A SURVIVAL STUDY ON FLOODING BASED ROUTING PROTOCOLS FOR UNDERWATER WIRELESS SENSOR NETWORKS (UWSNs)

A.Rehash Rushmi Pavitra[1], L.Karthika[2], P.Uma Maheswari[3], S.Keerthana[4], K.Rupiya[5]
[1]Assistant Professor, Sri Sairam Engineering College, Chennai.
[2,5]Assistant Professor, Gojan School of Business and Technology, Chennai.
[3]Assistant Professor, Anna University Regional Campus, Madurai.
[4]Assistant Professor, Sri Sairam Institute of Technology, Chennai.

Abstract

Recent exploration in underwater wireless sensor networks (UWSNs) has earned the radical consideration of researchers in both academic and industries for distinct number of undiscovered applications encompass of disaster and earthquake forecasting, quality of water and environment monitoring, emission and mine detection, military surveillance weather predication and underwater navigation. On the other side, the underwater medium is identical with a number of limitations and constraints such as limited bandwidth, long propagation delay, high interference and noise, harsh environment, insufficient underwater channels and limited battery power of the sensor nodes. To overcome this, the development of routing protocols for UWSNs is one of the assuring solutions to control with the above mentioned challenges. In addition, this paper presents a survey of the Flooding based routing protocols for UWSNs which are reliable methodology to deliver packets in underwater environment for long distance communication. Hence, these protocols potentially associate the sensor nodes done with forwarding procedure. Finally, wide range of parameters and future research directions are highlighted for further investigation.

Keywords: UWSNs, Protocols, Flooding, Forwarding, Routing, Sensor Nodes

Introduction

In general, the earth consists of 70% water in the form of sea, ocean, river, lake and so on. Acoustic mechanism is mostly adopted for long term communication which shows the concern of exploring the underwater medium [8]. Also, underwater sensor nodes in UWSNs cover a definite area of the sea to sense the determine attributes and transfer the information to onshore base station that situated near to the water surface. Consequently, communication systems in the underwater sensor network involve the transmission of data through radio frequency, electromagnetic or optical wave and acoustic medium [9]. Among these standardize of medium, transmission through acoustic is the most prominent and widely used method due to its minimal depletion features in water environment. Moreover, the aspect of low transmission is derived from penetration and transformation of energy into heat in surface of water. Meanwhile, acoustic signals serve at low frequency which facilitates them to transmit and receive over long distance communication [10].

In recent days the development of diverse routing protocols for UWSNs is of preeminent concern. With an inherent support of various protocols identify the optimal path from the bottom of the water surface which in turn ensures high network performance correspondingly with the relevant parameters [11]. Especially, the limitations incorporate with the underwater medium while forwarding the packets is examined by the routing protocols to obtain the actual performance of the network according to the desired standards.

For instance, these protocols bear the limited battery power, higher noise and interference, affected shadow zones [13]. However, due to harsh environment movement of the sensor nodes is extensive in large scale thereby reliable transmission of data packets seems to be destructive channel conditions and leads to high propagation delay [12]. Therefore, this survey focused on flooding routing protocols for UWSNs which are more reliable, robust, active, efficient and resourceful as compared to the existing protocols. Further, the rest of the paper is organized as follows, section 2 presents the various flooding based routing protocol in UWSNs. Section 3 illustrates the comparison table with certain parameters followed by section 4 states with conclusion and future work.

Survey on Flooding based Routing Protocols

Halikul Lenando & Mohamad Alrfaay (2018) has introduced Social-Based Epidemic-Based Routing Protocol (EpSoc) for electing node centrality at the level node deployment. Also, it becomes essential to predict higher node degree centrality and hence the node incurred with frequent number of nodes in the network [1]. If a node is socially active, it broadcast communication state to the remaining nodes that emphasize higher potential for energy efficient data communication. As a result, epidemic routing exposes a higher delivery ratio with minimal average latency and hop count.

Danli Huang *et al.* (2017) suggested Adaptable Quota-Stretchy Routing protocol (AQSR) to facilitate higher data delivery ratio and network adaption in DTN. The significant execution rule involved organization of information from different states together adjusting the total number of information copies for both quantitative and qualitative strategy with replica values and workload [2]. At the beginning, if the probability of workload is high then redundant copies of information reduces adaptively thereby redundant copies ensure a transmission speed periodically. Buffer management strategy required more buffer space to avoid congestion across the network. Therefore, this technique reduces overhead ratio and latency.

Srividya & Rakesh (2017) has addressed Epidemic Routing Protocol (ERP) to figure out node positioning level which actively finds multiple routes between source node and destination node. To determine path communication is done through selection of optimal route with highest trust. Further, node generates a random position number for every node with node id and position to enhance the propagation efficiency by updating the nodes traversal position to user interface. Therefore, this technique prolongs the network lifetime in terms of energy consumption and average hop latency [3].

Teerapong Choksatid *et al.* (2016) have presented Speed Epidemic Routing (SEd) to reduce the forwarding redundant messages. Sensor nodes are extended across at the mean of the network field with same transmission range. Each packet initiated with equal size of 256 bits which is in turn made possible to quantify data rate. Subsequently, mobility model introducing Random Waypoint to estimates the network lifetime bound and node speed [4]. This is turn pave way for high end message transmission with average packet rate.

Elvin Isuf *et al.* (2016) has proposed Geographical Dflood (GDflood) to analyzing the node location information in order to minimize the number of relays during data forwarding technique. In addition, network coding encodes the incoming data packets into one or more output packets contrary to adopting the typical store and forward mechanism. The encoding and decoding functions play a vital role in figuring out the packet error rate in underwater networks. The protocol capitalizes on certain assumptions with related to unique ID as source address, destination address, a sequence number and hop count. The option of data transmission is done through implicit acknowledgment strategy [5]. This ensures a packet delivery ratio in underwater environments.

Seung Deok Han & Yun Won Chung (2015) have contributed probability routing protocol using history of encounters and transitivity (PRoPHET) protocol by exploiting hybrid of flooding protocol for message dissemination. To ensure maximum data deliver, it is necessary for copying a message to all other nodes only if the transmission predictability to destination node over connection node is larger than he transmitting node. Also, message transmission counter and hop counter seems to be equal to the threshold values [6]. Hence, it reduces network load and storage overhead which in turn involves higher data delivery as the number of rounds increases.

Bhed Bahadur Bista & Danda B Rawat (2015) suggested Robust Energy Efficient Epidemic Routing Protocol (REERP) through maintain energy utility of active nodes in DTN. The function of data exchange between neighbouring nodes encloses vector message, available buffer size and present energy level with its neighbour. More often a given energy level is compared with neighbour whereas authentic information is broadcasted to balance energy level of node in the network. Also, for each round node receives buffer and store the replicate message to the host. The process of similarity analysis involves a comparison metric that minimizes resource utilization and overhead ratio [7]. Table 1 represents the comparison of flooding based routing protocols for underwater environments.

Table 1 Comparison of flooding based routing protocols

Protocol	Hop-by-hop/ End-to-End	Prioritization Metric	Parameters	Simulator
EpSoc	Hop-by-Hop	Hop count and Time to live	Delivery, overhead ratio	Opportunistic Network Environment (ONE)
AQSR	End-to-End	Pre-set range of replica numbers and bound value	Delivery ratio	Opportunistic Network Environment (ONE)
ERP	Hop-by-Hop	Time to live, Trust value	Average hop latency, energy	JSim
SEd	Hop-by-Hop	Hello message	Delivery rate, packet rate	OMNeT++
GDflood	End-to-End	Implicit ACK	Packet delivery ratio, end to end delay	NS-2
PRoPHET	Hop-by-Hop	Hop count and threshold value	Delivery probability, average delay	Opportunistic Network Environment (ONE)
REERP	End-to-End	Request-reply	Energy, network lifetime	Opportunistic Network Environment (ONE)

Conclusion

In this paper, several flooding based routing protocols are discussed in UWSNs. The primary objective of the reviewed protocols is to overcome the underwater constraints and to give further suggestions and future research directions to the researchers. Consequently, the proposed survey paper classified the routing protocols according to their flooding strategies into two categories namely hop-by-hop and end-to-end approaches. Ultimately, the research work highlights the overall performance with relevant parameters and simulators in terms of flooding strategy. In future, to deal with the development of flooding based routing protocols with massive communication channels and different MAC protocols in real time environment.

References

1. Halikul Lenando & Mohamad Alrfaay 2018, 'EpSoc: Social-based epidemic-based routing protocol in opportunistic mobile social network', Mobile Information Systems, vol. 18, pp. 1-8.
2. Danli Huanga, Zhipeng Gaoa, Kun Niub & Xuesong Qiua 2017, 'Adaptable quota-stretchy routing for delay-tolerant networks', Procedia Computer Science, vol. 107, pp. 513-519.
3. Srividya & Rakesh 2017, 'Enhancement and performance analysis of epidemic routing protocol for delay tolerant networks', Proceedings of the IEEE International Conference on Inventive Systems and Control, pp. 1-8.
4. Teerapong Choksatid, Worrawat Narongkhachavana & Sumet Prabhavat 2016, 'An efficient spreading epidemic routing for delay-tolerant network', Proceedings of IEEE Conference on Consumer Communications & Networking Conference, pp. 1-4.
5. Elvin Isufi, Henry Dol & Geert Leus 2016, 'Advanced flooding-based routing protocols for underwater sensor networks', EURASIP Journal on Advances in Signal Processing, vol. 52, pp. 1-12.

6. Seung Deok Han & Yun Won Chung 2015, ‘An improved PRoPHET routing protocol in delay tolerant network’, The Scientific World Journal, vol. 15, pp. 1-7.
7. Bhed Bahadur Bista & Danda B Rawat 2015, ‘A robust energy efficient epidemic routing protocol for delay tolerant networks’, Proceedings of the IEEE International Conference on Data Science and Data Intensive Systems, pp. 1-7.
8. Akyildiz I.F, Pompili D, Melodia T, 2005, ‘underwater acoustic sensor networks: Research challenges’, Adhoc Networks. Vol. 3, pp. 257–279.
9. Anwar A, Sridharan D 2015, ‘A survey on routing protocols for wireless sensor networks in various environments’, International Journal of Computer. Application, no. 112, pp. 13–29.
10. M. Ayaz, I. Baig, A. Abdullah, I. Faye 2011, ‘A survey on routing techniques in underwater wireless sensor networks,’ Journal of Network and Computer Applications, vol. 34, no. 6, pp. 1908–1927.
11. N. Z. Zenia, M. Aseeri, M. R. Ahmed, Z. I. Chowdhury, M. Shamim Kaiser 2016, ‘Energy-efficiency and reliability in MAC and routing protocols for underwater wireless sensor network: A survey’, Journal of Network and Computer Applications, vol. 71, pp. 72–85.
12. Y. Luo, L. Pu, M. Zuba, Z. Peng, J.-H. Cui 2014, ‘Challenges and opportunities of underwater cognitive acoustic networks’, IEEE Transactions on Emerging Topics in Computing, vol. 2, no. 2, pp. 198–211.
13. A.Rehash Rushmi Pavitra, Swagata Sarkar, V. Arun, C. Esther 2021, ‘A Survey on Software Defined Architecture for Underwater Wireless Sensor Networks’, International Conference on Computing and Communications Technologies (ICCCT).