Selecting optimum frequency using dynamic positioning parameter in Underwater WSN

***Abstract*- Underwater transmission has turned out an outstanding investigation field for underwater navigation, in-depth ocean research, and automatic submarine vehicles control Acoustic communication is a highly flexible and broadly used method underwater because of the below (signal minimization) noise in the water. The operation of the undersea acoustic communication (UWAC) framework is challenged due to aspects such as limited available bandwidth, time-intersections medium conditions, long-term delay delays, Doppler spreads, salt and various pressure conditions. Significant use of Under-Water Wireless Sensor Networks' (UWSN) underwater military surveillance and underwater research. With the current innovation, the framework of sensory networks was reborn in a new era of global business monitoring. This development of projects paved the way for the disclosure of new open-air facts within the realm of marine life, deep sea areas and ice sheet exploration. This function provides an in-depth package transfer strategy to improve coverage and communication between visual senses under the hidden ocean. The scientific model is used to show the changing changes in the ocean. The channel model has been developed considering all the underwater channel structures. AUVs go on associated to a cluster-based network and an efficient cluster-based route protocol (CBRP) is used to transmit 3-D AUVs. By selecting the correct routing frequency transmission, the entire network life time is extended with minimal route delays. The CBRP method is used to limit channel damage due to its potential against excessive transmission power and recycling. The simulation results of the proposed algorithm show better connectivity and integration between surveillance AUVs and local connectivity.**

Keywords—AUV, UWAC, UWSN, CBRP, coverage and connectivity.

I. INTRODUCTION

Over the years, we have seen an increase in the popularity of underwater acoustic transmissions because of its use in seaside investigation, defense, maritime work activities, oceanography, along with the maritime oil industry. Underwater acoustic sensory systems new techniques allow for more underwater use. Our earth is concealed by two-thirds of the water along with that 80% of the oceans have not been designed or explored. This has expanded the concern of much experimentation in focusing on underwater investigation and research. The size of the underwater framework in the forthcoming shall be similar to underwater oil - refineries, underwater channels, underwater testing grounds, underwater flyovers etc. Building this great infrastructure is the first and most important thing required to assess the essential of the underwater world. With the modern scanning devices, various public and private study enterprises had begun to study the sea bed. A major problem in this test is the scanning devices both remotely used and automotive vehicles go on plagued through the arbitrary attributes of the prevailing marine environment and maritime mystery. This threat is a major obstacle to underwater investigation and as it may be solved beyond properly managing examining equipment. Recent developments with it the underwater sensor network use an appropriate technique to imprint the region of these managing accessories and regions could be transformed in a contained method. As it may be accomplished by building a network based sensory network that can detect a ROV or AUV that travels below the ocean and travels in that target area.

II APPLICATION AND CHALLENGES

Major Underwater Sensor Acoustic Sensor Network applications for environmental monitoring, underwater shadowing, submarine oil fields, disaster prevention and monitoring of seawater and winds, shallow waterways, strategic surveillance and surveillance.

Despite these extensive applications the underwater sensor network is plagued by major limitations as underwater sensors are prone to embarrassment due to erosion and pollution, battery control is limited and often batteries cannot be renewed without hard work, accessible data transfer is severely delayed. , to a large extent influenced by natural and conventional factors such as fluctuations in water content, variations in sound speed versus smoothness, distinct and abnormal ocean displays, critical separation of angles and temperatures are very challenging for the underwater sensory network to deal with temporary losses. Connection, high bit errors, high distribution delay, battery restriction restricted, and available bandwidth limit.

II. RELATED WORK

The issue of topology force of Wireless Sensor network systems (WSNs) and UWSNs has been broadly assumed. This first medium topology force figure presented by Li et al, a small native tree can significantly diminish communication force while enduring a universal network [5]. In the case of topology force in various ad hoc networks it was described as a problem for specific systems of integrated numbers [1]. The experiment created a network topology that limits an excessive power application of nodes [6].

To extend network life along with secure message transmission, topology control calculations using the topography view edge, i. e., edge between topography, proposed. Improved- network life and minimal power utilization by decreasing the transmission capacity of nodes and selecting a flexible method from time to time [3].

A number of UASN topology properties with underwater conditions, have been proposed control algorithms that combine acoustic corresponding properties with underwater conditions, have been proposed [7]. A strategic technique one can build a topology network with a universal network and whole integration when improving other measures not management metrics (distribution delays, data transfers and transfer gain rates), was proposed.

A. *Comparison among UNDERWATER ACOUSTIC NETWORK (UAN) and TERRESTRIAL WIRELESS NETWORK (TWN):*

Global sensory networks and UWSN distinguish few of the features are following [6] [2]:

Storage Capacity - Underwater systems should have the ability to gather additional information. Performance - The execution of groundless wireless network networks is significantly higher than underwater acoustic systems. Compatibility - The sensor used in the ground wireless network will be solved naturally, however underwater systems are different. Cost - An underwater sensor is more expensive than a ground wireless network because of its multi-dimensional nature in the production and production of hardware. Differences in Usage - Global sensor networks are widely distributed; underwater network configuration is not sufficient due to the inclusion of an amazing cost factor. Power Requirement - Power Required Underwater networks are above the ground wireless network due to the very high divisions and on the beneficiary side a complex signal way is made use to adjust the channel impacts.

III. Proposed Underwater Acoustic Sensor Network

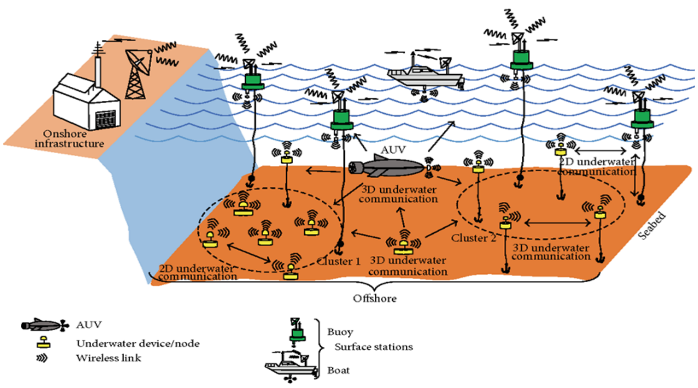

Fig-1 Underwater Network Structure

Fig-1 Presented Underwater Network infrastructure

A variety of networks are being built between the AUV, the static transponder and the hovering vessels. Ships (Surface location / Sink) are connected to a satellite or field entity. In this work the position based cluster head protocol is used to transmit and locate the AUV location and its position, on floating vessels. Code Division Multiple Access (CDMA), a multi-access network is used to point multiple senders are able to send information simultaneously to a single communication channel, at the link level. Therefore an effective cross-sectional design is required to effectively connect the AUV area using a cluster-based route protocol with CDMA.

Choosing a route protocol based on a data transfer network in an underwater acoustic network has the advantage of making better use of local node processing and target tracking. From the literature many algorithms of local research, the localization of Monte Carlo and links based on Assumption are localized surpassing other alternatives. Proper modeling of the group-based protocol at UWSN improves coverage and interaction between nodes and local ABC performance adds the added profit of computing the 3-D area of UWA nodes. Using the local ABC hidden method model Markov model modeling is used to replace the first sensor nodes along with the exact location will be calculated.

Routing Protocols in UWSNs:
Scheduling the appropriate route protocol is a fundamental problem involved in any network. Providing a router-compliant algorithm is a systematic issue identified by network layer. To date, most of the experimental activities associated with USNs have been tied to visual layers. But major fluctuations of concern about the investigation of network layers have occurred in recent times [3]. Major router protocols recommended by UASN, Distributed Integrated Underwater Composition Scheme (DUCS), Distributed-minimum-cost clustering (MCCP) protocol, Temporary cluster based routing (TCBR), data-based integration algorithm, Collection (LCAD), Vector based forwarding (VBF), Hop-by-hop Vector based forwarding (HH-VBF), Focused beam routing (FBR), Reliable and energy balanced routing algorithm (REBAR), based route in the area of destination Forecasting (SBR-DLP), Flood-based Route (DFR), Spatial Route (LASR) and Flexible Route [6].

In all of these group-based tracking protocols it has been the case for basic learning and integrating underwater sensors to help improve effective local performance [5]. The great benefits of integration are enhanced throughout the life of the Network - control over data processing, reduced data transfer and power efficiency. The development of a secure and efficient route protocol that is reliable and productive is seen as an integral part of UASNs. However the field of underwater sensory planning and regulatory processes is in the evolving phase of research.

A. *Framework Model:*

Cluster Parameters: Multiple Clusters- May vary depending on select algorithms for CH. Sometimes this check shall be the one created.
Intra-cluster transmission- The connection among a normal node and a CH can be one-hop transmission or multi-hop transmission.
Nodes and CH Mobility- Cluster formation has dynamism fluctuations in the sense that the sensors nodes move.
Node class and parts- Nodes can be naturally similar or different. Congruent, every sensor nodes have the same power as configured with the same power level. In a heterogeneous network, every sensor nodes vary in configuration.

Cluster Head Selection (CHS)- CHs are chosen for nodes used depends on principles that is transmission, communication costs, residual power, neighborhood value, radius from sink node and motility. The alternative of CH can be either determined or feasible.

Multi-Levels- In enormous networks, a multi-level integration method is used to accomplish better power circulation.

IV. ALGORITHM AND DATAFLOW

A. Topology Control Algorithm (TCA):

The TCA contains of dual aspects - The early phase, which is used in the Edge Constructed Model (ECM) that could detect the creation of the first topology. The alternate phase, a circulated integration algorithm particularly removes the integration organization from the first topology.

B. Network Model:

Our consideration of WSN for large vertical - scale with a top node. A group of nodes V = {v1, v2 ... vN}, consistently distributed on a two-dimensional aircraft S. We have the below expectations: every node has a different ID. The wireless underwater channel is uniform and hassle-free. There is a basic MAC layer that solves the disruption, and we do not consider disruption outside of the transmission distance.

A. *Algorithm Model:*

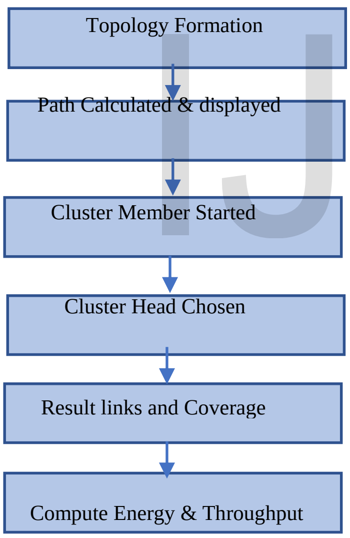

Fig-2 Work Flow Module

V. CLUSTER BASED ROUTING PROTOCOL

The unstructured structure is identified by the progress of the first topology from ECM, with TCA then presented to create a topology framework for integration. TCA is performed round, and in each round the TCA selects group heads and determines other nodes as group members. The details of the TCA are as given below.

Step 1: Distribute the nodes randomly and evenly throughout the area and save locations for every node.

Step 2: consider that all nodes are at the beginning standard and edge nodes are calculated using an Edge graph built into the topology model.

Step 3: Collection build: Generate the number of cluster heads to zero.

Step 4: Round cycle: The collection head selected on the topology graph assuming the location of the edge will not be constructed as the head of the collection to minimize the cover hole.

Step 5: Second cycle: Nodes calculate normal power, if the power of the node exceeds the maximum, the node is Clustering of Underwater Sensor nodes helps in improving effective localization. Major advantages of CBRP are selected as the header group. Contrarily the node will remain as a member node.

Step-6: Setup phase and the Communication Phase are as it its traditional Cluster Protocol.

Gathering of Underwater Sensor nodes assists in improving effective localization. Major advantages of CBRP are Network lifespan – control information development, Data re-launch reduction, and Energy efficient.

Functioning of Cluster Protocol contains of four aspects

- Broadcast aspect
- Cluster and Cluster Head (CH) system aspect
- Schedule formation aspect
- Data communication aspect

A. *Broadcas and Cluster system aspect*

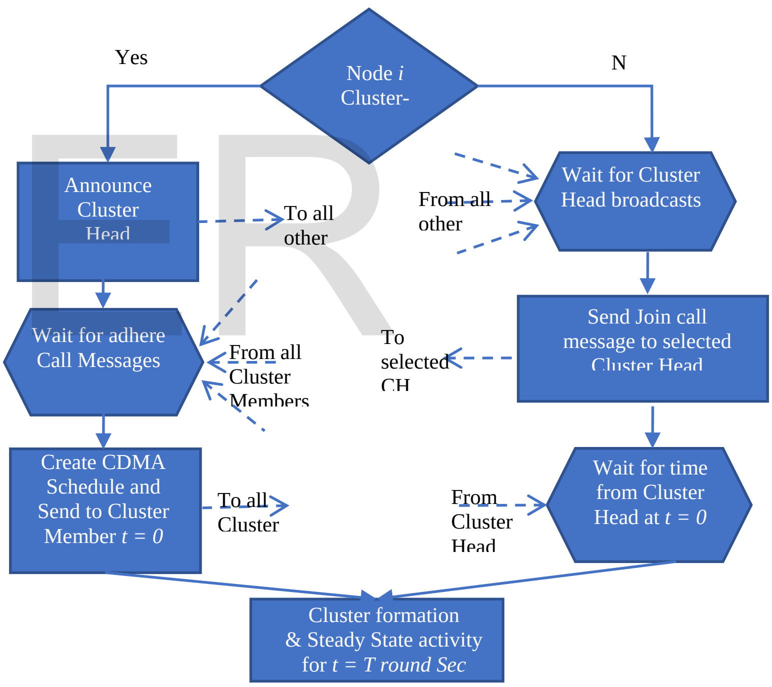

Fig-3 Cluster Head and Cluster Member Selection Process Flow Diagram

The first step in cluster-based routing protocol is advertisement phase. In this phase behind the early topology setup by topology control protocol, edge nodes are detected along with every node initially will send advertisement packets to all the other nodes in the network. Using the advertisement packets all the nodes will update the data about the neighbouring nodes and the distance between among every node.

In the second phase the cluster head is randomly chosen but the nodes will make sure that the edge nodes shall not be a part of cluster head in the first round. After the successful selection of cluster head the nodes which are neighbour to the cluster head (CH) will send added message to the cluster head and after the acceptance of cluster head the nodes which given added request will join as cluster members.

B. Schedule and Data transmission Phase

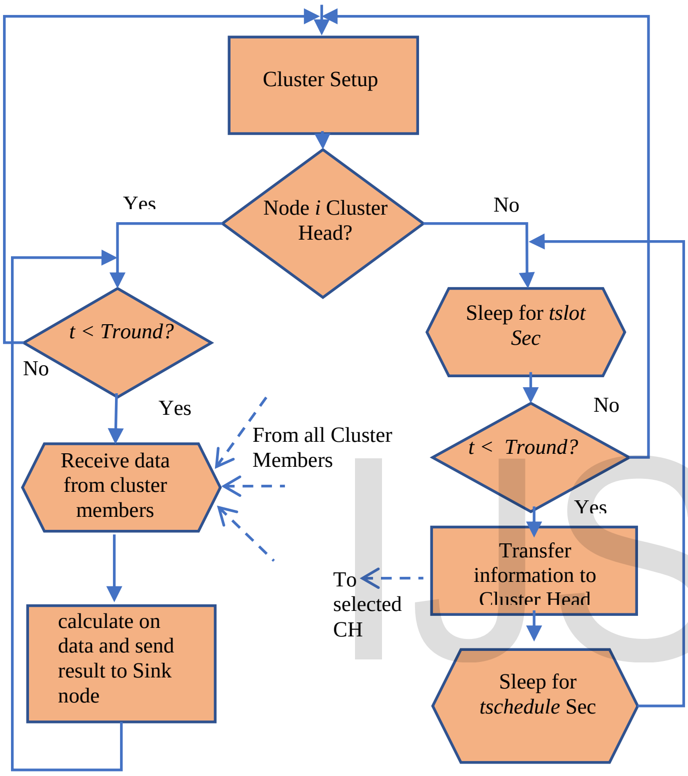

Fig-4 Scheduling and Data Transmission Flow Diagram

The schedule category is in control for network correspondence, linking along with distribution delays. In the standard Cluster Head system the TDMA scheme is applied to the MAC layer. Considering negative channel conditions such as blurring, multi-channel problem, salt, water, temperature, pressure and local noise, - The CDMA-established Spread Spectrum method is adopted on the MAC layer. This improves the network node connectivity, network connection time, reduced latency, resistance to ambient noise.

C. Energy consumption and Throughput analysis:

C. Power consumption and performance analysis:

Power consumption is made up of three components: Sensor use from Coverage, Connection use from Connection, Connection use from common nodes in the AWAKE- region.

To calculate the strength of each node is provided by

$$\textit{Energy consumed per node} = \textit{Initial energy} - \textit{final energy} \quad (1)$$

$$\textit{Average energy} = \frac{\textit{Total energy consumed of the network}}{n} \quad (2)$$

(i) Amount of neighbours linked. Based on distance from a node

$$D = \sqrt[2]{((x_1-x_2)^2+(y_1-y_2)^2)} \quad (3)$$

Where (x_1, y_1) co-correlate of one node

(x_2, y_2) co- correlate of another node

paramount the neighbor, the network will be denser.

VI. Simulation Assessmeny and Formation

Aqua sim an underwater sensor Network Simulator -2 established simulation mechanism is made use of investigate the performances of the Cluster head selection technique. TCA is made use to detect the edge nodes in the network and form a topology among the nodes. The parameters those are assumed for simulation is displayed in Table 1.

TABLE 1: SIMULATION PARAMETERS

Operating Frequency	25KHz, 50KHz, 100Khz	**Channel**	Physical Channel in underwater
Depth	30m, 60m, 90m, 120m	**Data Rate**	5Kbps
Transmission power	2dBm	**Network size**	100
Receiving capacity	0.75	**Simulation schedule**	120 Sec
Threshold for carrier sensing	5dBm	**atmosphere Noise Level**	60 dB
Antenna get for transmission and receiver	1dB	**Routing Protocol**	CBRP

VII. Simulation Outcomes

The Aqua sim 3-D Network Animator (NAM) file is made use of envisioned the position of the nodes in the simulation area. This will assist the client in a more flexible path to assess the nodes along with the timing of events and the regulation in which the nodes are in motion. The 3-D NAM is also useful in assessing the transmission and acceptance of nodes, their transmission width, sensor width, visibly. Aqua sim tracking file will track all network events to a text file with a specific format. It tracks the timing of each event, the source and destination node id, intermediate node id, packet control information, packet loss information and all other network events that will also be followed by

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the tracking file. Packet transfer between nodes is shown in fig-1. Acceptance of the same package is shown in fig-2. Sometimes the package may collide due to two or more information exchanges among the nodes displayed in fig-7.

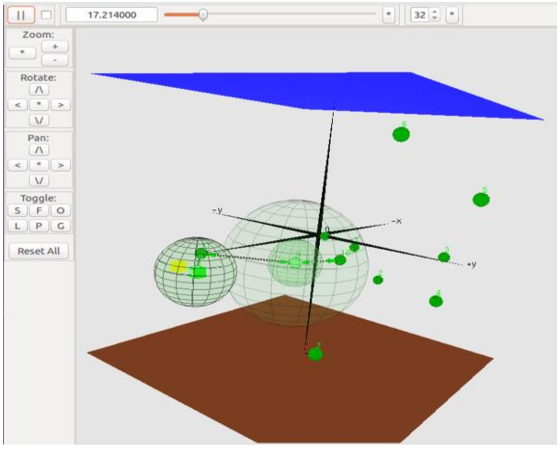


Fig-5 Cluster member to head Packet Transmission

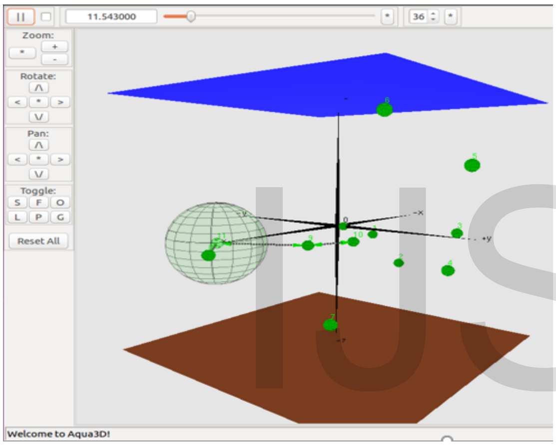


Fig-6 Reception of packet from Cluster Member (CM) To Cluster Head (CH)

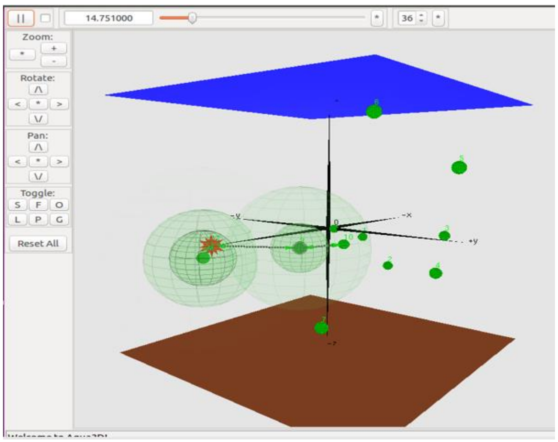
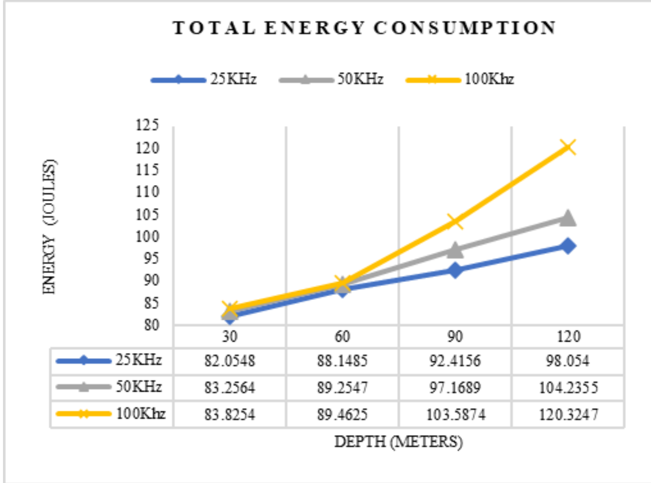


Fig-7 Collusion of Packets near Cluster Head (CH)

In all cases followed by the tracking file, complete packets transferred to the network, packets acquired in the first attempt, lost packets, complete control packets transferred, power utilization of every node along with general network are computed.

In order to investigate the significance of the frequency at which an indication to be transferred across water is measured at various frequencies and at different depths. The



various frequencies assumed in the simulation are 25KHz, 50KHz, and 100KHz at various depths of 30m, 60m 90m, and 120m.

TABLE 2: EXAMINATION AT DEPTH 30 METERS

Network Size 900 Meters x 900 Meters. Depth- 30m.			
# Nodes=1-00, transmission=98 nodes and sink=2 nodes			
Operational Frequency	**25Khz**	**50Khz**	**100Khz**
Energy consumption in total (Joules)	**82.053**	83.21	83.824
#Packets	3500	3500	3500
1st attempt successive transmission	3235	3335	**3453**
Successive retransmit packet	125	135	45
Packet loss	94	46	3
Acknowledge for transmit	4153	4241	4352
Retransmit packet	3468	3466	**3466**
Acknowledge for retransmit	3960	4164	4231

TABLE 3: EXAMINATION AT DEPTH 60 METERS

Network Size 900 Meters x 900 Meters. Depth- 60m.			
# Nodes=1-00, transmission=98 nodes and sink=2 nodes			
Operational Frequency	**25Khz**	**50Khz**	**100Khz**
Energy consumption in total (Joules)	**88.148w**	89.253	89.43
#Packets	3500	3500	3500
1st attempt successive transmission	3213	3235	**3335**
Successive retransmit packet	115	116	76
Packet loss	174	**104**	122
Acknowledge for transmit	4235	4246	4246
Retransmit packet	3346	**3357**	3346
Acknowledge for retransmit	4035	4146	4165

TABLE 4: EXAMINATION AT DEPTH 90 METERS

TABLE 5: THROUGHPUT ANALYSIS FOR 120 METERS DEPTH

Network size 900 Meters x 900 Meters. Depth- 90m.			
# Nodes=1-00, transmission=98 nodes and sink=2 nodes			
Network Area 900 Meters x 900 Meters. Depth- 120m.			
# Nodes=1-00, transmission=98 nodes and sink=2 nodes			
Operational Frequency	**25Khz**	**50Khz**	**100Khz**
Energy consumption in total (Joules)	98.0254	104.236	120.32
#Packets	3500	3500	3500
1st attempt successive transmission	2957	2458	2223
Successive retransmit packet	292	169	156
Packet loss	267	643	1113
Acknowledge for transmit	4213	4324	4735
Retransmit packet	3233	2827	2356
Acknowledge for retransmit	393	3761	3635

Fig-8 Graphical representation of energy consumption

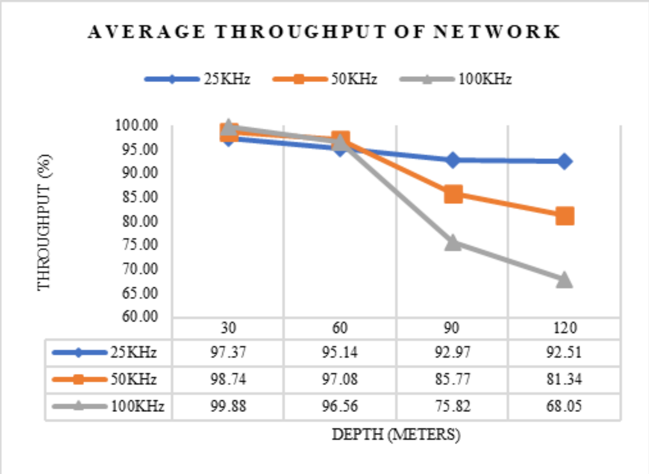


Fig-9 Average Throughput of Network

From the experimental investigation covered by varying insides the output in the middle of the system appears subsequent time approximately the look alike depth at 30m and 60m at all imaginable different frequencies. But at 90m and 120m the low prevalence beacons achieve enhanced than the high signal. Comparing the Figure-10 along with the fig-11 high signal performance was so bad that the rate of packet loss was high as the depth increased and that is why it even created a whole control pack over the network as the law tried to pass the packet forward loss. So from the Figure 9 during the time that the packet failures or loss rate is greater than the system output diminishes just as the depth upturns. Complete network power utilization at low frequency system is better as packet failure or loss at depth is lower along with performance is also high. But when the frequencies are high at high speeds the movement is small and consumes a lot of energy

VIII. CONCLUSION

Thus, from the CBRP analysis of local boundary transmission, keeping network coverage and low frequency signal life (25KHz to 50KHz) performs well. Although high signal performance improves at low depths, low frequency signals improve when depth increases in all outputs, power consumption, packet loss, and packet control.

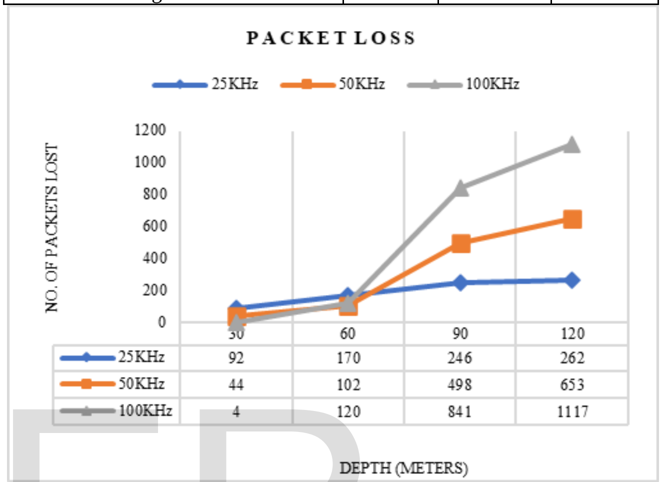


Fig-10 Packet Loss

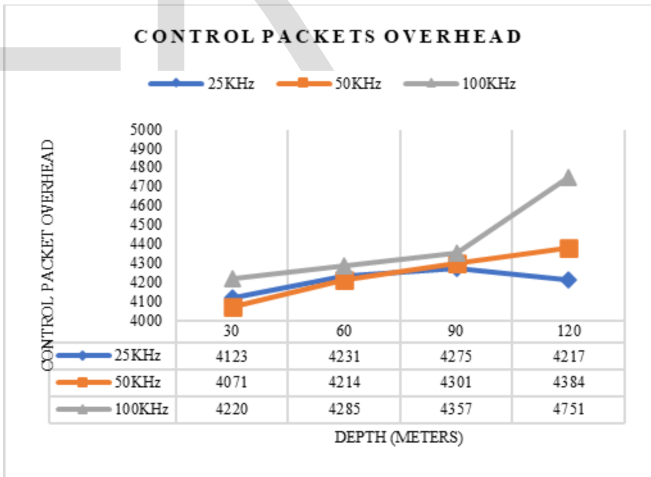


Fig-11 Control Packet Overhead

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