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Comprehensive Observation of Different Underwater Sensor Network Protocols

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ABSTRACT

Wireless Sensor Network (WSN) in serous channel also known as Underwater Acoustic Sensor Network (UASN) is noteworthy owing to its encircling environment. This domain of research is draw the concern of many investigators and has enabled a immense range of applications including assembling of information, assisted observing, mine inspection, observation of equipment, catastrophe prohibition, under sea scrutiny and surrounding observation [6]. In this paper we implement the differential routing protocols like Vector Based Forwarding, VBVF and DBR in an underwater architecture. The comparison among protocols is based on the simulation results, i.e Energy Consumption, Average Throughput, Residual Energy, Average End to End Delay and Packet Delivery Ratio are analyzed. Aqua-Sim, an NS2 based underwater simulator is used for carrying out the simulations and the evaluation results confirm that DBR can achieve better performance than other discussed protocols.

Keywords-UWSN; VBF;VBVA;DBR; AquaSim; Ns2

I. INTRODUCTION

The requirement of tracking environment in Deep Ocean is common during these days and this can be possible through communication using the sensor nodes in underwater environment. Acoustic waves are used for underwater communication which is time consuming than radio frequency. Propagation delay and slow data delivery are some problems which are faced by acoustic waves so there is in demand of investigation for best protocol to these problems. An impressive routing protocol and also a good communication system are needed to assure maximum efficiency. Packet transmission from source node to sink node is one of the primary obstacle that should be studious and further exploration can be done using some particular protocols like VBF, VBVA and DBR.

In this composition we initially convey introduction of routing protocols for UWSNs in section I. In section II we discuss some routing protocols for UWSNs. Section III focus on geographic protocols and section IV gives the detail of Land based protocols i.e DBR. Simulation metrics which measure the performance of network are discussed in Section V. Section VI describes the conclusion and future scope.

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II. ROUTING PROTOCOLS FOR UWSNs

There are many routing protocols that are utilized as a part of transmitting the information among nodes in underwater wireless sensor networks. Some of them are talked about as underneath:

- Location-based routing protocols
- Flat-based routing protocols

1.1 **Location based routing protocols**

Location based routing protocols are additionally called land directing conventions. Location based routing protocols can be utilized as a part of systems where sensors can decide their positions utilizing an assortment of localization algorithms. Normally in location based routing protocols, information is sent straightforwardly to a solitary sink node. Thusly, a sender sensor hub must know about its own particular area and the area of the sink node.

VBF and VBVA are examples of geographic routing protocols.

1.2 **Flat-based routing protocols**

In flat based routing protocols all sensor nodes have measure up to functionalities or parts. In flat based routing protocols are additionally called location free routing protocols. Normally in flat based routing protocols, every sensor node in the system does not require its own particular full dimensional area data.

The principle contrast between Geographic-based routing protocols and **Flat-based routing protocol i.e** DBR is that full-dimensional area data is not vital in DBR. Rather, just nearby profundity data of every node is necessitating in packet sending

III.LOCATION-BASED ROUTING PROTOCOLS

3.1 **Vector-Based Forwarding (VBF)**

One of the most recommended opportunistic protocols, Vector Based Forwarding Protocol (VBF) [1] utilizes the area information to choose the following forwarder node in the system. The header of the transmitted data packet contains the location information about the source node, destination and forwarder nodes.VBF makes a non existing pipe (vector) from the source to the sink nodes. Every one of the nodes in the pipeline is potential forwarder nodes for the information parcel. Data transmission between source and destination is done through this pipe. The packets that are closer to the line between the source and the destination are most elevated need. The upside of VBF is that it diminishes number of copy retransmissions that happen with broadcasting in opportunistic routing protocol. Nodes that are outside the imaginary pipe essentially dispose of the got data packet. Another significant favorable position with VBF is that being a stateless routing protocol it is effortlessly adaptable to more number of nodes in the system. Be that as it may, when less number of sensor hubs is situated in the virtual pipe, VBF will think that it's hard to locate the next forwarder nodes[3].

Likewise the vitality of nodes in the pipe may get depleted because of successive information transmission.VBF does not have a component to deal with correspondence gap [10] in the system.

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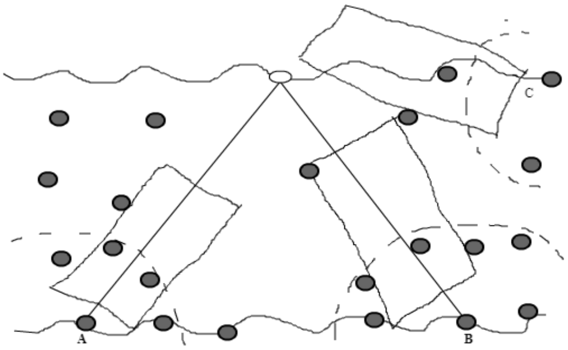

Figure 1 Single routing pipe is used for each source in VBF. The areas within the routing pipes are shown by rectangles. Dotted circles show the transmission area of the three sources.

3.2 Vector-Based Void Avoidance (VBVA)

For observing the gap obstacle in mobile underwater sensor networks, Vector-Based Void Avoidance (VBVA), is proposed which is vector-based perspective. At first, the sending way of unit of data is spoken to by a vector from the source to the sink. VBVA is basically similar to vector-based forwarding (VBF) [2] if there is absenteeism of gaps or voids in the sending way. VBVA supports two strategies i.e vector-shift and back-pressure to deal with the gap if it exists in the sending way. In the vector-shift strategy, VBVA endeavors to direct the packet along the edge of the gap by moving the forwarding vector of the data unit. Vector-shift method can effectively dispatch the packet around the gap if the gap is convex and convey it to the destination. Nonetheless, the vector-shift approach may come up short, if the gap is concave. For this situation, VBVA commute to back-pressure approach to directing the data unit back to some nodes sufficient to do vector-shift. Dependency on the topology information is not required in VBVA as it ignores gaps on desireness and handles the mobile network and mobile gaps proficiently and viably.

IV. OVERVIEW OF DEPTH BASED ROUTING PROTOCOL

DBR make effective use of underwater framework: data sinks are normally arranged at the surface of water.DBR advances units of data avariciously towards the surface of water consequently in light of the profundity data of every sensor. In DBR, a data unit has a field that records the profundity data of its current forwarder and is refreshed at each hop. The fundamental thought of DBR is as per the following. At the point when a node gets a unit of data, it advances the parcel if its profundity is littler than that implanted in the data unit Else, it disposes of the data unit. Clearly, if there are numerous data sinks sent at the surface of water, as in the numerous sink underwater sensor design [4] [5], DBR can normally exploit them. In any of the sinks achieve data units are supposed as effectively conveyed to the ultimate destination since these water-surface sinks can speak with one and all proficiently through radio means, which have significantly higher transfer speeds and much lower spread postponements.

To outline, the principle points of interest of DBR are as per the following.

- Full-dimensional location information does not require for it.
- It can deal with dynamic systems with great vitality effectiveness.

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- It exploits numerous sink arrange designing without presenting additional cost.

We will demonstrate the execution of DBR utilizing broad simulations.

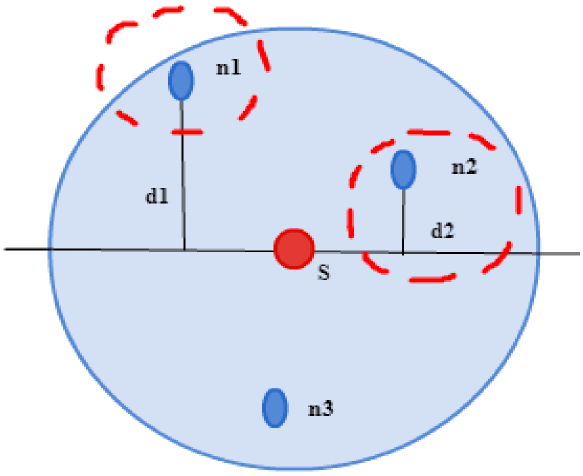

Figure 2 DBR

In [6] a Depth-Based Routing (DBR) protocol every sensor node settles on its own choice on packet sending in light of its profundity and the profundity of the past sender. As appeared in Fig. 2, node S is a sender, and all the neighbor nodes, e.g. n1, n2, and n3, will get its packets. Nonetheless, just n1 and n2 are picked as contender sending nodes since they are nearer to the sink node on the water surface. Moreover, node n1 is favored to forward the packets when contrasted with node n2. The progressing of node n2 is counteracted in the event that it gets the parcel from n1 before its own particular booked sending time for the data unit. DBR can deal with arrange flow productively without requiring full-dimensional regional information of sensor nodes. Be that as it may, if there are many neighbor nodes in the system, it is likely that various nodes forward similar packets and a sensor node may get a similar packet different circumstance, which brings about a high volume of packet crashes and high transmission postponement and energy utilization.

V. PERFORMANCE EVALUATION

In this section, we observe the achievement of all protocols analyzed in this framework.

5.1 Simulation Settings

Aqua-Sim (also called underwater sensor network simulation package) are being used for all simulations with Network Simulator (ns2) [7]).The Ns2 platform is very impressive accessible source and is widely used. It gives proficient and reasonable technique to arrange network and nodes. In our simulation sensor nodes are arbitrarily conveyed in region of 1000 × 10 × 10. Sensor nodes are stationary initially and after some time the sensor nodes move haphazardly in the X-Y-Z plane. Nodes speed is set to 0 to 3 m/s. We utilized following metrics for comparison.

3.1.1Average Throughput: It is the proportion of data unit acquired by the sink node to the entire number of data units sending by source node [8].

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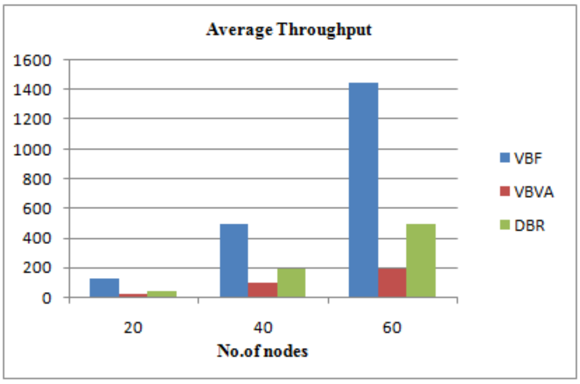

Figure 3 Average Throughput

Fig. 3 demonstrates that VBF achieved the best average throughput; as a result VBF attempts to locate the most limited way from the source node to the sink along the virtual vector between them. Along these lines the deferral in VBF is short-lived than that the VBVA and DBR. In multiple-sink DBR, nonetheless, unit data can be conveyed to any sink, rather than a settled sink as in VBF. It should be noteworthy that system settings are not same for VBF and DBR and have entirely disparate system suppositions. For example, VBF is devised for systems with a single sink. Despite DBR can work in one-sink system, it has preferable achievement in multiple-sink settings.

3.1.2Total Energy Consumption: Exemplify the entire energy dissipation in delivery of data unit, along with dispatching, acquiring, and unused energy depletion of all nodes in the system [9].

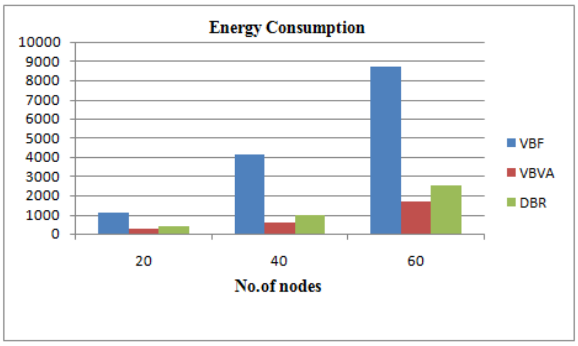

Figure 4 Energy Consumption

Fig. 4 demonstrates that DBR has preferable energy efficiency contrasted with VBF. In all occurrences, the total energy dissipation of DBR is around one fourth that of VBF. This is for the most part because of the repetitive data unit concealment methods received by DBR.

3.1.3Residual Energy**:-**Residual energy is utilized to characterize what remains of something when a large portion of it has gone.

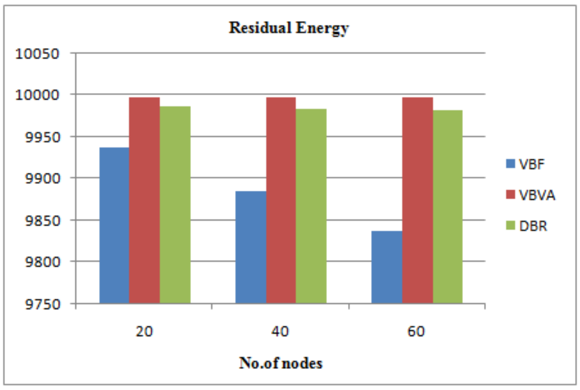

Figure 5 Residual Energy

3.1.4Average End to End Delay:- This can be explicated as amount of delay occurring between dispatching of packet from source node and acquiring a packet at the sink node [10].It constitutes all delays throughout packet retransmission, buffering and route discovery process delays.

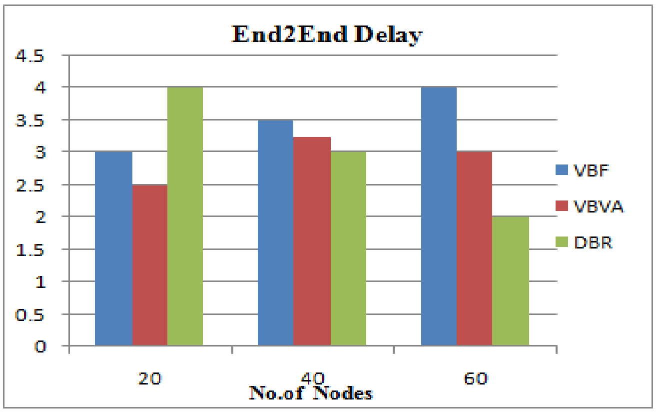

Figure 6 Average E2E Delay

3.1.5Packet Delivery Ratio:-It is the ratio of packet acquired by the destination node to the entire number of packets including drop packets [10]

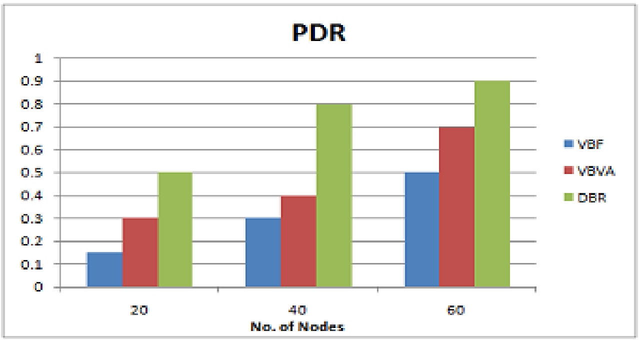

Figure 7 Packet Delivery Ratio

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IV. CONCLUSIONS AND FUTURE WORK

In mentioned framework we looked at three routing protocols in view of average throughput and energy dissipation for underwater sensor networks and in light of the outcomes acquired we locate that average throughput of VBF is more than VBVA and DBR. Since the disadvantage of VBF is conquered by DBR however underwater sensor networks is equipped with reserved source of energy. DBR have high packet delivery ratio than other protocols with minimum energy consumption.To accomplish better energy efficiency this routing protocol ought to be upgraded.

One of the future goals in designing routing algorithms is adding security mechanisms, and other protocols will be discussed and analyzed.

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