Performance Analysis of Grid-Oriented Underwater Wireless Sensor Network by Deploying Constant Bit Rate Application

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***Abstract*— Underwater Wireless Sensor Network, often known as UWSN, is an appealing research zone because of the mysterious aspect of the ocean. A network of sensor nodes and vehicles that work together as part of the UWSN to collect information and carry out activities in collaboration. Because of the sensor nodes and the limited battery capacity, it is essential for UWSN to have an efficient network. The significant delay in propagation, network dynamics, and probability of error all influence underwater communication, making it difficult to exchange or update sensor nodes. This article put up the idea of a Grid-oriented underwater wireless sensor network (GO-UWSN) and carried out an analysis based on the criteria of energy consumption, utilization, average transmission delay, average jitter, average path loss and average E- 2- E delay in various modes.**

Keywords*— *Underwater Wireless Sensor Network, Routing protocols, LAR1, DSR, AODV, OLSR DYMO.

I. INTRODUCTION

Because water covers one third of the surface of the globe, the ocean has a significant impact on human life [1]. Due to the rugged character of the undersea environment, only a tiny section of the sea's influence on the environment state has been investigated [2–4]. Monitoring has become important in recent years due to the discovery of a chemical poison, an underwater natural resource, and oil spillage [5,6]. Underwater sensor nodes form a small-scale cluster based underwater acoustic network (UAN) by accumulating data through the use of point-to-point communication [7-9]. Sensor nodes are typically fastened to presage or GPS systems, or they may be permanently installed on the surface of the water in UANs. Underwater wireless sensor networks, also known as UWSN, are being developed [8]. These networks will have a low price point, few restrictions on their functions, and will be easily implemented. The use of a wireless sensor network, often known as WSN, is an important step in unraveling the enigma of the environments found underwater. Underwater sensor nodes (SNs), also known as SNs [10,12].

The study of unexplored ocean [11] has sparked interest in the internet of underwater things (IoUT), which aims to contribute to the solving of issues in various fields, including the military, the scientific community, the security industry, and more. The amount of energy that is used and the quality of the links that are used to convey data are two major considerations in UWSN [11-14]. The task of SN becomes more difficult and costly as a result of the mobility of the water [13, 14]. Because of the frequent reorganisation of the topology of the network, hop-to-hop communication uses significantly less power than end-to-end transmission [15]. When any node in the network wants to transfer data to another node in the network AODV [14,15] creates a path between the nodes in the network. A route table is kept up to date between the source and the destination.. The architectural diagram of GO-UWSN is as shown in the figure 1.

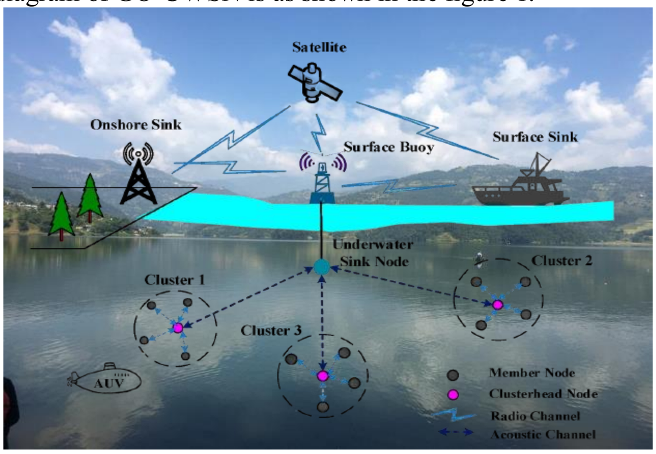

Fig 1. GO-UWSN Architecture

II. NETWORK SCENARIO

In Figure 2 the proposed view of GO – UWSN is shown with 50 nodes consists of 20 users, 15 sensors and 15 ships. Out of 50 nodes 20 nodes were used for CBR for generating the traffic. Figure 3 shows the 3D view of proposed GO-UWSN.

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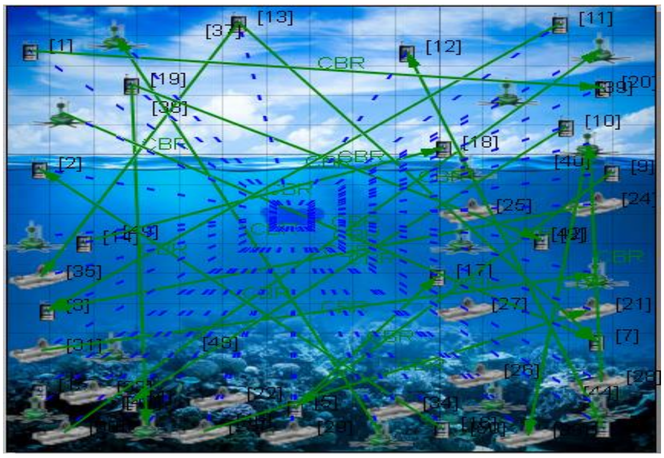

Fig 2. Proposed GO-UWSN

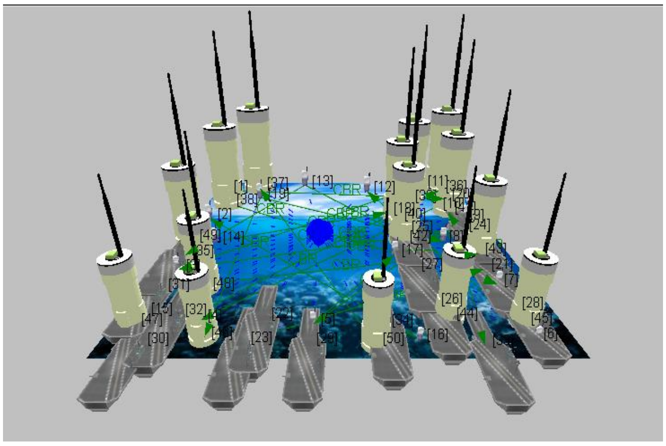

Fig 3. Proposed GO-UWSN 3D view

Parameter	Values
Nodes	50
Channel Model	Underwater Channel
Area of node deployment (meter square)	1500 x 1500
Range(Tx/Rx) of sensor nodes	5m
Routing Protocols	DSR,AODV, DYMO, LAR1,OLSR
Source of Generation	Constant bit rate
CBR number	20
Run time in sec	500
Medium Access Control Protocol	Wireless LANs
RPS voltage	6.5v
Packet size in words	1024
Communication link	Wireless
Wireless channel frequency	1000kHz

Table 1 : Mock –up attributes of the G-UWSN are listed.

In the GB-UWSN paradigm, the sensors nodes (SNs) are spread out in a grid pattern throughout the area 1500m by 1500m to collect sensing data. The wireless LANs physical and MAC layer specifications are utilized in this network, which consists of 50 nodes. In the work that is being suggested, packet size is referred to as item size.

III. SIMULATION RESULTS

In this section, the simulation environment is broken down and discussed. Using the QualNet 7.1 software, a simulation of the proposed GB-UWSN was carried out. In addition to software, simulation requires some kind of physical hardware.. In Table 1, we show the simulation parameter values that were used to simulate the DYMO, DSR, LAR1, OLSR and AODV routing protocols that were suggested for use in the GB-UWSN. In this part of the report, the functionality of the MG-UWSN was evaluated with the use of five different routing protocols: AODV, DSR, DYMO, LAR1 and OLSR.

A. Energy Consumption in Transmit mode

The amount of power expended by nodes in the transmission of data from their point of origin to their point of destination.

B. Utilization

A communication channel's throughput is the percentage of packets that are effectively transferred from the transmitting node to the receiving node.

C. Average Path loss

The term "path loss," also known as "path attenuation," refers to the gradual reduction in power density that any electromagnetic wave experiences as it travels through space.

D. Average Jitter

It refers to the difference in time that occurs between individual packets as a result of changes in route or network congestion. In order for a routing protocol to work more effectively, it should be lower. Congestion on a network, changes in its routing, or timing drift can all contribute to jitter by causing a delay in transmission between individual packets.

The following graphs are the simulation results of proposed GB- UWSN with respect to Energy consumption in three different modes, utilization, Avg. tx. delay, path loss, jitter, E-2-E delay for AODV, DSR, DYMO,LAR1 and OLSR protocols.

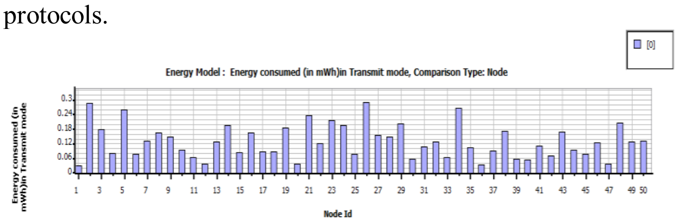

Fig 4.(a)

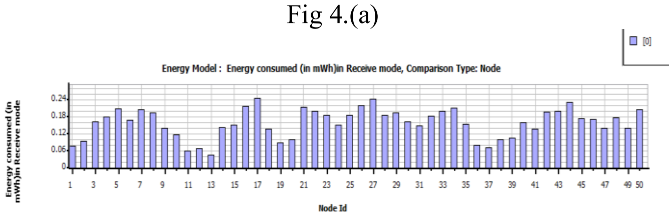

Fig 4.(b)

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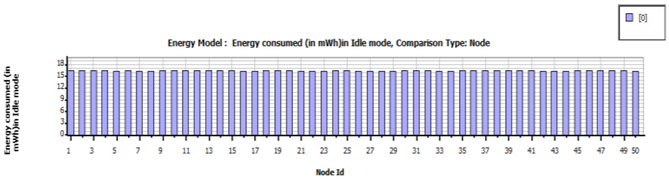

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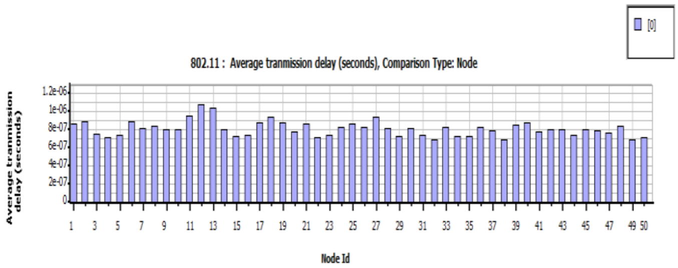

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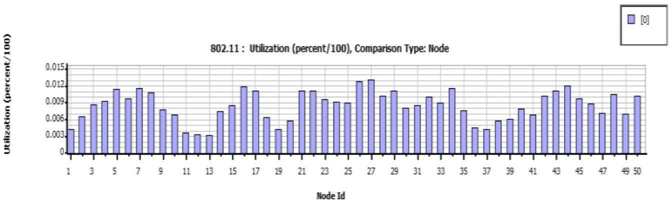

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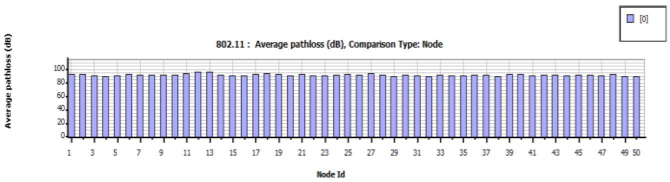

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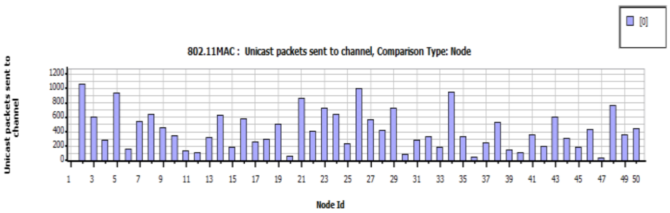

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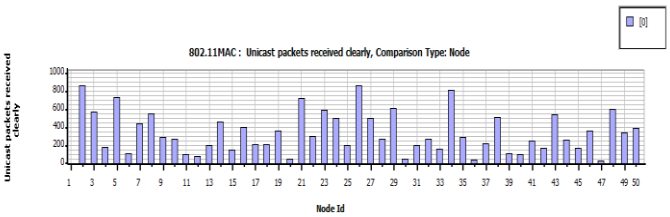

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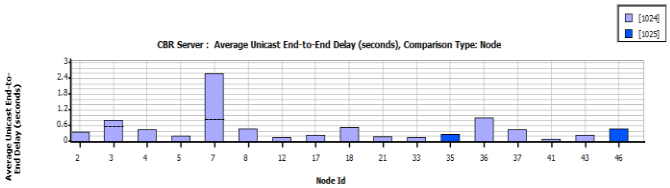

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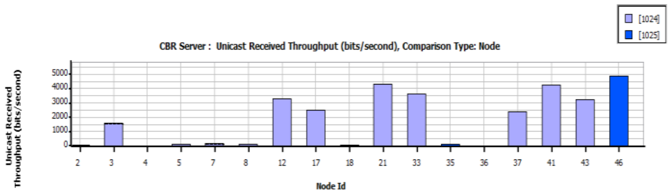

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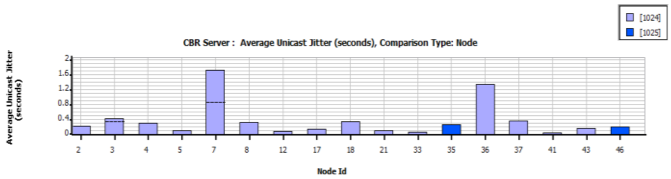

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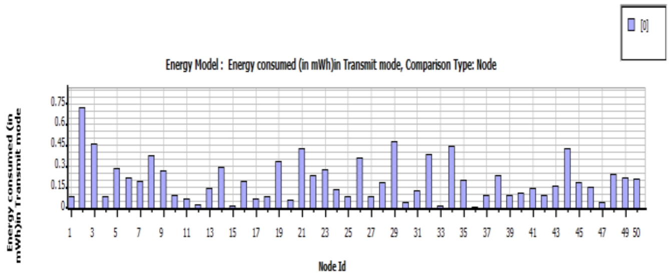

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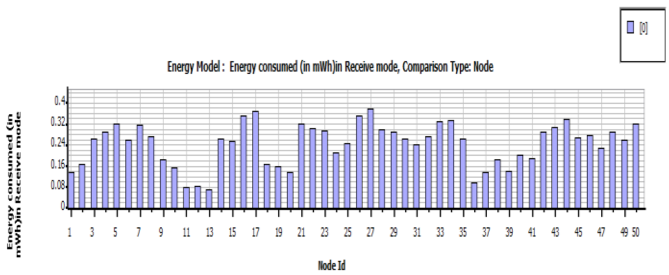

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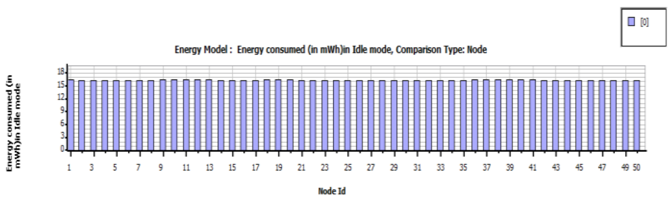

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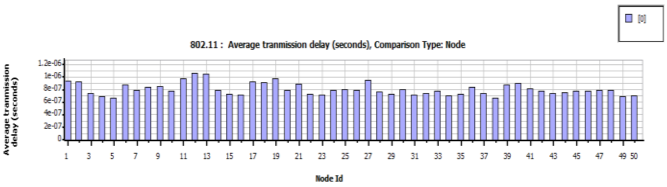

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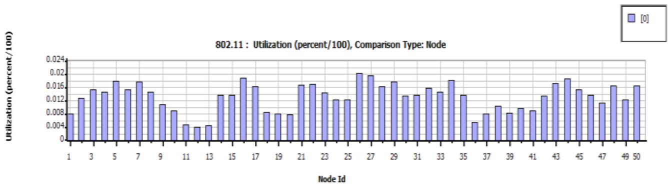

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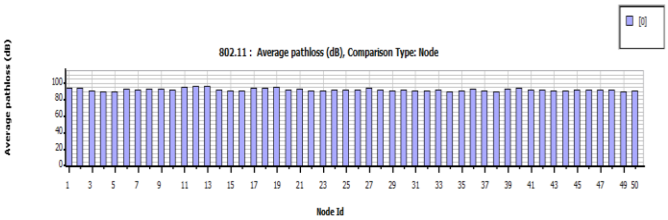

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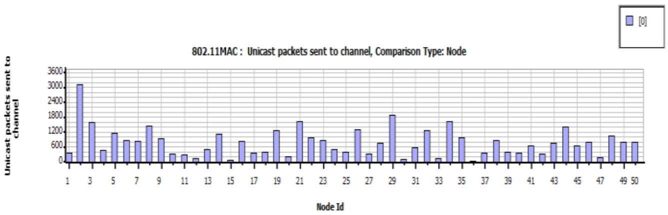

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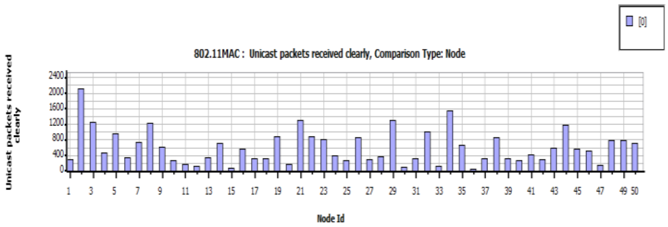

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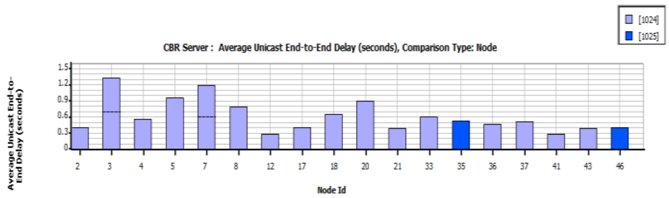

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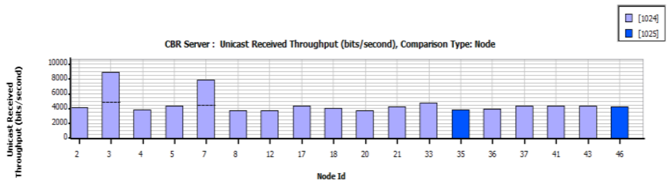

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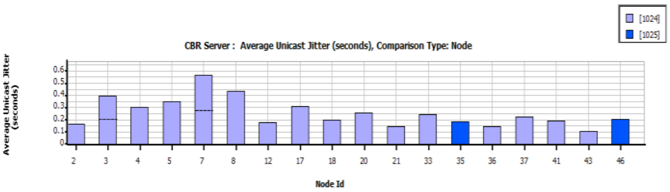

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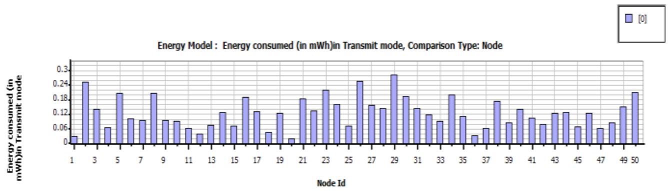

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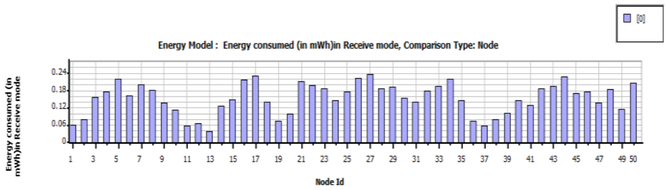

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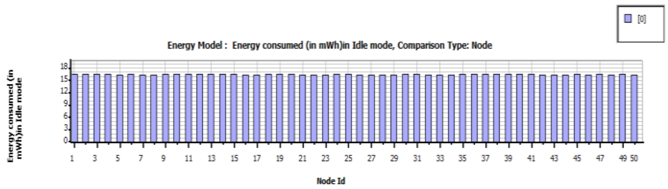

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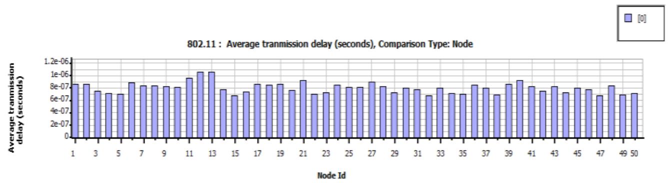

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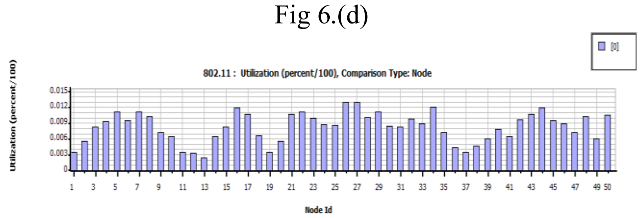

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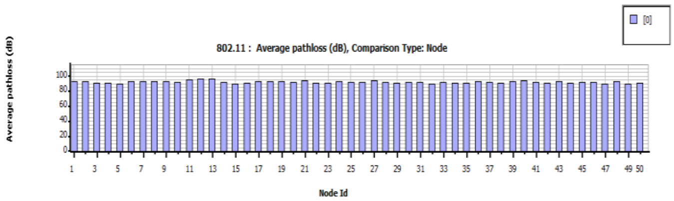

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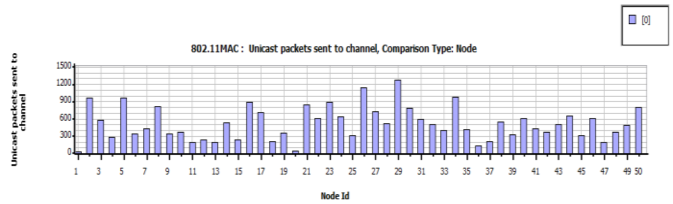

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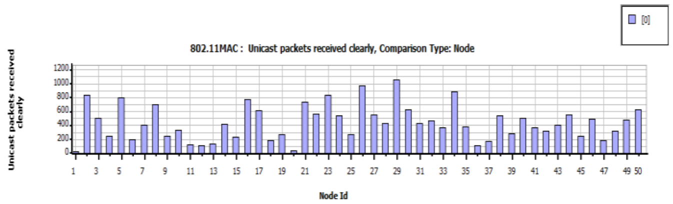

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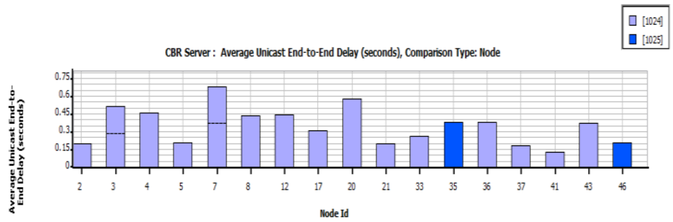

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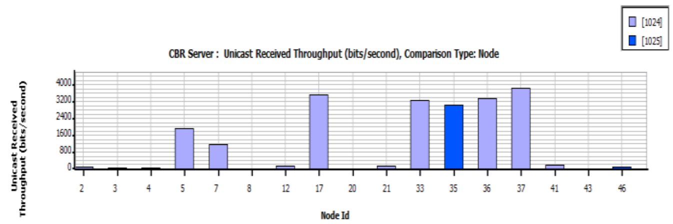

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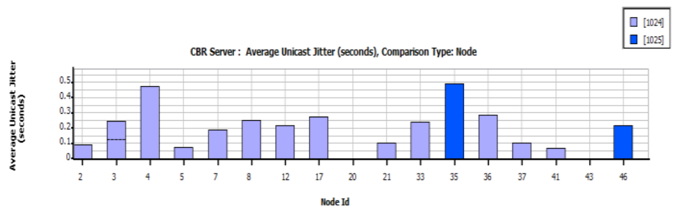

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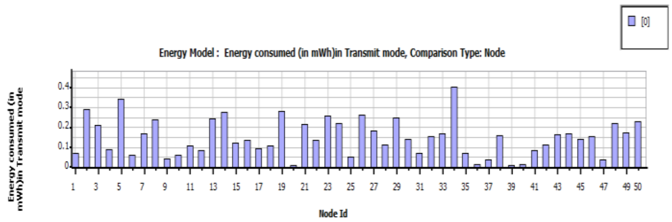

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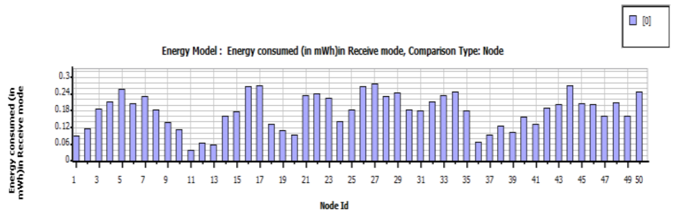

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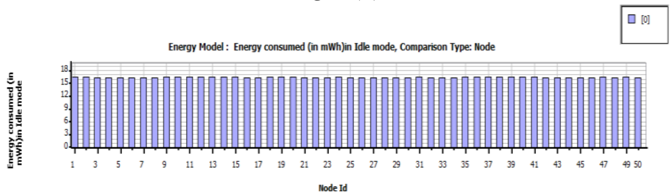

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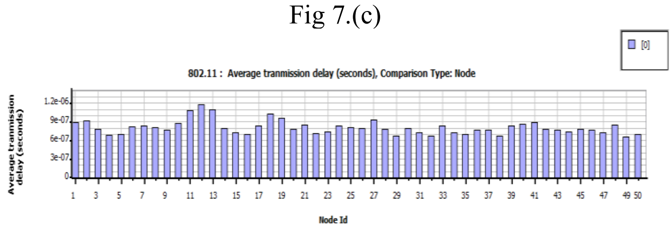

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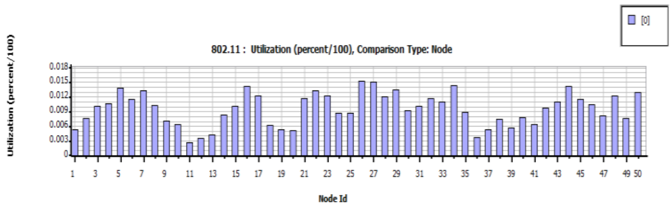

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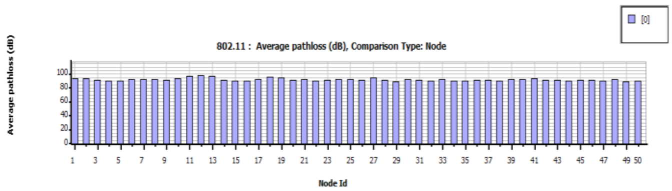

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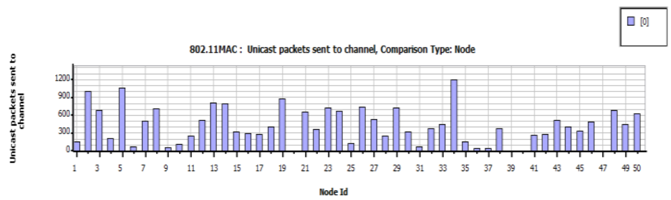

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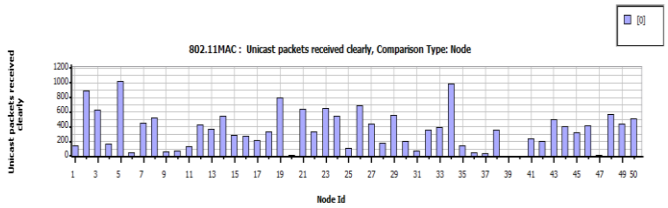

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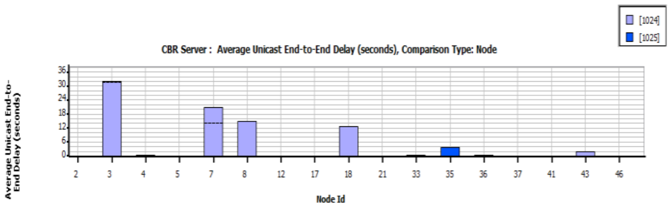

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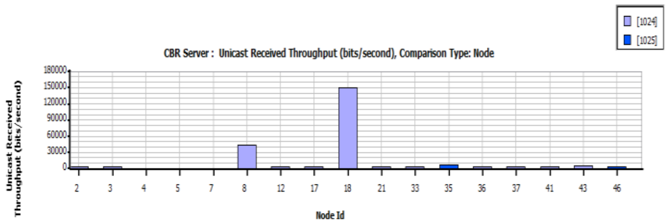

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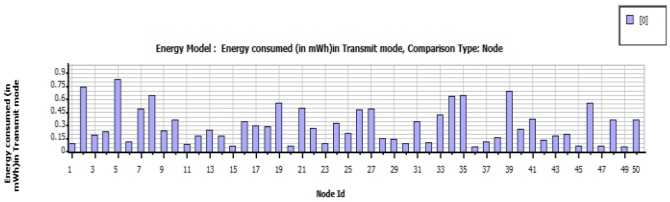

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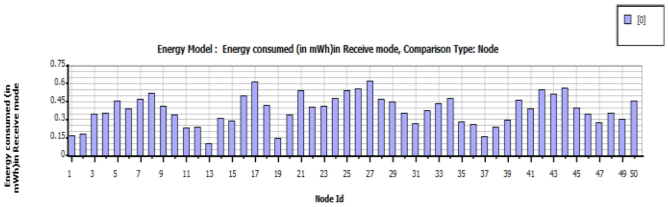

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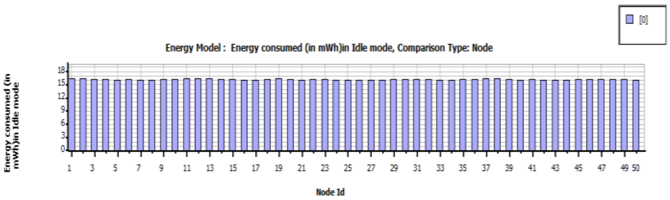

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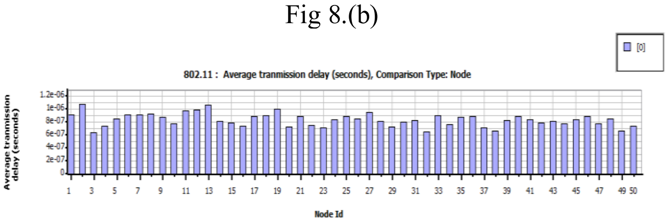

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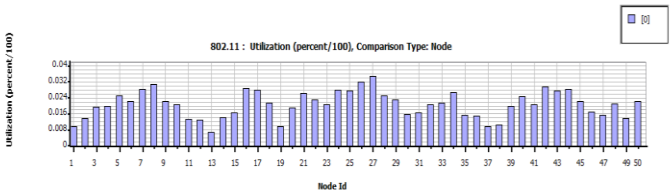

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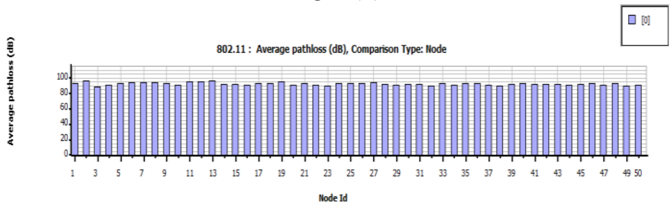

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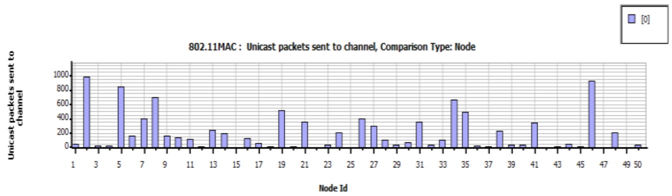

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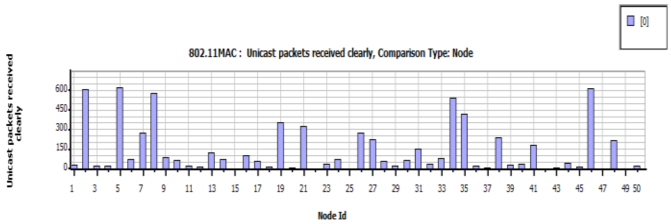

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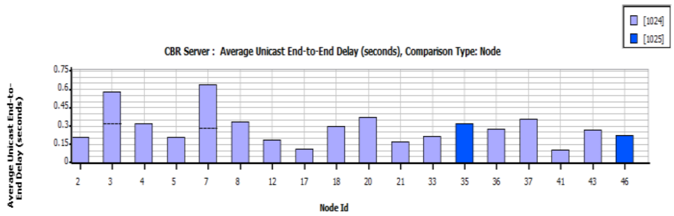

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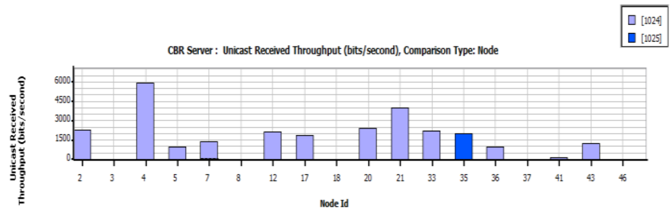

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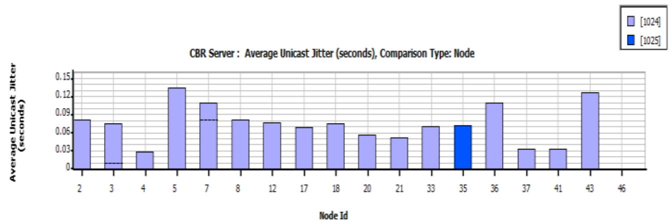

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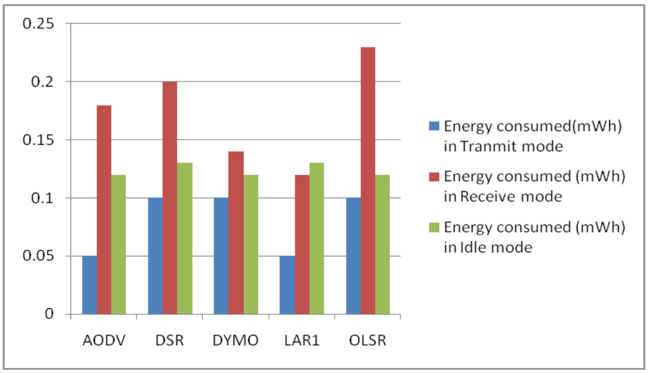

Fig. 9 Energy consumption of AODV,DSR,DYMO,LAR1 and OLSR protocols

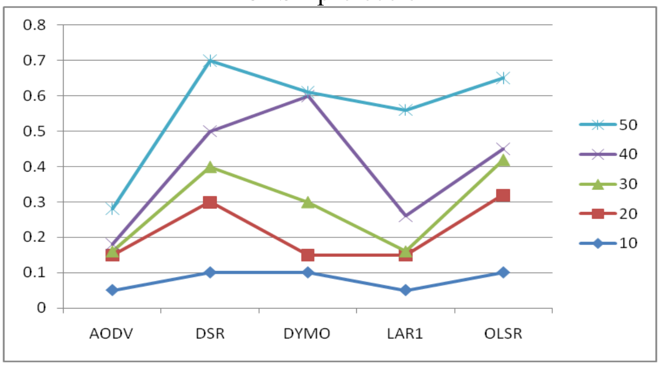

Fig. 10 Average transmission in seconds for AODV,DSR,DYMO,LAR1 and OLSR protocols

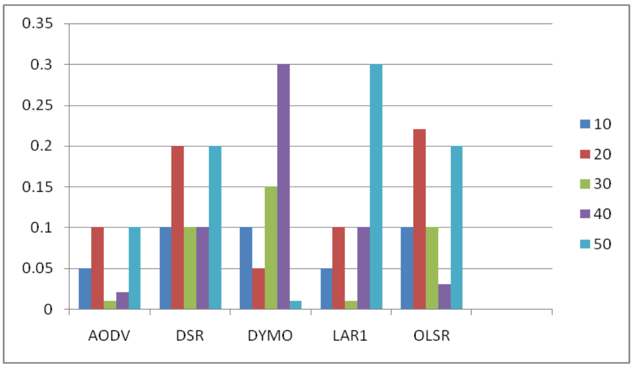

Fig. 11percentage of Utilization for AODV, DSR,DYMO,LAR1 and OLSR protocols

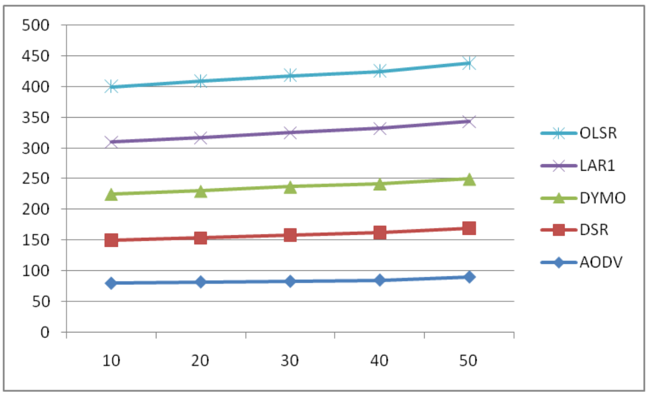

Fig. 12 Path loss in normal values for AODV,DSR,DYMO,LAR1 and OLSR protocols

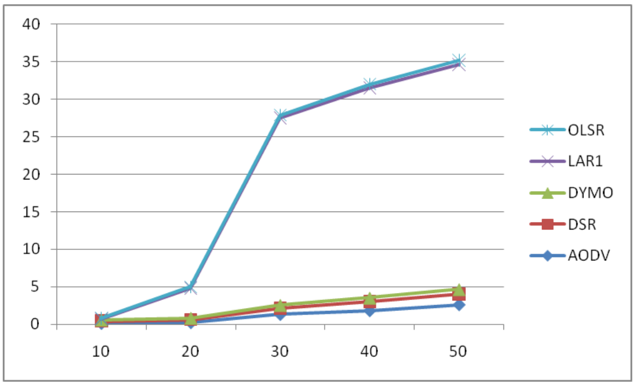

Fig. 13 Average Jitter in seconds for AODV,DSR,DYMO,LAR1 and OLSR protocols

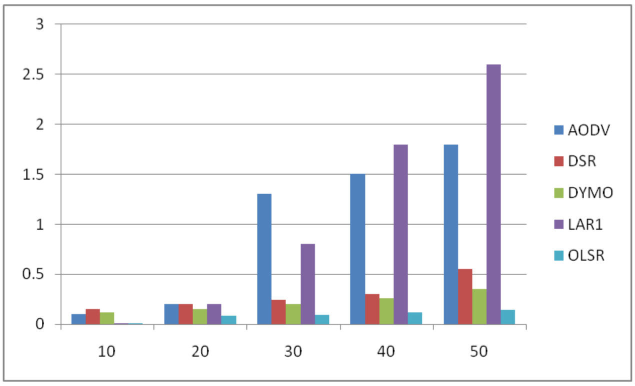

Fig. 14 E-2-E delay in seconds for AODV,DSR,DYMO,LAR1 and OLSR protocols

Parameter	Protocol				
	OLSR	DSR	AODV	LAR1	DYMO
Average transmission delay (usec)	650	700	280	560	610
Average E2E delay(sec)	1.89	4.1	6	87	1.93
Receive power consumption(mWh)	0.23	0.2	0.18	0.12	0.14
Idle power consumption	0.12	0.13	0.12	0.13	0.12
Transmit power consumption	0.1	0.1	0.05	0.05	0.1
Percentage of Utilization	65	70	28	56	61
Average jitter (sec)	0.44	1.44	4.9	5.41	1.08
Average Pathloss(dB)	26.65	25.75	26.23	26.46	25.88

Table 2: Comparison of different parameters for routing protocols

IV Conclusion

In order to send the information from underwater channel to destination node the Grid oriented architecture is used. The results show that OLSR performed in terms of receive power efficiency with 10% , DSR in point of average transmission delay of 14%, DSR with respect to utilization of 40% , DYMO and LAR1 in view of E-2-E delay and average jitter. The results have been carried out average of 50 nodes with respect to OLSR, DSR, AODV, LAR1 and DYMO. Comparatively, OLSR and DSR performance is better than the remaining protocols.

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