EFFICIENT AND TERRIFIC TRANSMISSION USING DYNAMIC ROUTING TECHNIQUE FOR UNDER WATER ACOUSTIC SENSOR NETWORK

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Abstract— *Underwater acoustic sensor networks (UW-ASNs) has recently been proposed for exploring the underwater resources and gathering the scientific data from the aquatic environments. UW-ASNs are faced with different challenges, such as high propagation delay, low bandwidth, and high energy consumption. However, the most notable challenge is perhaps how to efficiently forward the packets to the surface sink by considering the energy constrained sensor devices. The opportunistic routing concept may provide an effective solution for UW-ASNs by the cooperation of the relay nodes to forward the packets to the surface sink. In this paper, the energy consumption problem is addressed and an energy-efficient cooperative opportunistic routing (EECOR) protocol is proposed to forward the packets towards the surface sink. In the EECOR protocol, a forwarding relay set is firstly determined by the source node based on the local information of the forwarder and then, a fuzzy logic-based relay selection (FLRS) scheme is applied to select the best relay based on considering the energy consumption ratio and the packet delivery probability of the forwarder. In UW-ASNs, most of the energy is wasted due to the collisions amongst sensor nodes during the packet transmission. To alleviate the packet collisions problem, we have designed a holding timer for each of the forwarder to schedule the packets transmission towards the surface sink. We have performed our extensive simulations of the EECOR protocol on the Aqua-sim platform and compared with existing routing protocols in terms of average packet delivery ratio, average end-to-end delay, average energy consumption, and average network lifetime.*

Keywords—Energy Consumption Ratio, Forwarding Relay Set, Fuzzy Logic, Holding Timer, Packet Delivery Probability, Opportunistic Routing

1. INTRODUCTION

Acoustic communication is an only desirable feasible method for underwater communication in USWNs described by Gerhardt and Huber (2002). High frequency radio waves are powerfully captivated in water and optical waves suffer from heavy scattering and are restricted to short-range-line-of-sight applications. Nevertheless, the underwater acoustic channel introduces large and variable delay as compared with radio frequency (RF) communication, because of the rapidity of sound in water which is approximately temporary path loss and the high noise resulting in a high bit error rate; rigorously restricted bandwidth because of the strong attenuation in the acoustic channel and multipath fading; shadow zones; and the high communication energy cost, which is of the order of tens of watts.

In this context, geographic routing paradigm seems a promising methodology for the design of routing protocols for UWSNs. Geographic routing, also called of position-based routing, is simple and scalable described by Joshi and Kim (2009). It does not require the establishment or maintenance of complete routes to the destinations. Moreover, there is no need to transmit routing messages to update routing path states. Instead, route decisions are made locally. At each hop, a locally optimal next-hop node which is the neighbor closest to the destination is selected to continue forwarding the packet. This process proceeds until the packet reaches its destination. Geographic routing can work together with opportunistic routing (OR) (geo-opportunistic routing) to improve data delivery and reduce the energy consumption relative to packet retransmissions.

Using opportunistic routing paradigm, each packet is broadcast to a forwarding set composed of neighbors described by Coutinho et.al (2016

1.1 Underwater Sensor Networks

Wireless information transmission by means of the sea is considered as the empowering advancements for the foundation without future ocean-observation systems and sensor networks

described by Peleato and Stojanovic (2007). Uses of underwater sensing ranges from oil industry to aquaculture, and furthermore includes the administering of instrument, contamination control, atmosphere recording, and forecast of characteristic unsettling influences, hunt and review missions, and getting the learning of the marine life Ibrahim et.al (2013) and Brataas et.al , (2013).

These links supports the collaboration correspondence get to focuses, particularly as cell base stations which were associated with the telephone network, which allows the clients to explore and cooperate from places where links can't be associated. Another specimen is: cabled submersibles, named as remotely operated vehicles (ROVs).

With the help of the cable, the vehicles, with more than 10 metric tons, were connected to the mother ship and they were extending over several kilometers and deliver high power to the remote end, in addition to the high-speed communication signals. A famous sample of an ROV/AUV tandem is the Alvin/Jason pair of vehicles which is executed by the Woods Hole Oceanographic Institution (WHOI) in 1985 to discover Titanic. Those vehicles were also instrumental in the discovery of hydro-thermal vents, sources of tremendously hot water on the bottom of Deep Ocean which exposed forms of life varies from any others which are known earlier. The first vents were identified in the late 1970s, and new ones were under discovery described by Cheng et.al (2008). The significance of those discoveries is equivalent only to space missions, and so is the technology which favors them. Recently, both the vehicle innovation and the sensor innovation are set up adequately to empower the ideas of underwater sensor networks described by Hopp et.al (2012). To bring this idea into reality, by and by, issues like interchanges must be confronted. The acoustic innovation was used by underwater communication recently.

Complementary communication techniques, as optical and radio-recurrence, or even electrostatic correspondence, have been proposed for short-run links (normally 1– 10 m), where their high data transfer bandwidth (MHz or more) can be crippled. These signs fulfill rapidly, inside a couple of meters (radio) or many meters (optical), that requests either high-control or tremendous antennas. Acoustic interchanges exhibit longer ranges, yet they were confined by three elements: constrained and distance-dependent bandwidth, time-varying multi-way spread and low speed of sound. Together, these limitations result in a low quality propagation station and high latency, consequently joining the most noticeably awful perspectives of earthbound portable and satellite radio stations into a correspondence medium is perplexing assignment.

Among the principal submerged acoustic frameworks was the submarine communication system which is built up in the USA around the end of the Second World War. It used the simple regulation in the 8– 11 kHz band (single-sideband amplitude modulation). Propelled inquire about has been continued by pushing the digital modulation–detection techniques into the cutting edge of present day acoustic communications. As of now, bunches of acoustic modems were accessible financially, that typically gives a couple of kilobits for every second (kbps) over separations up to a couple of kilometers. Attractively higher bit rates have been clarified; however these outcomes remain consistent in the space of experimental research.

With the assistance of this development in acoustic modem technology, examine work has explored into the territory of systems. The significant question was perceived over the previous decade that alludes to the essential distinction between the acoustic and radio propagation. For example, acoustic signals broadcast at 1500 m s−1, making the engendering delays since a couple of moments over a couple of kilo meters. With bit rates of the request of 1000 bps, propagation delays can't be immaterial as far as the typical packet durations —a circumstance which is altogether not the same as that found in radio-based systems. Besides, acoustic modems were for the most part limited to half-duplex operation. These imperatives includes that a acoustic-conscious protocol design can give a decent efficiencies when contrasted with the immediate use of protocols which is built up for terrestrial networks (e.g. 802.11 or transmission control protocol (TCP)).

Additionally, for anchored sensor networks, vitality productivity is critical in terrestrial networks, on the grounds that the battery re-charging many meters underneath the ocean surface is an intricate one and it is expensive. Finally, underwater instruments (sensors, robots, modems and batteries) are neither low-estimated nor dispensable.

This idea is a critical component that (in any event until further notice) arranges the underwater sensor systems from their terrestrial counterpart, and fundamentally the adjustment many system plan ideal models which are considered for conceded.

As of late, we have no routinely operational underwater sensor systems, so their foundation procedure is pending. Applications that animate these foundations were expected in §2. The hidden frameworks includes, armadas of participating autonomous vehicles (where vehicles can respond to each other, not exclusively to the supervisory commands from a focal central authority that amounts to switch from mission A to mission B'), and long-term deployable bottom-mounted sensor networks. Dynamic research that gives vitality to this foundation is considered as the primary subject of our paper. In §3, we clarify key specialized issues and new research approaches that originate from altering the conventional acceptance and abuses the cross-layer optimization for both among the adjacent layers and all through the entire protocol stack, from the application to the physical connection. We additionally clarify the current equipment, and clarify the instruments for modeling and simulation, and in addition test beds.

1.2 Underwater sensing applications

The prerequisite for detecting the underwater world drives the foundations of underwater sensor systems described by Dini and Duca (2012). Applications may have different requests: fixed or mobile, short or enduring, best-exertion or crucial; these requests can bring about different plans. Next, we clarify the different assortments of organizations, classes of applications and heaps of particular examples, both present and theoretical.

(a) Deployments

Parameters like Mobility and thickness contrasts over different assortments of arrangements of underwater sensor systems. Here, we focus on remote underwater systems; however there is vital work in cabled underwater observatories, from the sound reconnaissance framework military systems in the 1950s, to the current Ocean Observatories Initiative described by Ruba and Ramakrishnan (2007).

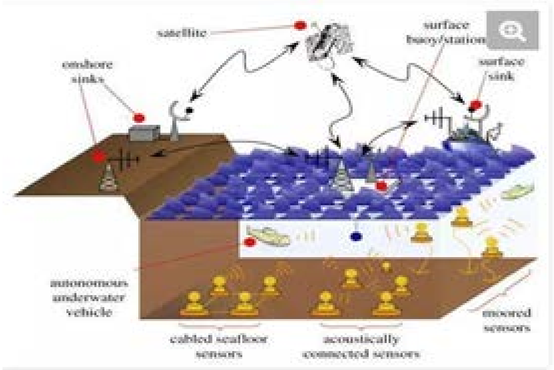

Fig 1.1 Under Water Sensor Network

(b)Application domains

Utilizations of underwater systems fall into similar types as for terrestrial sensor networks. Logical applications look at the earth: from geological processes on the ocean floor, to water qualities (temperature, saltiness, oxygen levels, bacterial and other toxin content, disintegrated matter, and so forth.) to tallying or imaging animal life (smaller scale life forms, fish or warm blooded animals). Modern applications direct and deal with the business exercises, as underwater equipment which depends on the oil or mineral extraction, underwater pipelines or business fisheries. Modern applications every now and again incorporate the control and activation segments too. Military and country security applications incorporate the securing or observing port offices or ships in outside harbors, de-mining and communication with submarines and divers.

2.RELATED WORKS

2.1Underwater Acoustic Sensor Networks: Research Challenges

Underwater sensor nodes recognize the applications in oceanographic information gathering, contamination checking, seaward investigation, fiasco counteractive action, helped route and strategic observation applications described by Shen et.al (2015). Moreover, unmanned or autonomous underwater vehicles (UUVs, AUVs), outfitted with sensors, can research the common undersea resources and to gather the logical information in community checking missions. For these applications, the underwater acoustic systems administration is considered as the empowering innovation.

Underwater systems have a variable number of sensors and vehicles which are executed to continue the communitarian observing work in the gave region. Here, heaps of principal key highlights of underwater acoustic interchanges were analyzed. Different structures for two-dimensional and three-dimensional submerged sensor systems were additionally clarified, and afterward explained the qualities of the underwater channel. The essential question for the foundation of an effective systems administration arrangements postured by the underwater condition were additionally clarified and a cross-layer way to deal with the connect the whole communication functionalities is likewise prescribed. Also, open research issues were clarified and recognized the feasible conceivable arrangements.

2.2. Data Collection, Storage, And Retrival With An Underwater Sensor Network

Kumara Pandian (2013) present a novel platform for underwater sensor networks to be used for long-term monitoring of coral reefs and _sherries. The sensor network consists of static and mobile underwater sensor nodes. The nodes communicate point-topoint using a novel high-speed optical communication system integrated into the TinyOS stack, and they broadcast using an acoustic protocol integrated in the TinyOS stack. The node have a variety of sensing capabilities, including cameras, water temperature, and pressure.

2.3. A Survey of Practical Issues In Underwater Networks

For researchers in terrestrial radio-based sensor networks, the underwater sensor networks are an interesting area. We have significant physical, technological, and economic variations among the terrestrial and underwater sensor networks. Here, we highlight various significant practical problems which aren't highlighted in recent surveys of underwater networks, with a planned audience of researchers who are navigating from radio-based terrestrial networks into underwater networks.

In networks covering larger areas, interactions need multiple hops to attain the destinations. When the geographic coverage is higher than an un-partitioned link-layer coverage of entire nodes, so the routing needs a techniques from disruptiontolerant networking (DTN). We have no techniques to create the network, if the mobility of nodes does not overlap. There are lots of additional variations occurs among the terrestrial radio-based networks and underwater acoustic networks described by Luo et.al (2014). One is that huge populations of nodes in small areas can cause fights among throughput and navigation.

2.4. Underwater AcousticCommunication Channels: Propagation Models And Statastical Characterizaton

Acoustic propagation is characterized by thee major factors: attenuation that increases with signal frequency, timevarying multipath propagation, and low speed of sound (1500 m/s) described by Stojanovic and Preisig (2009). The background noise, although often characterized as Gaussian, is not white, but has a decaying power spectral density. The channel capacity depends on the distance, and may be extremely limited.

2.5. VBF: Vector-Based Forwarding Protocol For Underwater Sensor Networks

Tackle one fundamental problem in Underwater Sensor Networks (UWSNs): robust, scalable and energy efficient routing. UWSNs are significantly different from terrestrial sensor networks in the following aspects: low bandwidth, high latency, node float mobility (resulting in high network dynamics), high error probability, and 3- dimensional space. These new features bring many challenges to the network protocol design of UWSNs. . Xie et.al (2006) designed a novel routing protocol, called vector-based forwarding (VBF), to provide robust, scalable and energy efficient routing.

VBF is essentially a position basedroutingapproach: nodes close to the "vector" from the source to the destination will forward the message. In this way, only a small fraction of the nodes are involved in routing. VBF also adopts a localized and distributed selfadaptation algorithm which allows nodes to weigh the benefit of forwarding packets and thus reduce energy consumption by discarding the low benefit packets. Through simulation experiments, we show the promising performance of VBF.

Recently, sensor networks have emerged as a very powerful technique for many Applications, including monitoring, measurement, surveillance and control. The Idea of applying sensor networks in underwater environments (i.e., forming underwater sensor networks (UWSNs)) has been advocated by many researchers. Even though underwater sensor networks (UWSNs) share some common properties with terrestrial sensor networks, such as dense deployment and limited energy, UWSNs are significantly different from terrestrial sensor networks in many aspects: low bandwidth, high latency, node float mobility (resulting in high network dynamics), high error probability, and 3-dimensional space.

2.6. DBF: Depth-Based Routing for Underwater Sensor Networks

Providing scalable and efficient routing services in underwater sensor networks (UWSNs) is very challenging due to the unique characteristics of UWSNs. Firstly, UWSNs often employ acoustic channels for communications because radio signals do not work well in water. Compared with radio-frequency channels, acoustic channels feature much lower bandwidths and several orders of magnitudes longer propagation delays.

Secondly, UWSNs usually have very dynamic topology as sensors move passively with water currents described by Yan et.al (2008). Some routing protocols have been proposed to address the challenging problem in UWSNs. However, most of them assume that the full-dimensional location information of all sensor nodes in a network is known in prior through a localization process, which is yet another challenging issue to be solved in UWSNs. A DepthBased Routing (DBR) protocol is introduced by Yan et.al (2008). DBR does not require full- dimensional location information of sensor nodes. Instead, it needs only local depth information, which can be easily obtained with an inexpensive depth sensor that can be equipped in every underwater sensor node. A key advantage of our protocol is that it can handle network dynamics efficiently without the assistance of a localization service

2.7 Distributed Routing Algorithms for Underwater Acoustic Sensor Network

Here, the data gathering issue is explored by conceiving the communications among the routing functions and the characteristics of the underwater acoustic channel. Two distributed geographical routing algorithms for delay-insensitive and delay-sensitive applications were suggested and explained with the help of simulation experiments to fulfill the application requirements.This problem is resolved by letting a sender transmit a train of short packets back-to-back without releasing the channel. Specifically, the proposed routing algorithms allow each node to jointly select its best next hop, the optimal transmit power, and the forward error correction (FEC) rate for every packet, with the aim of reducing the energy consumption, while considering the condition of the underwater channel and the application requirements into account. Note that, while the proposed solutions are tailored for static networks and do not account for mobility issues, their distributed nature helps in case of mobility.

2.8 Energy-Efficient Routing Schemes for Underwater Acoustic Networks

Interest in underwater acoustic networks has grown rapidly with the desire to monitor the large portion of the world covered by oceans. Fundamental differences between underwater acoustic propagation and terrestrial radio propagation may call for new criteria for the design of networking protocols. In this paper, we focus on some of these fundamental differences, including attenuation and noise, propagation delays, and the dependence of usable bandwidth and transmit power on distance (which has not been extensively considered before in protocol design studies).

2.9 Performance and Trade-offs of Opportunistic Routing in Underwater Networks

Underwater acoustic channel imposes many challenges into underwater networks communication, such as high bit error, temporary losses of connectivity due to shadow zones, limited bandwidth capacity and communication signal spreading over large areas. Opportunistic routing is a new routing paradigm described by Vieira (2012). It allows more than one node to forward a packet by taking advantage of the broadcast medium and overhearing of the packet transmission.

Investigate the tradeoffs present in opportunistic routing for underwater networks. In one hand opportunistic routing may increase the time it takes to receive a packet, since there is an increase in delay to allow all the nodes that are possible forwards to receive the packet. On the other hand, opportunistic routing can help mitigated underwater challenges, by providing gain in packet reception and channel utilization.

2.10 The WHOI Micro-Modem: An Acoustic Communications and Navigation System for Multiple Platforms

The Micro-Modem is a compact, low-power, underwater acoustic communications and navigation subsystem described by Freitag et.al (2005). It has the capability to perform low-rate frequency- hopping frequency-shift keying (FH-FSK), variable rate phase- coherent keying

(PSK), and two different types of long base line navigation, narrow-band and broadband.

The system can be configured to transmit in four different bands from 3 to 30 kHz, with a larger board required for the lowest frequency. The user interface is based on the NMEA standard, which is a serial port specification. The modem also includes a simple built-in networking capability which supports up to 16 units in a polled or random-access mode and has an acknowledgement capability which supports guaranteed delivery transactions.

3. INITIALIZATION

In this module used to initialize the nodes in network topology. We used network topology and topography for our network animator window (nam window). We have syntax for create nodes in network animator window. Then we can create nodes in two types like random and fixed motions. In random motion we fixed range for X and Y, fixed particular range then the nodes are randomly generate in that range of nam window. In fixed motion we give X and Y dimension position for all nodes then all the nodes are fixed in that particular dimension.

Routing is any cast, geographic and opportunistic protocol that attempts to broadcast a packet from a source node to some sonobuoys. Here, it utilizes the greedy forwarding strategy to improve the packet, at every hop, towards the surface sonobuoys. A recovery mode procedure according to the depth adjustment of the void node is utilized to route the data packet when it totter at a void node. The suggested routing protocol enforces the greedy forwarding strategy by means of the position information of the existing forwarder node, its neighbors, and the known sonobuoys, to define the qualified neighbors to proceed with the forwarding the packet towards some sonobuoys.

Here consider an underwater wireless sensor network sensor equipped aquatic (SEA) swarm architecture, in this architecture, we have a huge mobile underwater sensor nodes at the ocean bottom and sonobuoys, also termed as sinks nodes, at the ocean surface. They move as a group with the water current. Our model consists of a set N= Nn U Ns of nodes with a communication range of rc so that Nn represents the set of sensor nodes, and Ns is the set of sonobuoys.

4.MPSA ALGORITHM PHASE

The sensors are tied with a wire so that the height can be adjusted according to the target. The sensing range size of each sensor may differ due to its heterogeneous sensor type. Base station (BS) is placed, up above the sea level to collect the messages which is transmitted from the sea bed. At a particular time, each sensor could be in one of four modes: active, asleep, malfunctioned, and dead. Only active sensors will work to detect the targets and consume battery power. To save the battery power, sensors that are not active can be turned off. Sensor may be dead due to battery power depletion, or get lost due to external factors. By using different number of sensors and targets we can run the MPHSA algorithm to get various outputs. And the number of iterations can also be extended until we get better solution to detect the target.

MPSA Algorithm

1. At the τ-th key time survival sensors are updated
2. Initialize the parent harmony memory HM.
3. Divide HM into sub-HM (sub-HM1, sub-HM2, sub- HMδ)
4. Initialize the current iteration number as 1(ie., η=1,2,….,n)
5. if rand(0, 1) < HMCR then
6. Choose two harmonies xnew1 and xnew2 from sub-HMi
7. if rand(0, 1) < PAR(η) then
8. Make a uniform crossover operator on xnew1 and
9. End if
10. Let xnew be the one of xnew1 and xnew2 with a xnew2, and replace the resultant value in te place of collisions and synchronization. Additionally, after a node broadcasts a beacon,
it forms a new timeout for the next beaconing.
xnew1 and xnew2.
11. else
12. Randomly generate a feasible harmony as xnew
13. end if
14. If xnew is better than worst harmony in sub-HMi, xnew replaces it
15. end for
16. η = η + 1
17. end while
18. Decode the best harmony among all sub-HMi's
19. If number of covers is non zero, randomly choose one of the covers as the output, otherwise output is zero i.e., no solution.

5. SLEEP-WAKE MANAGEMENT

Sensors that are active or asleep are called as better fitness value surviving sensors and sensors that are malfunctioned or deadlines

Sensor nodes are aware of their own positions. The position information may be based on a global or a local geographic coordinate system defined according to the deployment area. Determining the position of the nodes might be achieved using a satellite based positioning system such as global positioning system (GPS) or one of the energy-efficient localization methods proposed specifically for MANETs.

Every sensor node should be aware of the position of its neighbors. This information enables greedy geographic routing and can be obtained by a simple neighbor discovery protocol. The coordinates of a network center point has to be commonly known by all sensor nodes. The network center does not have to be exact and can be loaded into the sensors' memories before deployment. The ring structure encapsulates the network center at all times, which allows access to the ring by regular nodes and the sink.

Similarly, every sensor node embeds a sequence number, its unique ID and X, Y, and Z position information. Furthermore, the beacon message of every sensor node is augmented with the information of its known sonobuoys from its set Si(t). Every node adds the sequence number, ID, and the X, Y location of its known sonobuoys. The target of the neighboring nodes is to have the location information of the all reachable sonobuoys. GPS cannot be used by underwater sensor nodes to determine their locations given that the high frequency signal is rapidly absorbed and cannot attain the nodes even localized at several meters below the surface. Hence, every sensor node knows its location with the of localization services, such as.

which isn't distributed in the predecessor round. Whenever a node obtains a new beacon message, if it has come from a sonobuoy, the node updates the respective entry in the acquire the knowledge of the sonobuoy set Si(t).

Else, it updates its known sonobuoys Si set in the corresponding entries if the information location available in the beacon message is more recent when compared with the location information in its set Si.

For every updated entry, the node modifies the appropriate flag L to zero, representing that this information wasn't reproduced to its neighbors. Hence, in the next beacon message, only the entries in Si (t) in which the L is equal to zero are embedded. We now include the random jitters which range from 0 and 1 at the time of transmission of beacon messages, to reduce the chance of both are called to fail. Sensor modes vary, based upon the active sensors vary at each and every time. So, in this work propose a method to decide a sleep schedule at each and every key time. The 1st key time is the initial time, at which each sensor is works with the initial battery power. Here the sleep schedule is initialized. During the 1st key if some targets are not covered mean the 2nd key time is started. At the 2nd key time, the sensors information is updated and sleep schedule is followed to cover all targets. Similarly, the 3rd key time, 4th key time and so on can be followed. And, a sleep schedule is followed at each key time until survival sensors cannot cover all targets.

After calculating the forwarding set, the existing forwarder node adds the address of the next-hop forwarder nodes in the packet and then transmits it. Every, node that has correctly acquired the packet, checks if it is a next-hop forwarder and then forms the timer to transmit it , based on its priority. The higher the priority of the node has less waiting time. The packet will be removed by the nodes that are not listed as the next-hop forwarder.

In opportunistic routing, the greatest priority node becomes a next-hop forwarder and the remaining lower priority nodes broadcast the packet only if the greatest priority node fails to do so. The lower priority nodes conceal their transmissions after listening to the data packet transmission of the next-hop forwarder. We can calculate the performance of our proposed protocol against the simple geographic and opportunistic routing protocol without recovery mode and the two other famous previously proposed routing protocols for UWSN.

6. CONCLUSION

Underwater wireless sensor networks have been disclosed as a hopeful knowledge to observe and discover the oceans in lieu of customary submarine cable link gadgets. Nevertheless, the information collecting of UWSNs is still strictly imperfect because of the audile frequency communiqué individualities. And, sensors power proficient and life stage growth is the leading difficult, physically cannot revitalize the battery by going bottomless into the sea or ocean. Study vigorous system prototypical for identifying the target. To recover the energy, communication and life time of Underwater Acoustic Sensor Network (UASN) established a Empirical Exploration System (Multi-population Synchronization Assessment Scheme) and Dynamic Routing Technique for energetically indicate to sleep or active a given set of sensors in order to refuge the specified set of goals. First, this effort reflects a dynamic problematic. Second, locations of some sensors are not static the planned process can dynamically apply the updated locations to make a new sleep schedule. Our simulation results were carried out in an NS-2–based underwater simulator, and the evaluated results reveal that the proposed protocol performs better in terms of average packet delivery ratio, average end-to-end delay, average energy consumption, and average network lifetime when compared with existing protocols.

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