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Investigations on Underwater Acoustic Sensor Networks Framework for RLS Enabled LoRa Networks in Disaster Management Applications

R. PONNI[1,+], T. JAYASANKAR[2] AND K. VINOTH KUMAR[3]
[1]*Department of Electronics and Communication Engineering*
Kings College of Engineering, Thanjavur, India
E-mail: ponnikings2021@gmail.com
[2]*Department of Electronics and Communication Engineering*
University College of Engineering BIT Campus, Anna University, Tiruchirappalli, India
[3]*Department of Electronics and Communication Engineering*
SSM Institute of Engineering and Technology, Dindigul, India

Underwater wireless sensor networks (UWSNs) are used for the exploration of underwater resources, oceanographic data collection, flood or disaster prevention, tactical surveillance systems, and unmanned underwater vehicles. Underwater Wireless Sensor Networks offer innovative ways to investigate and anticipate how aquatic environments behave. Without position information, sensed data is useless in approximating target tracking or disaster avoidance. In this research, we propose the RLS (Reverse Localization Scheme), for short, a unique 3D centralized localization structure for MWSNs. The proposed approach enhances energy economy and condenses localization reaction time by an apposite level of accurateness in expressions of the motion exemplary of water currents, according to simulation findings. It reduces the number of message exchanges required for localization, average localization response time and saves vitality. Acoustic communications are the most used physical layer technology in underwater networks. Radio waves may only travel great distances over conductive salty water at extremely low frequencies (30-300 Hz), necessitating outsized antennae and significant transmission power. This RLS Enabled LoRa Networks architecture is built on an ad-hoc WiFi network.

***Keywords*:** MWSNs, reverse localization scheme, clustering, data aggregation, effective routing, energy analysis, TWSN

1. INTRODUCTION

Since about 70% of the water on Earth can be regarded as the most significant resources, our planet has indeed been covered with roughly 70% of that water. Approximately millions of marine animals rely on ocean water as their primary habitat, as it is the primary habitation of all existing beings on the planet. Earth water absorbs everywhere one-fourth of the carbon dioxide produced by humanoid accomplishments. Navigation is one of the primary functions of water, which humans rely on heavily. Despite the fact that approximately 90% of the oceanic portion cannot be realized with the uncovered eye or is in accessible, there are hundreds of possessions waiting to be discovered in this vast oceanic. It is critical to comprehend the mineral possessions that must be developed deep beneath the water in order for the realm to develop. This obligates provided an excellent opportunity to have a better understanding of mother earth as more research is conducted

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[+] Corresponding author.

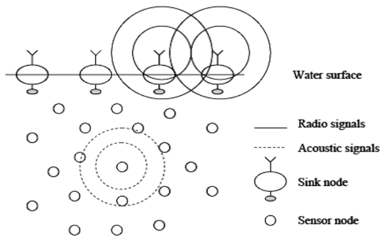

Fig. 1. Representation of data collection in UWN.

within the ocean. As illustrated in Fig. 1, connections that permit underwater connectivity are referred to as underwater wireless networks, underwater acoustic networks, or underwater wireless sensor networks. Nonetheless, we will refer to them together as underwater wireless networks (UWNs) in this context [1-3].

Offshore static sensor network, equipped with sensors, attached to or sitting on the bottom, and float at different elevations. Additionally, there are floating connections off of the coastline being under the sea that are somewhat autonomously or tested separately. The primary goal of UWNs is to sense and monitor the underwater environment that includes AUVs in order to transmit knowledge to an offshore station. Underwater WNM nodes have sensing capabilities to capture underwater features and parameters. Through the use of stations drifting over the sea surface (such as boats or buoys), such sensed data will be sent to the onshore stations. Additionally, several new technologies are being utilized, but this issue every of them faces is that they are too pricey and are proven to be inflexible [4]. Table 1 represents the factors involved in Terrestrial WSN and Underwater WSN.

The biggest obstacles to deploying any such connection are computational power, cost, memory, processing capacity, and sensor lifespan. Researchers will have a difficult time obtaining long operating duration while sacrificing performance of the system if indeed the battery's capacities are constrained. Therefore, a significant number of top researchers have invested time in the design of data aggregation algorithms to support UWSN nodes functionalities. The master node in UWSN data aggregation takes data from the nodes, processes, and sends it to the sink. When data redundancy is kept to a minimum while assuring a high level of data correctness, the primary difficulty for data aggregation in UWSNs comes into view [5, 6].

Table 1. Differential factors of WSN.

S.No	Terrestrial WSNs	Underwater WSNs
1	Because nodes are constant, the nodes of differing topologies can be supposed to apply.	Nodes flow with the water current, making the network more dynamic and difficult to see as a fixed topology.
2	Nodes are in 2D space, and are taken in to consideration to be progressing.	When you move modules in 3D volume, you don't have to move them according to any set pattern.
3	It is also the adjusted destination but instead changes rapidly destination.	For sinks, it is critical to place them on the surface of the water to follow water currents.
4	Devices can communicate at low time delay with the help of radio waves.	Instead of using radio waves, an acoustic wave sets the data rate to 1.6×104 meters per second.

2. RELATED WORK

Even though much research has been devoted to the development of novel applications and advanced architectures, relatively little research has been conducted in regard to the implementation of communication and networking protocols. Several original achievements have dealt with design of acoustically and modem acoustic and modem currently, a number of routing protocols aimed at underwater sensor networks has been advanced, and only certain of them are appropriate for network connections. UWSN architecture is covered in great detail. VBF is a standard protocol while HH-VBF (Hop-By-Hop Vector-Based Forwarding (HH-VBF) Protocol) is its more energy-efficient form. Both VBF and HH-VBF care for networking mobility, but they necessitate a connected network and a significant amount of energy. This same mobile UWSN is an intriguing concept in decentralized routing algorithms targeting delay-sensitive and delay-insensitive applications. One particular architecture is studied; it's geared toward long-term applications that aren't time-critical (like oceanographic and environmental monitoring) (*e.g.*, disaster prevention and military surveillance) [7, 8]. More information on energy-efficient routing strategies for UWSNs can be found in. For determining the life span of Wireless Sensor Networks, some critical characteristics have been found, and their utilization of AUVs has been described. To alleviate the effect of void infrastructures on vector-based routing protocols, like as VBF then HH-VBF, a novel approach named Vector-Based Void Avoidance (VB VA) [9] is presented. Vector-shift then back-pressure are applied in separate ways for the two kinds of voids, in order to address both types of voids. As a result, it would be difficult to carry out VBVA.s recovery operation in the real underwater environment. With this technology, it is possible to trap a packet in a concave hole, and before to use a time-conserving recovery technique in order to increase end-to-end delay [10].

Other location-based routing technology, called Relative Distance Based Forwarding (RDBF), applies the same principles. Nodes located close to the sink transfer packets using this protocol. Nevertheless, RDBF places a limit on the number of forwarding nodes within a pipeline and perhaps additional geometric shape, using a performance factor as a boundary. A RDBF database is also susceptible to the high bit error rate, as the nodes with either the shortest distance to the source have the most influence. RDBF is also unsuitable as a recovery technique for local maxima nodes. Because unpredictable statistical results may be added or eliminated from both the prior data set, control systems are becoming more sophisticated if nonlinear behaviors change over time [11].

3. DEPTH-BASED ROUTING PROTOCOL

3.1 Reverse Localization Scheme

In this research work, a Reverse Localization Scheme (RLS) that may be used for sensor networks submerged in water. RLS reduces the total amount of messages that need to be sent in order to achieve localization by basing itself on an event-driven location applicant message. The plan is broken up into its two primary phases, which are a transmission phase and a centralized geometric localization phase respectively. During the first phase, regular sensor nodes watch and identify an event before quickly communicating their findings to the surface. In order to overcome the problem of three-dimensional localization in two dimensions, the virtual position of the detector sensor will be projected onto the water's surface. While the latter is responsible for carrying out the centralized localization in an onshore sink.

3.2 Network Architecture

Due to the design of the multiple-sink underwater sensor network, DBR will be able to leverage it. A perfect example of this type of network is presented. Several sinks including both RF then acoustic modems are placed at the water's surface in the network. In the relevant 3D area, acoustic modem-equipped underwater sensor nodes are deployed in groups, and each is probable to be a data source. Information could be recorded, and data can also be used to communicate the data to the various sinks. It is very economical for all the sink RF modems to communicate because of the simple radio channels they all use. Since all sinks are capable of receiving data packets, we should assume that the data packets arrive and can be sent to any of the other sinks or faraway data centers efficiently. More than one neighboring forwarding nodes on the path towards the next packet transmission could be appropriate to forward a packet. A high collision then high energy usage would indeed follow if altogether of these qualifying nodes tried to broadcast the packet. The frequency of forwarding nodes requests to be regulated in order to reduce collision and energy usage. As a result, DBR nodes frequently broadcast the very same packet many times because of their multiple-path functionality, which causes them to receive the same packet numerous times [12].

3.3 UWSN Segmentation and Data Aggregation Policies and Procedures are Juxtaposed.

Table 2 shows various under network data collection schemes with the support of various protocols and clustering schemes, among all schemes LEACH and LCAD protocols offers, low use of bandwidth and average energy production.

Table 2. Comparison of protocols for data collection with clustering schemes.

Protocols for data collection with clustering schemes	Efficient use of bandwidth	Energy Productivity	Enhancement Value	Distribution Ratio Bit
PCRA -Data	Low	High	Average	Average
VBF -Data	Moderate	Moderate	Low	Low
HH-VBF -Data	Moderate	Less	Moderate	Average
LEACH	Low	Low	Moderate	Low
LCAD	Average	Moderate	Low	Middle

Sensor node n_1 and n_2 have a height difference d_1. Consider n_1 receiving packets from S at time t_1, n_2 receiving packets across S at time t_2, and refuse t_{12} connecting n_1 and n_2 at time t_2. The relevant inequalities can be used to describe the following conditions:

$$f(y_1) < f(y_2),\ (2)\ \text{then}\ t_1 + f(y_1) + t_1 \leq ty_2 + f(y_2). \qquad (1)$$

Replacing $f(y)$ by our linear term expression, we must

$$\alpha \leq (t_2 - t_1) - ty_2\, y_1 - y_2, (\phi < 0). \quad (2)$$

Now ϕ is negative. As extended as

$$|\phi| \geq (ty_1 - ty_2) + t_{12}\, d_1 - d_2 \quad (3)$$

both circumstances could be happened Seeing the wickedest situations for n_1 also n_2, we could elect

$$|\alpha| = 2\tau\, y_1 - y_2 \quad (4)$$

wherever $\alpha = R/v_0$ has the maximal broadcast makes delay of 1 hop (Z is the maximal communication range for a device node and v_0 as the sound broadcast speed in water). The value of α be determined by on ($y_1 - y_2$), the depth change of nodes n_1 and n_2.

One-hop neighbors of a base station, ϕ can differ among 0 and R, the maximal broadcast variety of a sensor node. Once ($d_1 - d_2$) methods 0, $\phi \to -\infty$. Here by the demonstrations that we can't discover a constant ϕ to kind condition (2) continuously contented. As a substitute, we usage a global value δ to substitute ($y_1 - y_2$) for this holding time design. There are three-dimensional Static Underwater Sensor Network Sensor nodes on the ocean floor are not able to detect and perceive occurrences that cannot be detected or viewed satisfactorily by means of 3D underwater networks. Three-dimensional (three-dimensional) UWSNs have sensor nodes that hover at varying depths to monitor a particular phenomenon. When it comes to the 3D situation, we have developed a really creative approach in which sensors are fixed to the oceanic floor and well-appointed with fluctuating buoys that may be expanded by an air propel. As the sensor is pulled towards the water surface, the buoy is also pulled it toward the surface. 3D random, below random and bottom grid deployment strategies have been presented. First 2 stratagems have sensors indiscriminately arrayed on the ocean floor wherever they are attached, but the bottom grid technique requires sensors to be aided by an author or several authors who organize these underwater sensors in a grid on the oceanic floor in order to acquire grid deployment. With the bottom-random technique as well as the 3D-random policy, a similar reporting ratio is achieved [13].

3.4 Energy Consumption for Hops

For underwater environment wireless communication, the battery power requisite for detecting and handling is low, thus we evaluate solely the energy usage for wireless communication. Fig. 2 shows the energy comparison based on data transfer. This is based on our assumption that the sensor nodes have a fixed accept power, but variable transmit power – that is to say, a variable transmit power that varies with operating range.

For our design calculations, we evaluate the effects of return loss and noise, with attenuation as well as spreading being the two main types of transmission losses. Using a propagation model, we may estimate the transmission rate required to achieve a given desired signal-to-noise ratio (SNR). The inactive acoustic general electric the SNR of a submerged received signal simply

$$\mathrm{SNR} = \mathrm{SL} - \mathrm{TL}(l, f) - \mathrm{NL}(f) + \mathrm{DI}, \quad (5)$$

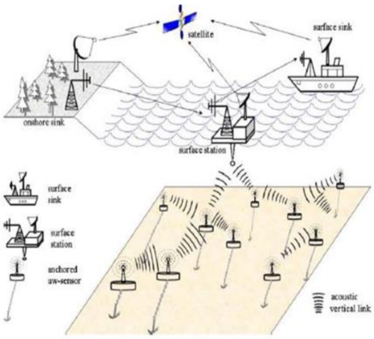

Fig. 2. Energy comparison with respective to transfer of data.

Packet Forwarding Algorithm

Performance Evaluation
Forward Packet (Q)
A: Check preceding depth rq from k
B: Infer current node depth dc
C: Calculate $\Delta Z = (rp - rc)$
D: IF Δr < Depth value Threshold rth THEN
E: while r is in Q_1 THEN
F: Eradicate r from Q_1
G: ENDIF
H: Fall r
I: return value
J: ENDIF
K: IF P in Q_2 THEN
L: Fall r
M: return
N: ENDIF
O: Modernize r with current depth rc
P: Calculate fixing time FT
Q: Calculate release time RT
R: IF r in Z_1 THEN
S: Get preceding sending time of r RTp
T: Apprise p's time sent with min(FT, RTp)
U: ELSE
V: Enhance the item into Z_1
W: ENDIF A

In our research, we placed it at an indiscriminate position in the bottom layer. Nodes at the source generate a packet every second, with a 55-byte size. As with a professional auditory modem, Link Quest UWM1500, the data rate is 15kbps; the maximum transmit power is 95 meters (in all dimensions); and those power depletion in transmitting, acceptance, and idle mode is 2.5w, 0.2.5w, and 11mwatts, correspondingly. In our experiments, we employ the identical broadcast Media Access Control (MAC) protocol has in [14, 15]. Parametric Chain Based Routing Approach are introduced the Energy Efficient PEGASIS Based protocol (EEPB), which has a network architecture that has major presentation concerns, the inefficient commander node selection is one such example. Besides which, it failed to take into consideration critical factors, such as how far apart the nodes are and which nodes are leading. Additionally, it neglected to examine the impact of energy, residual energy, and congested roads. All of which are major issues in underwater sensor networking. To address these and many other challenges, as developed a parametric chain based routing method (PCRA), which defines an algorithmic approach for next neighbour selection. The task entails defining an optimum path that begins at the farthest node from the base station and ends with the transfer of aggregate data to the base station after covering all network nodes [16]. Conclude all devices are located in sensor networks that are completely submerged in water. The project's goal is to implement a chain-based approach to connecting additional nodes, to increasing energy life. The nodes will be ordered into chains, which can be done by the sensor nodes themselves or by employing a greedy algorithm that starts at one node. When a node dies, the chain is rebuilt in the same way to skip the node that has died. To begin data transmission from the chain endpoints, the cluster head launches a token passing operation. Each node combines its own data with that of its neighbors to create a single packet of the same length. For selecting the next neighbour, an efficient and trustworthy approach is defined. However, it has completely eradicated issues based on several parameters also including distance, residual energy, and congestion, and that has done away with nodes having geographic parameters like distance, residual energy, and congestion in the water. Each base station performs these activities, taking into consideration the lack of GPS signal. The inclusion of a diverse range of sensor nodes poses a number of technical concerns around data routing [17].

3.5 PEGASIS

Approach to Routing Using Parametric Chains (PCRA) introduced the Energy Efficient PEGASIS Based protocol (EEPB), since it has a network architecture that has major performance concerns, such as inefficient leader node selection. Additionally, it neglected to consider important criteria, such as the distance connecting nodes and also the leader nodes, energy, residual energy, and congestion, which are all major issues in underwater sensor networking. Utilizing a parametric chain based routing method (PCRA), which utilizes an automated response for next neighbour selection, they have developed a mechanism to address the issues that have arisen. To accomplish this, we will start with the farthest base station from the base station and travel to each network node before transferring aggregate data to the base station [18].

This floating sensor network routing uses chain-based aggregation. Each project's objective is to generate a chain-based way to transfer assets through fewer nodes, thus prolonging network life. Ordered into chains, which can then be accomplished by sensor nodes using a greedy algorithm that begins at one node, or a sensor node using a greedy algorithm that allocates nodes based on its neighbouring nodes. To remove a node from the chain, the remaining nodes will duplicate themselves to continue the chain without the dead node. To begin data transmission from the chain endpoints, the cluster head launches a token passing operation. Each node combines its own data with that of its neighbours to create a single packet of the same length. For selecting the next neighbour, an efficient and trustworthy approach is defined. It has, however, resolved concerns based on parameters such as distance and residual [19].

3.6 Acoustic-Centric Algorithms

There have been two algorithms centered around acoustics. A completely different approach for the far and near neighbours. Acoustic guitars have descriptive names: Greedy Furthest Acoustic and Greedy Shallowest Acoustic, Most Extremely Visceral. To determine the network node furthest connected neighbour, a node receives a radio message and uses the interoperability matrix. After a short delay, a return command is sent to that neighbor, and the radio transmission is broadcast again. Wake-up commands are an acoustic message that rings in the ears (Table 3). This data-containing packet doesn't contain any data. The three fields in the packet are the destination, source, and a protocol/command field that identifies the "rise" command.

Table 3. Comparison of acoustic message with different nodes.

Windows Platform	Number of Nodes	
	40	100
Memory Pre-Run (B)	3704	125672
Memory Post-Run (B)	20787	700828
Run Time	0.17	7.36

Algorithm 1: Overview of Greedy Furthest Acoustic

```
for
    loop
            receive radio packet Q
        if R.Final Address ≡ Self then
            exit
        else
        queue R for delayed-transmission
        find furthest acoustic node.
      send increment cmd
        end if
    end loop
```

The first synthesizer with extreme acoustics. If all the nodes' forward-neighbors are unavailable, then one node closer to the destination is required. If nodes are evenly spaced throughout the audible range, then this topology is said to have only one forward neighbor. This algorithm sees significant performance improvement due to nodes located parallel together or having acoustic range sufficient to allow besides multiple forward-neighbors.

Algorithm 2: Greedy Shallowest Acoustic

```
loop
    receive radio packet P
    if Q.Destination-Self then
        exit
    else
        queue Q for delayed-transmission
        find shallowest acoustic neighbor.
        send increase command
    end if
end loop
```

In particular, instead of looking for our farthest neighbour, we instead look for all of our nearest neighbours, identify them, and pick the shallowest of that set to get promoted. This algorithm's best-case scenario occurs when the acoustic neighbor closest to the listener is also the shallower. If this approach is used, the worst-case scenario is an increasing depth monotonically and all nodes needing. The closest neighbor is one forward. Some all situations happen if either of these two things occurs [20].

4 INVESTIGATIONS

4.1 Leach

The Algorithm Low-Energy Adaptive Clustering Hierarchy is a protocol on behalf of terrestrial sensor networks (LEACH). As a consequence of this technique, the sensor network is allocated obsessed by clusters, apiece of which is formed of a cluster node and then a cluster node head. A number of algorithms can be used to select so every cluster's head. TDMAP allows the mobile node to be in a dream state on behalf of a long length of time, saving power, while the cluster member's necessity constantly is conscious to collect all information since its cluster nodes and relay that to additional heads [21].

4.2 Data Packet Size with Energy Efficiency

It can be described in data communication systems as the ratio between the amounts of data communicated and energy consumed during that procedure. Therefore, lowering the overall energy expended on its processes is a crucial component for a thermally saving technology, as is minimizing the overall amount of energy disbursed on its procedures. System failure is a potential in the underwater wireless channel due to its time-varying but noisy nature; packets are dropped at the sink and must be retransmitted consequential in a waste of energy and valuable resources. In reality, signal attenuation of data packets is a distinguished source of energy waste [22]. Energy efficiency declines with accumulative BER, which means that the more power is required, the less energy can be saved. When the network quality depreciates, further data packets will be degraded. As a consequence, more power is generated for package signal attenuation as shown in Eq. (6).

$$\eta = \frac{k1}{k1(l+\alpha)+k2}(1-\rho)^{1+\alpha} \tag{6}$$

In our imitation it is presumed that the source then the sink is of homogeneous Category, consequently they must the identical apparatus constants *i.e.* $k1 = k2$.

$$\frac{k1l}{k1(l+\alpha)+k2} \tag{7}$$

Algorithm 3: Determining the shallowest connected neighbor; excerpt from MATLAB code

```
Functionid=greedyshallowestalgorithm(selfID, conn, dstid, Node Pos)
id=0;
Connquickref=[];
        For i=1:length(conn)
                if i==selfID;
                        continue
                end
                ifconn(i)
                        if i==dstid
                        id=1;
                        return
                                else
                    Connquickref=[Connquickrefi];
                        end
                end
        end
Pos=zeros(length(Connquickref)+2,3);
        For i=1:(length(Connquickref))
                Pos(i+2)=Node Pos(Connquickref(i));
        end
Pos(1,:)=Node Pos(dstid);
Pos(2,:)=Node Pos(selfID);
dist=squareform(pdist(Pos(1:2)));
depthiter=inf;
        for i=3:length(dist(1))
                if(dist(i,1)<dist(2,1))&&(depthiter<=Pos(i,3))
                        depthiter=Pos(i,3)
                        id=i;
                end
        end
        if id==0
        error('Could not find any neighbors, which is not likely.nn')
                else
                        id=Connquickref(id2);
                end
        end
```

Compared to Greedy Furthest Acoustic, the required prediction accuracy has a similar range. It just takes a little longer to complete. Table 4 shows sample Statistics for Greedy Shallowest Acoustic. The outermost plot is used to show estimates of the error rates for acoustic-centric algorithms such as Greedy Shallowest Acoustic. Almost all of two radio-centric algorithms can be found in the lower plot (excluded are Greedy Look-Back and Min-Hop Furthest). While both Greedy Shallowest Radio and Min-Hop Shallowest reveal an error margin, Greedy Shallowest Radio reports more errors. Acoustic and radio algorithms are fundamentally different, and so we prefer to split the acoustic and radio algorithms. In order to accommodate these algorithms, it is imperative that there be more motion. This has a very negative impact on the standard deviation for the acoustic algorithms [23, 24]. Those who seem to be Min-Hop Shallowest, Greedy Look-Ahead, Greedy Shallowest Radio, and Greedy Shallowest Acoustic.

Table 4. Sample statistics for greedy shallowest acoustic.

Windows Platform	Number of Nodes		
	30	60	100
Avg. Distance of node (m)	7.1	6.5	6.2
Avg. under water Depth (m)	11.0	9.8	11.0
Avg. transmission Energy (J)	91.2	88.7	88.1
Avg. Time Taken by the node (μs)	64.2	64.5	62.1

When we are discussing global optimal algorithms, we should keep in mind that they are always centralized, and that they begin the chain by using the first node as the source point for all packets. Because of this decision, the algorithm's power requirement is artificially inflated and greater the distance travelled, the greater the power and the distance between two achieve the national as the separation between them increases. Fig. 3 depicts the connection between energy efficiency with respect to Packet size.

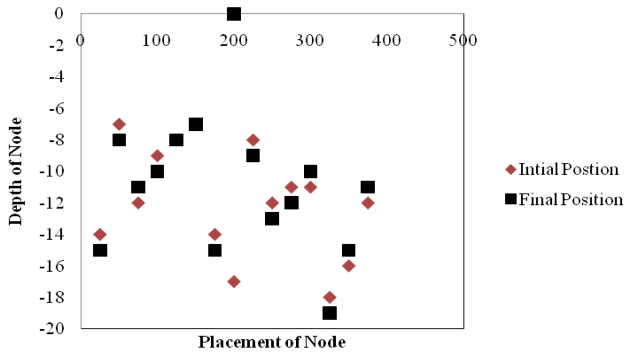

Fig. 3. Representation of energy efficiency with respective to packet size.

As disconnection increases, the distance between two nodes becomes greater, which means fewer potential neighbors to choose from, which leads to more nodes taking part in routing, which then necessitates even wider area travelled [25-27].

In Fig. 4, the effect of changing radio range based on the distance travelled is represented in four cases. Interestingly, the energy efficiency of a link without low BER diminishes added slowly afterward the maximum than that of a link without high BER, as shown in the graph below. We can see that energy efficiency might not deteriorate greatly underneath good network feature although with huge packet sizes. That's an important issue to keep in mind. The ideal packet width can be changed from 145 bits to 850 bits through energy efficiency of 92% or more. With the transmitting packets containing larger payload, better performance efficiency is possible. It would be used to generate the graphic [28, 29]. Table 5 shows comparison of Energy Efficiency with packet size.

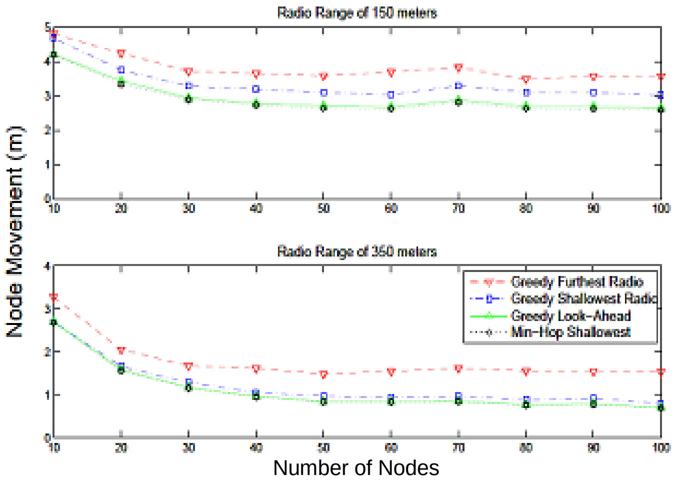

Fig. 4. Numbers of effects of changing radio range on distance travelled.

Table 5. Comparison of energy efficiency with packet size.

Packet Size(bits)	EPUB (mJ/bit)	BER	PER	Energy Efficiency
17	1.9658	0.01	0.15	0.44
		0.002	0.02	0.46
		0.001	0.011	0.51
97	1.0729	0.001	0.62	0.35
		0.002	0.09	0.84
		0.001	0.003	0.91
186	1.0303	0.001	0.83	0.17
		0.02	0.18	0.81
		0.01	0.034	0.93
254	1.0152	0.001	0.93	0.08
		0.01	0.23	0.84
		0.001	0.024	0.98
376	1.0075	0.1	0.97	0.04
		0.01	0.29	0.70
		0.1	0.032	0.95
516	1.0017	0.1	0.99	0.02
		0.001	0.35	0.65
		0.01	0.045	0.95

4.3 Comparison with VBF

As compared to the three measures, DBR and VBF are the two most important ones. (a) DBR attains a comparable packet delivery ratio to VBF in a single sink configuration.

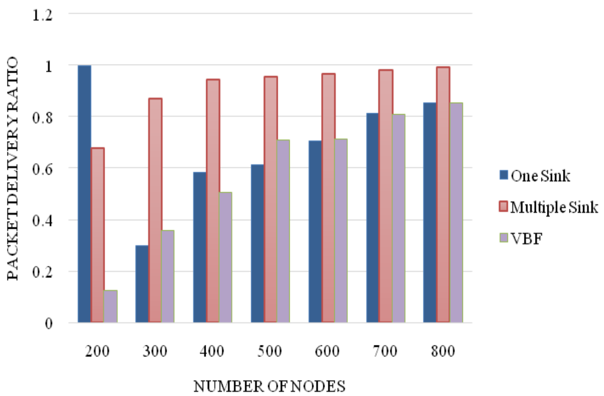

Fig. 5. Packet delivery ratio.

It is possible to attain a considerably better delivery ratio with this multi-sink setting of DBR. The Fig. 5 depicts packet delivery ration, with respect to number of nodes, from the results, VBF outperforms when the number of nodes is 200, if the nodes are increasing both multiple sink and VBF equally operated. Fig. 6 shows the energy consumption of the proposed research work, it was evaluated with one-sink, multiple sink and VBF. From the results, VBF shows better performance in minimizing the energy under various constraints.

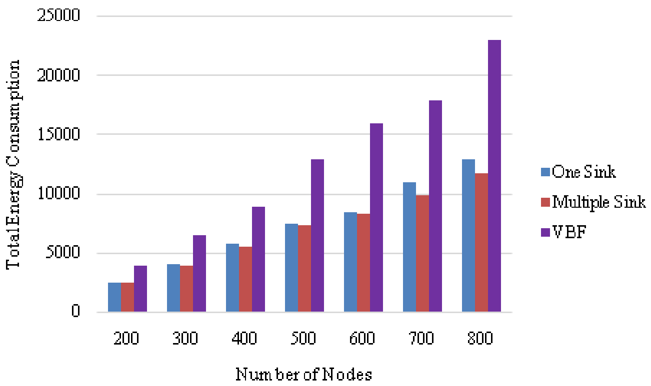

Fig. 6. Energy consumption.

Fig. 7 shows the Average count of packet consumption of the proposed research work, it was evaluated with one-sink, Multiple sink and VBF. From the results, VBF shows better performance in minimizing utilization of packets. If the consumption of packet is very less, this in turn reflects in energy utilization.

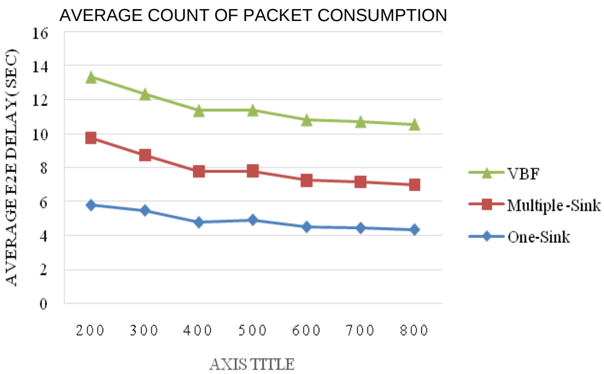

Fig. 7. Average count of packets consumption on sensor node.

This is more nearly four times bigger than VBF's packet delivery ratio of 16 percent [30]. BR's redundant transmission suppression mechanisms are largely responsible for this. Due to the two-queue system, duplicated packet transmissions have been considerably minimized on DBR's backbone. Understand that somehow this comparison is based around VBF's basic information. Whenever advanced adaption algorithms are employed and ideal settings are established, VBF may achieve higher energy efficiency. Note that DBR then VBF target dissimilar network situations and had rather diverse assumptions about network behavior and behavior. If you have a single sink, then VBF is not for you! In a one-sink network, DBR can be used, but it performs better in a multi-sink system. Because of the two buffering, the DBR protocol demands extra memory from the sensor nodes. Memory inefficiency is usually not an issue in just about all systems due to the fact that underwater sensors have greater resources than land-based sensors do. As a result, only tiny buffers now have to be preserved for underwater sensor networks. The average amount of packets in the transmission line within apiece location is fewer than 9 in our simulations. So, underwater sensor nodes can afford to add additional storage [31-33].

5. CONCLUSION

An examination of data aggregation and clustering strategies for submerged wireless sensor networks is offered in this research. Numerous ways and procedures are presented to meet the requirements. Research on clustering and aggregation is recognized as a vital component of improving network efficiency and reliability. Compares the methods to different parameters. These applications and designs are contrasted with terrestrial networks in this article. A number of clustering and data aggregation strategies have been developed for UWSNs. Protocols are also classified according to their proficiency. To target marketing to set down and create solid foundations for the development of more advanced designs, this paper provides a basis for aggregated and clustered schemes that have been developed. The first approach is to make the simulator itself more capable. The second way to use algorithms is by implementing them on a physical system. Additionally, it is possible to expand the simulator in various ways. It could have node sleep or power loss, as well as variable power requirements and network interference. We can verify whether power-saving measures work in a time-accelerated environment with the methods we show in that chapter. It takes multiple forms of interference. A first way to interpret these results is to consider how varied the success rate of communication is to serve as a proxy for general conditions. This data is available in a standard file format known as a binary file. In order to allow for environmental settings, like thermo clines, the simulator could be made more complex and capable. A dependable device would take note of all relevant communications, calculate the amount of acoustic power they use, and distinguish between background noise and other nodes "talking" or objects reflecting off of surfaces.

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R. Ponni was born in 1983 in India. She is working as an Assistant Professor in Kings College of Engineering, Punalkulam, Tamil Nadu, India. She received the Bachelor of Engineering in Electronics and Communication Engineering from Bharathidasan University and Master of Engineering in Communication Systems from Anna University in 2009. He has 18 years of experience in Teaching. She has published more than 10 papers in various reputed national and international journals. She has worked for project funded by TNSCST, Chennai. She is a member of IEEE and ISTE. Her research interests are in the broad areas of wireless communication, mobile ad-hoc networks and biomedical instrumentation.

T. Jayasankar is currently working as an Assistant Professor (Sr. Gr) in the Electronics and Communication Engineering Department, University College of Engineering, Bharathidasan Institute of Technology Campus, Anna University, Tiruchirappalli, Tamilnadu, India. He has 21 years of experience in Teaching. He is a member of IEI, ISTE. He has published more than 80 papers in the reputed International Journals including Science Indexed Journals and Scopus Indexed Journals, 20 papers in the International and National Conferences. He has published 2 Books, 6 Book chapters and 5 Indian patents published. He has completed two projects in TNSCST student's projects scheme. He is currently working with a team in developing a prototype model of a Brain Controlled Wheelchair for Motor Neuron Disorder Patients. His main interests currently include bio signal processing, medical image analysis, speech synthesis, speech and image processing and wireless networks.

K. Vinoth Kumar is working as a Professor in SSM Institute of Engineering and Technology, Dindigul, Tamil Nadu, India. He received the Bachelor's degree in Electronics and Communication Engineering from the Kurinji College of Engineering and Technology, Manapparai, Tamil Nadu, India, in 2009. He received the Master's degree in Applied Electronics from the J.J College of Engineering and technology, Trichirappalli, Tamil Nadu, India, in 2011. He received Ph.D. in Communication and Networking from Karpagam University Coimbatore, Tamil Nadu, and India. He is a member in Universal Association of Computer and Electronics Engineer (UACEE) and member in International Association of Engineer (IAENG). His research interests include wireless communication, mobile ad hoc networks, and sensor networks and communication networks. He has published 15 Science indexed journals and 25 Scopus Indexed journals. He was recognized research supervisor and guiding 8 research scholars under Anna University Chennai, Tamil Nadu, India.