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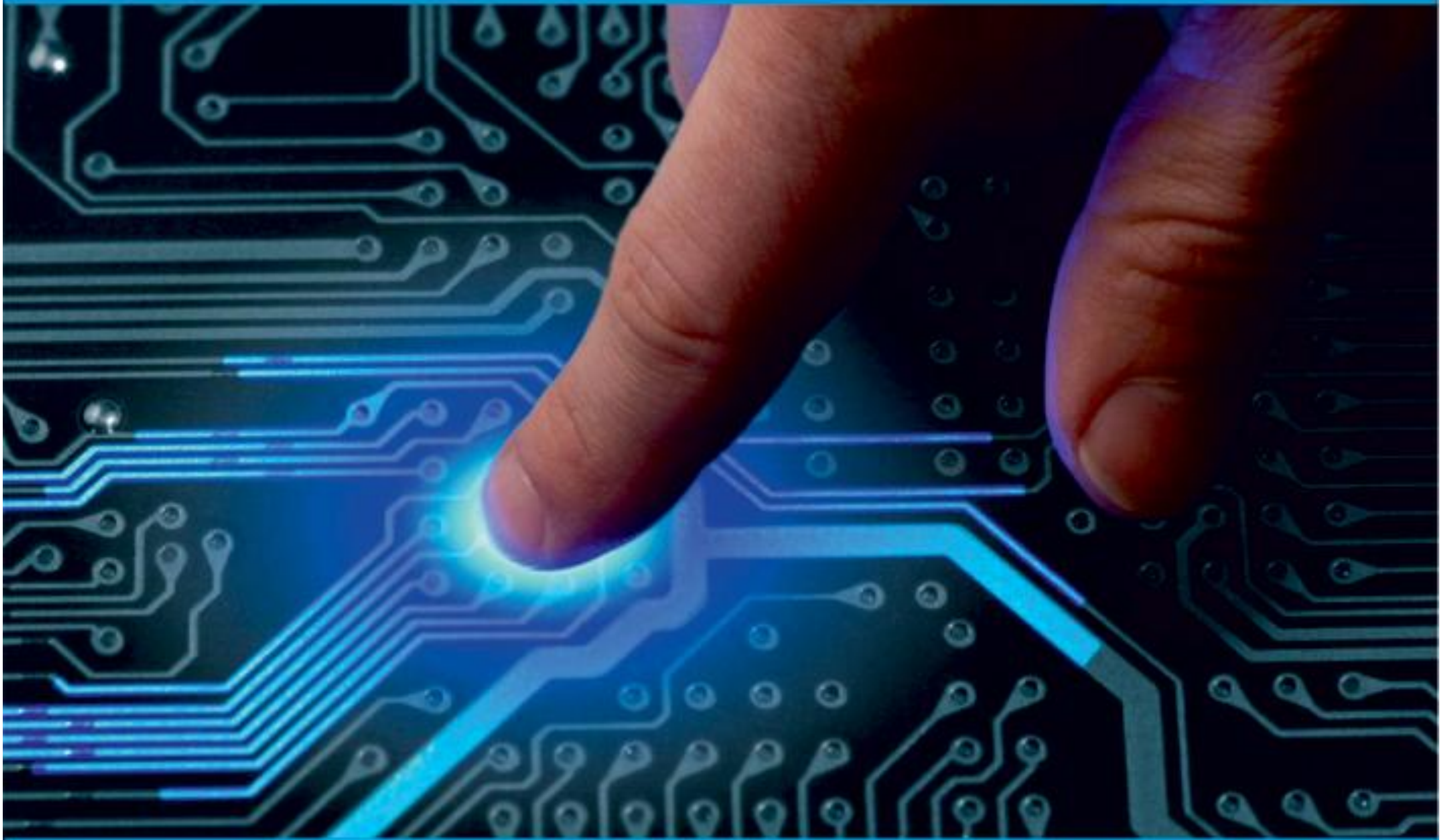
e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 8, Issue 8, August 2020

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.488

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.488 |

|| Volume 8, Issue 8, August 2020 ||

Design and Implement Energy Efficient Distributed Algorithm with Relay Node Selection for Underwater Sensor Networks

Shree Chordia[1], Ajay Singh Dhabriya[2]

M.Tech Research Scholar (CS), SITE, Nathdwara, India[1]

Assistant Professor (CS), SITE, Nathdwara, India[2]

ABSTRACT: This paper examines the main approaches and challenges in the design and implementation of underwater wireless sensor networks. We summarize key applications and the main phenomena related to acoustic propagation, and discuss how they affect the design and operation of communication systems and networking protocols at various layer The UASN is a chemical sensor that uses batteries as a power source. Due to the difficult environment of UASN, replacing these batteries is difficult. One way to alleviate this problem is to extend the life span of UASN batteries by reducing energy consumption (improving energy efficiency). This proposes an Energy Balanced Inequality Hierarchical Clustering (EULC) algorithm that can improve acoustic sensor operation. The UASN layer produced by the EULC algorithm differs greatly from the nodes, providing a solution to the "hot spot" problem by building different clusters of similar size. Simulation results show that the EULC algorithm can efficiently balance the energy of the UASN platform, thus enhancing network life.

KEYWORDS: USAN, EULC, WSN, LEACH, DEBCR

I. INTRODUCTION

Technique of sending and receiving message under the utilization of sound propagation in underwater environment is known as acoustic communication. Underwater sensor networks have number of vehicles and sensors that deploy in a specific area to perform collaborative monitoring and data collection tasks [1]. Traditionally for the monitoring of ocean bottom, oceanographic sensors are deployed for recording data at a fix location and recover the instruments at the completion of task. Te major disadvantage of traditional approach is lack of interactive communication between different ends, recorded data can never get during any mission, and in case of any failure recorded data will be destroyed. Underwater Sensor Networks support a wide variety of applications [2]; for example, aquatic surveillance, river and sea pollution discovery, monitoring, oceanographic data compilation, and commercial exploit the aquatic environment [3]. Underwater Sensor Networks can be utilized in any scenario from underwater warfare to the monitoring of environmental conditions [2]. Underwater Sensor Networks face constraints like limited bandwidth, high propagation delay, 3D topology, and power constraints. Radio and optical waves are not feasible for communication at each point of ocean. Under the entire limitations underwater sensor networks can only utilize acoustic signal that is a technique which is utilized by nature from the birth of ocean [4, 5]. Speed of sound is considered constant in underwater environment. However, speed of sound is affected by temperature, depth, and salinity of underwater environment. These factors produce variations in speed of sound in underwater environment [6].Underwater acoustic channel frequencies spectrum, especially on mid-frequencies, is heavily shared by various acoustic users in underwater environment. Still acoustic spectrum is temporally and spatially underutilized in underwater environment [7]. Variable characteristics of underwater environment have become a challenge for utilizing acoustic channel. For example, multipath propagation results in fading and phase fluctuations; Doppler Effect is observed due to the movement of both the sender and receiver nods. Speed of sound and underwater noise are other factors that influences the performance of acoustic channel [8]. Underwater sensor networks nodes are not static like ground-based sensor networks nodes. Instead, they move due to different activities and circumstances of underwater environment, usually 2-3m/sec with water currents. Sensed data is meaningful only when localization is involved. Another major issue that is affecting underwater sensor networks is energy saving. Because of nodes mobility, the majority of offered energy competent protocols become inappropriate for underwater sensor networks. Different protocols regarding land-based sensor networks are, for example, Directed Diffusion, Gradient, Rumour routing, TTDD, and SPIN. However, because of mobility and rapid change in network topology these existing grounds based routing protocols cannot perform efficiently in underwater environment [9]. Optimal packet size is depending on protocol characteristic like offered load and bit error rate. Poor packet size selection decreases the performance of the network throughput efficiency, latency, and resource utilization and energy consumption in multihop underwater networks can be greatly improved by a using optimum packet size [10–13]. To improve the better utilization of the available resources in underwater environment considering the energy and life time of network is discussed in detail in this paper. Balancing of energy consumption is carried out in underwater environment using the proposed techniques. Te important contributions of this work are not only to highlight the deep and shallow ocean characteristics, but also to present the effect of temperature in acoustic communication and efect of temperature in noise, errors and protocols due to variation in environmental factors. In addition, classification of routing protocols for UWSNs and their comparison in terms of bounded latency, multipath, load balancing, energy consumption, geographic information, communication overhead, and time complexity. Similarly, data delivery ratios for single and multipath and the strengths and weaknesses of MAC protocols, with the used topology, are compared [14– 16]

Underwater Sensor Networks: The Wireless sensor networks (WSN) are a set of sensor nodes for performing the collaborative task in a given area. WSN has an extensive variety of potential applications to attract many researchers. WSN are classified in different types such as given below (Aftab et al., 2015): Terrestrial WSN: It is a collection of tiny sensor nodes, which are deployed in a given area. Underground WSN: In an underground WSN, the sensor nodes are buried in the underground for observing the underground conditions. Underwater WSN: It is comprised of sensor nodes and vehicles which are deployed in underwater.

Multimedia WSN: In multimedia WSN, the sensor nodes can handle the multimedia traffic.
Mobile WSN: In mobile WSN, sensor nodes have mobility. Underwater sensor networks (USN) are a collection of sensor nodes and vehicles for performing the cooperative task in the specified region. In autonomous networks, the sensors and the vehicles are self-organized. The network can alter itself for achieving this goal to the features of the marine environment The water covers 75% of the earth's surface. Many resources lie underwater. Those are to be investigated. The current advances in technology have prompted the opportunities to try and do underwater explorations by using sensors at all stages. USN is the combination of wireless technology with a very tiny micromechanical sensor technology that has an intelligent computing, smart sensing, and communication capabilities A sensor network deployed in underwater can monitor physical variables. The various challenges facing designing USN are (Akyildiz et al., 2005):

COMMUNICATION ARCHITECTURE The different categories of architecture for USN are given below (Akyildiz et al., 2005) Static 2-Dimensional USN In the ocean bottom, the sensor nodes are anchored in the 2-dimensional USN. The architecture of the 2-dimensional USN is specified in Figure 1 The underwater sensor nodes are interconnected via a wireless acoustic link with one or more uwsinks (underwater sink). The devices in USN are accountable for delivering the information from the bottom of the ocean to the surface station. To obtain this goal, the uw-sink is prepared with two transceivers such as a horizontal transceiver and a vertical transceiver. The horizontal transceiver utilized in uw-sink has the ability to communicate with a sensor to perform the data collection task. The collected data is transferred to the surface station by the vertical transceiver.

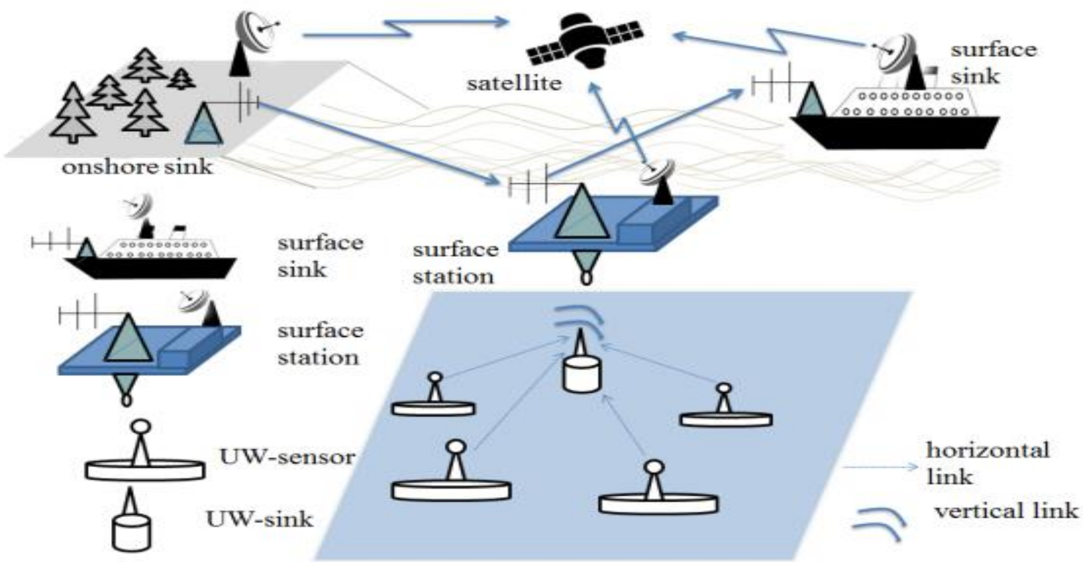


Figure 1. Architecture of 2-Dimensional USN

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The surface station is capable of communicating with up-sink as well as offshore sink and satellite. The sensor nodes can communicate with up-sink in direct links or multihop paths. Static 3-Dimensional USN : The 3-dimensional USN is used for detecting and monitoring phenomena that cannot be sufficiently monitored using ocean bottom sensor nodes. The 3-dimensional architecture is specified in Figure 1.2. In the 3-dimensional architecture, the floating buoy is used for anchoring the sensor nodes in the bottom of the sea. This floating buoy is bloated by means of a pump. The usage of the floating buoy is to push the sensor in the direction of the ocean surface. The positing depth of the sensors is regulated by the help of anchors as well as wires. 3. The 3-Dimensional USN of Autonomous Underwater Vehicles (AUVs) The architecture for 3-dimensional USN with AUVs is depicted in Figure 1.3. The sensor nodes are fixed on the ocean, and the vehicles are mobile. AUVs have a number of uses such as environmental observing, oceanography, and the study of the underwater resource.

II. PROPOSED SYSTEM

In the proposed framework, the algorithm used is Energy Balanced Inequality Hierarchical Clustering (EULC), which divides the UASN into several layers based on the depth and the mixing within each layer. The algorithm selects the cluster head to look at the residuals of each node, the specifications and the distances of the converter nodes, making the cluster head distribution consistent. To reduce energy consumption in the network, select the next hop node depending on the energy and the depth. EULC ranks among the most active DEBCR and LEACH on energy consumption, single-line management, and network life, ensuring energy efficiency using the EULC with UASN.

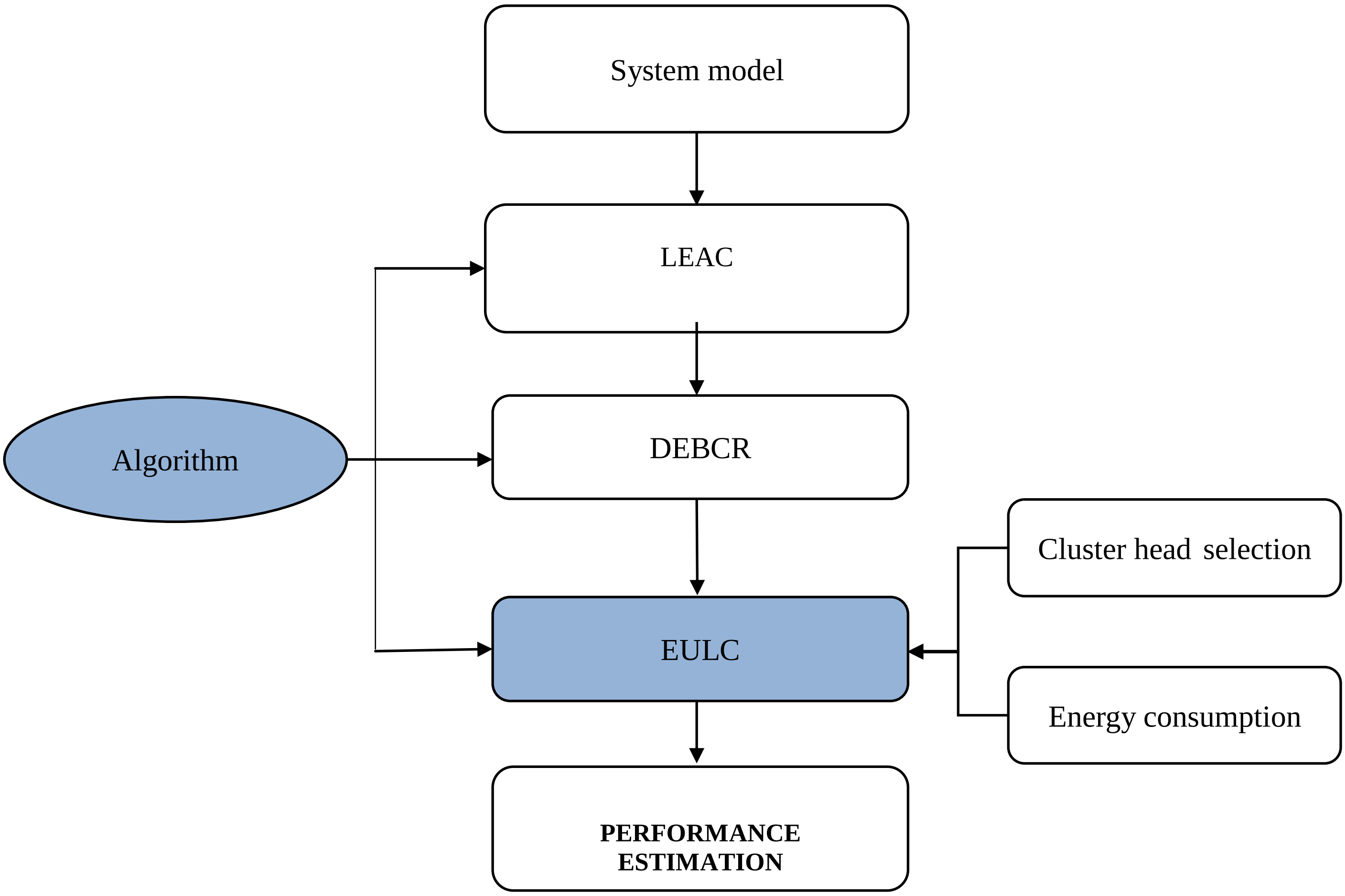

Fig 2 proposed flow Diagram

Sensor nodes collect data constantly. The nodes in one layer transmit the data in the cluster to this cluster, the cluster head sends data from the cluster head to the next layer, and the head of the cluster the cluster in the top layer sends data to the sink node. The database may cause the twin heads of the UASN to be distributed evenly, simplifying the network model and helping to balance energy consumption. To solve the problem of "hot spots," the EULC model divides the UASN into space with a non-uniform surface area, and the sliding line gradually ascends to the top.

III. MODULE DESCRIPTIONS

System Model: The three-dimensional UASN system is composed of static nurse cells built up to the sea floor, a motion sensor that floats in the water, and a floating meeting place above the water. During the installation process of the UASN, the sensor plate is distributed separately into the dough product, while the sample is immersed in water. All sensor nodes are dispersed in cubed water and have the same structure and energy, but have a unique ID; moreover, each node knows its location. Each node can think of the function of a normal node or a head node. All nodes are capable of inserting data packets and adjusting the transfer power according to the data transfer distance. The access node is located in the centre of the 3D network and can connect to any shadow of the network. Sensor nodes collect data continuously. The nodes in a layer transmit the data to the cluster in this layer, the cluster head sends the data to the cluster head in the previous layer, and the cluster head the cluster at the top sends the data to the sink.

EULC Routing algorithm: Given the limitations of the above method, it is suggested that a hierarchical clustering scheme with energy balance is proposed. The proposed EULC algorithm differs from the above method in three main ways. First, we divide the UASN into sheets based on the depth and branching of each layer. The algorithm selects the cluster head to look at the residuals of each node, the specifications and the distances of the converter nodes, making the cluster head distribution consistent. Second, it sets the competitive environment at each cluster head depending on the distance between the cluster head and the node node. Third, it uses multi-hop networks and hops for data transfer and inter-cluster. To reduce energy consumption in the network, select the next hop node depending on the energy and the depth.

Unequal layering model: The database may cause the twin heads of the UASN to be distributed evenly, simplifying the network model and helping to balance energy consumption. To solve the problem of "hot spots," the EULC model divides the UASN into space with a non-uniform surface area, and the sliding line gradually ascends to the top. The acoustic sensor nodes are locked in a grid based on the distance between the heads of their respective clusters and receive nodes with competing radius regions.

Cluster head selection: The cluster head plays a key role in the UASN. In EULC, the cluster head is set to dynamic. At the beginning of the UASN broadcast, the channel sent information to all nodes in the network. Each node calculates the distance from the node node based on the power of the received signal, and then estimates the depth. After pollination, all the islands enter the cluster selection stage. In EULC the head of each cluster is automatically selected. Each cluster head consists of cluster selection, cluster formation and migration steps. In each case, the node selected as the cluster head must record the remaining node, node height, and node node distance. Because the UASN cluster is distributed in different ways, the energy is saved by not requiring all nodes to participate in the cluster cluster selection. In this case, the whole network is divided into several circuits, and a selected cluster is the local coordinator for the circle. Each node uses a circular method to determine if this node has become a cluster island. A node that has become the head of a flower can no longer be the head of a flower.

Cluster establishment: Cluster construction is divided into two stages: cluster head and cluster clustering. In the first step, depending on the election window and their conditions, the exit of a page becomes a cluster head competitor, and sends a competition message about the cluster of head clusters, radius, weight, and so on. The weight is selected as the cluster head and the message is sent within the competing radius to declare its selection. In the second step, after receiving the message of the successful cluster head, the other cluster head candidates in this contest withdraw from the election and join the cluster with the non-cluster islands in this case.

Data Transmission Stage: Data transmission is the transmission of data through a communication channel or point-to-point. Examples of these channels are copper wire, optical fiber optic cable, storage media and bus. The data are displayed as electromagnetic signals, such as sensors, radio waves, radio waves or infrared signals. In each cluster, the non-cluster head sends packets to the cluster island, and the cluster head integrates those packets and exports the results to the next cluster head, which is further synchronized and exported upward. . In EULC, each cluster title contains a source of information about the title of the adjacent cluster.

The Energy Balancing Inequality Hierarchical Cluster (EULC) divides the UASN into layers based on the depth and volume of the individual plates. This algorithm is used to reduce the energy of communication between clusters

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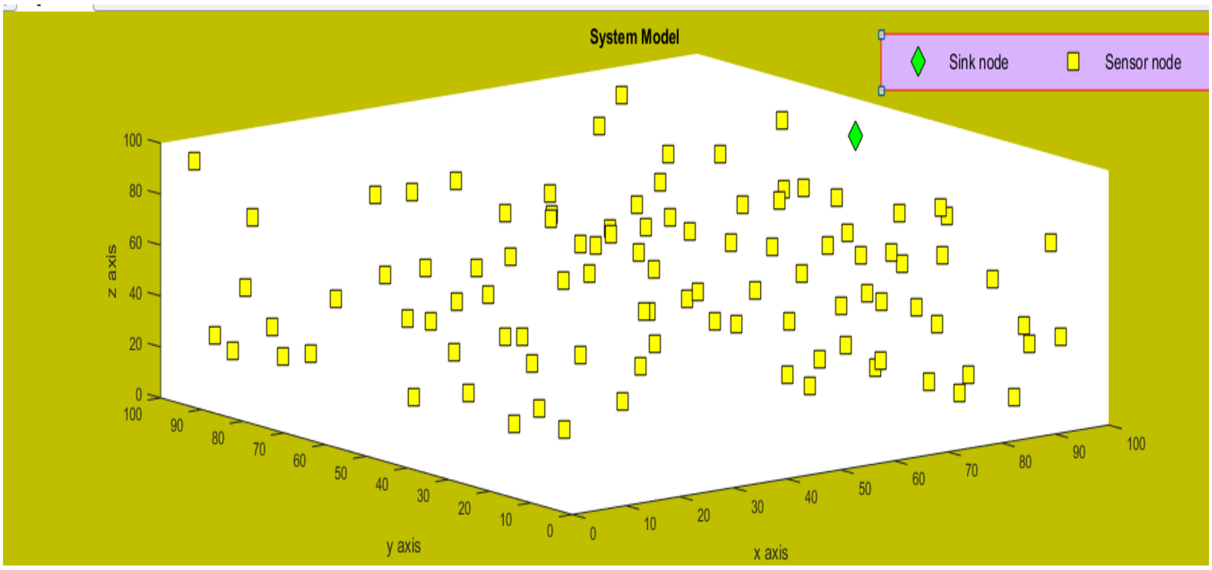

Fig system model

The UASN is equipped with an acoustic sensor or that uses batteries as a power source. Because It is difficult to replace these batteries in underwater systems using UASN. One way to alleviate this problem is to extend the life span of UASN batteries by reducing energy consumption (improving energy efficiency). an algorithm for Energy Balanced Inequality Hierarchical Clustering (EULC) that can improve the efficiency of acoustic energy. The EULC algorithm generates a UASN with a layer that differs from the depth of the node, providing a solution to the "hot spot" problem by building different clusters of the same size. Simulation results show that the EULC algorithm correctly balances the energy in the UASN arena, extending the network life.

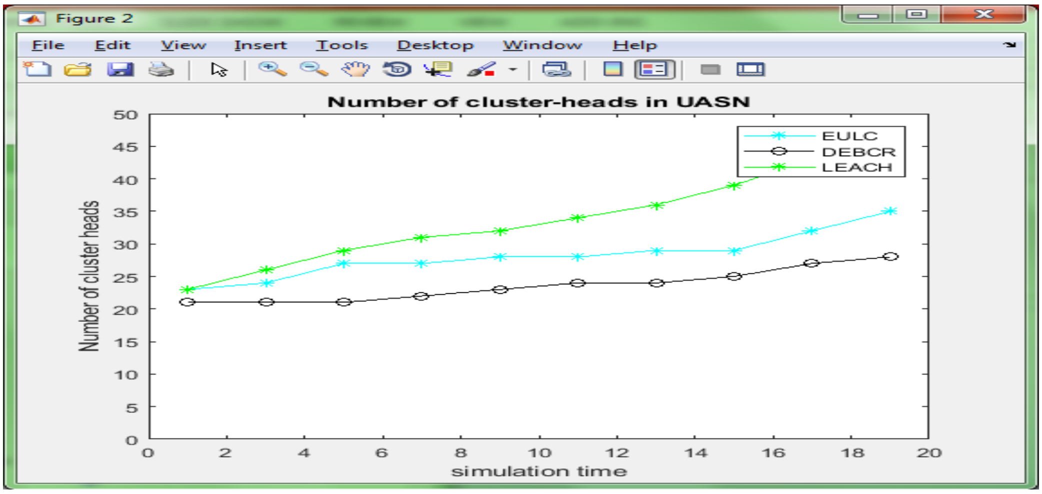

Fig. 3 number of cluster head in USAN

The change in the number of cluster heads can be used as a measure of clustering accuracy. Figure 4.5 shows the evolution of more than 20 cluster heads per algorithm. It can be seen that the number of clusters in the EULC and DEBCR clusters is more stable than the cluster clusters in the EELC. This is because LEACH relies on a reliable metric to determine the number of clusters per cycle, and the metric that can exist on each side, while the EULC and DEBCR both consider the president cluster. Other non-physical properties. In particular, the use of the EULC diffraction method imposes a more precise flowering.

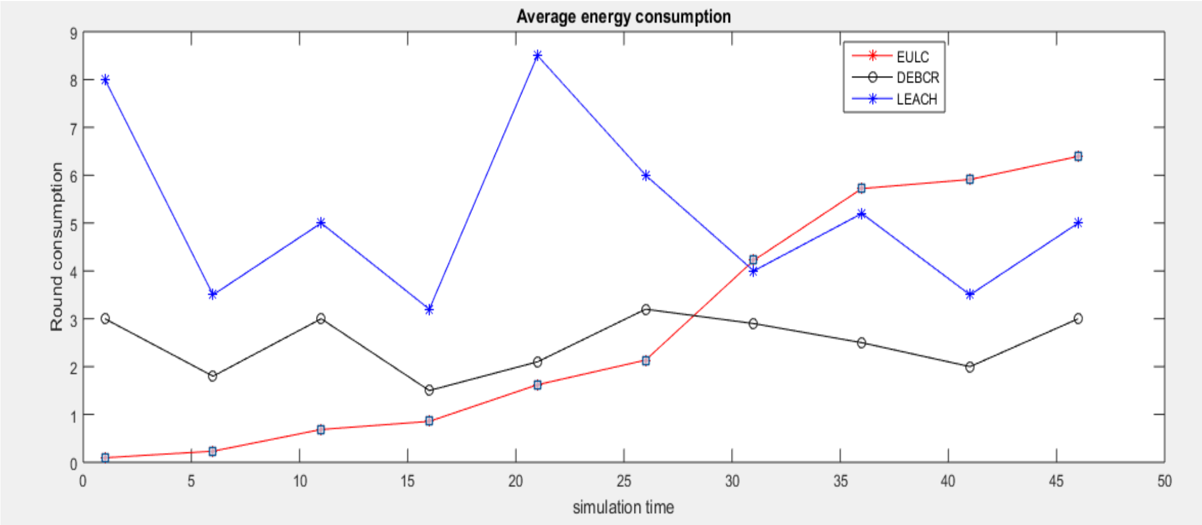

Fig. 4 Average energy consumption Number of cluster-heads in UASN per node over one turn.

Figure 4. shows the energy consumption of each revolution. It can be seen that LEACH has the highest value. Figure 4.4 Number of flower heads in UASN. Figure 3 shows the energy consumption of each node in a circle. Higher energy consumption and higher race, while EULC has the lowest energy consumption and the lowest reduction, indicating that the EULC algorithm has higher energy efficiency

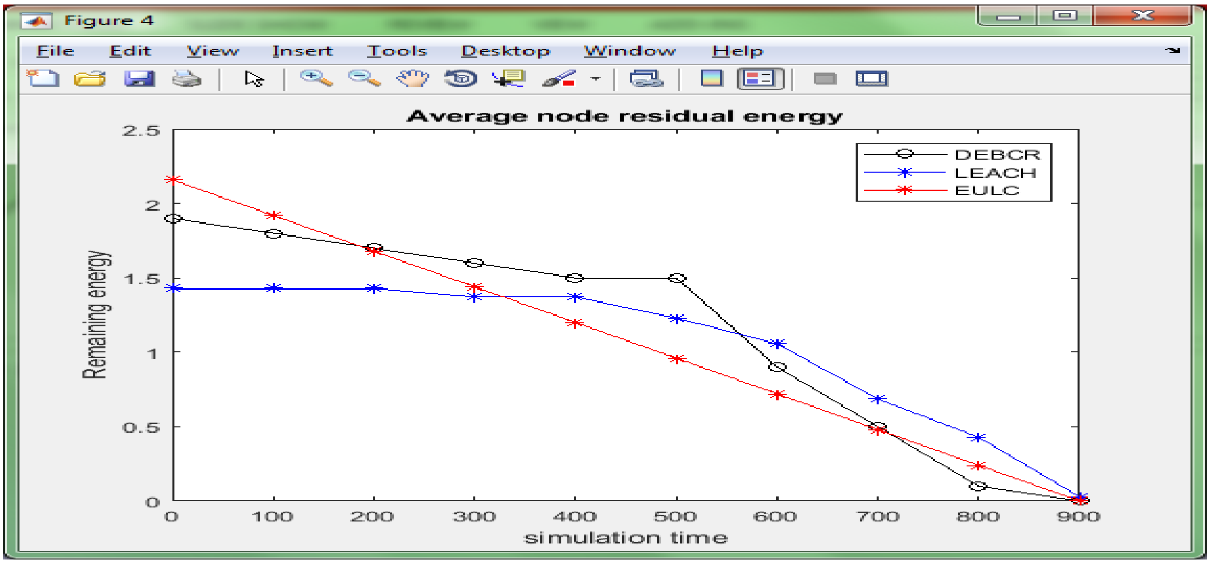

Fig. 5 Average node residual energy

Figure 5 shows the change in residual energy as the number of chemical cycles increases. Of course, the highest average energy reduction in teaching is zero, with a maximum of 325 degrees. In contrast, EULC uses a non-uniform method and active modeling to solve effectively address the "hot spot" problem and balance the energy consumption by distributing energy between the nodes and within the cluster. In EULC, cluster head selection is taken into account, which makes the cluster head propagation more uniform and the energy balance more balanced. The amount of packets received by the recipient under each algorithm is shown. It can be seen that over a period of time, the packet receives a large amount of data packets under the EULC and DEBCR through the code contained within the LEACH algorithm. Of these three algorithms, EULC has successfully implemented the most efficient data packets from the cluster head, demonstrating that EULC can dramatically improve energy use rates. Calculate the energy, the other levels, and the distance of the flight

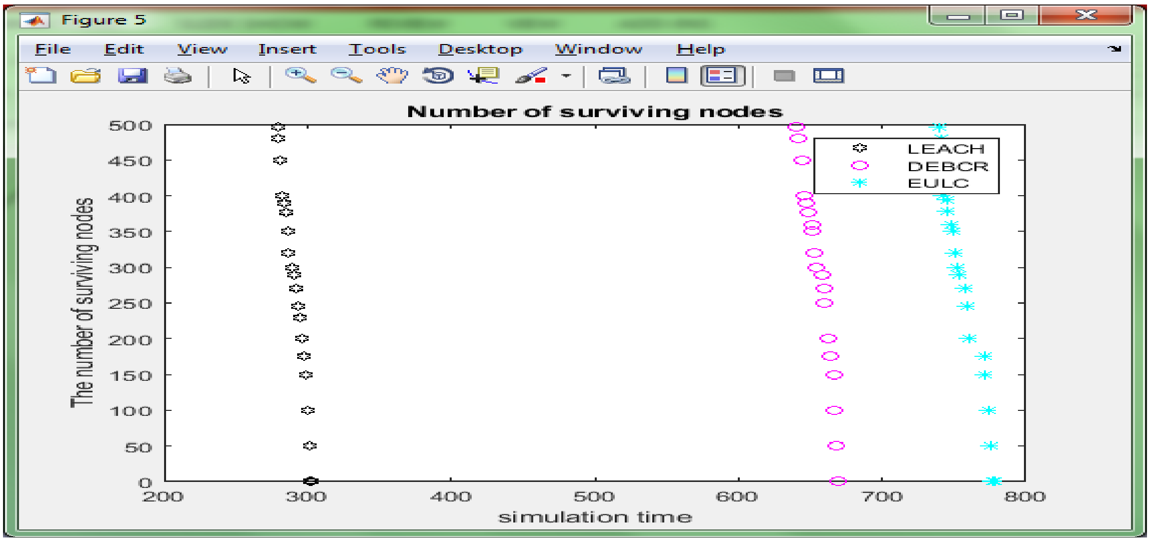

Fig. 6 Number of surviving nodes

Figure 6 shows the lifecycle of each algorithm, showing that as the number of rotations increases, the number of idle lifetimes decreases, and the time to die of the first node and all nodes is 30%. For LEACH, DEBCR and EULC, the first died at 208th, 587th and 609th. In the instruction, the energy consumption increases as the cluster head at a distance communicates directly with the sink node. In DEBCR, the residual energy and the level of the nodes are taken into account when choosing the joint head, so the blood supply is uniform. In EULC, so that the propagation of the cluster head is the same and energy consumption is more balanced.

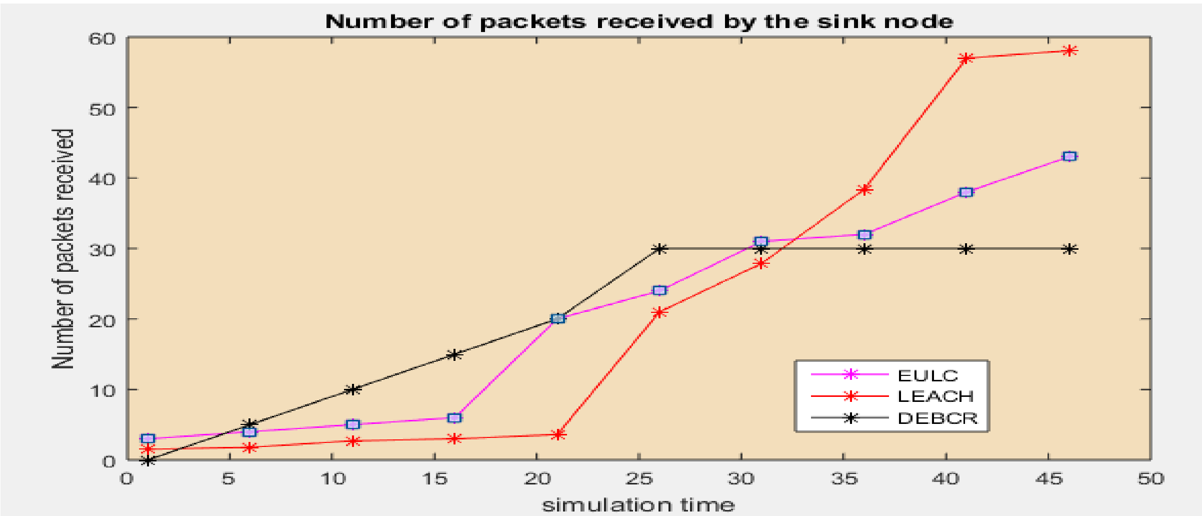

Figure 7 the number of packets received by the sink

node under each algorithm. It can be seen that over a period of time, the packet receives a large amount of data packets under the EULC and DEBCR through the code contained within the LEACH algorithm. of these three algorithms, EULC has successfully implemented the most efficient data packets from the cluster head, demonstrating that EULC can dramatically improve energy use rates.

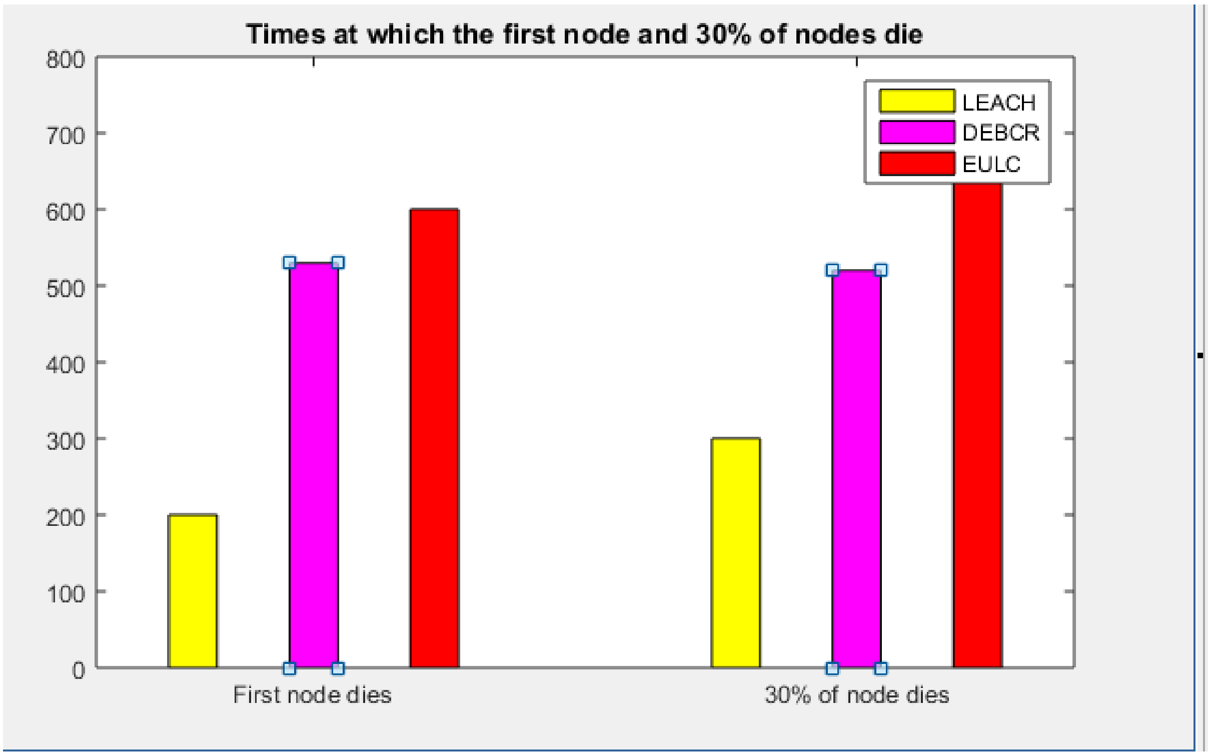

Fig. 8 Times at which the first node and 30% of nodes die

IV. CONCLUSION

Energy efficiency has a direct impact on the life of the UASN. In each cluster, the non-cluster head sends packets to the cluster head, and the cluster head integrates those packets and exports the results to the next cluster head, which is further synchronized and exported. going up. In EULC, each cluster's header contains the information table for the adjacent cluster. This paper proposes the UASN standard for Energy Balanced Inequality Hierarchical Clustering (EULC). The main advantage of EULC is that the layers are not uniformly based on the depth of the sensor node; when selecting the cluster head, the remaining energy, the distance of the converter nodes and the height of the nodes; "Hot spot" problems; and it is based on the energy edge and node distance to determine the best hop response that EULC performs better than the DEBCR and LEACH algorithms in terms of energy consumption, head management cluster and network life, confirming it as EULC Success at UASN.

REFERENCES

1. S. Climent, A. Sanchez, J.V. Capella, N, Meratnia, and J.J. Serrano, "Underwater acoustic wireless sensor networks: Advances and future trends in physical mac and routing layers," Sensors, vol. 14, no. 1, pp. 795-833, 2018.
2. S. Basagni, M. Conti, S. Giordano, and I. Stojmenovic, "Advances in underwater acoustic networking," Mobile Ad Hoc Networking, vol. 39, no. 6, pp. 804-852, 2017
3. H. Yu, N. Yao, T. Wang, G. Li, Z. Gao, and G. Tan, WDFAD-DBR: Weighting depth and forwarding area divisionnDBR routing protocol for UASNs," Ad Hoc Networks, vol. 37, no. pp. 256-282, 2016.
4. X. Jin, Y. Chen, and X. Xu, "The analysis of hops for multi-hop cooperation in underwater acoustic sensor networks," in IEEE/OES China Ocean Acoustics, pp. 1-5, 2016.
5. J. Wang, Y. Liu, M. Li, et al. "QoF: Towards comprehensive path quality measurement in wireless sensor networks," in INFOCOM, Proc. IEEE Xplore, pp. 775-783, 2011.
6. W. B. Heinzelman, A. P. Chandrakasan, and H. Balakrishnan, "An application-specific protocol architecture for wireless micro sensor networks," IEEE Trans. Wireless Commun., vol. 1, no. 4, pp. 660-670, 2002.
7. O. Younis and S. Fahmy, "HEED: A hybrid, energy-efficient, distributed clustering approach for ad hoc sensor networks," IEEE Trans. Mobile Comput., vol. 3, no. 4, pp. 366-379, 2004.
8. C. Li, M. Ye, G. Chen, et al., "An energy-efficient unequal clustering mechanism for wireless sensor networks," in IEEE International Conference on Mobile Ad hoc and Sensor Systems Conference, vol. 8, pp. 604, 2005.

9. G. V. Selvi and R. Manoharan, "Unequal clustering algorithm for WSN to prolong the network lifetime (UCAPN)," in 4th International Conference on Intelligent Systems, Modelling and Simulation, pp. 456-461, 2013.
10. J. Cao, J. Dou, Z. Guo, S. Dong, and H. Xu, "ELT: Energy-level-based hybrid transmission in underwater sensor acoustic networks," in 9th IEEE International Conference on Mobile Ad-hoc and Sensor Networks, pp. 133-139, 2013.
11. T. Liaqat, N. Javaid, S. Muaraf Ali. M. Imran, and M. Alnuem, "Depth-based energy-balanced hybrid routing protocol for underwater WSNs," in 18th IEEE International Conference on Network-Based Information Systems, pp. 20-25, 2015.
12. G Kannan, T Sree, and R. Raja, "Energy efficient distributed cluster head scheduling scheme for two tiered wireless sensor network," Egyptian Inform J., vol. 16, no. 7, pp. 167-174, 2015.
13. A. Das, and P. N. Astya, "A relative survey of various LEACH based routing protocols in wireless sensor networks," in International Conferences on Computing, Communication and Automation (ICCCA), Greater Noida, India, pp. 630-636, 2017.
14. W. Kun , G. Hui, X. L. Xu , J. F. Jiang , and D. Yue, "An energy-efficient reliable data transmission scheme for complex environment monitoring in underwater acoustic sensor networks." IEEE Sens. J., vol. 16, no. 11, pp. 4051-4062, 2016
15. M. Aslam, F. Wang, Z. Lv, M. Asad, S. Zafar, E. U. Munir, and X. Hu, "Energy efficient cubical layered path planning algorithm (EECPPA) for acoustic UWSNs," in IEEE Pacific Rim Conferences on Communications, Computers and Signal Processing (PACRIM), Victoria, BC, Canada, pp. 1-6, 2017.

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