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An Energy-Efficient Routing Protocol Via Angle-Based Flooding Zone in Underwater Wireless Sensor Networks

M. Kashif Manzoor[1], Rana M. Amir Latif[2], Izharul Haq[3], NZ Jhanjhi[4]

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Abstract: The underwater wireless sensor network provides a comprehensive range of marine applications considering several aspects, including node float mobility, high error probability, high latency, low bandwidth, and 3-dimensional space. These aspects provide many demanding situations to the network protocol layout. One of the significant challenges the sensor nodes face in routing is energy consumption which reduces the nodes' lifetime while delivering the packet. Most nodes are battery-powered in an underwater network, so energy efficiency is essential because recharging the node is difficult. Building an energy-efficient, robust network and analyzing energy consumption characteristics is essential because the acoustic signal is affected by many ambient environmental conditions like a high probability of error in transmissions, extensive propagation delays, and volatile network dynamics. We would use a position-based routing approach to conserve sensor nodes' energy in the UWSN environment. Only a selected area from source to target will forward the packet. In a location-based routing protocol, the location of the sink and its own is known by sensor nodes. So, we can save energy, processing, and time if we find a relay node in a small area. In this way, an optimal relay node would be selected. We will find that area with the angle between sources and sink nodes. So, the flooding zone would be optimal for finding a relay node. If the relay node is in a flooding zone, it will reduce energy, processing, and time, increasing their performance. By using this technique, less, several nodes will participate in routing. To reduce energy consumption, low-benefit packets will be discarded. Moreover, to forward the data packets flooding zone, an angle will be introduced between the surface sink and the source node. With the simulation results, we will prove that the metric parameters such as energy consumption, throughput, transmission, delay, and packet delivery ratio show performance improvement.

Keywords: *UWSN, delay, angle based, routing protocol, energy consumption*

1. Introduction

As we know that we can call Earth a water planet; almost 70-75% of the planet is a water body, most of which is still to be explored. So, water is an essential portion of the needs of industry demands and humans in the future. There are many resources to discover that can be utilized in the future. Not too long ago, quite a few (UWSNs) Underwater Wireless Sensor research programs have progressed to encourage professional software like submerged mining, submerged strategic surveillance, and seismic observation [1]. UWSN Software is gaining fame for overburdened resources, observation of elements of this environment, and empowering progress within the subject of sea checking and observatory programs ocean surveillance [2]. UWSNs discover their app in areas such as international gas and oil extraction, army surveillance and reconnaissance, mine discovery, air pollution tracking, organic calamities such as tsunami and storm prediction, coral reefs, and habitat observation of maritime lifestyle, along with Fish farming [3]. An all-inclusive classification of UWSN software is displayed in Figure two. This segment studies the latest improvements in the domain UWSN software [4]. On the top level, we categorize the UWSN software, for example, sport, disaster forecasting and direction, navigation, military, and tracks that substantially affect the environment and supply advantages. The software of UWSN has gotten common for investigating areas from the sea that may have tools such as oil/gas, nutrition services and products, and useful vitamins [5]. The underwater wireless sensor system can stop tripping injuries such as catastrophic pollution, submarine detection, and tsunami warning [6]. UWSN involves some common characteristics of this wireless detector system, radio station signs employed from the wireless detector system are not appropriate in submerged surroundings. Radio station signals may disperse long distances with minimal frequencies and not as much channel malfunction, necessitating high antennas and higher transmitting strength. As a result of the job, UWSNs need to handle some different troubles [7].

The rate of sensory signs from the water will be just five sequence magnitudes, much less than the waves' rate. Second, the bandwidth is wholly dependent upon the exact distance resulting from elevated street error prices and the elevated energy absorption variables behind acoustic signs. Surprisingly, consumptions are separate for each kind of WSNs energy [8]. Even the UWSN demands more energy than the cortical established sensor system due to the submerged atmosphere [9]. There is not any mechanism readily available to recharge the battery from submerged surroundings or readily substituted.

In underwater sensor networks, the routing protocols are

[1 1]*Department of Computer Science COMSATS University Islamabad, Sahiwal Campus, kashifmanzoor028@gmail.com*
[2]*Department of Computer Science COMSATS University Islamabad, Sahiwal Campus, ranaamir10611@gmail.com*
[3]*College Of Sciences and Human Studies Prince Mohammad Bin Fahd University, Saudi Arabia, ihaq@pmu.edu.sa*
[4]*School of Computer Science and Engineering (SCE) Taylor's University, Subang Jaya, Selangor, Malaysia, noorzaman.jhanjhi@taylors.edu.my*
** Corresponding Author Email: noorzaman.jhanjhi@taylors.edu.my*

categorized as passive, active, and geographic routing [10]. The active and passive routing protocols are not energy efficient as they count on flooding causing high energy consumption, whereas the geographic routing protocol is scalable and simple. They do not maintain complete routes to the destination as they are energy-efficient and thus can extend the lifetime of UWSN. Taking advantage of the location of the sensor node geographic protocol can reduce flooding [11]. Due to redundant routing paths in an underwater environment, there is a definite possibility of an end-to-end delay. The communication between detector nodes onto identical thickness ranges is due to raising the information route into the face sinks in level nodes [12]. The system operation degrades to contemplate life the package shipping ratio of these networks. An angle-based flood zone is applied to overcome the extensive route. Sensitivity information is bombarded via the detector nodes involving the top layer employing the angle between sink and anchor nodes. The amount of energy ingestion and emptiness nodes could be relieved [13]. One of the significant challenges the sensor nodes face in routing is energy consumption, which reduces the nodes' lifetime while delivering the packet. Most nodes are battery-powered in an underwater network, so energy efficiency is essential because recharging the node is difficult [14].

The rate at which knowledge is transmitted through the network is reached. If a network is congested and discipline is strong, packets will queue at the source and never reach the network. Such packets would not aid with a password, but they will not impact the PDR since they were never delivered [15]. The risk is that the PDR would be maintained in traffic control, limiting traffic so much that it suffers. From the consumer's point of view, throughput is a core factor. However, from a network architecture point of view, PDR is important to detect problems that may contribute to bad results. PDR is like the car engine search for compression. If things are going well and your fuel kilometric is fine, there is no point. But it's a decent review if mileage decreases because it might help you discover what could be wrong.

The period required to forward a packet from one source to the next is end-to-end or one-way latency (OWD). It is a general concept in IP network monitoring and varies in that only route from source to destination is determined in a single direction from the round-trip period (RTT). The proposed routing protocol increases the network's lifetime, which is the main objective of every routing protocol regarding energy efficiency.

2. Literature Review

Battery substitution is not an efficient resolution in an underwater environment. Once the detector nodes begin controlling their battery life, vitality openings (lifeless habitats) begin generating. That interrupts the transport of information packets and, in turn, starts the degradation of this system operation. This limit requires beneficial and productive usage of the detector node's capacity [16].

As a robust technology for tracking seas, seas, and rivers, the underwater wireless sensor network (UWSN) has gained prominence. The sensor node drifting along with the sea current gives a 4D (space and time) monitoring for real-world underwater applications. The biggest obstacle is underwater acoustics, leading to heavy transmission delays, packet failure, and network overhead. A depth modification and avoiding pressure routing protocol are suggested for UWSN to solve these problems. A selfish forwarding technique forwards the packet. If a node fails to forward the packet using a greedy transfer technique, it automatically moves to recovery mode. The node uses particle swarm optimization to assess the current depth in recovery mode. The latest depth with reduced displacement offers the global best value. Without loss and delay, the void node will forward the packet with limited displacement [17].

Due to the low energy power of the sensor nodes, the existence of WSNs is highly constrained. For this cause, energy conservation is considered the key priority of WSN science. The most energy-consuming feature of a WSN is radio transmission. Energy-efficient routing is also needed to conserve energy and extend WSNs' existence. Therefore, various protocols have been suggested for energy-efficient WSN routing. This report includes an empirical and up-to-date survey of those protocols. Rely on how the network is structured; (ii) how data is exchanged; (iii) whether or not local knowledge is used; and iv) whether the quality of service (QoS) or several routes are provided. The classical and current protocols displayed are classified. The protocols' advantages and drawbacks are defined and compared in unique performance metrics in each different class of protocols. Finally, the thesis's outcomes are reviewed, final statements are made, and open-ended analysis problems are listed [18].

Most of the world's surface is protected by oceans. However, nothing is understood about the underwater environment, and much of it remains unexplored. Oceans have significant marine wealth and marine life, like some water bodies. Since the human condition is unsuitable and harmful, these remain undiscovered and uncertain. It inspires the autonomous discovery of these hot spots. Without the Underwater Wireless Sensor Network, unmanaged or remote real-time control is feasible (UWSN). Multi-hop communications are used by multiple devices to efficiently receive and transmit the data from the bottom of the sea to the sinks at the surface. Leading researchers have suggested various routing protocols for connectivity from the seabed to the surface drain. These routing protocols aim to improve the underwater communication mechanism's reliability, quality, and efficiency. This paper explores some routing protocols' progress to identify the most effective routing protocol and some recent UWSN implementations. This work also summarizes the other problems and patterns of the routing protocols. This study supports more progress on improved UWSN underwater control and discovery routing protocols [19].

The storage, memory, and computing power constraints of the WSN nodes as clustering algorithms for resource-restricted WSNs are known as energy-efficient approaches. A survey of advanced routing techniques in WSNs is presented in this paper. The first study to be performed by writers is to illustrate our contribution to routing protocol surveys [20]. The author then explains the context, robustness requirements, and shortcomings of WSNs. A study of numerous WSN routing methods is then carried out. The routing methods are commonly known as flat, hierarchical, and locational routing. This survey focuses on the fundamental review of WSN protocols for the routing hierarchy. The author often classifies hierarchical protocols dependent on their routing methods [21].

The writers indicate a geographical routing with a thickness adjustment-based topology controller for communicating retrieval (GEDAR) [22]. The protocol forwards the packets to the vacation spot at a vogue. An origin node chooses the collection of forwarding nodes predicated on chart progress. The package progress is accessed by subtracting the distance between the destination and a neighbor node from a distance between the vacation location and the origin node [23]. In the retrieval manner, as soon as a node finds itself at an empty location (it does not have neighbors), it educates its two-hop neighbors [24]. To predicate their neighbors' location advice, it determines the newest thickness location to get around the emptiness zone. This forwarder set's assortment could be achieved in relay the foundation or recipient aspect. While the management packets on the list of detector nodes absorb vitality, the latter contributes to energy ingestion. Additionally, the routing chooses nodes close [25].

Vector-based forwarding (VBF) addresses the difficulty of sensor nodes. For the sensor nodes, it predefines a pipe for info storage. Each packet comprises information regarding the place of the forwarder, the foundation, and the location. If a node gets a packet, then it computes its location. Then the exact location information is added to the package in the event [26]. In concentrated beam routing (FBR) protocol, an origin node sends a command package to share location advice about itself and this vacation location with them. However, maybe not all neighbor nodes react to this package. Neighbors who lie inside a cone formed with the destination's angle and the origin node respond to this package [27]. Each Single node computes its location line linking the destination and the origin node to determine whether it is positioned inside the cone. A sender node employs many Power amounts and its neighbors to convey. It begins with all the electricity increases and receives responses from the neighbors [28].

WSN will be an in-depth technical advancement for an excellent near future. Water is vital to our lives because of our welfare insurance and other situations, for example, agriculture, the marketplace, and the horse's protection. Water monitoring processes are necessary to deter the problem of inappropriate household allocations, excessive usage, and lack of decency. It radio network for monitoring purposes would lower the overall observational cost for the implementation time and labor price tag. Still, it may also provide flexibility over position or scope. The built framework is cheap and can be personalized. The criteria for measuring drinking water consistency will be pH, turbidity, dissolved oxygen, and temperature [29].

Frost incidents must be expected accordingly so the farmer may take precautionary steps. A collective learning methodology is used for detecting frost incidents for CNN. The forecast of frost incidents with a precision of 98.86% was achieved after several days of a real frost case. The study on Google Play was carried out [30].

Congruent Gravity Value (CGV) is a network existence enhancement routing protocol. CGV utilizes cluster head collection to tackle the gravity value of the Congruent. Network Simulator was used to test CGV performance and equate its findings with ER2PR, VBF, and UFCA. According to the writers, the protocol would save resources and extend the network's lifespan. It uses only those best for selecting the relay node and minimizes the answer packet transmitting region if the conditions are possible. Centered on a network emulator, it uses an ER2 PR and VBF-like protocol to test its output [31].

According to reports, people devote one hour in front of the mirror every day. Mirror has interactive instruments, including headphones, a microphone and Arduino. Data processing for this work is carried out utilizing the Arduino UNO cloud. More details from home appliances such as deep freezers, air conditioners and washing machines may be obtained. The RFID is used with a Master-Slave design to create an intelligent home device with all knowledge in the Live Mirror [32].

Wireless Sensor Network (WSNs) Internet of Things (IoT) has shown its utility in supplying vital knowledge for hostile applications such as Wildfire detection (WD). However, these networks' sensor nodes have a disruptive problem with scarce energy supplies and hinder their ability to identify wildfires successfully. The authors suggest an intelligent system, the Energy Optimized Framework (SEOF), which operates in two folds. They say that SEOF improved the network stability period by 35.3 percent and 216 percent for two separate network parameter cases vis-à-vis the Cluster-based Intelligent Routing Protocol (CIRP) [33].

Wireless sensor networks (WSNs) play a significant role in nearly all applications. Because of their easy implementation and lower costs, WSNs are part of almost all applications. Nodes are usually deployed randomly, and finding their position is too difficult. The location is critical for knowing the data correlation: its objective monitoring and the real proximity to the incident. This chapter discusses the latest approaches, problems and difficulties available with current approaches [34].

Due to its special characteristics of scale and self-organized networks, wireless sensor networks are easily deployed. WSN routing is the costliest activity since it uses more fuel. The position-responsive routing protocol significantly improves the energy performance of the entire wireless sensor network by 45 percent. PRRP demonstrates dramatic improvements in data efficiency and provides a stronger approach for routing energy holes because of its fairly dispersed selection mechanism [35].

VBF works on the concept of vector pipe region. Only those nodes will be considered or participate in routing, which is present in that vector pipe. So, few best node options are available outside that vector pipe region, but unfortunately, those nodes will not consider routing. It is a drawback in VBF.

3. Angle-Based Flooding Zone Routing Protocol for Energy Efficiency

To illustrate that vertical and diagonal movement is favorable to horizontal movement, we take a network model. Multiple sensor nodes and a sink node are floating in the defined zone. We assume that O is taken as the sink node, and A, B, and C are the floating sensor nodes in that scenario. The sensor node A is considered the source node that has the packet. Sensor node B is at the same depth as the source node A. Now, there are three routes to forward the data packet. The first route is through A to B, B to C, and C to O. The second routing path is from A to C and C to O. The third routing path is the direct transmission from A to O. Now, if we compare the first and second routing path then by the Pythagoras theorem, we deduce that from the triangle ABC. The equation |AB| + |BC| is a longer path than the |AC|, so it consumes less energy from the routing path discussed earlier, as shown in Eq. 1.

$$|AC| < |AB| < |BC| \ldots\ldots\ldots\ldots\ldots (1)$$

We reach the sink node positioned at point O. So, by adding |OB| on both sides of the equation, we get the result, as shown in Figure 1.

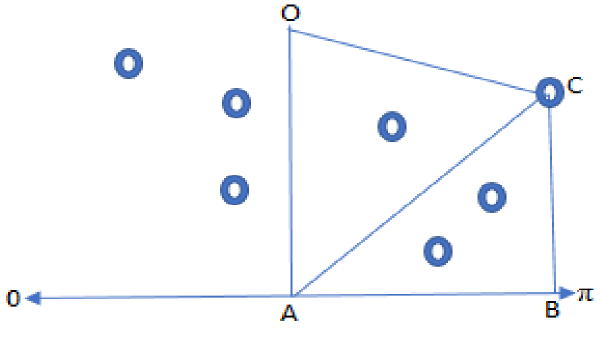

Figure 1. Flooding Zone

Eq.2 depicts diagonal communication, and vertical communication is better than horizontal transmission. So, we conclude that the nodes at the same depth level could not communicate with each other.

$$|BC| + |AC| < |AB| + |BC| + |OB|\ldots\ldots\ldots\ldots\ldots(2)$$

3.1. Routing Algorithm

Node forwards the info packets beneath the outside sink. The packet forwarding procedure is the following. The node features an information packet that is prepared to be sent. The sensor node will compute its flood zone using the fundamental formulation θ = θ/ ±10k. The intent of the flooding zone will always be to stop the flood of the full community. Even the node will flood the initial inquiry packets over the flood zone space and watch for a reply. The node will forward the sensation data to the lymph pathways when the reply has been acquired. The nodes at the flooding zone may answer of initial inquiry packet. If a node could not get a reply within the time, it will utilize the following worth of ±k at the first formula to raise its flood zone before the first requirement matches (0 < Θ < π). The most significant price of k would be to avoid flat communications amongst detector nodes that it is crucial to be aware that nodes could use the arbitrary significance of factor k and raise how big the flood zone is. Even the randomness of k appreciates significantly and helps restrain the complete flaws and these nodes' energy intake. Even the collection of the arbitrary worth of k is based upon the movements of nodes.

3.2. The Mechanism for Data Forwarding

We used the angle-based flooding zone to select floating nodes in the proposed technique to forward the packet. We take s0 as the source node with the packet to be forwarded, and ss is the sink node taken as the destination for the data packet. The flooding zone will be designed based on the angle between the sink node and the source using the formula θ = θ/ ±10K, where the value of k will vary from 1 to 7. A specific zone will be selected between the source and the sink node [36]. A limited flooding path means less energy would be utilized to forward the data packet. As we discussed, s0 is the source node, ss is the sink node, and TTL is the time to live for a data packet to be forwarded. Px is the routing path through which the data packet is transmitted.

A queue is used to store the floating node that would be selected to forward the packet. The flooding zone will be designed with three main causes. There is an upper and lower limit on the flooding zone's angle to forward the data packet. The lower value is taken as the function min, and the upper value is taken as the function max. In the first case, if the min value of the flooding zone is more significant than 900, then the min value will vary based on the min function with the help of value k, and if the min value is less than 900, then the min value will be set equal to 900. A much sparse area will be avoided by boosting the nodes' energy conservation, and much selection will be restricted [37].

In the second case, if the max value of the flooding zone is less than 900, then the max value will vary based on the max function with the help of value k, and if the max value is more significant than 900, then the max value will be set equal to 900. Many sparse areas will be avoided to boost the nodes' energy conservation, and much selection will be restricted. The candidates selected in that zone and the most suitable floating node would be selected as the relay node. Until the packet reaches the sink node, the procedure will be repeated.

The third case is that the sink node and source node is at a right angle, which means the angle between the sources and the sink node is 900. Then the communication will be vertical among the sensor nodes, as shown in Figure 2.

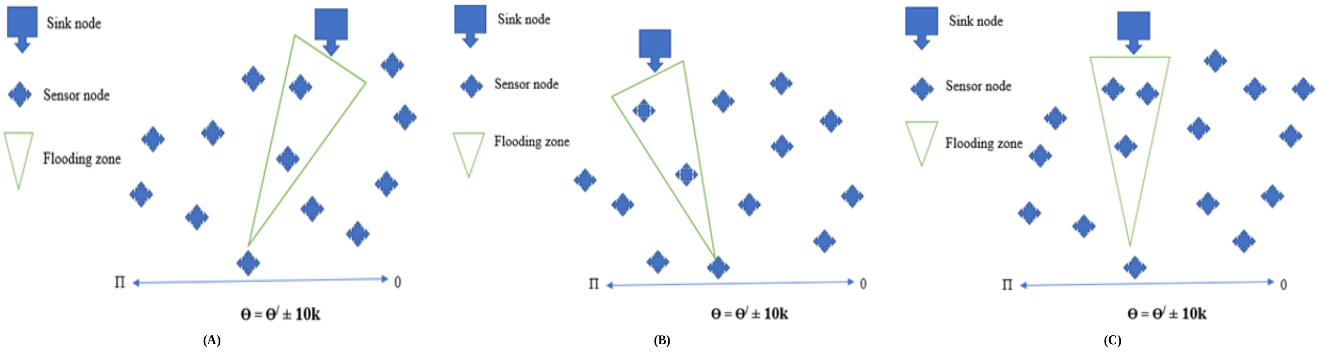

Figure 2. A, B, C Three Different Cases of The Data Forwarding

The nodes in the flooding zone will be selected for forwarding the data packet with the same energy levels based on the designed formula. The distance between the source node and the nodes within the flooding will be calculated with the Euclidean distance formula's help. The formula is given below in Eq. 3.

$$\delta(i,j) = \sqrt{(ix - jx)^2 + (iy - jy)^2 + (iz - jz)^2}\ldots\ldots(3)$$

The source node's residual energies are given as εresi, and the residual energy of the destination node is given as εresj. With the Euclidean distance and the nodes' residual energy, the relay node will be selected to forward the data packet to the best suitable floating node. Figure 3 shows the overall routing protocol process. To understand the above phenomenon, the algorithm designed for the proposed technique is given in Algorithm 1.

Algorithm 1: For Angular Base for Flooding Zone (ABFZ)
Input: source node so, sink node ss, TTL, and k
Output: routing path px

1. Queue px ← Φ
2. while (TTL > 0) and (so ≠ ss) do
3. so. CandiSet ← Φ
4. find angle θ from so to ss
5. flood_zone = θ/±10k
6. transmits sending packet in that flood_zone
7. for all sm with (receive_sending_packet = true) do
8. so.CandiSet.add(sm)
9. endfor
10. if (so.CandiSet = empty) then
11. if (flood_zone_min > 90) then
12. for all sn with (receive_sending_packet = true) and (k < 8) do
13. min = MIN {θ/ ±10k}tim
14. max = MAX {θ/ ±10k}

```
        if (min > 90) then
            flood_zone_min= min
            transmits sending packet in that flood_zone
        else
            flood_zone_min = 90
            transmits sending packet in that flood_zone
        endif
    so.CandiSet.add(sn);
    increase k by a step //k++
        if (so.CandiSet ≠ empty) then
            return
        endif
        endfor
    elseif (flood_zone_max < 90) then
    for all sn with (receive_sending_packet = true) and (k < 10) do
        min = MIN {θ/ ±10k}
        max = MAX {θ/ ±10k}
    if (max < 90) then
        flood_zone_max= max
        transmits sending packet in that flood_zone
    else
        flood_zone_max = 90
        transmits sending packet in that flood_zone
    endif
        so.CandiSet.add(sn);
        increase k by a step //k++
    if (so.CandiSet ≠ empty) then
        return
    endif
    endfor
    else
        for all sn with (receive_sending_packet = true) and (k<8) do
            flood_zone = θ/ ±10k
            transmits sending packet in that flood_zone
            return
        endfor
    endif
        return
    endif
        if |Q_OC| = MAX {Q_om} sm ∈ so.CandiSet) then
            px.enqueue(sc)
            so ← sc
            decrease TTL by a step // TTL--
        endif
endwhile
    if so ≠ ss then
        px.clear()
        return Φ
    else
        return px
    endif
```

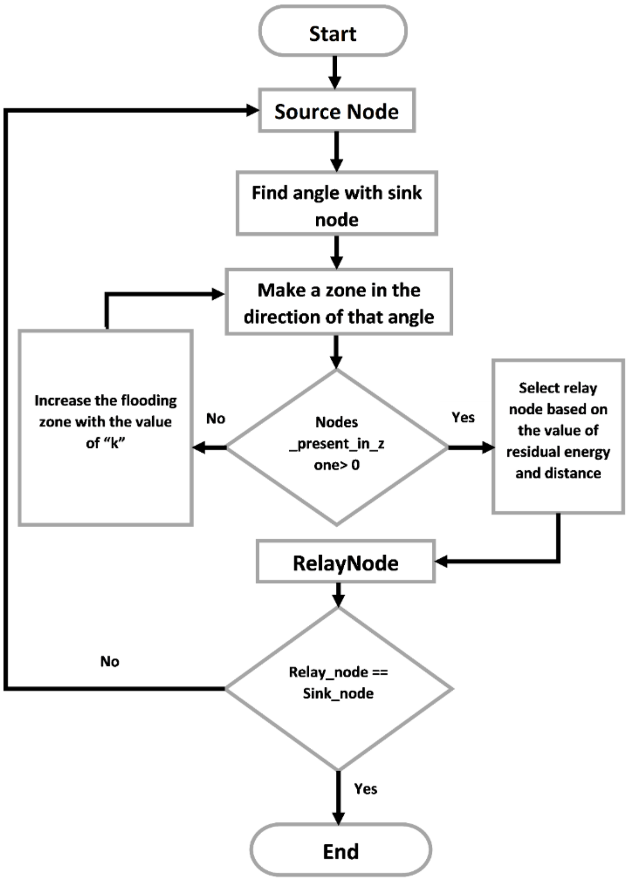

Figure 3. Flowchart of the Routing Protocol

3.3. Simulation Settings

Simulation Settings: We use Aqua-Sim to test our method in a simulation sense. It is designed and is based on a network submarine sensor simulator at the University of Connecticut (University of Connecticut). Extend Aqua-Sim to simulate acoustic channels with Thorp attenuation and spherical loss of direction. Using a 1000m x 1000m x 1000m 3D field, the sensor nodes range from 100 to 600. 6 sink nodes on the water surface are deployed uniformly in all stationary simulations. Sensor nodes accompany random walking mobility patterns. Any node from which it travels to a new location selects a random pace and path. 0m/s and 4m/s are the mean velocities and the highest velocity of the random velocity. The data generation rate ranges from 1-6 packets a second, with 50 bytes of packet size (i.e., from 400bps to 2.4kbps). Bitrate is 10kbps, and connectivity specifications are used as a commercial acoustic modem. The TTL (time-to-live) value for each data packet is set to 30 hops. Each outcome would be derived an average of 30 times [38].

With restricted acoustic channel bandwidth and a long propagation delay, the widespread usage of the MAC exit protocol for UWSNs in radio networks prevents conflicts between data packets. The underlying MAC protocol adopts the R-MAC protocol. R-MAC is scheduled to transfer both the sender and the recipient to prevent conflicts with data and control packets. We cannot differentiate between the MAC sheet, hi packet, and answer packet. It only has to be ensured in a session where the node is the sender and recipient [38].

4. Evaluated Results

The underwater wireless sensor network provides a comprehensive range of marine applications considering several aspects, including node float mobility, high error probability, high latency, low bandwidth, and 3-dimensional space. For forwarding the data packets flooding zone and an angle will be introduced between the surface sink and the source node. With the simulation results, we will prove that the metric parameters such as energy consumption, throughput, transmission, delay, and packet delivery ratio show performance improvement, as shown in Table 1.

Table 1. The overall analysis of different parameters

Parameters	*Routing Protocols*	*Number of Nodes*							
		125	*150*	*175*	*200*	*225*	*250*	*275*	*300*
	DVRP	*30%*	*42%*	*57%*	*63%*	*69%*	*75%*	*76%*	*77%*
Packet Delivery Ratio (%)	*DBR*	*37%*	*54%*	*60%*	*70%*	*75%*	*80%*	*85%*	*90%*
	ABFZ	*42%*	*57%*	*66%*	*77%*	*83%*	*88%*	*93%*	*99%*
	DVRP	*9s*	*6s*	*4.3s*	*3.7s*	*3s*	*2.4s*	*2.3s*	*2.2s*
End-to-end delay (sec)	*DBR*	*8.3s*	*7.2s*	*6.3s*	*5.8s*	*5.1s*	*4.3s*	*4.1s*	*4s*
	ABFZ	*8.6s*	*5.7s*	*4s*	*3.4s*	*2.6s*	*2.2s*	*2s*	*1.9s*
	DVRP	*120J*	*230J*	*380J*	*450J*	*580J*	*690J*	*770J*	*850J*
Energy Consumption (J)	*DBR*	*130J*	*250J*	*400J*	*410J*	*610J*	*710J*	*810J*	*910J*
	ABFZ	*100J*	*220J*	*370J*	*405J*	*562J*	*673J*	*758J*	*827J*

4.1. The Packet Delivery ratio parameter

Figure 4 exemplifies the shipping ratio using a different quantity of information packets. The shipping ratios are all nearly the very same from the dense network. The effect reveals, together with all the sparseness of nodes, that the variant is gradual. With a greater variety of Information packs and a couple of nodes inside the system, each day can create raised info packets at the buffer, which causes shedding. The overall analysis of the parameter is shown in Table 1.

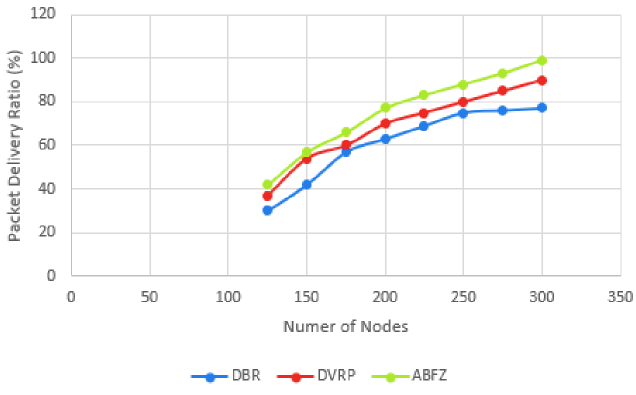

Figure 4. Packet Delivery ratio

4.2. The End-to-end delay parameter

Figure 5 offers the gap in perpetual misery whenever the quantities of packets from the system are significantly raised. The effect indicates the network could be dealt with readily when 45% much more information packets have been generated inside the system. These flaws are fair, and once the established info packets are twice, the overall parameter analysis is shown in Table 1.

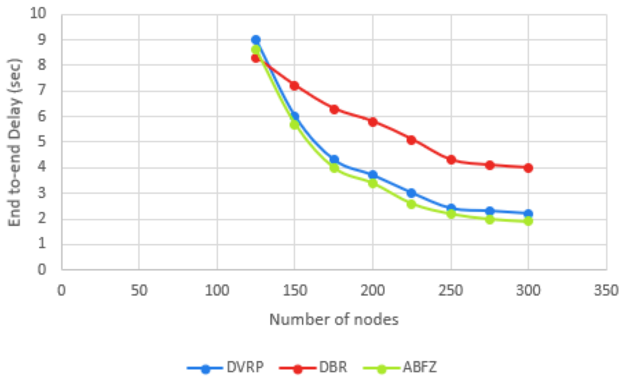

Figure 5. End-to-end delay

4.3. The Energy consumption parameter

Every node at DBR and DVRP decides about the bottom of its present thickness to forward information packets. A node includes an info package, and its own ready-to-be routed node reviews its present thickness using all the embedded thickness to access info packets. When its present thickness exceeds the sender's, the node forwards the info packets differently lost the packets. DBR has several severe problems compared with DVRP and ABFZ as its potential that numerous nodes could get smaller thickness ranges. In an identical period, the nodes ahead info packets, which could cause crashes from the system and boost the vitality overhead. Further, we contrasted ABFZ using DBR and DVRP to appraise the operation. We compare the exact data shipping ratios using only spout and numerous sinks, as exhibited in Figure 6.

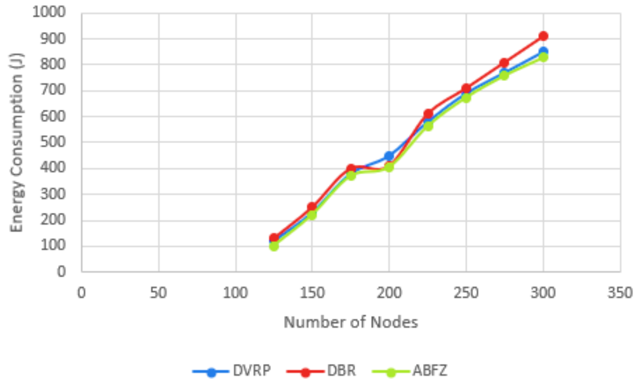

Figure 6. Energy consumption

5. Conclusion

The proliferation of sensible, lightweight detectors has generated a wireless detector system hot. Even the sudden capacities of these apparatus ought to be fully considered for software evolution for all these devices. Regarding the navigation procedures, the decreased electricity sources, scalability, and durability appear while the principal limits wireless sensor networks. We have suggested an Angle-based Flooding Zone (ABFZ) to deal with a few significant routing problems within UWSNs successfully. ABFZ is efficient and scalable to eventual warming and electricity ingestion. We have discovered that ABFZ trusts in the flood base way to raise the trustworthiness of the community. No matter how the range of nodes flooding the info packets is managed by calculating the angle to get the flooding zone to keep the flood within the full system. The flood zone has been corrected with layer by coating mode by the angle foundation procedure on the list of top coating nodes. The suggested protocol's novelty is that it does not rely on positioning info since there is no requirement to keep the complex routing tables. It is relatively easy to bring new nodes from the system at any given moment and some other location. The actual magnificence of ABFZ is that all the sparseness of nodes does not substantially influence shipping and delivery ratios. The simulation results reveal it is way better for a very long duration and real-time software.

6. Future Work

We will add more features in our routing protocol so results on different parameters can enhance.

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