Intend Adaptive Algorithms for Time Critical Applications in Underwater Wireless Sensor Auditory and Multipath Network

Syed Mohtashim Mian[1] Dr. Rajeev Kumar[2]
[1,2]Department of Computer Science
[1]Shri Venkateshwara University Amroha, India [2]Teerthanker Mahaveer University Moradabad, India

Abstract— Underwater wireless sensor network are those network which is self-powered sensor nodes and autonomous vehicles are deployed in oceans, because seventy percent of the earth is covered by oceans, and there are many natural disaster occur in the earth like earthquakes, tsunami, etc. So these type of disastrous protection the sensor are deploy for early warning generation system and performing collaborative task by using acoustic links. Underwater wireless sensor network is also helping for ocean mapping, oil and mineral exploration and assisted navigation & tracking. By developing an intent adaptive algorithms for time critical applications in underwater wireless sensor auditory and multipath network is a difficult task due to high propagation delay, low bandwidth (Data transmission rate), limited battery power of nodes and the charging of batteries or replacement is difficult job. So we are facing these type of so many problems, we design an intent adaptive algorithms which take less time in underwater for receiving the data or information and to send the sink node.

Keywords: Multipath Power-Control Transmission (MPT), Underwater Wireless Sensor Network (UWSNs), Cross Layer-Energy, Optimization, Large Propagation Delay, Decentralized Algorithms

I. INTRODUCTION

Our Earth is called a blue planet cause 71% of earth surface is covered by water, besides the ocean containing about 96.5% of the world's water, Therefore in new era we have a sensor technology called underwater wireless sensor network which help us to learn more about our oceans with the help of Autonomous Underwater Vehicles (AUVs) & Remotely Operated Underwater Vehicles (ROVs) which deployed underwater and it performing collaborative task using acoustic link to find applications in exploration of natural underwater resources and gathering of scientific data in collaborative monitoring mission. However, the radio frequencies propagate underwater at extremely low frequencies (30Hz-300Hz) and it required large antennae or high transmission power. Optical frequency do not suffer much attenuation but are affected by scattering, so acoustic waves are the best signal solution for communication in underwater.

In short, underwater acoustic channel have long propagation delay and high error probability. In such tough network scenarios, in time critical applications is a challenge to transfer authentic data which is energy efficient. For time critical application, it creates an ample amount of delay if even one time retransmission upon failure takes place. So in order to go through less or no delay requirement, retransmission is to be avoided. On the other side, with less or no retransmission we generally improve the transmission power of nodes to decrease end-to-end packet error rate so that we can meet communication reliability, as frequently leads to a large amount of energy consumption which degrades the energy efficiency of network.

WSN and UWSN are not same because of its application scenario. WSNs mechanisms cannot directly applied to all aspect of UWSNs as water holds several unique characteristics. The dissimilarity created because of dissimilar plebeian issue. Some of the major differences are as follows:

- The method of Communication: Radio waves are used by WSNs whereas acoustic signals are used in UWSNs.
- Price: One of the criteria of the WSNs is the devices should be cheap. On the other hand the devices utilized in UWSNs is costly, it is to deal with the hardware protection from the water and complex transceiver.
- Energy: In order to deal with the propagation and acoustic signal the UWSNs devices consumed more energy. RF signal used in WSNs so it consumed less energy.
- Storage devices: As there a big possibility of losing the data because of the propagation and acoustic signal to the UWSNs devices need to have bigger memory to acquire more data and prevent the loss of data.
- Density: In typical WSNs application it is possible to deploy the node with high density without causing problem and cost. Whereas UWSNs are costly so dense deployment will cost a lot and not easy to deploy.

A. Two Dimensional Underwater Sensor Network:

In 2D UWSNs all the nodes connected to the ocean floor. The underwater sink collects the data from the sensor nodes by horizontal transceiver and then send the information to a surface station by the vertical transceiver. However, the RF signal is used to communicate the surface station to onshore and surface sinks.

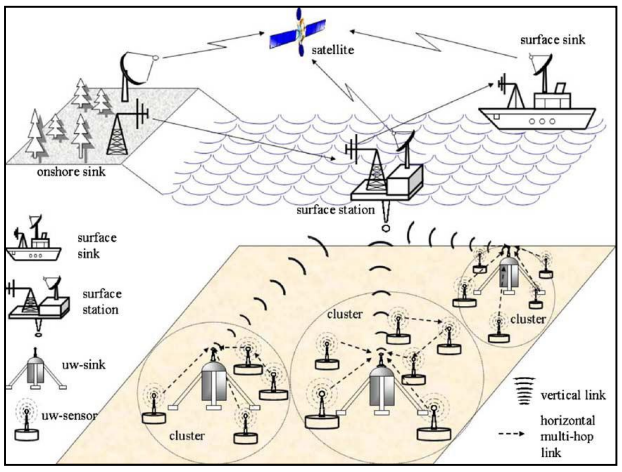

Fig. 1: Architecture of 2D UWSNs

B. Three Dimensional Underwater Sensor Network:

In 3D UWSNs all the nodes are connected to a buoy by a cable which can transmit data between each other. Apart from

this by using RF the collected data is transmitted to the central station. For data harvesting Autonomous Underwater Vehicles (AUVs) play a vital role. AUVs contain more energy and it considered as super node.

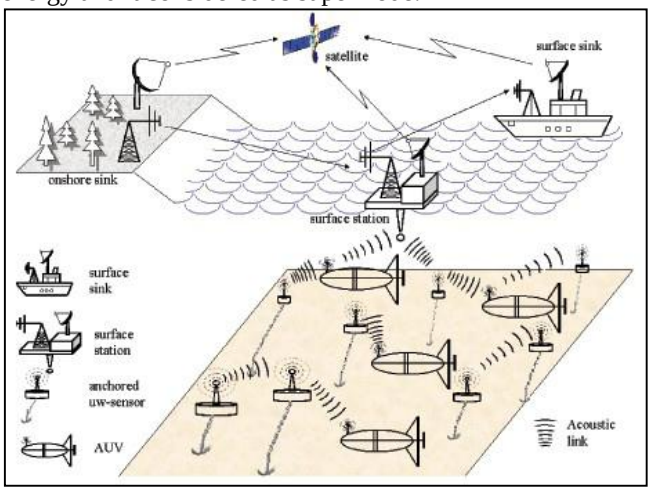

Fig. 2: Architecture of 3D UWSNs

UWSNs facing many challenges are as follow:-

- Limited battery power and bandwidth.
- Propagation delay, multipath and fading problems.
- High attenuation and bit error rate.
- Frequent failures to sensors.

Applications of UWSNs are:-

- Ocean Mapping
- Oil and Mineral exploration
- Disaster prevention like earthquake and tsunami
- Assisted navigation & tracking

II. Related Work

In this section, we review some well-known routing protocol proposed for UWSNs.

Depth based routing protocol (DBR) [1] is used to consider the depth information of each sensor nodes and its localized for free routing protocol. In DBR the sensor nodes know their depth.

Interference Aware EEDBR [2] If the congestion in a region the sensor nodes select their region and forward the node which has minimum neighbor less energy consumption and leads with proper network lifetime.

Improved Adoptive Mobility of Courier nodes in Threshold-optimized Depth based routing (IAMCTD) [3] is a routing protocol which contain three different forwarding functions that are used in different regions and that regions are separated to their depth.

- Signal Quality Index (SQI) – It is used in lowest depth region.
- Energy Cost Function (ECF) – It is used in mid region.
- Depth Dependent Function (DDF) – It is used in the highest depth region.

Focused Beam Routing (FBR) [4] is a technique in which different energy levels are used to forwarding the data packet and a RTS packet which has nearest to a destination. Data packet is transmitted to the relay node, if the CTS received to closer to a sink. High transmission power level is used to find suitable relay node if there no CTS received. The major disadvantages FBR is used to RTS or CTS causes excessive power consumption and largest delay.

Multi-hop cooperative transmission protocol [5] is also used to transmission of data packets from cooperative node. By developing the optimization model help to find the least number of cooperative nodes.

In [6] Effective relay selection for underwater cooperative acoustic network. In this phase the instantaneous channel is less needed as compared to the statistical information.

Distributed cooperative transmission [7] for UWSN. To improve the energy consumption and packet acceptance ratio with in cooperative manner. Also, distance from the sink and link quality which is used signal to noise ratio is considered in relay node.

Energy Efficient Depth Based Routing protocol (EEDBR) [8] has contains two parts data forwarding and knowledge acquisition. In data forwarding the nodes are used to routing table to send the data packets to that node which has high remaining energy and minimum depth from the sink. In knowledge acquisition the sensor nodes are used to find the neighboring node which has high remaining energy and minimum depth from the sink and store their ID in routing table.

Improved Interference Aware EEDBR [9]. In IiA-EEDBR is also used to improve the network lifetime. It is a technique when the sensing dies in a network the sleep node become active and start sensing the environment.

CODBR (Cooperative Depth Based Routing) [10]. In underwater wireless sensor network the Cooperative Depth Based Routing protocol is used to forward the data and information when the source node selects a neighbor node which has less depth and send the data to two other neighbor nodes.

Balanced Transmission Mechanism [11]. In BTM the data transmission process is divided into two phases first, optimum transmission distance which a node is form of tree that are used to find optimum path for transmission and Secondly, routing algorithm which is used to maintain the energy consumption.

Distance between a sink or a source node [12]

For transmission a data packet to a source node the Fitness factor is used to make a decision [13]

In [14], Balanced energy mechanism for shallow and underwater sensor nodes.

III. Motivation

Underwater Wireless Sensor Network (UWSNs) is becoming rapidly growing interest for every day due to their indispensable role in different applications. Beside this underwater sensor network enable a large range of oceanographic data collection, offshore exploration, pollution monitoring and military surveillance. So this type of application monitoring the communication process is indispensible for collecting the data and information. However, RF is not working in underwater so the acoustic link is used to communicate for monitoring the application.
On the other hand, the major issue in UWSNs is limited battery power because batteries cannot recharge as solar energy also available bandwidth is limited depending on the

frequency, we usually need to increase the transmitted power of every nodes and contain more energy consumption.

IV. LITERATURE SURVEY

Literature survey is a search and evaluation of the current project and also explanation of the complete knowledge in order to analyze the background of the current project and also help us to find out the problems and flaws in the existing system. Literature reviews guide us to solve the problems.
Depth Based Routing protocol (DBR) help the depth information of sensor nodes. DBR is the algorithm which delivers a packet from a source node to sinks that acquire the depth of current node. Advantage of this protocol is that can handle a network dynamics efficiently without the assistance of localization service and also have multiple-sinks.

Enhanced Energy Efficient Depth Based Routing protocol (EEEDBR). In underwater wireless sensor network (UWSNs) an energy efficient routing protocol is a challenging task due to limited battery power. So, EEEDBR is the protocol which performs reactive routing and reduces the number of transmission of sensor nodes and to save energy consumption which increase network life.

Focused Beam Routing (FBR). In FBR, each node knows their own location and the final destination location. Some other routing protocols are as follows which work in different field.

- Directional Flooding Routing (DFR)
- Location Aware Source Routing (LASR)
- Information Carrying Routing Protocol (ICRP)
- Constraint Based Depth Based Routing Protocol (CDBR)
- Mobile Delay Tolerant Approach (DDD)

On the other hand, in UWSNs there are many issues which are unsolved like in location based routing protocol, each transmitted data packet contain location information and it is necessary to focus on the node location privacy. Implementing the existing routing protocol with security mechanism involvement. There are various fields of interest with increasing need for security in UWSNs, like in military applications.

V. METHODOLOGY

UWSNs using many routing protocol for forwarding data from source nodes to a sinks it is a very challenging task. So, we consider the multi sink underwater sensor network model where the nodes with acoustic modems are densely distributed in 3D space. 3D aqueous space are those where the sensor node are deploy the ocean bottom to the ocean surface and it create a column, through deployment the sensor node they have to maintain their position inside the ocean column because the different type of waves hit the nodes and the nodes is moving from one point to another. However, multiple gateway nodes with acoustic and RF modem are strategically deployed to the water surface.

Underwater sensor node has collect the data and information and to transfer it toward one or more surface gateway nodes with the help of acoustic links and the surface gateway nodes received data to the control with the help of radio links.

In addition, radio communication consumes less energy than acoustic communication and sink nodes (gateway node) are usually more powerful and have more energy supplies.

VI. CONCLUSION

In this paper, a review of Underwater Wireless Sensor Network and its applications where its work. There are so many challenges are still facing like limited battery power, limited bandwidth, propagation delays, multipath and fading, high attenuation and high bit error rate. So, the routing protocols trying to solve these challenges in UWSNs and also some security challenges. Related research studies are in progress and we expect to see more research on this topic.

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