Review the Optimization Algorithm for Underwater Acoustic Sensor Network

Neha Jamrey[1], K K Sharma[2]
Patel College of Science and Technology

Abstract - The significance of water resource is extremely concerned. Earth covers 70% of water, so there are sufficiently of resources still untouched. Wireless underwater sensor network have been advanced for monitoring conservational events, oceanic exploration, seismic monitoring, etc. Consequently, it's required to monitor, search and achieve the water resource. . Due to the underwater sensor nodes is certainly affected by ocean currents affect which occurred in the position drift, surface gateway deployment locations essential regular dynamic optimization and update. In this research paper to review and designs an improved existing optimization algorithm, to accomplish a fair and proficient surface gateway layout optimization. At the similar time, the influence of dissimilar gateway quantity on network capacity and network delay is signify, which provides scientific decision support for the overall optimization of underwater sensor networks.

Keywords - Underwater acoustic sensor network, underwater acoustic communications, and medium access control layer.

I. INTRODUCTION

Underwater sensor networks are expected to enable applications for exploring shallow sea, monitoring pollution, assisted navigation and tactical surveillance applications [1]. The underwater acoustic sensor networks are made up by massive sensor nodes. These sensor nodes collect and process data. Identifying the physical positions of nodes is one of the critical issues for it. This is because transmitted data are meaningful to most applications only when they are labeled with geographical position information, and position information is essential to many location-aware sensor network communication protocols, such as packet routing and sensing coverage [2]. Localization has been widely studied for underwater acoustic sensor networks. Localization algorithm can be broadly classified into two major categories, range-based algorithms and range-free algorithms. In the range-based localization algorithms, the distance or angle estimates of neighbors will be used for calculating the exact location of sensor node, and range-based localization algorithms can receive high location accuracy but require additional hardware and energy consumption at the sensor nodes. Range-free algorithms can obtain the location of node without using any distance and angle information, only according to network connectivity. Range-free localization algorithms are simple but generally offer a less precise estimate of location compared with range-base algorithms. For the hardware limitations and the inherent energy constraints of underwater acoustic sensor network devices, energy efficiency is an important performance parameter when designing a localization algorithm for underwater acoustic sensor network [3]. Besides, coarse accuracy is sufficient for most underwater acoustic sensor network applications, such as routing, target tracking and so on. Time synchronization/localization: Time synchronization and localization are usually accomplished on land by GPS receivers where it is possible to get an accuracy of within nanoseconds and meters respectively. In the underwater domain, time synchronization and localization are crucial for efficient media access control algorithms due to the fact that propagation time between nodes is so high. Synchronization has typically relied on acoustic triangulation by a number of buoys with a know position to solve for both location and propagation delay, which can then be used to determine to synchronize times. This is subject to errors due to fluctuations in pressure and temperature, as well as variations in the position of the triangulation buoys due to wave motion [3]. Acoustic triangulation is greatly complicated by the fact that the speed of sound in water is not constant, but varies with temperature and salinity. TCP communication: Bandwidth of underwater acoustic communication is greatly limited by the fact that attenuation increases with the square of the frequency in water [4]. This means that, for practical purposes, acoustic communication is limited to frequencies of less than 1 MHz, while the bandwidth of optical communication is limited by the frequency response of the LEDs and photo-detectors being used, typically many MHz or even GHz. In addition, the low propagation delay of optical communication makes it capable of supporting TCP links, which opens up applications such as realtime video.

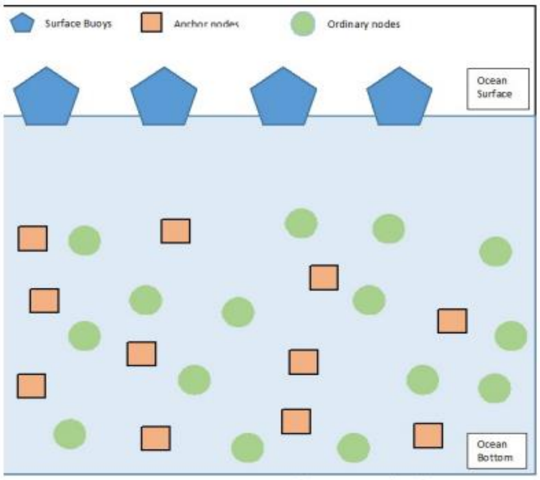

Figure 1: network under water [9]

Therefore, taking the consumption, cost, volume of sensor node and extremely harsh underwater environment into consider, the range-free algorithm is widely used in many applications than range-based algorithm. In this paper, we introduce the platforms of underwater acoustic sensor networks. The platform evaluates the networking protocols on the personal computer, by which all the aspects of the networking protocols can be investigated conveniently. The platform evaluates the networking protocols on the embedded devices in the sea trial with the same programming codes of protocols as those on the platform, which can improve the development efficiency and guarantee the consistency of programming codes. Which have the layered structure supporting the cross-layer signaling. To date, the functionalities of number of layers, i.e., application layer, routing layer, medium access layer, and physical layer, have been achieved, which facilitates the researches of each layer. In the following, the architecture of the platforms is explained in detail. we have considered the prediction algorithm for the localization of ordinary nodes and anchor nodes in underwater sensor network. The localization of ordinary nodes is done by estimating the path of the ordinary node and previous location. The location is estimated with the help of localization message from the anchor nodes. This approach overcomes the problem, thus reducing the communication cost and the overall delay in the network. The remainder of this paper is organized as follows: In Section II, the related work and emulation platforms are described in detail. Section III represent the proposed methodology and algorithm. Finally, Section IV concludes this paper.

II. RELATED WORK

The localization scheme concept is developed and cantered mainly for applications. In [1], a recursive review underwater acoustic sensor network optimization algorithm localization scheme is considered in which all sensor nodes are placed randomly underwater. Anchor nodes are used to obtain the geographical information, also it is localized. These sensor nodes respond to the localization request message broadcasted by the ordinary sensor nodes and they are equipped with an acoustic transmitter and receiver. Ordinary sensor nodes perform the tasks assigned to it, which is sensing the environment; it is non-localized. Many neighboring nodes are present for ordinary nodes which are distributed randomly. Reference nodes acts as anchor nodes as they help other non-localized ordinary nodes to get their exact location, which is known as an event-driven technique. The localization success ratio and the mean energy dissipated per node are the parameters with which the performance is evaluated. Localization success ratio is defined as localized nodes by total number of ordinary nodes which rises as the beacon nodes within the network increases.

Zheng, S., et al[1] —Underwater acoustic (UWA) network testbed offers an efficient way for performance evaluation and comparison from the viewpoint of quasi-practical environments. In this paper a cross-media underwater sensor network test-bed is designed and implemented to investigate its performance for cross-media networking. The hardware design, network protocol and field experiment setting of the test-bed is provided. Finally, experimental results collected from the test-bed are also discussed.

Wu, Z., et al[2] In this paper, they have introduce an improved underwater acoustic network localization algorithm. The algorithm processes the raw data before localization calculation to enhance the tolerance of random noise. We reduce the redundancy of the calculation results by using a more accurate basic algorithm and an adjusted calculation strategy. The improved algorithm is more suitable for the underwater acoustic sensor network positioning.

Hongyu Cui et al[3] introduce the platforms developed by our laboratory, which are based on the wellknown ns2 and ns-miracle simulators, with the layered structure supporting the cross-layer signaling. The simulation platform works on the personal computer equipped with linux operating system. The architecture of the platform is divided into four layers: application layer, routing layer, medium access layer, and physical layer. The emulation platform works on the embedded devices in the sea trial, such as the OMAPL138 DSP+ARM dual-processor of Texas Instrument company. To guarantee the consistency, the programming codes of networking protocols in the emulation platform can be adopted directly from those in the simulation platform. Finally, in this paper, we present the simulation and emulation results to verify the accuracy and efficiency of the platforms.

Kebkal, V., et al [4] present results of network coding experiments, conducted in a subsea environment of practical interest, and include an analysis of channel asymmetry, observed for signals travelling between the end nodes in opposite directions. Experimental results reveal a significantly improved network performance achievable in channels of practical interest by implementing network coding. The improvement is demonstrated by a comparison of network coding with a standard FIFO (first in, first out) queuing approach.

Zhang, H., et al [5] In view of the above-mentioned literature in multi surface gateway network deployment optimization algorithms exist deficiencies, based on the advanced thought of cuckoo search algorithm designed an improved cuckoo optimization algorithm. A reasonable water surface gateway deployment optimization goal is proposed to achieve a fair and efficient dynamic layout optimization of the water surface gateway. Based on the analysis of the influence of the quantity of the water gateway on the network capacity and the network delay, the performance cost decision basis for the design of underwater sensor networks is presented.

Liu, L., et al [6] The main contributions of this paper are as follows. first provide a mathematical network model to describe the topology control problem, and this model embodies three most typical characteristics of UASNs, that is, large propagation delay, signal irregularity, and rapid energy consumption. Then, a scale-free model edges constructed model (ECM) based on complex network theory is established to generate an initial topology, which eventually evolves into a double clustering structure by proposed topology control strategy based on complex network theory (TCSCN).

Yifan, W et al[7] In this paper, they have summarized different transmission schemes for the construction of underwater communication networks. After describing the uniqueness of the underwater channel, we make a layered research to summarize and compare different schemes. They also present the results from recent experiments. Based on this, we have come up with limitations for better performance in each layer and offer guidelines for better implementation. At last, simulate and compare a CDMA system and a TDMA system in underwater communication and offer guides for better performance.

III. PROPOSED METHODOLOGY

We presented an improved optimization algorithm for underwater sensor nodes and wireless sensor nodes localization in this paper. The algorithm uses the maximum likelihood estimation method to improve the positioning accuracy of every single node in the network and reduce the effects of measurement error caused by the sound velocity distortion, signal refraction and other factors. Meanwhile, the algorithm uses a strategy similar with the optimization algorithm, improving the overall positioning accuracy alone with the node localization capability and reliability of the consequences. In addition, the rational design of the order of evaluation optimization algorithm reduces the redundancy of the consequences. The algorithm proves out to be more robust and more reliable. Works will focus on improving the efficiency and accuracy of the algorithm, combining the algorithm with some heuristic algorithm to make the algorithm more intelligence and extending the algorithm to the positioning of the three-dimensional space to adapt to more actual needs. a proposed protocol a low overhead routing protocol for underwater network is proposed. The proposed protocol tries to reduce the control overhead in route maintenance technique than existing routing protocols. The proposed routing protocol is compared with the two most popular technique in the reactive category (AODV and DSR)[6]. Since a low overhead routing protocol is based on reactive protocol, it consists of two operations: route Discovery and route Maintenance. The route discovery process is similar to that of AODV. The proposed protocol has a fixed length header and every operation is maintaining the same length format. The protocol has 3 types of operational message at the moment Route Request, Route Reply and Route Alive. Route Request and Route Reply are used for Route discovery while Route Alive is optional message which serves two purposes; it is used to check route alive process and helps for route recovery process. The route maintains is similar procedure as that of AODV and DSR. Communication in the network layer is performed by using the Internet Protocol Suit, where each layer provides a well-defined service to the immediate layer. The routing protocol operates at the Network Layer. Low overhead routing protocol can avoid the problems with existing route maintenance procedures by monitoring traffic flow at the network layer. Moreover, the route is maintained at the source node and the destination node to concern about route maintenance. The novelties of low overhead routing protocol, its avoid the need of neighbor maintenance with periodic messages or executing the protocol separately. Its avoid the timer maintains for individual entries in the routing table as done in AODV and DSR. Then it does not have separate route recovery mechanism.

Proposed algorithm - Optimization algorithm aims at minimizing the number of hops, because adding hops notably increases the total delay. The algorithm is to find the farthest node it can reach (G) and forward the message. The same method as mentioned in Optimization algorithm is used to determine whether the next node is closer to the destination.

The optimal distance algorithm performs the best in comparative study and the undertaken in also prove this. But this does mean that optimal distance is the best choice for the following reasons:

- This necessitates knowledge for the position of entirely nodes. But localization is problematic. Individual recently, there are researchers who convey conceivable schemes.
- Our Optimization algorithm is easy to carry out and it is robust to contentions.
- The delay of optimal distance algorithm can be enormous, which is not acceptable by particular real-time applications. Consequently the best routing algorithm is still an open topic to discuss.

IV. CONCLUSION

The purpose of the research is to increase network throughput at access points by implementing the network coding algorithm. This paper presents review network coding in real underwater environment and demonstrates a significant improvement of network performance with network coding versus the standard queuing approach. In this paper to enhanced the performance of LOARP, AODV and DSR routing protocols. This analysis is based on the packet delivery ratio, end to end delay and throughput. Increasing the number of nodes, mobility and control overhead. In this paper, low overhead routing protocol, is proposed and its performance is compared with two most popular protocols (AODV and DSR) in the reactive category. In order to improve the performance of existing, other protocols should be explored. Current result suggest the protocol to handle large propagation delay.

V. REFERENCE

[1]. Zheng, S., Wang, X., Jiang, W., & Tong, F. (2017). Lake trial of an underwater acoustic cross-media network testbed. 2017 IEEE International Conference on Signal Processing,

Communications and Computing (ICSPCC). doi:10.1109/icspcc.2017.8242613.

[2]. Wu, Z., & Li, X. (2015). An improved underwater acoustic network localization algorithm. China Communications, 12(3), 77–83. doi:10.1109/cc.2015.7084366.

[3]. Hongyu Cui, Youwen Zhang, Xin Liu, & Dajun Sun. (2016). The simulation and emulation platforms of underwater acoustic sensor networks. 2016 IEEE/OES China Ocean Acoustics (COA). doi:10.1109/coa.2016.7535751.

[4]. Kebkal, V., Kebkal, K., & Kebkal, O. (2014). Experiments with network coding in dynamic underwater acoustic channel. 2014 Underwater Communications and Networking (UComms). doi:10.1109/ucomms.2014.7017136.

[5]. Zhang, H., Wang, S.-L., & Sun, H.-X. (2016). Research on water surface gateway deployment in underwater acoustic sensor networks. OCEANS 2016 MTS/IEEE Monterey. doi:10.1109/oceans.2016.7761476

[6]. Liu, L., Liu, Y., & Zhang, N. (2014). A Complex Network Approach to Topology Control Problem in Underwater Acoustic Sensor Networks. IEEE Transactions on Parallel and Distributed Systems, 25(12), 3046–3055. doi:10.1109/tpds.2013.2295793.

[7]. Yifan, W., Zaichen, Z., & Guangguo, B. (2010). An overview on Underwater Acoustic Sensor Networks. 2010 17th International Conference on Telecommunications. doi:10.1109/ictel.2010.5478812

[8]. Tennenbaum, A., Dyakiw, M., Cui, J.-H., & Peng, Z. (2014). Application of Low Cost Optical Communication Systems to Underwater Acoustic Networks. 2014 IEEE 11th International Conference on Mobile Ad Hoc and Sensor Systems. doi:10.1109/mass.2014.130

[9]. Mandalapa Bhoopathy, V., Ben Haj Frej, M., Richard Ebenezer Amalorpavaraj, S., & Shaik, I. (2016). Localization and mobility of underwater acoustic sensor nodes. 2016 Annual Connecticut Conference on Industrial Electronics, Technology & Automation (CT-IETA). doi:10.1109/ct-ieta.2016.7868249.

[10]. Petrioli, Chiara, and Roberto Petroccia. “SUNSET: Simulation, emulation and real-life testing of underwater wireless sensor networks.” Proceedings of IEEE UComms 2012 (2012): 12-14.

[11]. Masiero, Riccardo, et al. “DESERT Underwater: an NS-Miracle-based framework to DEsign, Simulate, Emulate and Realize Test-beds for Underwater network protocols.” OCEANS, 2012-Yeosu. IEEE, 2012.

[12]. S. Li, X. Ding, and T. Yang, "Analysis of five typical localization algorithms for wireless sensor networks," Wireless Sensor Network, vol. 7, no. 4, pp. 27-33, 2015.