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RESEARCH ARTICLE

A Paper on Implementation of Adaptive Load Balancing Technique in E-Leach

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ABSTRACT: ***In Wireless Sensor Networks (WSNs), minimizing energy consumption of available resources remains unsolved. To reduce power consumption many types of routing protocols have been developed. In these protocols, cluster-based routing protocols are found to be more energy efficient. In cluster-based routing, a cluster head is selected to aggregate the data received from root nodes and forwards these data to the base station. The selection of cluster heads should be efficient to save energy. In our proposed protocol, we use E-LEACH (Low energy adaptive clustering hierarchy) protocol with ALB (Adaptive load balance) technique where E-LEACH improves the performance of basic LEACH protocol whose aim is to elect the cluster-head on the basis of remnant energy of sensor node in WSN and ALB avoids congestion. The proposed routing protocol works efficiently in large as well as small areas. For an optimal number of cluster head selection we divide a large sensor field into clusters. For efficient communication between a base station and cluster heads these clusters are further grouped into zones. We perform MATLAB simulations to observe the throughput, average jitter, energy consumption, end-to-end delay and network lifetime. Our proposed ALB routing protocol outperforms in large areas in comparison with the E-LEACH and E-LEACH with TSP routing protocols.***

Keywords:- E-Leach, optimal, routing, TSP

I. INTRODUCTION

Due to their potential use in a wide variety of applications, researchers have been attracted by Wireless Sensor Networks (WSNs) in recent years. WSNs were initially used only in the battlefields for military purposes. Their use has however extended to monitoring and controlling of different processes in many other civilian areas. A WSN consists of different types of self-directed sensor nodes that are used to sense and transfer the data wirelessly to the base station or the next receiver node. Hundreds or thousands of low cost sensors are used in a single WSN. The advancements in technology have made possible reduction of cost and size of the electronic devices. A wide range of sensors are available to monitor the different ambient conditions such as movement, humidity, pressure, temperature, and lightening conditions. Use of the large battery source is not feasible due to low cost and smaller size of sensor nodes. The requirement of lower energy utilizationposes restriction on the sensor to use limited resources such as less memory capacity, low transmit power and less processing computations. Data communication and a periodic routing protocol transmission are required to update the sensor's routing table. Excessive use of routing updates can be prevented by selection of a proper routing protocol. This research is aimed at finding an energy proficient routing protocol for Wireless Sensor Networks. Our proposed algorithm aims is to provide a better end-to-end delay, higher throughput, a fewer number of dead nodes and overall lower energy consumption compared to other protocols.

II. LITERATURE SURVEY

Cluster and Traffic Distribution Protocol for Energy Consumption in Wireless Sensor Network Irkhede Tejal, et al - This paper discuss about the approach is to combine the ideas of clustering first and then traffic is evenly distributed in network. In clustering, each node takes part in cluster head formation. For load balancing in the network we improved the traffic splitting protocol (TSP). E-LEACH (Low energy adaptive clustering hierarchy) improves the performance of basic LEACH protocol whose aim is to elect the cluster-head on the basis of remnant energy of sensor node in WSN. Cluster head collects the data from all common node of their range. E-LEACH has the same concept as of LEACH protocol. Difference between LEACH and E-LEACH is that in E-LEACH protocol includes additional parameter one is residue energy and second is consumed energy. There are two phases in E-LEACH as same in LEACH first phase is cluster set up phase and second is steady-phase. In cluster set up phase, cluster head select on the basis of round time as same LEACH protocol. The main improvement in cluster head selection algorithm is to avoid the lower energy residual energy node and elect the higher residual energy node. In second phase i.e. steady state phase each intermediated node sends the data during its own TDMA time slot. E-LEACH uses minimum spanning tree between cluster heads and sends the data to sink node. Traffic splitting protocol (TSP) consists of two methods. The first method is route assignment method and second is load sharing method. Route assignment method uses the information collected about each route to calculate weight for route. Second method i.e. load sharing method select particular route for individual data dynamically at real time. Also, it keeps the actual traffic allocated to each route relevant to the weight assigned to the route [8].

Adaptive load balancing routing algorithm Xiao Guo Ye, et al - In this paper author describes a novel adaptive load-balanced routing algorithm (ALB) based on minimum interference and cross-layer design principle is proposed. The least interference path algorithm principle is introduced briefly, and the implementation of adaptive load-balanced routing algorithm

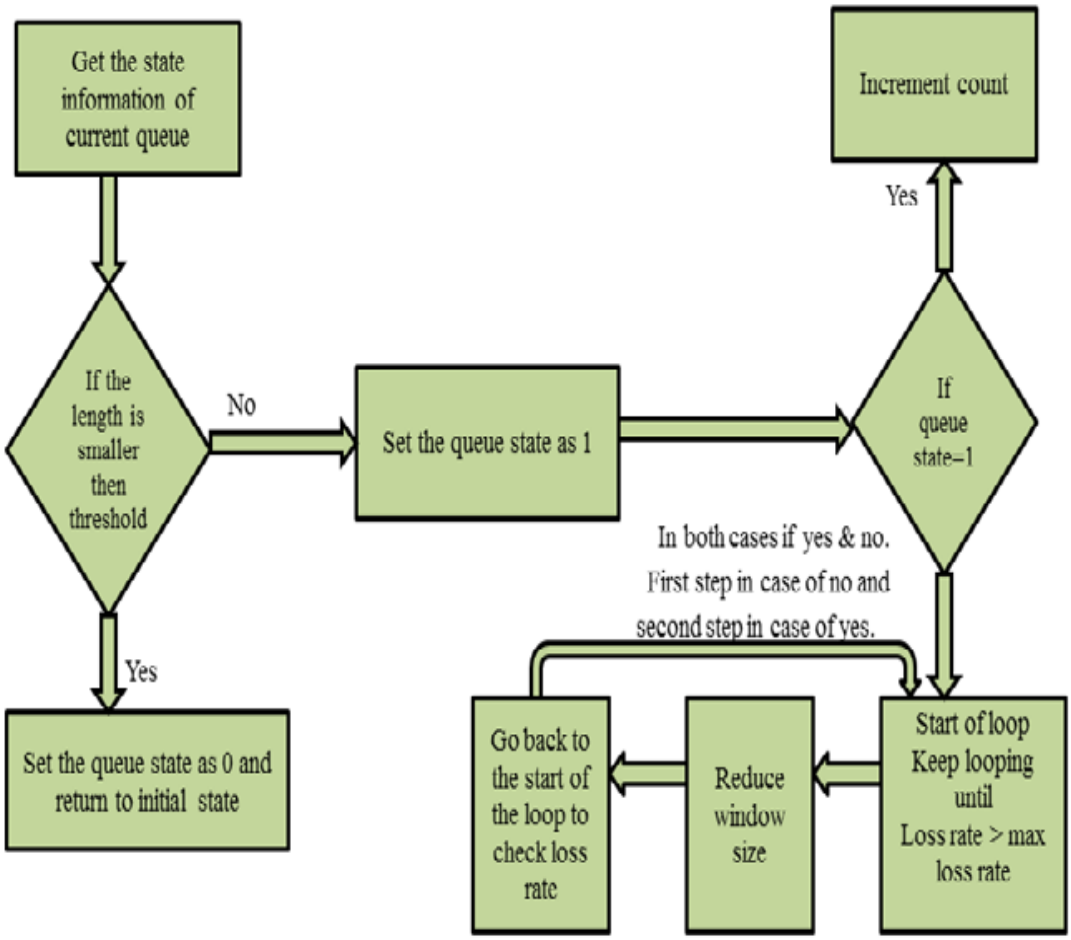
is elaborated in detail. The good interaction of the information between the layers can be achieved through cross-layer design. Based on cross-layer optimization, this paper improved the least interference path algorithm and presented a new routing algorithm named adaptive load-balanced routing algorithm which could effectively avoid the occurrence of link overload, was put forward. The algorithm could realize the prediction of network congestion and TCP can adjust the congestion window size self-adaptive according to the real-time status of link. The simulation results show that packet loss rate had been greatly improved and throughput rate had got a large scale enhancement. It not only avoided the occurrence of link overload phenomenon, but also increased the network resource utilization rate and ensured data transmission reliable [9].

Improved clustering protocol for energy efficiency algorithms in wireless sensor networks Kalaiselvi K. and Suresh G.R., et al - In this paper, author proposes a novel clustering algorithm for energy efficient routing based on a cluster head selection. To extend the lifetime of networks and it improves node energy efficiency, balances energy consumption of all sensor nodes, increases dependability of data transmission and remits network lifetime in comparison of existing clustering protocol. The proposed algorithm having a two layer of cluster formation between the nodes and Base station like LEACH, it consists of two layers of clusters establishment. On the first layer Cluster Heads are formed where the member nodes transmit the data to their respective Cluster Head and CH aggregate the received data. Once again the second layer super Cluster Heads are formed. After the formation of Super Cluster Head (SCH), the CHs look for the nearest SCHs by computing the distance between the CH data to respective Super Cluster Head (SCH) in the similar like a LEACH. The Super Cluster Head (SCH) received data from their Closest Cluster Head, aggregate all received data, transformed them into a compressed data and send to the base station (BS). The number of Cluster Heads and S-CHs are initially decided by using a predetermined fractional value. In SCH LEACH, Minimize the overall communication distance between the nodes and Base Stations. The routing protocols LEACH, M-LEACH and Proposed algorithm have simulated in MATLAB. The average distance and average energy dissipation are calculated and compare the average energy and distance [10].

Distributed Event Detection in wireless sensor network for Forest Fires Yashwant Singh and Suman Saha,et al. - In this paper new automated machine learning technique are used to decide whether the event has occurred or not. Approach works in two phase base and meta phase. Various different approaches machine are made for detection and prediction of events. Hop tree is used in this approach to prevent the delay time in transmission of information. Author has also discussed the environmental problem like forest fire. Detection and prediction of such events requires accurate and precise technology with state of the art mechanism. Author has discussed general node to base working method of WSN's. The new algorithm for event detection proposed by the author uses clustering technique for data streaming and signaling and works in time series model with different levels of granularity and has linear complexity. Method presented by the author leads to energy efficiency in distributed environment.

III. Methodology

- The network is analyzed to get the information about the current queue.
- If the length of the current queue is smaller than then threshold value, the queue is set to '0' state and is set to the initial value
- If the length of the current queue is greater than or equal to the threshold value then the state of the queue is set to 1.



- Next the status of the queue is checked. If the queue status is set as 1, count is incremented and next queue is checked. If the queue status is 0, the control goes to start of loop and looping continues for as long as loss rate is greater than maximum loss rate.
- Loss rate is kept reducing by reducing the window size and comparing the loss rate with the value of maximum loss rate. Loss rate is repetitively kept reducing till it becomes equal to or lower than the maximum loss rate. As soon as this condition is reached the loop is reset to the initial state.

IV. PERFORMANCE EVALUTION

By using the MATLAB simulation environment, extensive simulations have been conducted to compare the performance of our proposed Adaptive load balancing E-LEACH (ALB E-LEACH) protocol with the E-LEACH (Low Energy Adaptive Clustering Hierarchy) and E-LEACH using TSP (Traffic splitting protocol). The results show that the ALB E-LEACH extends the network lifetime, minimizing end-to-end delay, increases the overall throughput and reduces the energy consumption.

SIMULATION PARAMETERS

The nodes are randomly deployed within the area of 400m X 400m. This area is divided into clusters and each cluster elects the cluster-head on the basis of remnant energy of sensor node in that cluster. For this simulation the population of nodes is 100 (i.e. n=100).

Table 1: Simulation parameters

Parameters	Values
Network size	400m X 400m
Initial Energy	500 mJ
Pd	100 mJ
Data Aggregation Energy cost	50pj/bit j
Number of nodes	100
Packet size	4000 bit
Transmitter Electronics	50 nJ/bit
Receiver Electronics	50 nJ/bit

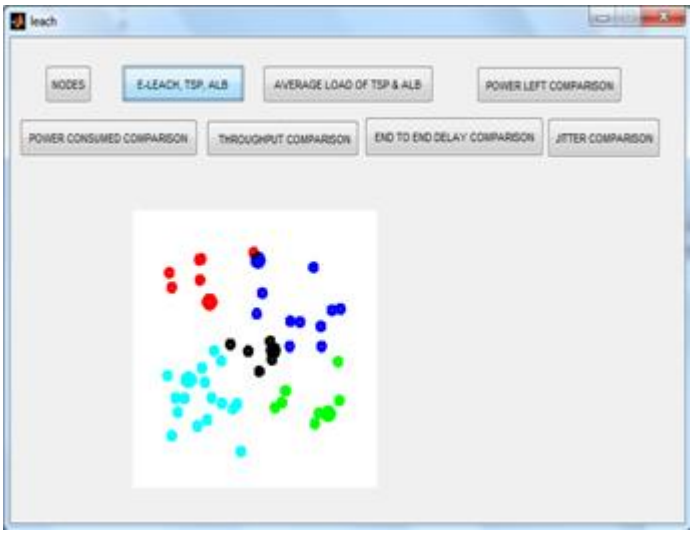


Fig.1 Random deployment of nodes

SIMULATION RESULTS

To get the simulation results MATLAB tool is used. As mentioned earlier, E-LEACH using ALB works in rounds. For our experiments the total number of rounds used is 20. Simulations of E-LEACH using ALB in comparison with E-LEACH [……] and E-LEACH using TSP […..] performed to observe the average load, power left, power consumption, end-to-end delay, average jitter and overall PDR or throughput.

Fig.2 Average Load Comparison:-

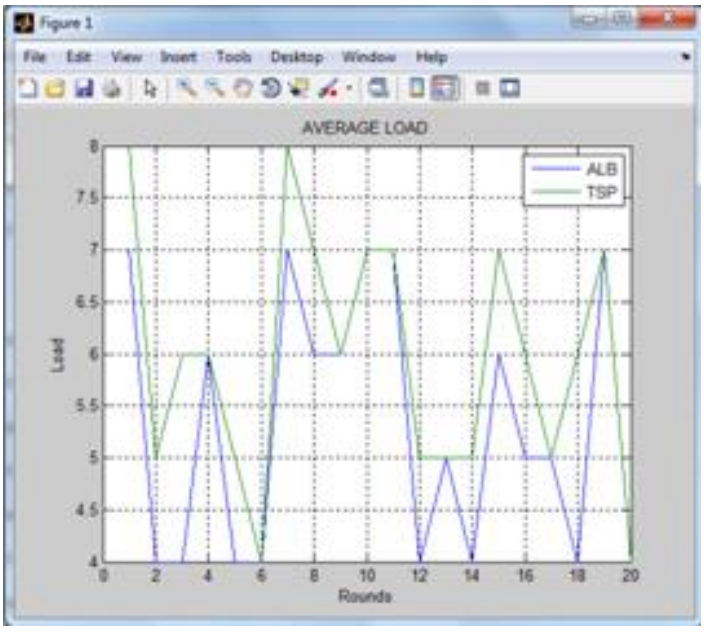


Fig.3 Power left comparison

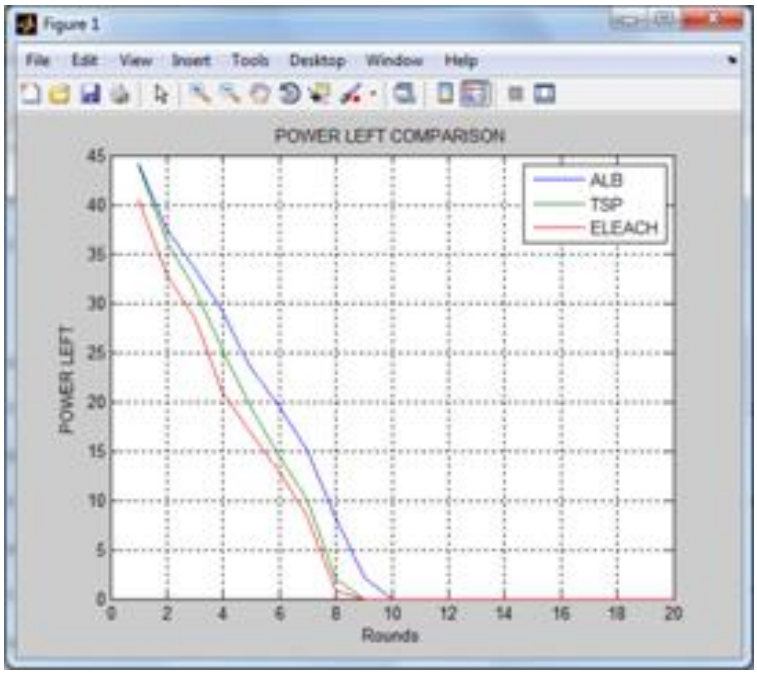


Fig.4 Power consumption comparison:

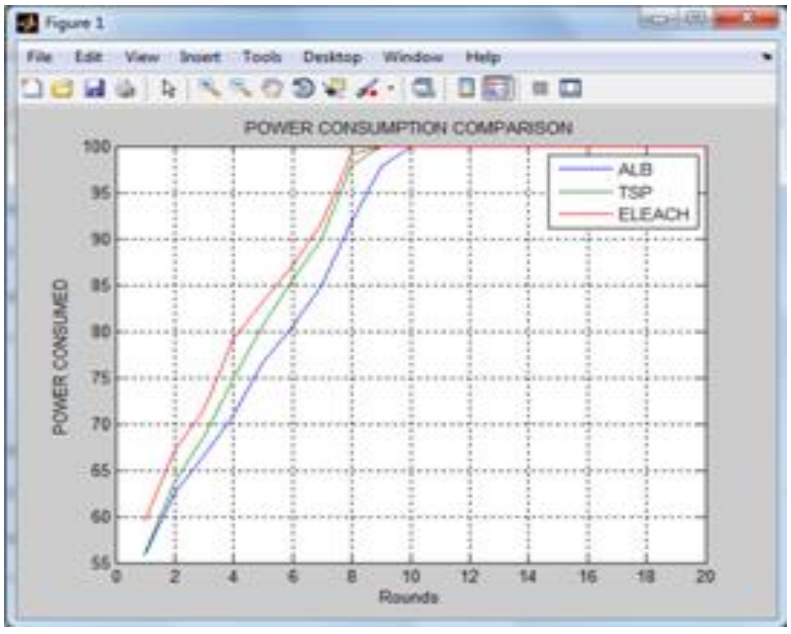


Fig.5 Throughput (Bits/s) Comparison:

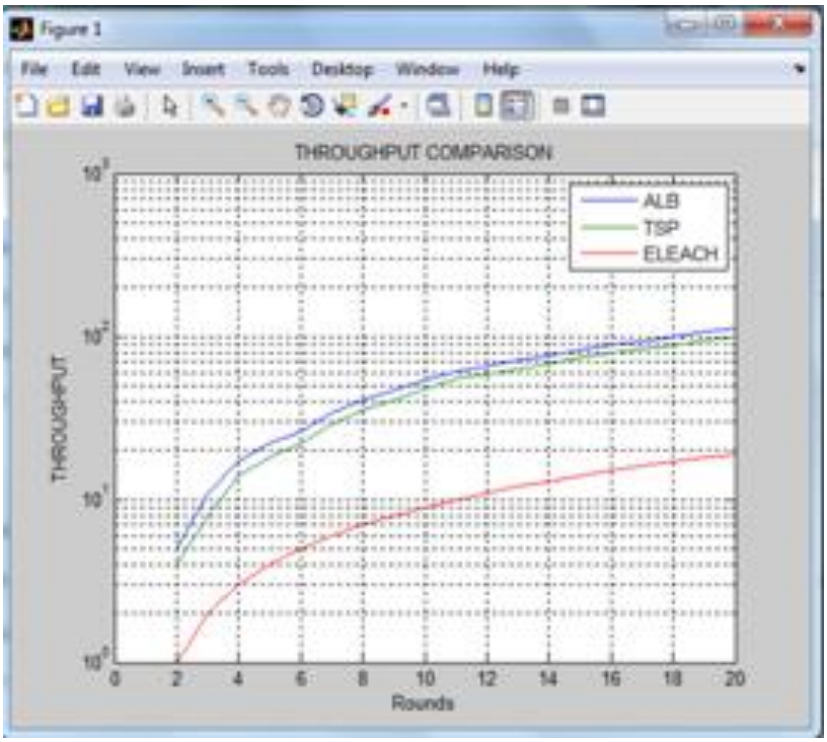


Fig.6 Average End-to-End delay Comparison:

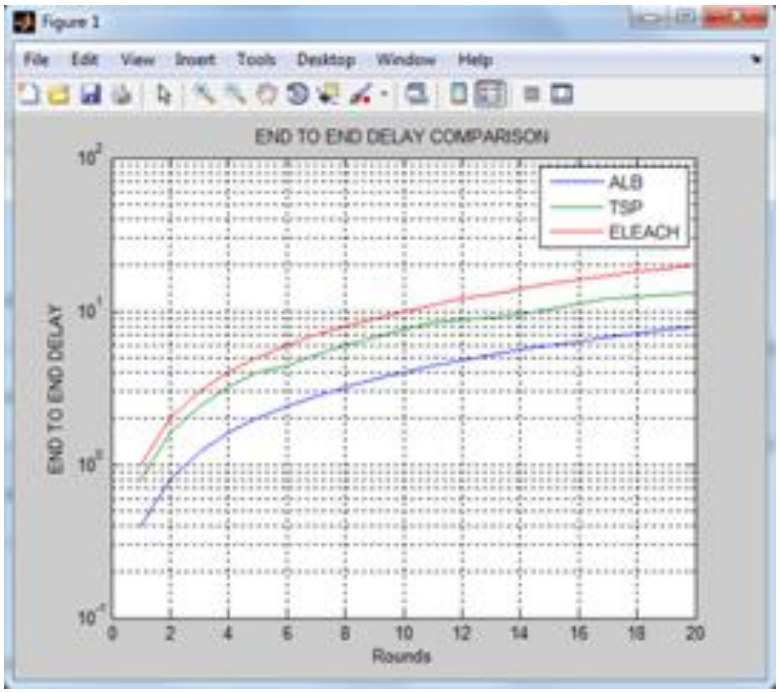
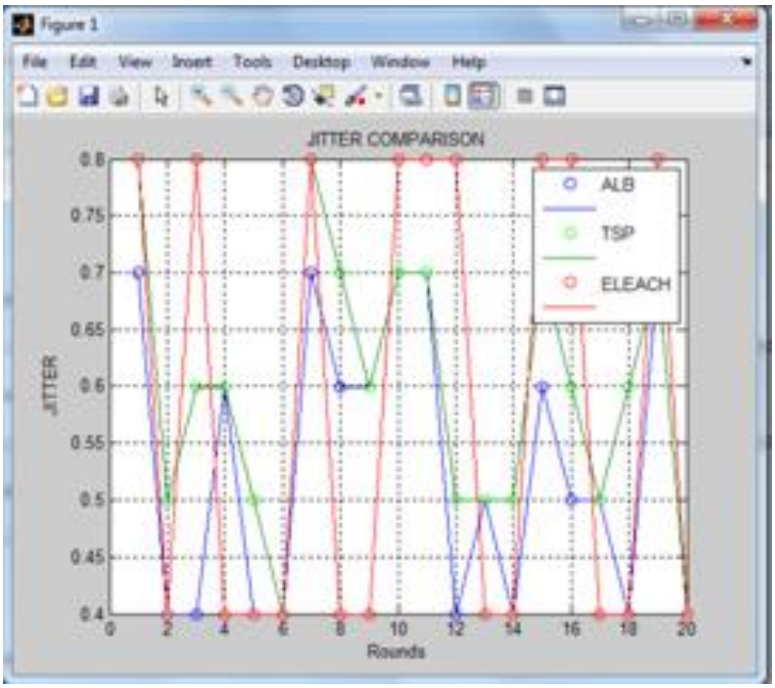


Fig.7 Average Jitter(s):



V. CONCLUSION

Sensors are required to routing packets as well as transmit the data to the base station. If more of these operations are performed the sensor battery life decays drastically. By using the proper communication protocol, the control of congestion and unnecessary data transmission or reception can help in better management of battery life. By considering the influencing factors such as congestion, energy awareness, scalability and latency, the purpose of this research is to find a congestion free energy efficient routing protocol for Wireless Sensor Networks.

In this thesis, we proposed an optimized routing scheme for WSNs. The main focus was to provide the congestion free protocol. In our proposed scheme, Adaptive Load balancing is used in clustering. In E-LEACH using ALB, cluster heads are selected in each cluster on the basis of residual node energy. The E-LEACH using ALB scheme decrease the congestion in the network which make the WSN communication more energy efficient. The stability period of network and network lifetime have been optimized in our proposed strategy. Simulation results show that when compared with existing routing protocols E-LEACH and E-LEACH using TSP, there is significant improvement in all these parameters.

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