

## An Analysis Result Using MATLAB WSN Communication E-LEACH

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**Abstract**— In wireless communication network (WSN), routing is a major part of communication as in network layer the data is transmitted from sender to receiver over the sensor nodes and acknowledgement is received by sender from receiver. This whole process is done under different algorithms such as LEACH, E-LEACH and TSP etc. These algorithms have their own advantages and disadvantages. Main problem is with energy and power consumption. In this paper we are going to introduce advancement in TSP i.e. ALB (Adaptive Load Balancing) to improve the TSP algorithm in its energy consumption and traffic management.

**Keywords**— WSN, ALB, TSP, LEACH algorithms

### I. INTRODUCTION

In WSN OSI model there is third layer which is network layer which controls routing, subnet traffic control, frame fragmentation, address mapping and subnet usage accounting etc. In this paper we are introducing an improvement in the algorithms for routing to control traffic and manage energy and power consumptions. There are various algorithms available for routing.

### II. LEACH

LEACH [1] is low-energy adaptive clustering hierarchy. LEACH is the first protocol of the network layer that uses hierarchical routing for WSN to enhance the life span of the network. In a network the nodes form multiple clusters or aggregate to form a cluster [1] and choose a cluster head from the nodes of cluster. Then while communication all the nodes of cluster transmit data to the cluster head and the cluster head transmit further the gathered data to base station. Cluster head has more associated work as it has to transmit all data collected from the nodes. This makes the more depreciation in the energy of cluster head and the node dies faster than the other nodes of the cluster. As the cluster head dies the communication link to that cluster also breaks. So LEACH protocols helps in this by implementing high-energy cluster head. Means the node having higher energy will be the cluster head. After this for next time the node has higher energy will be the cluster head.

Reason for use of LEACH:

- LEACH is adopted due to the reason that a node in the network is no longer useful when its cluster head dies due to power failure.
- This protocol allows us to increase the network life with allowing node to do only the minimum work as it needs power only to transmit data.

### III. ELEACH

In ELEACH [3] (Enhanced LEACH) is introduced to bring improvement in the LEACH protocol. In this protocol two basic improvements were introduced, i.e. residual energy and consumed energy. In ELEACH the process of electing the node as the cluster head is same as LEACH but the difference is after each cycle the residue energy of the nodes belongs to the cluster is monitored and the node having high energy is chosen as cluster head.

### IV. TSP

TSP [6] is traffic splitting protocol. In this protocol there are two steps that are path/route assignment and second is load sharing step. In this protocol at first step, multiple paths are assigned at place of single path from sender to receiver. This improve the data communication speed along with power distribution among multiple nodes at for particular cycle. In second step load is distributed among the routes dynamically in relevant to the weight assigned to the route.

### V. RELATED WORK

The limitation in the energy resources of nodes are the main challenging issue in the process of developing routing protocols for the Wireless Sensor Networks. Introduction of clustering protocol in the WSN's network topologies succeeded in the reduction in number of transmissions in the network as with this topology nodes are grouped to form clusters and these clusters have one cluster head. In each cluster nodes have to transmit data to cluster head and then further the cluster head communicate with the linked base station. But this lead to power failure for the cluster head and the link to related nodes to dead cluster head come to an end. For this problem Heinzelman, et.al [4, 5] introduced a new clustering algorithm i.e. Low Energy Adaptive Clustering Hierarchy (LEACH). LEACH [7] form clusters which have right for nodes to make anonymous decision without any

fixed/centralized decision. In LEACH nodes have right to choose one of them as cluster head. For the next time the cluster head will be the node having higher energy as compared to other nodes in the cluster. The functioning of LEACH is distributed into rounds. Each round begins with a setup phase when the clusters are ordered, followed by a steady-state phase when data are transmitted from the nodes to the cluster head and then to the Base Station.

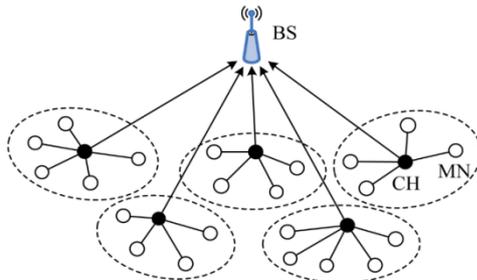


FIG: 1 Illustration of LEACH protocol

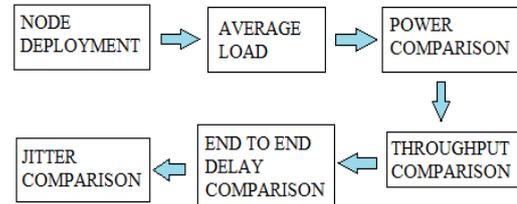
ELEACH [8] is the Enhanced LEACH. In ELEACH there are same rounds as there in LEACH algorithm. But the difference is there are two more terms added those are residue energy and consumed energy. In ELEACH the cluster head is selected on the basis of the residual energy after each cycle, means the node having higher residual energy will be the cluster head in the next round. With this all nodes remain alive for long time. Further the improvement in ELEACH made is TSP [9] (Traffic Splitting Protocol). In this protocol the number of paths increased from sender to receiver for the particular cycle. This helps in distributing the load among the more nodes for a particular cycle. With this more information transmitted in lesser time along with overall energies of nodes remains high as load distributed among more number of nodes.

### Our contribution

In this paper we are going to introduce an improved algorithm for network layer which is improvement in TSP. As in TSP load is distributed among the routes dynamically and due to this the load is unbalanced for each route. In some route there are fewer loads and in some route there are data packets on waiting for transmission. This makes consumption of more energy for nodes of rushed route than non-rushed nodes.

So we are proposing an algorithm named as ALB (Adaptive Load Balancing) which is proposed to improve the load balancing in the TSP. These algorithms govern the load ratio of each route and balance it. This algorithm is completely tested on simulation on MATLAB.

### VI. BLOCK DIAGRAM and PSEUDO CODE FOR SIMLUATION



#### Pseudo code

- Step 1: let load at 4 paths be L1, L2, and L3 & L4.
- Step 2: Start for loop path 1  $\geq 4$
- Step 3: if (L1 > T)  $\parallel$  T is the load threshold
- Step 4: find difference in load  $D = L1 - T$ ;
- Step 5: if (L2' < T)
- Step 6: put extra load to this path  $L2 = L2' + D$ ;  $\parallel$  L2 & L2' are the current and previous loads.
- Step 7: end if condition;
- Step 8: if (L3' < T)
- Step 9: put extra load to this path  $L3 = L3' + D$ ;  $\parallel$  L3 & L3' are the current and previous loads.
- Step 10: end if condition;
- Step 11: if (L4' < T)
- Step 12: put extra load to this path  $L4 = L4' + D$ ;  $\parallel$  L4 & L4' are the current and previous loads.
- Step 13: end if condition;
- Step 14: end if condition;

### VII. ALB

In this process load is distributed over all paths in balanced format. If in start we distribute them over paths, this will become more time consuming. In ALB governing of data is done during transmission, in the path data seems more is diverted to less loaded path, this neither increase END to END delay nor waiting time. Comparison of ELEACH, TSP, and ALB algorithms:

#### A. Average Load

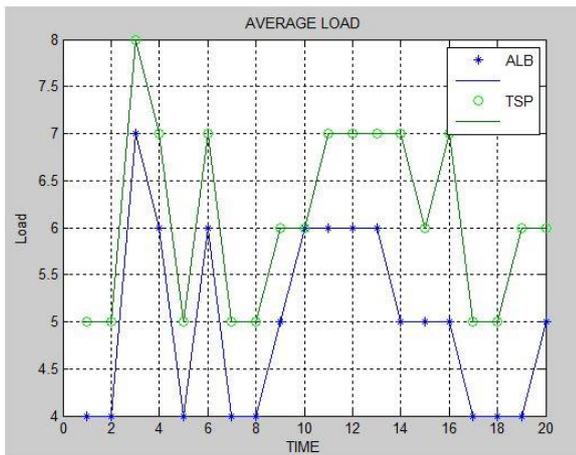


FIG: 2 Average load in TSP and ALB

In ALB the average load over each routing path is more balanced as compared to the average load in TSP

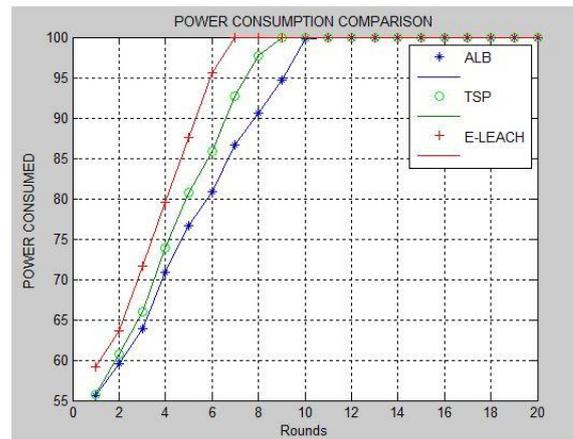


FIG: 4 Powers Consumed

It is clear from the above graph that power consumed in the ALB is less as compared to both other ELEEACH and TSP algorithms.

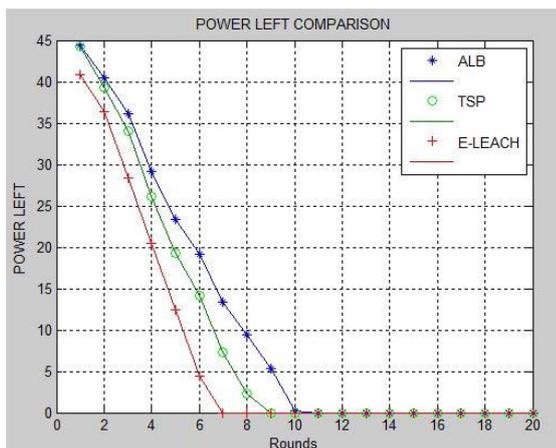


FIG: 3 Power Left comparison

It is clear from the above graph that power left in the ALB is more as compared to both other ELEEACH and TSP algorithms.

**B. Power consumption comparison:**

**C. Throughput (Bits/s):**

Throughput can be expressed mathematically as;

Throughput (bit/sec) = Number of delivered packet \* Packet size \* 8 Total duration of simulation. The throughput of the algorithms can be expressed as percentage of the packets received by the destination among the packets sent by the source. The throughput is measured in bit/s or bps (bits per second). The number of bits per sec must be high for a better system performance.

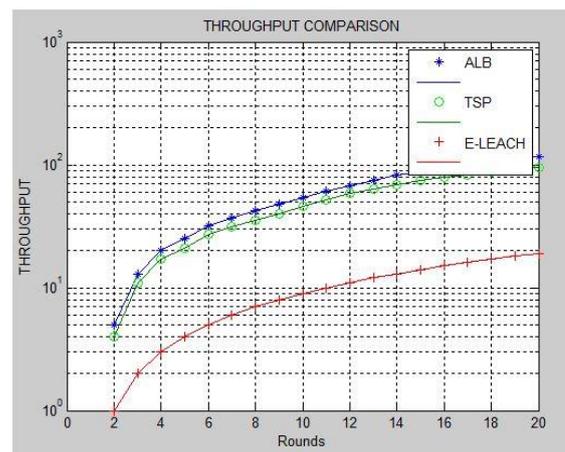


FIG: 5 Throughput comparison

The throughput is much higher than ELEACH in both TSP and ALB but ALB has more throughput than TSP.

#### D. End to End Delay

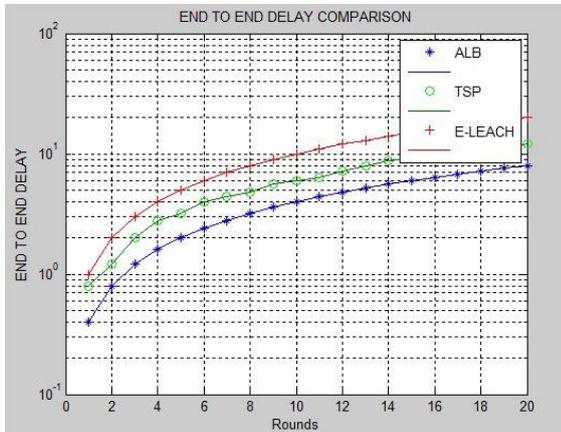


FIG: 6 End to End Delay comparison

The graph clearly shows that the End to End Delay is minimum in ALB.

#### E. Average Jitter

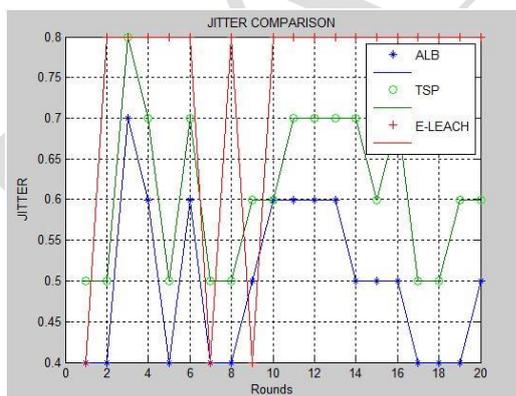


FIG: 7 Average Jitter

Average jitter is the time variation in between packets arriving, caused by network congestion, timing drift, or route changes. Average jitter is more in ELEACH and minimum in ALB.

#### CONCLUSION

- WITH ALB WE HAVE IMPROVED THE THREE PARAMETERS OF QUALITY OF SERVICE.
- THROUGHPUT IS INCREASED USING ALB.
- END TO END DELAY HAS IMPROVED.
- JITTER IS IMPROVED WITH ALB.

#### REFERENCES

- [1] Arjan Duresi, Vamsi Paruchuri, Leonard Barolli, "Clustering Protocol for Sensor Networks", Proceedings of the 20th International Conference on Advanced Information Networking and Applications (AINA'06)2006 IEEE.
- [2] Parminder Kaur, Mrs. MamtaKatiyar, "The Energy-Efficient Hierarchical Routing Protocols for WSN: A Review", ISSN: 2277 128X 2012
- [3] A.Koucheryavy, Ahmed Salim, and WalidOsamy, "Enhanced LEACH Protocol for Wireless SensorNetworks".
- [4] H. Yang and B. Sikdar, "Optimal Cluster Head Selection in the LEACH Architecture",IEEE International Conference on Performance, Computing, and Communications,2007, 93-100.
- [5] W.R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "Energy-efficient communicationprotocol for wireless microsensor networks", Proceedings of the 33rd HawaiiInternational Conference on System Sciences, 2000, 1-10.
- [6] TejalIrkhede, PrachiJaini, "Cluster and Traffic Distribution Protocol for Energy Consumption in Wireless Sensor Network", 2013 IEEE.
- [7] Meena Malik1, Dr. Yudhvirsingh2 ,Anshu Arora3, " Analysis of LEACH Protocol in Wireless Sensor Networks", ISSN: 2277 128X 2013.
- [8] M.Usha, Dr.N.Sankarram, "A Survey on Energy Efficient Hierarchical (Leach) Clustering Algorithms in Wireless Sensor Network", International Journal of Innovative Research in Computer and Communication Engineering ISO 3297: 2007
- [9]Umar Javed, Martin Suchara, Jiayue He, and Jennifer Rexford, "Multipath Protocol for Delay-Sensitive Traffic".