Energy Efficiency in Vector based forwarding protocol in Underwater Sensor Network

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***Abstract*— Underwater sensor networks (UWSN) resemble terrestrial sensor networks in many aspects. However, the high propagation delay and limited bandwidth make terrestrial sensor network's protocols unsuitable for UWSN. Underwater sensor node are powered by batteries which are even difficult to recharge. So, energy efficiency is major concern for underwater routing. In this paper ,based on VBF, we provide a new routing protocol, efficient VBF. In this paper we discuss the some fundamental about underwater sensor network, issue relating to routing, related work, our proposed protocol and result analysis and conclusion.**

***Keywords*— acoustic sensor network; vector; depth; routing**

I. INTRODUCTION

Earth is largely covered by water. This is largely unexplored area and recently humans are showing interest towards exploring it Underwater Acoustic Sensor Networks (UW-ASN) consist of a variable number of sensors that are deployed to perform the monitoring tasks over a given area. Many disasters that took place in recent past made humans to greatly monitor the oceanic environments for scientific, environmental, military needs etc., in order to perform these monitoring task industries are showing interest towards deploying sensor nodes under water[1].

TWSNs operate in an environment dominated by RF communication. Yet, RF communication is not an optimal communication channel for underwater applications because of the extremely limited RF wave's propagation underwater. Conductive sea water only at extra low frequencies (30 ¡ 300 *Hz*), which require large antennae and high transmission power. Thus, links in underwater networks are based on *acoustic wireless communications a*coustic communications are the typical [2].

PROBLEM WITH ROUTING IN UNDERWATER SENSOR NETWORK

There are many problem with routing in underwater sensor network[3]. Those problems are:

A. Harsh deployment environment is the major challenging factor which comes under routing protocol for underwater sensor network.

B. Bandwidth capacity is low because routing protocol for underwater sensor network comes from high bit error rates.

C. Another problem related to low energy problem. For each battery energy is require.

E. Radio single are not efficient compare to routing protocol for underwater sensor network. Because it provides high propagation delays.

F. High propagation delays are the major factor of routing protocol for underwater sensor network.

II. RELATED WORK

There are many routing protocol in underwater sensor network.

There are four family of routing protocol in underwater sensor network [4]. Those are:

- Flooding based routing family
- Multipath based routing family
- Cluster based routing family
- Miscellaneous based routing family

In Flooding based routing protocol, the source node broadcast the packet to all other node within its range. So, due to broadcasting, duplicate packet will transmitted and high energy consumption will result.

In multipath based routing protocol, more than one path from source node to destination node are established. So, packet delivery ratio can improve to transmit the multiple paths simultaneously.

In cluster based routing protocol, In the cluster based approach, the sensor nodes are grouped together into clusters. In this type of approach, the sensor nodes are divided into two types: cluster-head nodes and cluster member nodes. The cluster-head is a node which is responsible for the collection of the data packets from its cluster members. The cluster member nodes sense the data and transmit the data packets to their corresponding cluster heads.

In Miscellaneous based protocols includes Adaptive, ICRP, phero-trail etc.

The Vector Based Routing protocol is based on flooding based protocol. In VBF dose not require full dimension of location information of sensor nodes. In VBF depth will obtain by the depth sensor which are attaching to the ordinary sensor nodes. The key idea of VBF is when a node receive the packet, it forward the packet when its depth is smaller than embedded in the packet. Otherwise it drops the packet. [5]

The protocol operation can be summarized as follows. Upon the reception of a packet, a node verifies itself as a qualified forwarder based on the depth difference with the sender of the packet. If a node is a qualified forwarder the node computes the *holding time* and inserts the packet into *priority queue Q1*, otherwise the packet is dropped. In case the node is a qualified forwarder, the packet is transmitted upon the expiry of the *holding time* and the information about the transmitted packet is recorded in *packet history buffer Q2*. In order to suppress the transmission of the duplicate packets, a node always checks *packet history buffer Q2* before transmitting a packet. Due to the flooding based approach, VBF will generate the duplicate packet, therefore based on the VBF we proposed new protocol, efficient VBF.

III. EFFICIENT VBF PROTOCOL

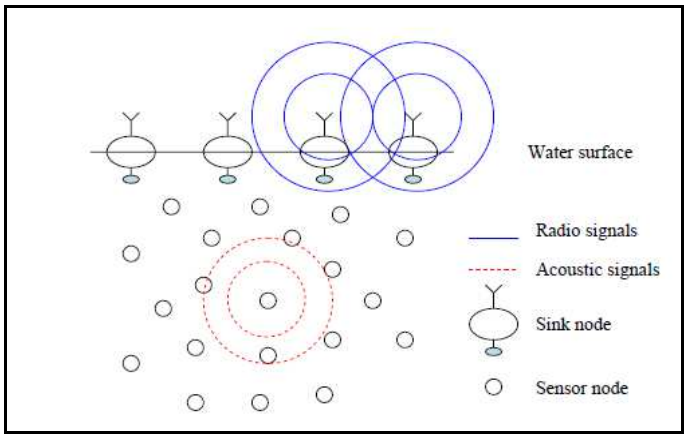

Fig.1 Structure of VBF

Underwater acoustic sensor network structure is shown in the figure 1.There are two kind of nodes, ordinary sensor nodes and sink node. Sink nodes are deployed on water surface which have two communication module, acoustic communication module and RF communication module. The ordinary sensor node are in water which have only one communication module, acoustic communication module. They collect the data and pass to its neighbour nodes. They collect the data and pass to its neighbour too.

A. PACKET TRANSMISSION PROCESS IN EFFICIENT VBF

There are several steps of transmission process in efficient VBF

Step 1: Source node broadcast the request packet with its vector and wait the T amount of time. T depends on propagation delay and sensing range.

Show in figure 2, the source node S broadcast the request packet with its depth within its range. Node n1, n2, and n3 receive the packet. Here node n3 is bellow the source node so its simply drop the packet.

Step 2: Node n1 and n2 check the two conditions, d1>ds or
d1<ds. Same way d2>ds or d2<ds.If d1>ds and d2>ds then simply discard the packet. Otherwise n1 and n2 send the reply packet to the source node with its depth and node ID.

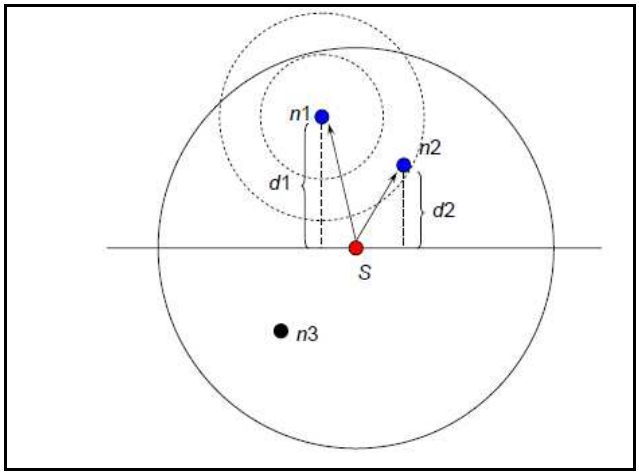

Fig.2 Example of transmission process in efficient DBR

Step 3: Source node store the reply packet in the buffer.

Step 4: After T amount of time the source node check the buffer and find the minimum depth node. Here n1 has minimum depth

Step 5: Source node directly send the packet to node n1.

IV. SIMULATION SETTING

In this paper simulation are performed using NS2 with aqua-sim. From energy consumption and delivery ratio to analyze the efficient in underwater sensor network. Packet ratio means ratio of number of packet received by receiver and number of packet generated by sender. Energy consumption is total energy consumption by entire process. In our simulation each node has a same communication range 120m. All ordinary nodes are follow a random mobility pattern but depth is fixed.

A. Implementation

As we have proposed a scheme for implementing modified VBF protocol which shows required output that is identification of dense network, final node localization, node mobility, routing in static table and etc. Now here we have come up with these new protocols and also we have tried to get some results. On the basis of these results, we made some analysis which helped us for directing us in positive direction.

B. Output of DATA file

```
the file name is vbf_Modified.data
the sending interval is 10.0
Node 1 is sending first!!
starting Simulation...
NS EXISTING...
num_nodes is set 100
GOD: the old file name istest.data
```

```
GOD: the new file name isvbf_example_16.data
UWSink (id:0): I get the packet data no.0 from 58
UWSink (id:0): I get the packet data no.4 from 58
SK 0: Num_Recv 2, InterArrival 40.347775
UWSink (id:0): I get the packet data no.5 from 58
SK 0: Num_Recv 3, InterArrival 9.740300
UWSink (id:0): I get the packet data no.6 from 58
SK 0: Num_Recv 4, InterArrival 11.676222
SINK 1 : terminates (send 10, recv 0, cum_delay 0.000000)
SINK 0 : terminates (send 0, recv 4, cum_delay 30.401254)
SINK(0) : send_id = 1, num_recv = 4
god: the energy consumped is 116.848914
```

This made us to make a comparative analysis in the form of graph with other parameters VBF verses Node in both VBF and Modified VBF and results. This comparison is as given below.

Table1:- showing improvements in modified VBF protocol

Parameters	**VBF**	**M-VBF**
Layered		**Y**
Sparse		**Y**
Full Localization	**Y**	**Y**
Depth		**Y**
Local info		**Y**
Sink localization		**Y**
Geographic location	**Y**	**Y**

V. RESULT AND ANALYSIS

The result analysis of efficient VBF is below:

Fig. 3 shows the energy consumption of both protocols. we have taken the 20, 40, 80, 60 and 100 numbers of nodes. When number of node increase, the energy consumption will increase because the more number of packets will take the participate into forwarding the packet. In above graph we have seen that our proposed protocol is energy efficient than existing Vector Based Routing protocol.

Fig. 4 shows the packet delivery ratio of both protocol. We have taken the 0, 1, 2, 3 and 4 numbers of sink nodes. When number of sink node increase, the packet delivery ratio will increase because the more number of packets will receive by the sink node. In above graph we have seen that our proposed protocol has higher packet delivery ratio than existing Vector Based Routing protocol.

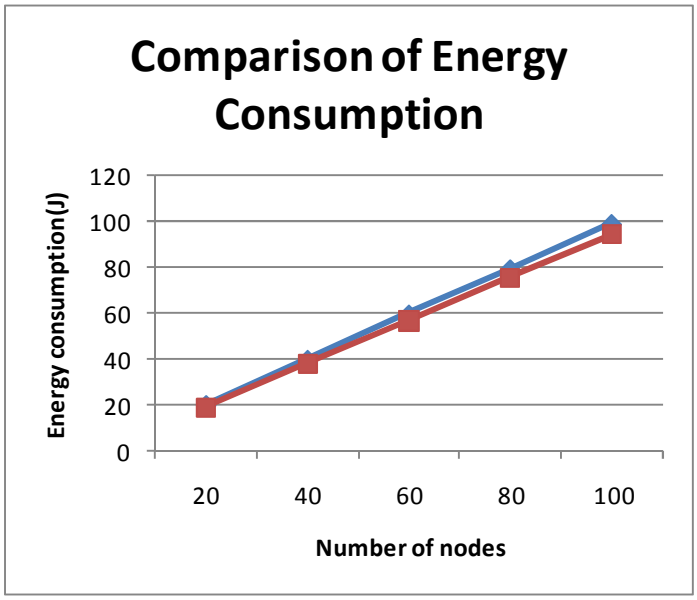

Fig.3 Comparison of Energy consumption

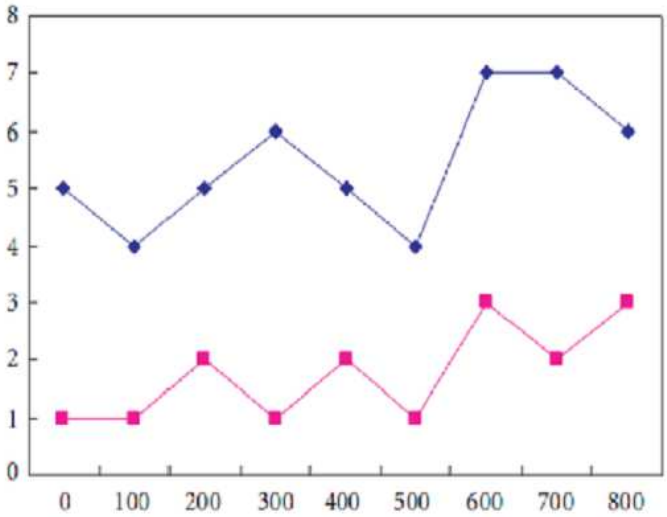

Fig.4 Comparison ratio of VBF and New VBF Energy

VI. CONCLUSION

In this paper, we present the efficient VBF protocol. It only needs the vector information of the nodes. Simulation results show that, it improves the much of distance based and energy efficiency.

References

[1] "A Survey on Underwater Sensor Network Architecture" by Rakesh V S, Srimathi C. In International Journal of Computer Science & Engineering Technology.

[2] "Challenges for Efficient Communication in Underwater Acoustic Sensor Networks" by Ian F. Akyildiz, Dario Pompili, Tommaso Melodia of Georgia Institute of Technology-2005.

[3] "Survey on Routing Protocol in Underwater wireless sensor network" by Aman Sharma Abdul Gaffar.H in Aman Sharma et al, International Journal of Computer Science & Communication Networks.

[4] "Analyzing Routing Protocols for Underwater Wireless Sensor Networks" by Abdul Wahid, Kim Dongkyun in International Journal of Communication Networks and Information Security (IJCNIS), December 2010.

[5] "DBR: Depth Based Routing in underwater sensor network" by Hai Yan, Zhijie Jerry Shi, and Jun-Hong Cui 2008.

[6] "Aqua-Sim: An NS-2 based simulator for underwater sensor networks", Peng Xie, Zhong Zhou, Hai Yan, Tiansi Hu, Jun-Hong Cui, Zhijie Shi, Yunsi Fei, Shengli Zhou, university of Connecticut,storrs-2009.

[7] NSby Example, http://nile.wpi.edu/NS/overview.html

[8] "FBR:Focus Beam Routing protocol in underwater sensor network" by Josep Miquel Jornet, Milica Stojanovic, Michele Zorzi in September 15, 2008

[9] "Hop-by-Hop Dynamic Addressing Based (H2-DAB) Routing Protocol for Underwater Wireless Sensor Networks" by Muhammad Ayaz, Azween Abdullah in 2009 International Conference on Information and Multimedia Technology.

[10] "A Localization Scheme for Underwater Wireless Sensor Networks", Kai Chen, Yi Zhou, Jianhua He, International Journal of Advanced Science and Technology, Vol. 4, March, 2009

