

Self-Directional Packet Sending (SDPS) for Underwater Sensor Networks



Salman Ali Syed

Abstract: Underwater sensor networks (UWSN's) have been proposed as an approach to investigate and monitor the sea, by observing of underwater situations. The paper proposes another directional algorithm dependent on a geo location, named Self Directional Packet Sending (SDPS). The algorithm enhances the current Directional Forwarding Strategy and appends a methodology to process the safety alert packets that having priority as high, which builds the algorithm solid and productive. We contrast the execution of SDPS and with existing algorithm VBF (Vector Based Forwarding) utilizing NS2, in the recreation, SDPS demonstrates a greatly improved execution than VBF, the packet delivery rate is increased when there is a long distance from the surface. Thus, SDPS is increasingly appropriate for underwater sensor networks.

Keywords : Packet delivery ratio, Self Directional Packet Sending (SDPS), Underwater sensor Networks (UWSN's), Vector Based Forwarding (VBF).

I. INTRODUCTION

The water superficially is triple times more than the earth. Underwater research needs more consideration because of earth in light of its larger part quantities of uses [1-3]. In a underwater domain, the optical signaling or radio frequency signaling can't perform well, so for the communication purpose in a underwater situation the best option we have acoustic channel [2, 4-6]. In the underwater condition, the effective action by the node isn't so easy task because nodes turned out to be inadequate or density because of pressure of the water and flexibility of the node is out of control [7-9]. The water distance from the surface of the ocean to bottom of the ocean is also unable to control because of its long depth. Due to this uncontrollable situation there is a routing breaks off, node drop, packet delay, duplicate packet occurrence, like a P2P network [17] there must be a communication between node to node even though having centralized server, every node information is backed up in all the other nodes like node address, its distance status of the node etc. Now it is a challenging task to develop a routing protocol to make a communication solving all the above issues during data forwarding for long depth regions and also to control packet loss rate. The applications of UWSN are:

Distributed smart observation: Acoustic underwater sensor nodes perform continues scans the territory for observation, inspections and Intruder detection systems.

Sensors for Navigation: Sensors can be utilized to discover threats on the sea floor find risky shakes in waters, locations of the berths, overwhelmed accidents, and dangerous rocks in little depth of water.

Environmental Observations: UWSN can track the natural state of the ocean or sea which are nuclear position of water, chemical changes and biotic changes in underwater. Through UWSN we can predict the atmosphere changes; we can estimate the impact of human actions on the marine echo framework and risks caused by them.

Identifying Disasters: Through Underwater sensor networks we can additionally predict the earthquakes and alert the human life in beach front zones.

Exploring the Underwater: UWSN can recognize the location, quantity and other details of minerals and oilfields under the ocean. Despite the fact that there are many protocols designed for routing. But still the design of routing protocols is challenging issues. We have many data forwarding directional protocols like

Routing protocols based on Flooding Address: Protocols which depend on flooding addresses and using the methodology of dispatching the data packets to all sensor nodes. Some of the protocols are Protocols depending on Flood based are Hop by hop Dynamic Address Based and Temporary Clustered Based Routing.

Routing Protocols Based on Flooding Depth: Data forwarding directional protocols and dependent on addressing the functioning of sensor nodes until the water surface. Protocols depending on Flood Depth are Aided Underwater Routing Protocol and Energy Efficient Depth Based Routing Protocol.

Routing Protocols Based on Clustering Source: Refers to the development of the clusters. The cluster development comprises of group head and member nodes. Head cluster node gathers the packets from the group members and sends the data packets to the descend nodes or destination. Protocols depending on Clustering Source are Hydro Cast.

Routing Protocols Based on Path: Depending on the improvement of the single way or multiple ways from source nodes to sink nodes. The data forwarding directional protocols with multipath improve the data transmission, if the pathway initiation is solid than this sort of directional protocols are well organized as contrast with previous protocols. Protocols depending on path are Power Efficient Routing Protocol, Multipath Power Control Transmission, Multi Path Division Transmission Protocol, Multi-Layer Routing Protocol, Link State Adaptive Routing Protocol and Layered Multiple Powered Protocol.

Revised Manuscript Received on 30 July 2019.

* Correspondence Author

Salman Ali Syed*, Department of Computer Science, College of Science and Arts, Jouf University, Tabarjal, Kingdom of Saudi Arabia.

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an open access article under the CC-BY-NC-ND license <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

There are some advantages and some limitations for every protocol. This paper is composed as follows. In Section II, we audit the Literature Review on the field. In Section III, we present the Proposed standards and methodology of Self-Directional Packet Sending. We portray four systems of Self-Directional Packet Sending. In Section IV, we present the Experimental Results by using NS2. In Section V, We Conclude the work.

II. LITERATURE REVIEW

Darehshoorzadeh et.al(2015) The research field is highly interested in exploring UWSN's that refers to the outstanding application information like surface investigations, gas observing, oil, mines, geographic navigations etc.[1]. Ayazet.al(2011) surveyed on different routing techniques in UWSN[2]. Akyildiz et.al(2005) explained research challenges in underwater acoustic sensor networks[3]. Lee et.al(2010) Many protocols are suggested for packet routing in UWSN's, under inconsistent acoustic channels, sharp sending can battle packet loss by exploiting synchronous packets gathering between adjacent nodes[4]. At the point when data packets are sent from sensor nodes to sink nodes, packet loss, delay, and energy utilization are challenging task in very close sink nodes [5]. Biswas et al (2005) The organization of the sensor networks and the strategies received for communicate packets have to adjust to the underwater environment limitations [6]. Chandrasekhar et.al(2006). In a GPS refused underwater domain, the require for overall, distributed location for sensor data attaching a label to geo is relaxed via offline, estimated location at a tracking center that uses local distance calculations from sonobuoys nodes [7]. Xie et.al(2006) proposed Vector Based Forwarding [12], endorses that data packets be sent to the nodes that are situated inside a course of the provided width between the source node and the target node. This algorithm controls the energy consumption by diminishing the quantity of packet transfers. Casari et.al(2007) [14] proposed a few protocols for broadcasting that influence the capacity to utilize little groups to transmit a packet with alert for a long distance. Nodes decrease the Transmission Range (TR) by transmitting the alert packet and select just certain adjacent nodes so as to repeat the communication, so that reduces the number of transmissions required. Nicopolitidis et.al (2010) Comparative thoughts can be found in other related work [16]. Nicolaou et.al (2007)[15] proposed how to improving the Robustness of Location-Based Routing for UWSN.

III. PROPOSED METHOD

The fundamental thought of Self-Directional Packet Sending is that by utilizing Self-Directional Packet Sending, every packet will have multiple duplicates, which guarantees a generally delivery rate as high. The sending procedure of Self-Directional Packet Sending prompts one packet with a few backups, which subsequently leads to extreme impacts in the sending nodes. Issue need to be take care, every node in Self-Directional Packet Sending arbitrarily backs off before sending packets, to diminish clashes and increment the data distribution rate. When a single packet having multiple backups, every one of the nodes in Self-Directional Packet Sending need to make a search with hash value the packets gotten by the destination nodes while sending or getting packets, in order to contract with duplicate data packets and reducing the network load. Self-Directional Packet Sending

cooperates with 802.11p and manages the priority of the packet, consequently making the safety alert application.

Self-Directional Packet Sending

The sending node receives the constant locations and movable desired points of its adjacent nodes and the target node. Depending on the data, we can ascertain the point in middle of its sending node and the target node, jointly with the edges in middle of its target node and the adjacent nodes. At that point we can determine the direction of sending and its adjacent nodes. The static sending node transmits the data packet to its adjacent when it is near to the target node; when the sending node is far away from the target node, it will straight forwardly advance the data packets to the adjacent nodes who are still or near to target node. Furthermore, it will advance data packets to the nearest adjacent nodes which are a long way from target node, when the target node is having more distant to the sending node than compared with the adjacent nodes; when the sending node is near to the target node, it would advance data packets to the adjacent nodes which are near to the target node and with a small separation to the target node than the sending node. The architecture of underwater sensor network is given as below.

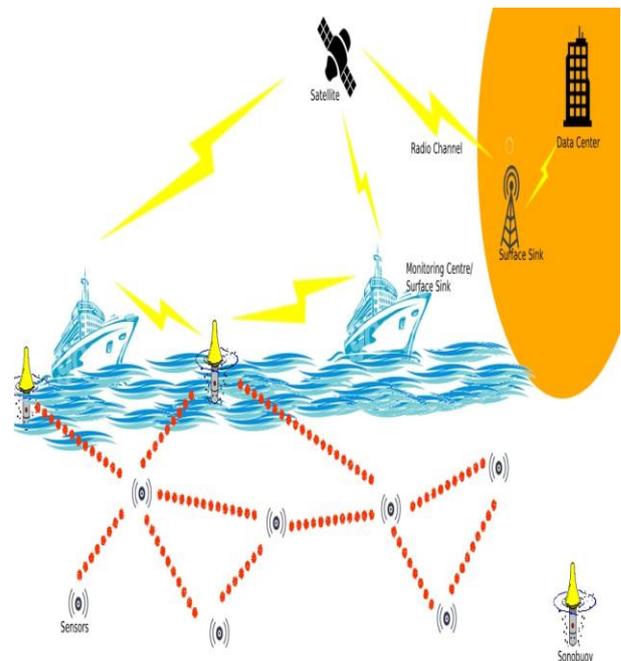


Figure.1. Functioning of underwater sensor network architecture

We have sensors in the underwater and have communication between every node, the sensors sense the information and transfer to the sonobuoys where placed on the surface of the water. There the data is transferred to the surface sinks or monitoring center which is operated in the ship or somewhere on the surface of the water. There the analysis is made. And again the data gathered by the monitoring center communications with the satellite and transfers the data to the data center which is located on the surface means in a building by surface sink.

Algorithm: Self Directional Packet Sending set Selection

1. START
2. Self DPASS (packet, node)
3. Initially make K as empty set that is $K = \phi$
//Verify each and every adjacent nodes
4. While x belongs to adjacent (node) do
5. If (PA (node) == down &
6. Π (node) $\geq n.\pi$ & $n.PA = data.NPA$)
7. Then
8. $K \leftarrow K \cup n$
9. End if
10. If (NPA (node) = up &
11. Π (node) $\leq n.\pi$ & $n.PA = data.NPA$)
12. Then
13. $K \leftarrow K \cup n$
14. End if
15. End while
16. A = Cluster _ ASS (K, node, data)
17. Return A
18. END

Packet Forwarding

The previously mentioned Self-Directional Packet Sending is utilized in copying packets in the network. On the off chance that we utilize the conventional data packet sending network and not good in dealing with the transmitting delay of the data packets, there is an extreme crashes, which are at last lead to low packet delivery ratio and misuse of resources. To take care of the issue, the paper exhibits a new data packet transmitting procedure, which will guarantee the great utilization of the transmission capacity and keep away from impacts. In the latest network, when the immediate node sends a data packet, then it indiscriminately picks a value from a range as the transmitting delay for the data packet. It's demonstrated that a delay range will successfully lessen the crashes and enhance the transmission rate.

Target node handling duplicate packets

Self-Directional Packet Sending is different from other routings, there are a few duplicates of a single data packet, and the target nodes need to process the duplicate data packets. The preparing steps as per the following are: The target node performs a hash search of every data packet, the search is depend on the sequence number assigned to the packet, in order to see whether the data packet has been received previously. If doesn't, packet will receive, else specifically drops the data packet. At that point store the sequence number assigned to the packet. The middle node additionally performs a hash inquiry for every data packet's sequential number before sending. If the data packet is received previously then it will refuse the packet, or else send the packet. We utilize direct addressing method to accelerate the sequence number inquiry by using NS2.

Assigning and Organizing Packet Priority

There are primarily two types of application in node to node communication, one is a general application, for example, distribution of traffic flow, Access to the Internet, and so on; the other is developing an alert application like safety alarm. In Self-Directional Packet Sending, the packets that are emerged with alarm are packets having priority as high and are assigned the priority meter with high. At the point when transitional node gets a data packet, it first determines its need. In the event that it has a high priority and less

communicates nodes (let's take 4 nodes for example) at that point communicate it to every one of the adjacent nodes. As 4 communication hops guarantee a dispatch scope of thousand meters, the emerging alarm data will be useless for nodes out of the given range. Subsequently, we dispose of the data packet in the event that it has in excess of 4 communicated hops. In the event that the data packet is having a priority as low, forward the data packet as indicated by the self-directional packet sending procedure. Altogether, the handling of the data packet need has conquered the data transmit trouble caused by the quick movable nodes. In addition, it guarantees the ongoing and quick communication of the new alert data, subsequently making the security alert application over node in underwater is achievable. By communicating packets with high priority and less number of hops, the regular data packet sending is less influenced.

High Priority Algorithm:

1. Start
2. The Sensor node 'k' determines its area coordinator (A_k, B_k, C_k) , sink's area coordinator (A_s, B_s, C_s) and its adjacent NEs ID
3. The sensor node 'k' determines the Euclidean distance D_{cs} from present node to sink node
4. The Sensor node 'k' determines the Euclidean distance between present node, adjacent and sink node
5. If D_{cs} is less than all the other NEs, this NE is identified as the next NE and go to step 7
6. IF D_{cs} is not less than all the other NEs, the lease D_{cs} is selected and NE is identified as the closer NE to sink and go to step 7
7. Verify if there exists any awake ode in the identified NE, IF no select the next nearest NE, Repeat this until there will be awake node in the present NE
8. Select the final next hop sensor node
9. Stop

Algorithm Flow

In general, Self-Directional Packet Sending incorporates the accompanying parts:

Managing the information list of target node position, adjacent node position Assigning and managing the priority of the packet, process the transmitting delay. The nodes managing the packets retransmit technique. The administration of the target node location data list and the adjacent list, jointly with the retransmit technique acquires the possibility of the current position based routings. In Fig. 2 the stream is appeared:

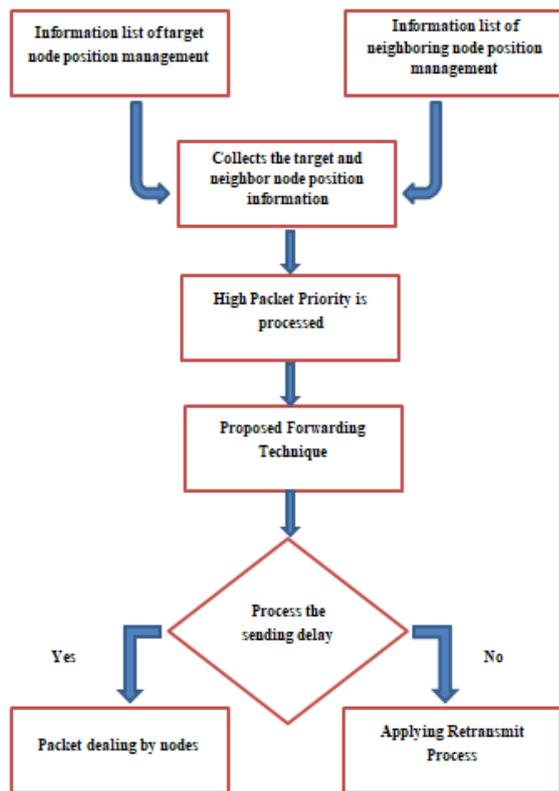


Figure 2: Self Directional Packet Sending with High Priority

IV. EXPERIMENTAL RESULTS ANALYSIS

In fig 3, We can see the difference between Self Directional packet Sending Algorithm with high priority with the existing algorithm. The packet delivery ratio for SDPS is increased when compared it with existing algorithm which is not having high priority. In underwater the packet delivery ratio is playing a great role for communication between node in underwater and data center on surface.

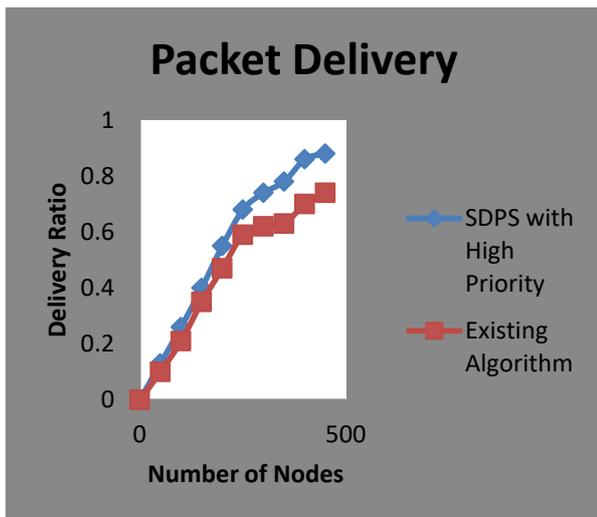


Figure 3: Proposed method with high priority and without priority

In the simulation analysis our proposed method is also compared with some of the routing algorithms. They are HBR(Hop Count Routing) and VBF. In fig 4, we found that our proposed algorithm is consuming less energy than HBR and VBF. Energy consumption is utilized less for a single

message per node

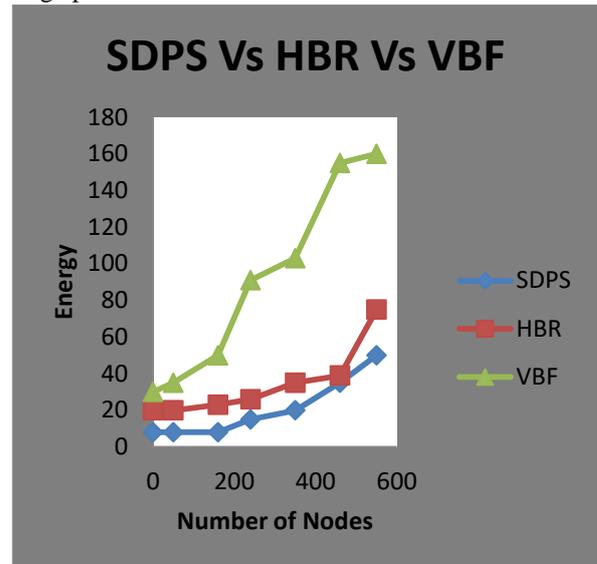


Figure 4: Energy that is consumed per single message per node

V. CONCLUSION

In this paper, I have proposed the SDPS protocol for transmitting a packet from a surface having long distance, which can accomplish better proficiency by high priority to the nodes. The delay of the high priority packet and packet loss rate are likewise decreased and packet delivery ratio increased. The communication between the nodes from surface to the monitor center is increased even having a long distance and heavy packet drops. Henceforth, SDPS is a superior decision for UWNS to send a packet from the surface with long distance; It can execute the packets having priority as high and gives security alert application. SDPS is having a more extensive application possibility if transmitting the data and data security are considered over.

REFERENCES

1. Darehshoorzadeh, A., & Boukerche, A. (2015). Underwater sensor networks: A new challenge for opportunistic routing protocols. *IEEE Communications Magazine*, 53, 98–107.
2. M. Ayaz, I. Baig, A. Azween, and F. Ibrahim, "A Survey on Routing Techniques in Underwater Wireless Sensor Networks," *J. Network and Computer Applications*, vol. 34, pp. 1908-1927, 2011.
3. Akyildiz, I. F., Pompili, D., & Melodia, T. (2005). Underwater acoustic sensor networks: Research challenges. *Ad hoc networks*, 3, 257–279.
4. U. Lee, P. Wang, Y. Noh, L.F.M. Vieira, M. Gerla, and J.-H. Cui, "Pressure Routing for Underwater Sensor Networks," *Proc. IEEE INFOCOM*, 2010.
5. V.D. Park and J.P. Macker, "Anycast Routing for Mobile Services," *Proc. Conf. Information Science and Systems*, 1999.
6. S. Biswas and R. Morris, "Opportunistic Routing in Multi-Hop Wireless Networks," *Proc. ACM SIGCOMM*, 2005.
7. V. Chandrasekhar, Y.S. Choo, and H.V. Ee, "Localization in Underwater Sensor Networks—Survey and Challenges," *Proc. First ACM Int'l Workshop Underwater Networks (WUWNet)*, 2006.
8. X. Sun, X. Li, "Study of the feasibility of VANET and its routing protocols," *In Proceedings of International Conference on Wireless Communications, Networking and Mobile Computing, DaLian, China*, 2008, pp.1–4.
9. Luo, H., Guo, Z., Dong, W., Hong, F., & Zhao, Y. (2010). LDB: Localization with directional beacons for sparse 3D underwater acoustic sensor networks. *Journal of Networks*, 5, 28–38.



10. Y. Noh, P. Wang, U. Lee, and M. Gerla, "VAPR: Void Aware Pressure Routing Protocol," WUWNet Work-In-Progress Poster, 2010.
11. B. S. Gukhool, S. Cherkaoui, "IEEE 802.11p modeling in NS-2," In Proceedings of the 33rd IEEE Conference on Local Computer Networks, (LCN' 08), Montreal, Canada, 2008, pp. 622-626.
12. P. Xie, J.-H. Cui, and L. Lao, "VBF: Vector-Based Forwarding Protocol for Underwater Sensor Networks," Networking Technologies, Services, and Protocols; Performance of Computer and Comm. Networks; Mobile and Wireless Comm. Systems, vol. 3976, pp. 1216-1221, 2006.
13. H. Yan, Z. Shi, and J.-H. Cui, "DBR: Depth-Based Routing for Underwater Sensor Networks," in *IFIP Networking'08*, May 2008.
14. P. Casari and A.F. Harris, "Energy-Efficient Reliable Broadcast in Underwater Acoustic Networks," Proc. Second Workshop Underwater Networks (WUWNet), 2007.
15. N. Nicolaou, A. See, P. Xie, J.-H. Cui, and D. Maggiorini, "Improving the Robustness of Location-Based Routing for Underwater Sensor Networks," Proc. IEEE OCEANS Conf., 2007.
16. P. Nicopolitidis, G. Papadimitriou, and A. Pomportsis, "Adaptive Data Broadcasting in Underwater Wireless Networks," IEEE J.Oceanic Eng., vol. 35, no. 3, pp. 623-634, July 2010.
17. Gera Jaideep, Dr.Bhanu Prakash Battula. (2016).Survey on the Present State-of- the-Art of P2P Networks, Their Security Issues and Counter Measures. *International Journal of Applied Engineering Research*, 11(1).p 639-643.

AUTHOR PROFILE



Dr. Salman Ali Syed working as assistant professor in college of science and arts, Jouf University, Tabarjal, Kingdom of Saudi Arabia. He completed his PhD from Pacific academy of Higher Education and Research University, Udaipur. He completed M.Tech from University College of Engineering, JNTU Anantapur and B.Tech from Jawaharlal Nehru Technological University, Hyderabad. His research area

includes Wireless Networks, Databases, Network Security and Data mining.