International Journal of Scientific Research & Engineering Trends
Volume 6, Issue 4, July-Aug-2020, ISSN (Online): 2395-566X

A Review on Energy Efficient Sensor Network Routing Protocol for Underwater Sensor Networks

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***Abstract* – 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.**

Keywords– USN, EULC, DEBCR, LEACH, Sensors, Electromagnetic communication.

I. INTRODUCTION

Underwater Sensor Networks Architecture, Underwater network's physical layer utilizes acoustic technology for communication. Limited bandwidth, capacity, and variable delays are characteristics of acoustic technology. Therefore, new data communication techniques and efficient protocols are required, for underwater acoustic networks.

Designing the network topology requires significant devotion from designer, because underwater network performance is generally depending upon topology design. Network reliability should increase with efficient network topology and network reliability should also decrease with less efficient topology. Energy consumption of efficient network topology is highly less as compared to incorrect and less efficient topology design of underwater network. Design of topology for underwater sensor network is an open area for research [1]. Underwater sensor networks architecture is shown in Figure 1.

Underwater Sensor Networks in Three Dimensions: Activity required to present three-dimensional environments new architecture which is known as underwater three-dimensional networks is used. Sensor nodes float at different depth to monitor a specific activity in three-dimensional underwater networks. Traditional solution regarding underwater three-dimensional sensor networks is the use of surface buoys that provide ease in deploying such kind of network. But this solution is vulnerable to weather and tampering. Also, effortlessly can be discovered and disabled by enemies in the scenario of military operation. In underwater three-dimensional sensor networks architecture, ocean bottom is utilized to anchored sensor nodes. Depth of these nodes is controlled using wires which are attached with these anchors. Major challenge regarding such network is influenced by the current properties of the oceans [1–2].

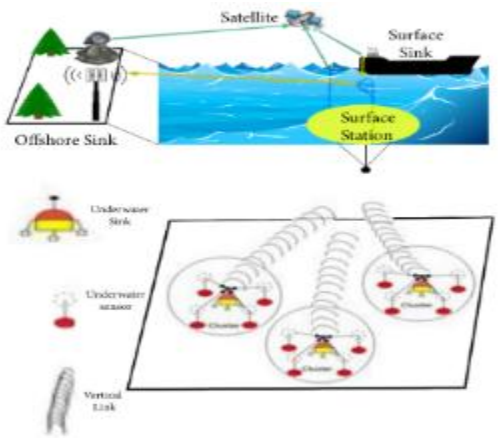

Fig.1. Two- and 3-dimensional networks architecture for UWSN regarding communication.

Underwater Sensor Networks in Two-Dimensions: Deep ocean anchors are utilized for collection of sensor nodes in two-dimensional underwater sensor network architecture. Anchored underwater nodes use acoustic links to communicate with each other or underwater sinks. Underwater sinks are responsible to collect data from deep ocean sensors and provide it to offshore command stations, using surface stations. For this purpose, underwater sinks are provided in the company of horizontal and vertical acoustic transceivers. Purpose of horizontal transceivers is to communicate with sensor node, to collect data or provide them commands, as have been received by offshore command station, although vertical transceiver is used to send data to command station. Because ocean can be as deep as 10 km, vertical transceiver should contain enough range. Surface sink that is equipped with acoustic transceivers has the capability to manage parallel communication, by means of multiple organized underwater sinks. Surface sink is also equipped through extensive range radio frequency transmitters, to communicate with offshore sinks.

Propagation Phenomena of Underwater Sensor Networks: Acoustic communication regarding underwater environment is a complex phenomenon because a lot of environmental factors affect acoustic communication. These factors are variable like long propagation delays, environmental noise, path loss, Doppler spread, and multipath effect. Underwater environmental factors make acoustic channel highly variable. They also create bandwidth dependency upon both frequency and distance between two nodes. Generally, ocean is divided into two parts; these are shallow and deep ocean. Shallow and deep ocean characteristics are described in the Table 1. Shallow ocean highly affects acoustic channel because of high temperature gradient, multipath effect, surface noise, and large propagation delays, as compared to deep ocean. Underwater environment major propagation factors that affect acoustic communication are described in subsequent sections.

II. RELATED WORK

Presently underwater communication system utilizes electromagnetic, optics, and acoustic data transmission techniques to send data among different positions. Electromagnetic communication technique is affected by conducting nature of seawater while optic waves are applicable on very short distance because optic waves are absorbed by seawater. Acoustic communication is only one technique that has better performance regarding underwater communication due to less attenuation in seawater.

Acoustic communication also has less attenuation in deep and thermally stable oceans. Shallow water affects acoustic communication by temperature gradients, ambient noises regarding surface, and multipath effect because of reflection and refraction [5].Acoustic Sensor Networks (UASN) such as Jin Xiaoting has attracted the latest attention in the field of mining and environmental monitoring. Sensor nodes used in UASN can be used on batteries that are difficult to install or replace. It is important to meet the size of the hop set in the multi-hop network, but works well when faced with the necessary delays. In this article, we first discuss the relationship between energy consumption, final delays, and hop count in UASN multi-hop, and then consider how you can successfully count hops with different distances. Measurement based on transaction conditions. Energy is consumption and the introduction of gas. Next, we define the cost function to evaluate each child. Simulation results show that the assumption of energy consumption and ultimate delay, by working with different distances, a potential trap for multiple UASNs can be avoided. The model presented in this paper is used to determine the number of hops in a successful UASN for large-scale water works. This article examines the relationship between energy consumption, postponement, and hop count. With multiple cooperative UASNs. In addition, based on the potential for delays, the trade-offs between energy consumption, end-to-end latency, and annual numbers of UASN cooperatives are dispersed. It then offers a price application that includes energy consumption, end-to-end and money transfer. It can be used to determine the number of hops needed to maintain energy consumption and end-to-end consumption.

III. LITERATURE SURVEY

In order to extend wireless sensor networks to the underwater environment, the Acoustic Sensor Network (UASN) has been gaining ground in the community. At UASN Due to the diverse underwater environment (such as the well-known oil monitoring) (based on the importance of energy consumption in establishing multiple UASNs, efficiency and reliability data transmission is extremely difficult.) EGRC design.). It has the following characteristics: consider in-water media, such as 3D editing, high-speed propagation, motion and distance. Major issues, e.g., energy conservation and mobility regarding underwater sensor networks, create unique challenges for designing of routing protocols and make all existing ground-based routing protocols (proactive and reactive) inadequate. Underwater environment required such protocols that are efcient in energy consumption, manage random variation in topology, and consider asymmetric links and huge propagation delay.

DU et al. Present a protocol which is known as Level-Based Adaptive Geo-Routing (LBAGR) that divides communication traffic into four categories. These are upstream to sink, downstream to sensor nodes, downstream to specific nodes, and downstream to all nodes. Data forwarding is based upon density, available battery power, and level between neighbours that is used to elect next best hop. Level-Based Adaptive Geo-Routing goal is to achieve minimum communication delay, consume less battery power, and improve delivery ratio as well as received packets percentage. This protocol reduces communication end-to-end delays and improves delivery ratio and efficient utilization of battery power. Efficient utilization of battery power is the major concern of underwater sensor networks routing protocols.

M Sunithaet.al (2019) Localization refers to the estimated position of each sensor node within a network. It's necessary since underwater sensor nodes depend on this information for reliable communication. The main challenge over here would be that the environment underwater is naturally quite different from land, posing uncertainty in sound speed variations and hence more noise in the channel. Here, the Kalman filter and extended Kalman filtering methods are explored to minimize the localization errors. This is validated by simulating the shallow water experiment and further the localization results are compared.

Jianxin Liu et.al (2018) In recent years, the underwater wireless optical communication has been arising a great concern of academia because of its high bandwidth, low time delay spread, stability, high rate and so forth. In this paper, a distributed energy- efficient and balanced routing algorithm (DEEB) for an underwater wireless optical sensor network is proposed. The DEEB is applicable for both static and dynamic network. It reveals through simulation experiments that the DEEB can significantly reduce the routing consumption of energy, balance the energy load of nodes to prolong the work time of nodes comparing with existing algorithms.

Huang et. al. proposed a routing protocol that utilized energy efficiently using fuzzy logic and decision tree techniques for data forwarding towards the surface sink. Routing protocol goal is to utilize battery power efficiently in that manner that reduces the expenditures of energy during acoustic communication. Protocol reduces traffic overload on acoustic channel and reduces energy consumption also. Presently, for routing protocols minimum end-to-end delay and high efficiency are the major requirements for underwater sensor networks.

Ali et. al. Present an end-to-end delay efficient routing protocol which is known as Diagonal and Vertical Routing Protocol for Underwater Sensor Network (DVRP). Packet forwarding mechanism is depending upon angle of flooding zone and flooding nodes are also controlled by manipulating the angle for food region to avoid the flooding over the entire network. Diagonal and Vertical Routing Protocol goal is to minimize end-to-end delay and consume less battery power of sensor nodes. Diagonal and Vertical Routing Protocol has no need to maintain large routing tables; instead of this it uses its local information to rout data packet towards destination. Adding or removing new nodes create no disturbance for existing nodes.

Basagni et al. select two protocols. These are Code Division Multiple Access (CDMA) and Distance Aware Collision Avoidance Protocol (DACAP) and compare them by varying packet size, bit error rate, and traffic load. Under the exploitation of variant packet sizes, bit error rates, and traffic load, author determines the impact of packet size upon multichip underwater sensor networks.

Basagni et. al. introduce technique of data fragmentation that minimizes disadvantage of collision by partitioned long data packet into small fragments. Technique is experimented upon DACAP by considering and no considering data fragmentations. Fragmentation decreases retransmissions, energy consumption, and packet latency as well as overall traffic and huge overhead. Basagni et al. do not consider the factor of varying bandwidth and interference and as a result of fragmentation traffic load increases that congested communication channel. Since improving the throughput of a single hop packet size is considering a critical parameter regarding communication in field of underwater sensor networks. Underwater sensor networks use the half duplex methodology for communication that can be avoided by utilizing optimal packet size selection. In this proposed feeding control system sensor nodes works in groups for necessary decision making. Te contribution of this system is to avoid loss of food and then reduces negative impact on environment as well as economically feasible [7-9].

QERP is proposed by **Faheem et al.** To improve the reliability of data transfer in underwater acoustic sensor networks. Te mechanism used for organizing sensor nodes is in the form of small clusters which are connected hierarchically for distributed energy and data transfer evenly. Tis technique reduces the probability of packet loss and preserves high link quality in underwater environment. Te issue with this technique is no mobility and node density is not addressed.

Basagni et. al. observe the performance of multichip network in provisions of throughput, energy efficiency, and latency. Effect of bit error rate, interference, collision, and retransmission leading selection of optimal packet size is also considered. For this, Basing et al. select two-media access control protocol CDMA and DACAP and compare their results and change the network deployment scenario and then observe the effect of the packet size upon throughput, energy efficiency, and latency of network. Basagn et al. achieve improvement in all metric, e.g., throughput, energy consumption, resource utilization, and packet latency underutilization of optimal packet size selection.

Junget al. Have investigated energy efficiency using optimal packet size under the utilization of NS-2 simulator. Authors create a cluster of 100 nodes in dimensions of 2 km×2 km×200 m. Experiment proves a relationship between energy efficiency and packet size. Optimal packet size reduces utilization of extra energy. Erroneous channel offers large bit error rate that causes wastage of large energy amount, but the utilization of optimal packet size for erroneous channel reduces wastage of energy. Reliability (in sense of data delivery) is a major issue regarding underwater sensor networks because of highly variant environment.

Ayaz et. al. provide an algorithm that has the ability to determine the best suitable packet size for reliable data transfer, using two-hop acknowledgment methodology for same packet size. Algorithm investigates optimal data packet size for underwater sensor networks, with energy efficiency as the optimization metric. Te goal of the algorithm is reliable data delivery from source node to destination node or surface sink is a major requirement of a network. In this section, paper presents a brief overview of different advancements in the field of Underwater Wireless Sensor Networks that uses acoustic channel for communication. But still some issues and challenges exist. Tat not only affects the performance of above described methodologies but also needs solution from research community. Tese issues, challenges, and drawbacks are discussed in the next section.

IV. 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.

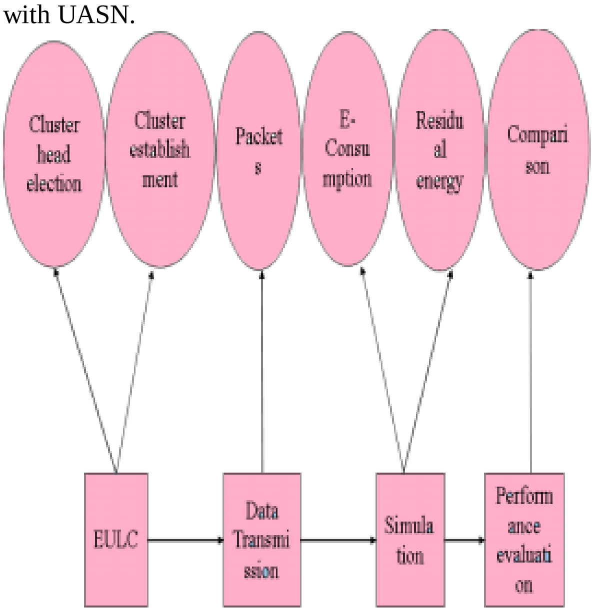

Fig .2.proposed flow Diagram.

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.

V. CONCLUSION

In this paper, we have discussed several techniques of underwater sensor networks. Te objective of the reviewed techniques is to overcome the underwater challenges and to give directions to future researchers. Also, we presented a vibrant view to academia by providing a base for a better solution. In this perspective, we have presented future directions which are still not yet explored in this research area. A better communication technique can be proposed by considering environmental efect during communication. In the development of underwater communication technique utmost care must be taken regarding the life of marine animals and their communication. Te deep digging out in the areas regarding nonlinear sound propagation of acoustic signals can be more useful for designing future communication techniques. Te future identified research areas include cognitive networks area and underwater spectrum for their efficient use. Major challenges for the design of cognitive acoustic network

REFERENCES

[1]. M Sunitha R.K Karunavathi Localization of Nodes in Underwater Wireless Sensor Networks 2019 4th International Conference on Recent Trends on Electronics, Information, Communication & Technology (RTEICT) Year: 2019 ISBN: 978-1-7281-0630-4 DOI: 10.1109/ IEEE Bangalore, India, India

[2]. Jianxin Liu Hongxi Yin Fangyuan Xing XiuyangJi Bin Wu An Energy-Efficient Routing Algorithm for Underwater Wireless Optical Sensor Network 2018 10th International Conference on Communication Software and Networks (ICCSN) Year: 2018 ISBN: 978-1-5386-7223-5 DOI: 10.1109/ IEEE Chengdu, C

[3]. C.-J. Huang, Y.-W. Wang, H.-H. Liao, C.-F. Lin, K.-W. Hu, and T.-Y. Chang, “A power-efcient routing protocol for underwater wireless sensor networks,” Applied Sof Computing, vol. 11, no. 2,pp. 2348–2355, 2011.

[4]. T. Ali, L. T. Jung, and I. Faye, “Diagonal and Vertical Routing Protocol for Underwater Wireless Sensor Network,” Procedia -Social and Behavioral Sciences, vol. 129, pp. 372–379, 2014.

[5]. J. Lloret, S. Sendra, M. Ardid, and J. J. P. C. Rodrigues,"Underwater wireless sensor communications in the 2.4 GHzISM frequency band," Sensors, vol. 12, no. 4, pp. 4237–4264,2012.
[6]. B. Z. Chen and D. Pompili, "Reliable geocasting for random-access underwater acoustic sensor networks," Ad Hoc Networks,vol. 21, pp. 134–146, 2014.
[7]. L. T. Jung and A. B. Abdullah, "Underwater wireless network Energy efficiency and optimal data packet size," in Proceedings of the 1st International Conference on Electrical, Control and Computer Engineering 2011, In ECCE 2011, pp. 178–182, Malaysia,June 2011.
[8]. S. Gopi, K. Govindan, D. Chander, U. B. Desai, and S. N.Merchant, "E-PULRP: energy optimized path unaware layered routing protocol for underwater sensor networks," IEEE Transactions on Wireless Communications, vol. 9, no. 11, pp. 3391–3401,2010.
[9]. T. Hu and Y. Fei, "QELAR: a machine-learning-based adaptive routing protocol for energy efficient and lifetime-extended underwater sensor networks," IEEE Transactions on Mobile Computing, vol. 9, no. 6, pp. 796–809, 2010.
[10]. Y. Luo, L. Pu, M. Zuba, Z. Peng, and J.-H. Cui, "Challenges and opportunities of underwater cognitive acoustic networks," IEEE Transactions on Emerging Topics in Computing, vol. 2, no. 2, pp.198–211, 2014.
[11]. X.-P. Gu, Y. Yang, and R.-L. Hu, "Analyzing the performance of channel in Underwater Wireless Sensor Networks(UWSN)," in Proceedings of the 2011 International Conference on Advanced in Control Engineering and Information Science, CEIS 2011, pp. 95–99, China, August 2011.
[12]. J. Kong, M. Gerla, and S. Zhou, Challenges: Building Scalable and Distributed Underwater Wireless Sensor Networks (UWSNs) for Aquatic Applications, 2005.
[13]. S. Basagni, C. Petrioli, R. Petroccia, and M. Stojanovic, "Optimized packet size selection in underwater wireless sensor network communications," IEEE Journal of Oceanic Engineering,vol. 37, no. 3, pp. 321–337, 2012