An Implementation & Iterative study on LEACH and Its Different Versions of Protocol of UWSN.

1. **(Author & Corresponding author)Prof. Bhaumik Machhi,**Research Scholar, CSE, Institution: Gujarat Technological University, Ahmedabad, Gujarat, India- 380005 Email:Bhaumik46@yahoo.co.in, +919510680739.

Asst. Prof. **Bhaumik Machhi (Author & Corresponding author)**

CSE Department, PIET, Parul University,

Waghodia, Vadodara, Gujaraat, India, 391760.

2. **(Co-Author)Dr. Paresh P. Kotak,**Institution: Gujarat Technological University, Department: CSE, Ahmedabad, Gujarat, India- 380005, Email: kotaksir11@gmail.com.

Abstract

The LEACH protocol is a popular protocol used in underwater wireless sensor network analysis and simulation. This paperanalyses the effect of varying the parameter values used in the LEACH protocol.Simulation results are presented. We show that the parameters normally used apply to a specific network only. Researchers have focused on Underwater wireless sensor networks (UWSNs). Because there are a lot ofapplications we used. The UWSN consists of many small sensor nodes that contain a small andself-charged battery. Sometimes it is possible to change the power source of the node battery but sometimes it isimpossible to do so, and this varies depending on the nature of the network environment so, the underwater wireless sensornetwork may be destroyed over time. This makes the process of increasing the lifetime of the UWSN a major challenge for researchers. There are a lot of UWSN protocols to improve the lifetime of UWSN, oneof these protocols and some of its modified versions.LEACH is used to investigate wireless sensor networks (UWSN) by evaluatingLEACH, V LEACH, TL LEACH, S LEACH, Multi-hop LEACH. Moreover, The LEACHand Multi-hop LEACH are implemented byNS2 to achieve simulation results. The performance evaluation is shown in more charts to prove theperformance of theseprotocols.

Introduction

The vast advancement in wireless communication has given us anopportunity to produce small, durable, easy to handle, low costsensors that can monitor the surrounding compute the data andtransmit signal to the user from a distant location. UWSN is used invarious supplication like forecasting environmental pollution andweather conditions, providing health care in remote

814

Eur. Chem. Bull. 2023,12(7), 814-822

area, checkingair traffic, monitoring and tracking enemy and force protection inmilitary, early warning system and post disaster response (searchand rescue)[1].The sensor nodes used in wireless sensor network require energy tocommunicate and transmit data to other node and base station. Allthe sensor nodes are battery operated, and recharge or replacementof battery is difficult due to their placement in remote and hostileenvironment[2]. As we know data is routed from one node to otherand reaches to the user through a specified path using a routingprotocol.The real challenge of this technology is to provide energy efficientrouting protocol. The purpose of routing protocol is to minimizeenergy consumption and maximize sensor nodes capacity, toimprove network lifetime[3].

This protocol uses the radio model to estimate energy consumptionin transmission of data. Leach consists of large number of associatesnodes along with a cluster head[4]. The responsibility of a clusterhead is to congregate the data from member node, compress andtransmit it to the base station. Every node is provided with a timeslot to respond in order to prevent collision[5].
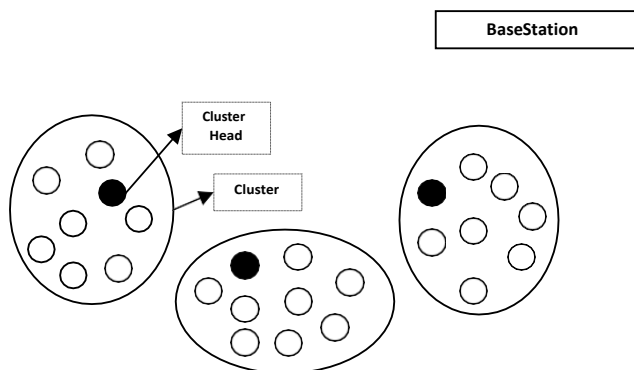

Fig. 1 UWSN arrangement of BS & CH

LEACH

ModelLEACH is one of the energy efficient hierarchical routing protocol.This routing protocol use a clustering method to transmit data inorder to obtain advantage on reduction of energy consumption.[6]. In this method sensors are gathered into a disjoint set knownas cluster and one of the sensor node acts as the head of a cluster,which communicates compressed information to the base station.Nodes that are not cluster head only communicate with the clusterhead in a TDMA fashion, according to the schedule created bythe cluster head[7].

815

Eur. Chem. Bull. 2023,12(7), 814-822

Comparison of LEACH and its Modified LEACHProtocolsEvery protocol has some limitations along with the benefits.To improve the functioning of protocols we need to study thecomparison between these protocols, and further modify themfor better result[8].

V LEACH

The cluster head has a heavy task so that the energy reduces quickly causing dies early. Vice cluster-LEACH, assigning of the vice cluster based on the residual energy in each sensor nodes. The vice cluster will take over shortly when the cluster head will die[9]. The vice cluster head gives a positive impact to prolonging the network lifetime. Based on the simulation result shows that the vice cluster head extends about 12.5% of the network lifetime[10]. In addition, the V-LEACH routing protocol also consumes lesser.Energy than the LEACH protocol in a specific number of rounds[11].

TL LEACH

Routing sensor data from SN to BS is a challenging task in a UWSN application. The SN have a number of constraints such as limited energy, low memory, processing capabilities, etc. it is important to consider these constraints while designing a routing protocol so that the overall network lifetime and the data robustness may be efficiently maintained[12].
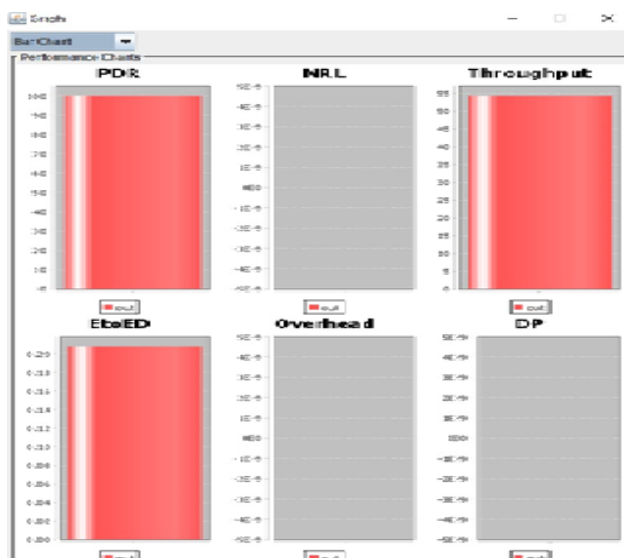

Fig. 2 Graphical Structure of Different Parameter

816

Eur. Chem. Bull. 2023,12(7), 814-822

The two-level hierarchy for low energy adaptive clustering hierarchy (TL-LEACH) protocol to provide energy efficiency. In terms of communication overhead and making the communication among the end-nodes, cluster-heads and BS as robust as possible[13]. Two major drawbacks of the TL-LEACH protocol have been focused are mainly related to using the protocol for large scale UWSN and making thecommunication among the nodes robustness[14].

MULTI HOP LEACH

we analyze the effectiveness of low-energy adaptive clustering hierarchy (LEACH) and LEACH-based protocols in extending the lifetime for energy-constrained UWSNs[15]. An improved LEACH clustering protocol called enhanced multi-hop LEACH is proposed to reduce and balance energy consumption in order to allow increased packet delivery and network lifetime in UWSNs[16].

S LEACH(Solar-AwareLowEnergyAdaptiveClusteringHierarchy)

The goal of inventing S LEACH is to extend the lifetime of thesensor nodes and thus increasing the stability of network. Solarpoweredsensornodesarechosenforintensivetaskbyclusterhead.Thisprotocolisusedtoenhanceen ergyoftheisolatedsensornodesusingsolar power[17].
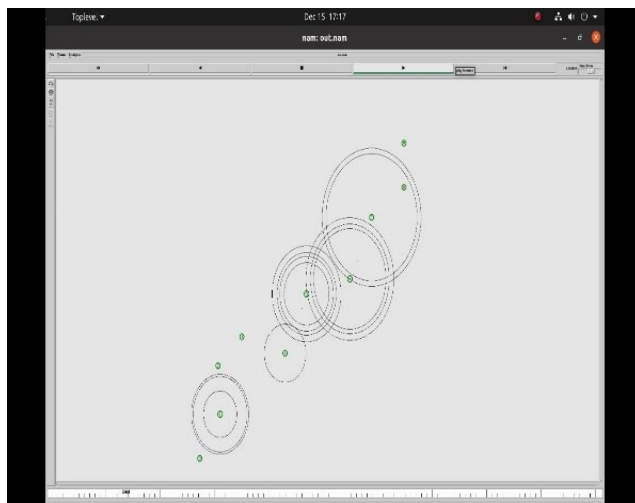

Fig. 3 Snapshot of NS2 Implementation of UWSN

817

Eur. Chem. Bull. 2023,12(7), 814-822

As thesesensor nodes are used in battlefield search and rescue operation in remote areas where

replacementofbatteriesisnotfeasible[18].ToovercomethislimitationSLEACHwasproposedinwhichs omenodesareprovidedwithsolarpowerand these nodes acts as cluster head. Selection of cluster head isonthebasisofsolarpoweralongwiththeenergypresentwithinthesensornodes[19].Here, we have mentioned simulation parameter values and results of LEACH and its successors.

Sr. No.	Parameter Name	Value
1	Sent Packet	39
2	Received Packet	39
3	Dropped Packet & Overhead	00
4	Dropped Bytes	00
5	EtoE Delay	0.21
6	Packet Delivery Ratio	100%
7	Throughput	54.34
8	Normalized Routing Load	00%

Table 1 Test Parameter Value

We Have also mention overall energy usage of simulation

Average Energy Usage

- average energy consumed = 9.61349, total energy consumed = 96.1349, Average Distance between 2 nodes, X: 150, Y: 150

818

Eur. Chem. Bull. 2023,12(7), 814-822

Outcomes of Simulation

Clusteringroutingprotocol	Classification	Mobility	Scalability	Self-organization
LEACH	Hierarchical	FixedBS	Limited	Yes
VLEACH	Hierarchical	FixedBS	Verygood	Yes
TLLEACH	Hierarchical	FixedBS	Verygood	Yes
MUTIHOP LEACH	Hierarchical	Mobile BSand nodes	Verygood	Yes
SLEACH	Hierarchical	FixedBS	Good	Yes

Table 2 Comparative result of Different LEACH Protocols 1.

Wireless Sensor Networks would be of great use infuture mission applications. If we analyze the previousresearch, we could observe that a lot of work is beingcarried out on routing i.e. what is the best optimal pathfor the nodes to communicate with each other.

In thispaper,wehavealsodiscussedLEACHroutingprotocol.Basically, how does it work has been explained abovewithitsadvantagesanddisadvantages.

Clusteringroutingprotocol	Hopcount	Energy efficiency	Resourceawareness
LEACH	SingleHop	High	Good
VLEACH	SingleHop	VeryHigh	Verygood
TLLEACH	MultiHop	VeryHigh	Verygood
MUTIHOPLEACH	SingleHop	VeryHigh	Verygood
SLEACH	SingleHop	VeryHigh	Verygood

Table 3 Comparative result of Different LEACH Protocols 2.

It is observed according to the simulation and comparisonsofpreviousstudiesoftheprotocolsthathavebeencomparedinourarticlewithdifferentpa

819

rametersofrouting   protocols   the   results   showed   that   the   alive nodes,deadnodes,packettoBS,clusterheads,totalenergynetwork,throughputandpacketdeliveryrat ioareaffected anddifferentiatewithLEACHprotocolanditsmodifications.

Clusteringroutingprotocol	Randomizedrotation	Distributed	Centralized
LEACH	Yes	Yes	No
VLEACH	Yes	Yes	Yes
TLLEACH	Yes	Yes	Yes
MUTIHOPLEACH	Yes	Yes	No
SLEACH	Yes	Yes	Yes

Table 4Comparative result of Different LEACH Protocols 3.

Asregardstothecomparisonsforhierarchical protocols we found different results of usingdeferentparameterstotesttheperformance

oftheseprotocols.Therefore,thenetworklifetimedifferentascompared tothese protocols.

CONCLUSION

In this paper We have discussed about some modified versions of LEACH andanalyze that each routing protocol addresses specific on clustering routing protocol LEACH.Further improvement in energy efficiency is possible in routingprotocolsby improvingcluster headselectiontechniques.

Weconcludethattheseparameterswillincreasetheperformanceofthenetworkquality.Itwillbe affectedinall applications that use the UWSNs. It is expected to workin fields such as industry, rubout or agriculture. Themodeling of these protocols seems to suggest that in futureofdesignandprocessoftheclassificationoftheseprotocolsmusttakeinconsiderationthesepara metersbecause these protocols will be efficient for applicationsthatare time critical bynature.

820

References:

[1]   "Scientific Journal Impact Factor (SJIF): 1.711." [Online]. Available: www.ijmter.com

[2]   Y. Liu, Q. Wu, T. Zhao, Y. Tie, F. Bai, and M. Jin, "An improved energy-efficient routing protocol for wireless sensor networks," *Sensors (Switzerland)*, vol. 19, no. 20, Oct. 2019, doi: 10.3390/s19204579.

[3]   P. T. Agarkar, M. D. Chawan, P. T. Karule, and P. R. Hajare, "A Comprehensive Survey on Routing Schemes and Challenges in Wireless Sensor Networks (WSN)," *International Journal of Computer Networks and Applications*, vol. 7, no. 6. EverScience Publications, pp. 193–207, Nov. 01, 2020. doi: 10.22247/ijcna/2020/205320.

[4]   S. K. Singh, P. Kumar, and J. P. Singh, "A Survey on Successors of LEACH Protocol," *IEEE Access*, vol. 5, no. May, pp. 4298–4328, 2017, doi: 10.1109/ACCESS.2017.2666082.

[5]   N. Kaur, M. Mahajan, R. Sharma, and M. Tech, "Comparative Study of LEACH Protocol in Wireless Sensor Network," 2019. [Online]. Available: www.IJCSN.org

[6]   H. El-Sayed, E. Zanaty, S. S. Bakeet, and E. MAbd-Elgaber, "Performance Evaluation of LEACH Protocols in Wireless Sensor Networks," *Int. J. Advanced Networking and Applications*, 2021.

[7]   A. Vyas and S. Puntambekar, "Cluster Based Leach Routing Protocol and Its Successor: A Review," *JOURNAL OF SCIENTIFIC RESEARCH*, vol. 66, no. 01, pp. 326–341, 2022, doi: 10.37398/jsr.2022.660135.

[8]   T. Sharma, H. Singh, and A. Sharma, "A Comparative Review on Routing Protocols in Wireless Sensor Networks," 2015.

[9]   J. Kim, D. Lee, J. Hwang, S. Hong, D. Shin, and D. Shin, "Wireless sensor network (Wsn) configuration method to increase node energy efficiency through clustering and location information," *Symmetry (Basel)*, vol. 13, no. 3, pp. 1–11, Mar. 2021, doi: 10.3390/sym13030390.

[10]   C. Nithya Praba and D. D. Kalaivani, "Study Of Energy Efficient And Secure Routing Mechanisms In Wireless Sensor Network," 2021.

[11]   M. S. M. Yadav and M. Ghosh, "Performance analysis of different types of LEACH protocol depending on various parameters," pp. 2290–2296, 2016.

[12]   G. Han, "Specialty Grand Challenge: Sensor Networks," *Frontiers in Sensors*, vol. 2, Jun. 2021, doi: 10.3389/fsens.2021.700967.

[13]   K. Gulati, R. S. Kumar Boddu, D. Kapila, S. L. Bangare, N. Chandnani, and G. Saravanan, "A review paper on wireless sensor network techniques in Internet of Things (IoT)," *Mater Today Proc*, May 2021, doi: 10.1016/j.matpr.2021.05.067.

[14]   A. P. Singh, A. K. Luhach, X. Z. Gao, S. Kumar, and D. S. Roy, "Evolution of wireless sensor network design from technology centric to user centric: An architectural perspective," *International Journal of Distributed Sensor Networks*, vol. 16, no. 8. SAGE Publications Ltd, Aug. 01, 2020. doi: 10.1177/1550147720949138.

[15]   M. S. Bensaleh, R. Saida, Y. H. Kacem, and M. Abid, "Wireless Sensor Network Design Methodologies: A Survey," *Journal of Sensors*, vol. 2020. Hindawi Limited, 2020. doi: 10.1155/2020/9592836.

821

[16]   A. Kaur, E. S. Singh, and N. Kaur, "Review of LEACH Protocol and Its Types," vol. 3, no. 5, pp. 20–25, 2015.

[17]   J. C. López-Ardao, R. F. Rodríguez-Rubio, A. Suárez-González, M. Rodríguez-Pérez, and M. E. Sousa-Vieira, "Current trends on green wireless sensor networks," *Sensors*, vol. 21, no. 13. MDPI AG, Jul. 01, 2021. doi: 10.3390/s21134281.

[18]   N. Ansari and R. K. Paul, "Comparative Analysis of Different Type Leach in Wireless Sensor Network," vol. 8491, pp. 3–6, 2014.

[19]   A. Braman and G. R. Umapathi, "A Comparative Study on Advances in LEACH Routing Protocol for Wireless Sensor Networks : A survey," *International Journal of Advanced Research in Computer and Communication Engineering*, vol. 3, no. 2, pp. 5683–5690, 2014.

822

Eur. Chem. Bull. 2023,12(7), 814-822