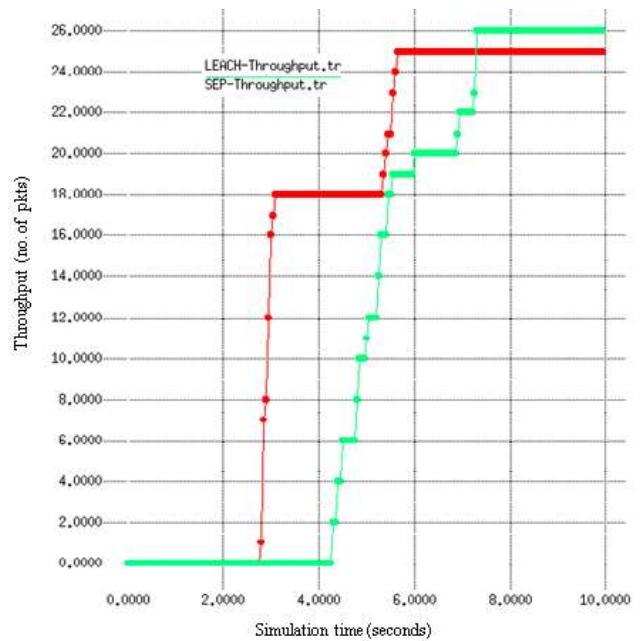


Fig. 5. Throughput

V. CONCLUSION

Several techniques are used to implement wireless sensor network for the increase of lifetime of network, but still need improvements to overcome the issues of wireless sensor network (WSN). In this paper, we have evaluated the performance of SEP WSN protocol and compared with LEACH protocol. Comparative analysis showed performance of SEP protocol is better as compared to LEACH protocol. SEP protocol performs better in terms of delay, packet loss and throughput. Further the performance of SEP is needed to improve for the higher efficiency and accuracy in terms of delay and Packet Loss.

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