A Novel Routing Protocol Design for Underwater Sensor Networks

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Abstract – Underwater sensor networks (UWSNs) is a best way to explore the aqua regions like lakes, rivers, seas and oceans. Hence it needs a secure implementation technique with effective routing and high security routing protocol in the acoustic region. UWSNs have some difficulties in terms of delay and in power utilization. It is difficult to achieve in this medium which have been already proved in the terrestrial networks. A new metric called Node to Node Latency is introduced for delay responsive underwater sensor networks. Forwarding set determination and packet forwarding prioritization algorithms are used to solve the delay problem. The proposed scheme involves that any small package which cannot get together its target is go down. The new routing protocol was implemented namely EGOUR (Exploiting Geographic Opportunistic Underwater Routing) is proposed for reducing time delay and increase the energy efficient.

Index Terms – Underwater Sensor Network, Aqua, terrestrial Networks, EGOUR.

1. INTRODUCTION

In wireless communications the routing from source to destination is done by the use of routers. Each network has many routers to route and sensors for determine and sagacity the network criteria's in wireless networks. The wireless sensor network consists of many nodes which can be communicated through routers and connection can be done by means of sink node.

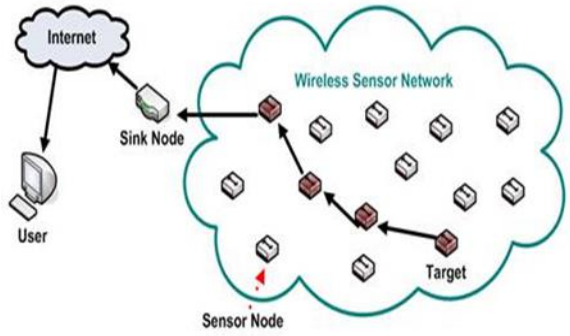

Figure: 1.1 Wireless Sensor Network

Thereby the sender can easily communicate with the receiver. The connection between source and destination by means of hope-node is called routing. In submarine sensor networks an acoustic wave sensor is used. It can measure the phenomena and characteristics of underwater like sound levels, changes in amplitude, stage, regularity, or time-delay between the input and output electrical signals. Underwater wireless sensor networks (UWSNs) are highly preferable for monitoring the liquid medium [1].

UWSN's uses Acoustic statement and it is considered to be the feasible method for underwater message. But in acoustic communication there is a big challenge arises when UWSNs are used in underwater surface it will produce high transmission delay because of acoustic signals in water. It leads to the limitation of bandwidth and the dynamic packet loss probability is high. Hence, it creates more problems such as retransmissions, high power use and low consistency results [2]. Because of these problems the protocol routing design for the underwater surroundings a demanding task. Due to these characteristics of underwater, the traditional routing protocols are not effective in this medium. In this kind of scenarios, the preferable routing is geographic since it does not need the forming and correction of routes so that there will be no need of transmitting the forwarding messages to update states [3].

The geographic information is used in Geographic routing protocols to send the datagram towards the destination. Greedy forwarding strategy is used here to deliver the information to a neighbor node, which is nearest to the destination. This process will continue until the data packet will reaches its final destination. This hungry forwarding strategy makes this protocol is the simplest one and measurable protocol [4], [5].

In geographic routing the statement void is a big problem. Here some packets are surplus or have to recover it again[6].To increase the conformation of data and to reduce the energy consumption, this routing can work together with critical routing and depth adjustment-based topology control also included for contact remedy over empty regions[7]. To avoid

un-necessary transmissions, the priority basis is followed. The packet which having the highest priority was sent. There by, the routing task is much easier and the network traffic can be minimized [8].

The concept of the paper is to build a contact link without any time delay in an efficient manner. Here the performance can be enhance the system requirement through which it can be processed and performed in a simple and effective time field. It can be used for the acoustic link. The link communication was maintained in the simplest way of protection to which it can be designed. The routing that implemented in this paper is EGOUR. The best scenario of this routing methodology is, it will overcome the system with extra system requirements. Here the number of packets that send by the communication link is proposed here.

The configuration of the proposed model is convincing to make believe the packet delivery ratio will be high when compared to the previous techniques. This system is guaranteed for the best accommodation of data transfer. Here the model is used to enhance the work by applying the system in the real time scenario. The best methodology of the system should be processed in the relevant manner. The routing scheme and also the proposed model should be developed in the simple sequence concept.

2. BACK WORK

A SEA Swarm is a wireless sensor that is used to monitor sea surfaces and screen the changes in the medium. It is an efficient any cast routing algorithm for dependable under water sensor event for reporting to surface sonobuoys. In [9] author proposed a hydraulic force based any cast direction-finding protocol uses the pressure levels for routing the packets in underwater surface medium. The problems arises in this technique were the ocean current and resources used here is available in minimum.

In [10], For the sea level the routing protocol using lighting and firing for allowing the data to send through the nodes. However, this is demanding because geographic greedy routing causes a information pack to be dispatched to a node. It requires high level energy utilization.

In [11], R. W. L. Coutinho proposed a geographic steering protocol for ocean surface that uses the nodes depth for organizing the network topology. A challenging issue happens when the acoustic signal in the water may vary due to the difficulties transmission. Also R. W. L. Coutinho present a novel any cast insatiable geographic forwarding protocol with controlled architecture mechanisms. It organizes the network through depth alteration of some nodes. The delay occur in the network is minimized and also the consumption of energy is low. But Node-to-Node interruption is high and energy utilization is more.

In [8], proposed a solution to increase the delivery of datagram in the network layer. For forwarding the datagram the GEDAR protocol it uses the geographic information but it has issue in Depth adjustment of nodes.

In [12], basic characteristics of acoustic communication were studied. The main dare for the growth of proficient networking solutions posed by the submarine location are detailed and a suitable approach to the integration of all contact functionalities is recommended. In [13], I. Vasilescu presented a new platform for undersea sensor arrangement to be used for long-term examine of coral reefs and Sherries. Here node steady efficient is low. In [14], author mentioned many issues based on the present occurring in water networks which is studied and researched by various researchers and explained about the transformations of networks from classical to acoustic medium. Here Collision occurs between nodes.

In [15], paper observe the main factors and requirements plan about the execution of wireless sensor networks and talk about about the effect of design and operation of message systems. In [16],[17], presented a network simulator, Aqua-Sim, is based on NS-2, one of the most widely used system simulators, and it follows all set-up entities are implemented as classes.

In [18], multi-hop cooperative schemes for under water sensor networks are studied and shown and it generates an energy efficient protocol. The signal frequency and the forwarding distance will leads to the path loss in the networking channel.

In [19], a set of algorithms can be selected to transmit the datagram via nodes which is send through radio waves. Here both acoustic and Radio packet loss is the disadvantage. The package contains group of reality information with secure. If anyone node does not send properly that node find as a malicious node.

3. EXISTING MODEL

Position based information can be complete and power resourceful are high. In the network this hungry forwarding approach routing protocol works. [12] The data can be passed over the particular sonobuoys (sink). The information is carried out by the neighboring or nearby node to the receiving node. The use of GEDAR routing protocol is it distributes frequently the information where multiple sink are available. Each transmitter in the sea surface is connected with the GPS. It spreads the information to all nodes by means of lighting or by firing. The sensor detects the node position so that it can be correctly send to the destination.

In water surface has several interference may occur. GEDAR protocol will minimize the effects due to the acoustic signals in water. The neighbor node is detected first for sending and the process will continue until it reaches the offshore station. If the node is in empty region the GEDAR protocol will search new depth by using ravenous promote algorithm thereby it will find

the new node. The problem is it requires long time to re-build the communication and having Latency problem.

4. PROPOSED MODEL

The objective of the proposed model is to enhance the security and performance in the coastal region. The main concept of the systematic design is to fetch the information in the system through which it should be demanded. The scope of the work is to build a communication link without any time delay.

Here the performance can be enhanced by a simple and effective time field. The proposed model can be used for the acoustic link in underwater surface medium. The link communication was maintained in the simplest way of protection to which it can be designed.

4.1 System Model

System model consists of the basic elements such as nodes, interfaces, gateways and routers. The routers and gateways makes the system transforms to the network. The information is carried through these interfaces.

4.2 System architecture

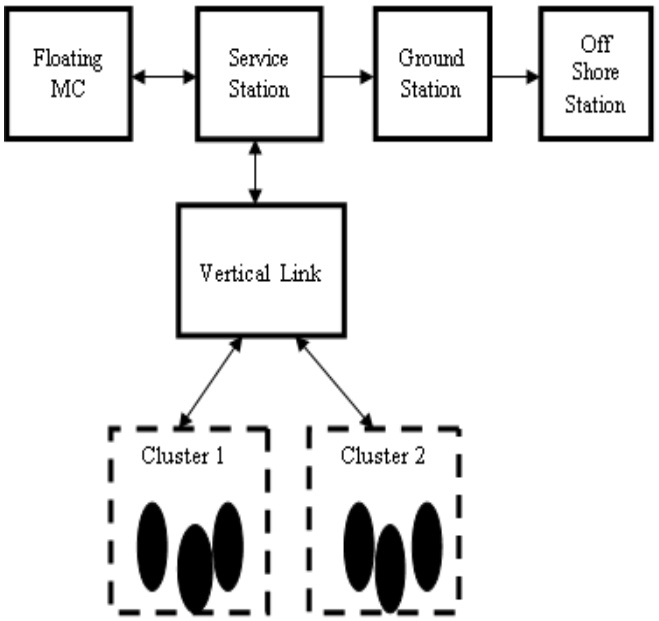

Fig.4.1. System architecture

The architecture of the arrangement is presented in figure.4.1. The scheme mainly consists of five entities: Floating MC, Service Station, Ground Station, off shore station and Vertical Link. The proposed work is based on the EGOUR routing algorithm. In this work, the monitoring center is considered to monitor the node selection and the energy node is found. The packet delivery is only made upon through energy node. If any malicious node found by the EGOUR algorithm then it will drop only malicious node. Service station is performed as sender and receiver in between process and also controlled the ground station. Normally the result of the information sends to off share station through vertical link.

4.3 Network Modeling

The network modeling is used to deploy the network in this field. The model represented in the system of which it should be used for the node initialization in the underwater/ acoustic model. In acoustic range the data send through the system that can be used for the performance should be maintained in the systematic representation. The EGOUR, the node and the static sink placed in the landmark were fixed in the mechanism through which it should be deployed.

4.4 EGOUR Routing

The EGOUR routing will accept the data far away from the routing model that could be use. The EGOUR protocol is a well-organized and well protected protocol used in acoustic medium. A frame router connects all nodes present in the network.

4.5 Query Processing

The query processing is done by accepting the query in the routing. It should be used for the performance of which it could be maintained in the MC. The MC is used to transmit the query which could be maintained until the process gets completed. It uses tree structures for query developing.

4.6 Data Transmission

The data transmission can be done through routers from source to destination with the help of routing protocol.

The GEDAR protocol contains some drawback that is not useful for the system. Thus new routing protocol was implemented namely EGOUR (Exploiting Geographic Opportunistic Underwater Routing) is mainly proposed for reducing time delay and increase the effectiveness of energy. The EGOUR is processed for the communication to be enhanced for the real scenario usage.

4.7 EGOUR Steering Protocol

EGOUR protocol spreads the information through routers from one node to another. Routing algorithms having the information about their route and direction. Each and every router has all details about the sender and the receiver.

Firstly it shares every details about the neighbor to the node afterwards it shares the details to the entire network. It uses many gateways for information sharing purpose. Also the authentication of the data is important so that the protocol will protect the details of all nodes in the network

The network layer in the OSI model provides the routing and data sharing to the network. The main characteristic of this routing protocol is, it should avoid forming loops.

The protocol must be a securable, easily communicable for networks. The network functionalities should be satisfied in the model so that the network will be guaranteed to send the data.

4.8 Flow Chart

The flowchart will clearly describes about the transmission of data in network from one node to another. It has the following entities.

They are:

- Monitoring Centre
- Service Station
- Ground Station
- Off share Station
- Wireless sensor Network

The monitoring centre produces the query request .The query request is sends to the service station through the vertical link. The cluster of monitor depth information is linked with the plumb link. It tells about several monitoring information based on the surrounding circumstances.

The vertical link is connected with the service station. Then the node sends the data packets to the ground station. From the ground station it will be send to the offshore station for further screening and monitoring purpose of the underwater medium.

Then the analysis of the water surface is happens to announce whether any unwanted things like earthquakes or high sea tides are going to happen or not.

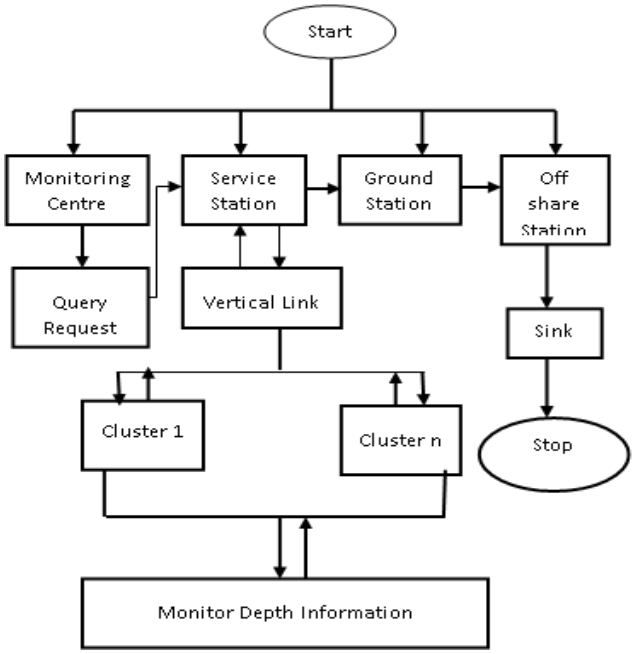

Fig.4.2.Flowchart of proposed method

5. PERFORMANCE ANALYSIS

The performance and evaluation of the two models are taken to process under the different set of scenarios. The main scheme of the proposed and the existing work is based on the easy and well-organized process of the scheme through which it can be maintained. The below figures will shows the graphical representation of the data security and time efficiency. Thereby, it is proved that the data security and time efficiency is highly achieved in this research work.

5.1 Time Delay Calculation for EGUOR

The time delay calculation is given below. The formula for time delay calculation is

$D_T = N/R$ seconds

D_T denotes Delay Time

N represents number of packets to be broadcast

R denotes Transmission speed

Thus the calculation provided to be,

Existing system = 10/2= 5 sec

Proposed System =10/5= 2 sec

Table: 5.1 Time delay Accuracy

Number of packets	Time delay Accuracy	
	Existing System	Proposed system
10	5s	2s
20	10s	4s
30	15s	6s
40	20s	8s

The table 5.1 shows that the time delay accuracy of packets delivery of proposed is lower than the existing system. If 10 packets can be send by using proposed model only 2s time delay will produce while in existing system 5s time delay appears. But when the number of packets increases the time delay also increases. Even though it is better when compared to the existing system.

The fig.5.2 shows that the time delays comparison of proposed is lower than the existing system.

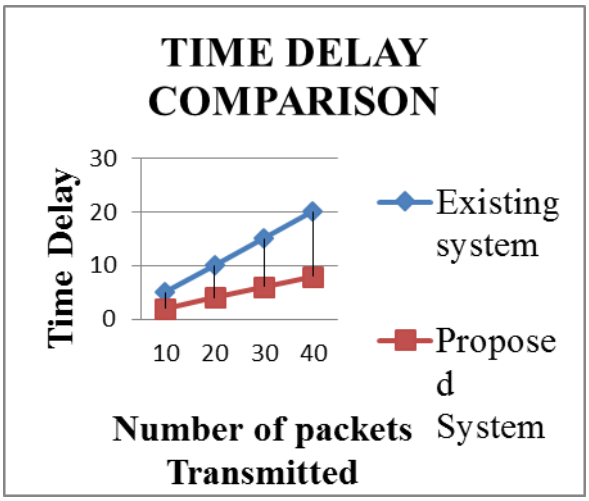

Fig. 5.2 Time delay Comparison

5.2. Package Delivery Ratio

The pack deliverance ratio is defined as the percentage of number of received package to the number of pack which has been generated.

$$PDR\% = \frac{\text{Number of received pack}}{\text{Number of generated pack}}$$

Proposed system = 40/50 = 0.8%

Existing System = 20/50 = 0.4%

Table: 5.2 Packet delivery ratios

Number of packets transmitted	PACKET DELIVERY RATIO	
	Existing System	Proposed System
10	0.5%	0.9%
20	0.5%	0.75%
50	0.4%	0.8%

The table 5.2 shows the package deliverance ratio of proposed is advanced than the existing system. The package delivery ratio for packet transmission of 10 packets in proposed system will be 0.9% when compared to 0.5% in existing system.

The fig 5.2 shows the package deliverance ratio of proposed is advanced than the existing system.

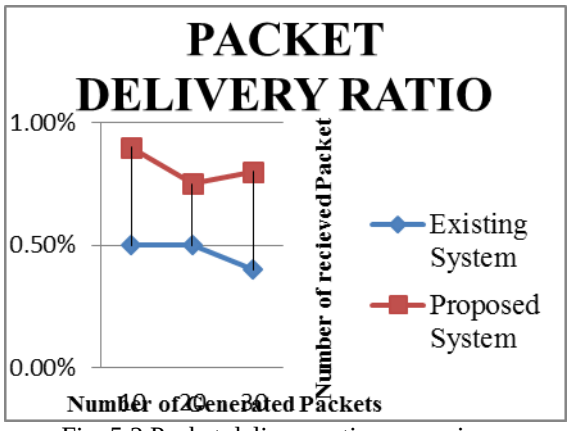

Fig. 5.2 Packet delivery ratio comparisons

5.3 Data security analysis

The fig 5.3 shows the data security analysis of existing and proposed system.

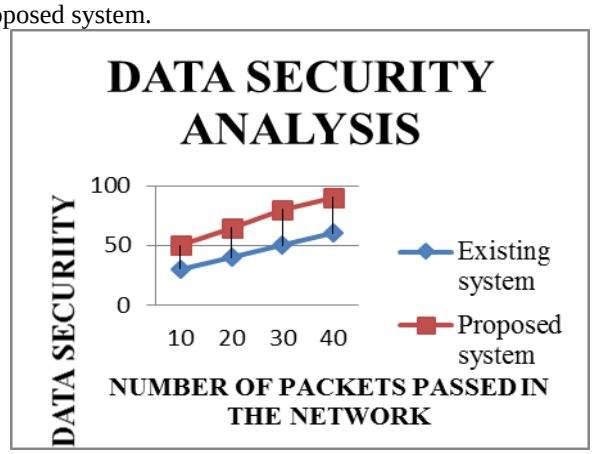

Fig. 5.3 Data Security Analysis

Table: 5.3 Data Security Analysis

NUMBER OF PACKETS PASSED IN THE NETWORK	DATA SECURITY	
	EXISTING SYSTEM	PROPOSED SYSTEM
10	30	50
20	40	65
30	50	80
40	60	90

The table 5.3 shows the data security analysis of existing and proposed system.

6. EXPERIMENTAL RESULTS

EGOUR protocol is a secured algorithm for delivering the data packets in underwater surface. Now, it is proved by means of many experimental results. For experimental purpose, the EGOUR protocol produces a low time delay high reliable output. And the nodes send by using this algorithm can able to send the data very fast.

Now, it is proved by means of many experimental results. For experimental purpose, NS-2 simulator is used. The NS-2 simulator will produces the results based on the comparison of classes and objects.

The experimental results are shown below.

6.1 Compile and Running

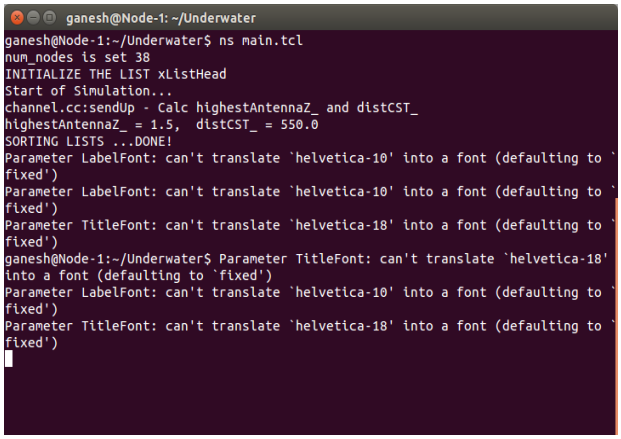

Fig.6.1 Compilations and Running

6.2 Energy Calculation

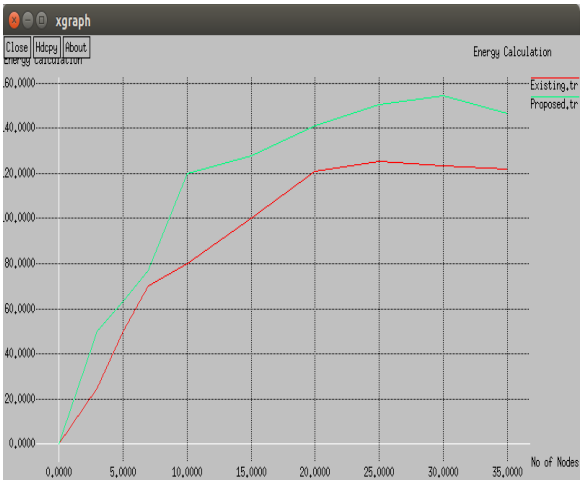

Fig.6.2 Energy Calculations

The fig 6.2 displays the energy calculation process which was done by calculate efficient energy and how much amount of energy need to send the pack from source to destination. But wastage of energy is less than the existing system

6.3 Power Utilization

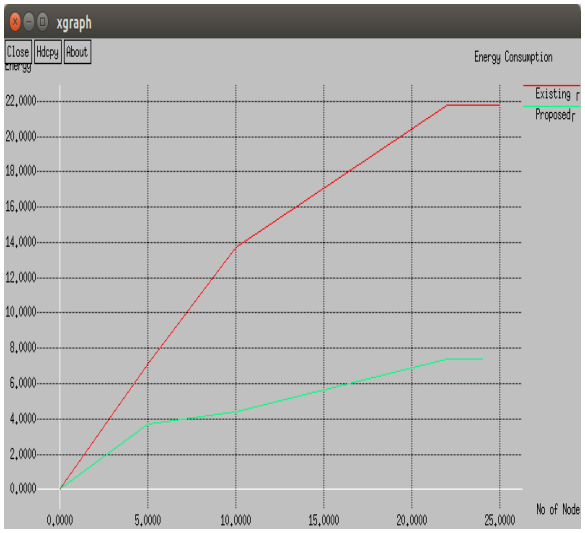

Fig.6.3 Power Utilization

The fig 6.3 displays how the power is saved in the sink. While the pack sending the node select the shortest distance path and forward the pack. In Service station get the full energy pack.

6.4 Package Delivery Ratio

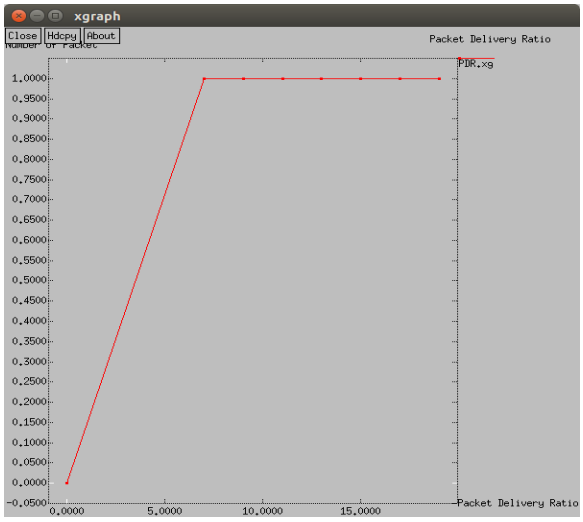

Fig.6.4.Package Delivery ratio

The fig 6.4 shows that delivery ratio of pack. Each and every node takes some time to send the pack from node to node. So here we have introduced end to end delay process and get the ratio of package deliverance in efficient level.

6.5 Network Deployment

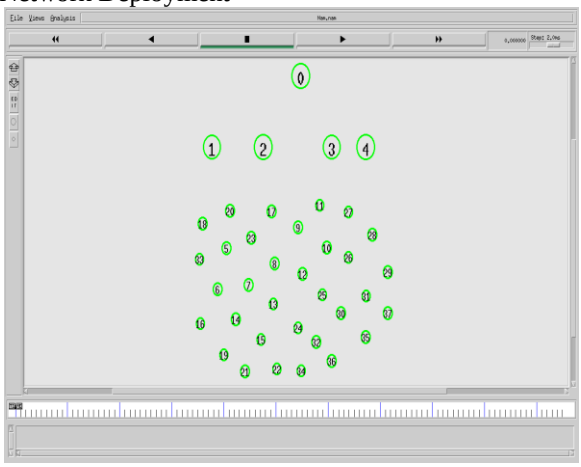

Fig.6.5 Network Deployments

The fig.6.5 shows that the network deployments of nodes.

6.6 Network Formation Process

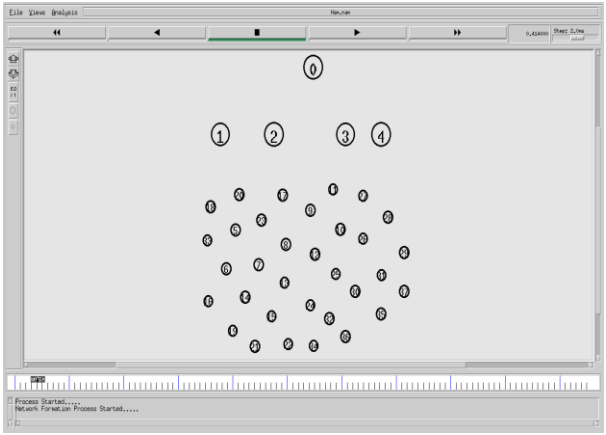

Fig.6.6 Network Formation process

The fig.6.6 shows that the network formation process of nodes.

6.7 Node Send Message to Sender

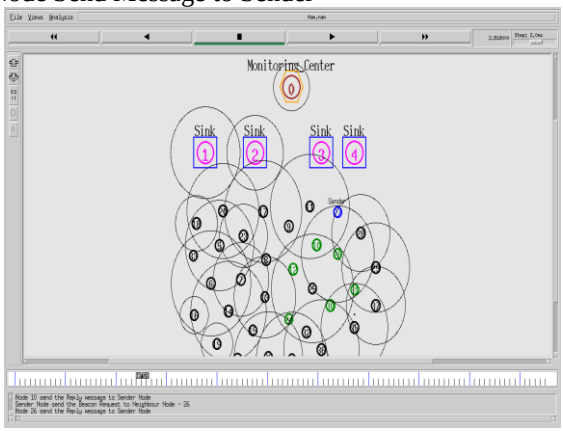

Fig.6.7 Node Send the message to sender

The Fig 6.7 shows the node Send the message to sender.

6.8 Beacon Request

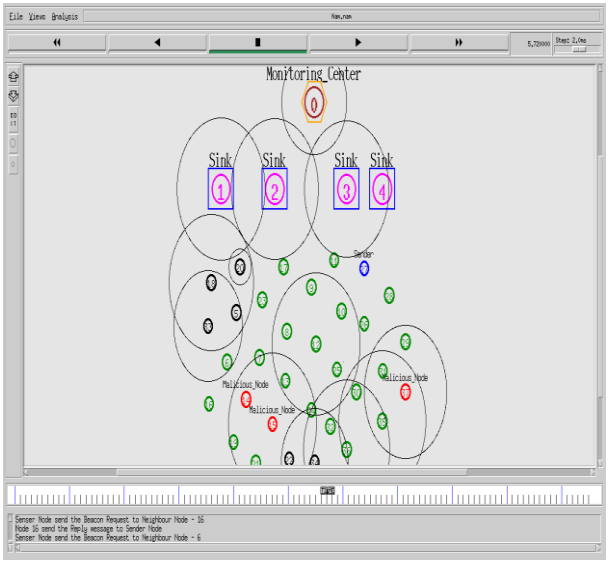

Fig.6.8 Beacon Request

The sensor node sends the Beacon request to the neighbor node 16. At that time the node 16 sends the reply message to sender node. Complete information passed to monitoring center until this process going continuously.

6.9 Find Malicious Node

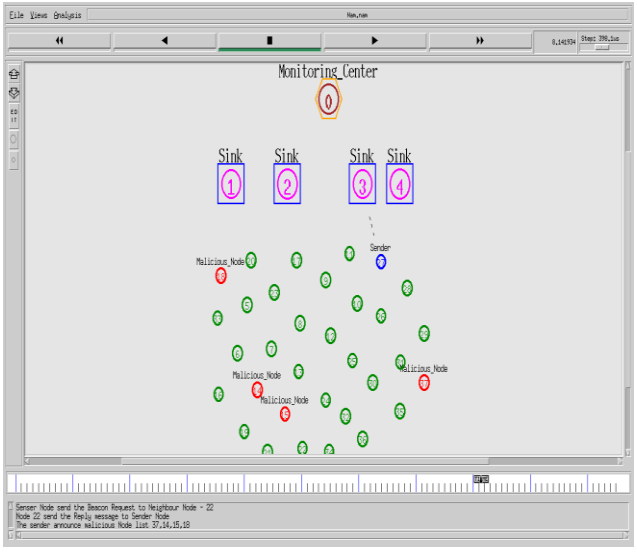

Fig. 6.9 Find Malicious Node

The information reached to sender in correct time after the beacon request otherwise the sender announces the malicious node. The malicious node act as a attack node. This node did not pass any information.

6.10 Message Send to Sink4

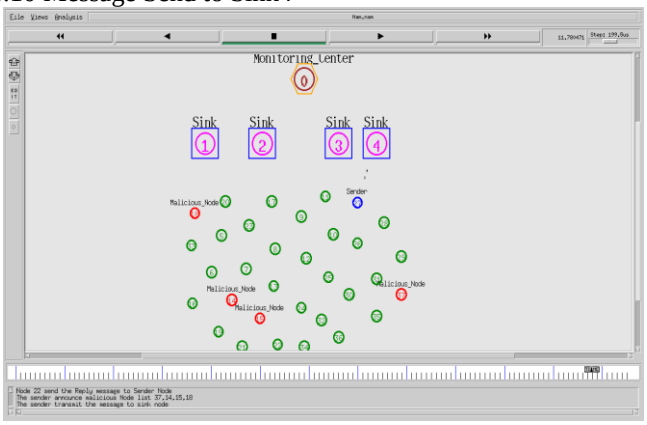

Fig.6.10 Message sends to Sink4

The fig.6.10 shows the message send to sink4.

6.11 Message Transmit Sink to Mc

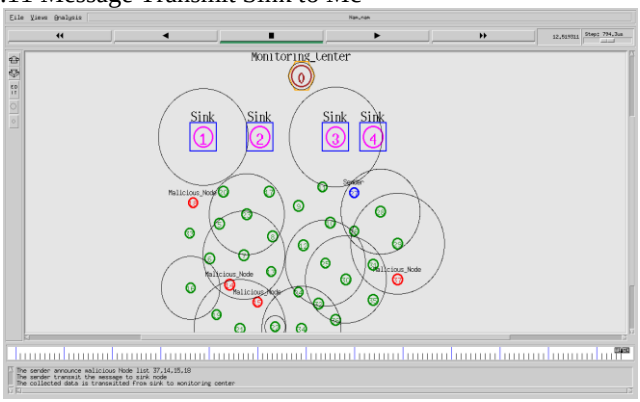

Fig.6.11 Message transmit sink to MC

The fig.6.11 shows the message transmits sink to MC.

7. CONCLUSION AND FUTUREWORK

The proposed model is maintained under the systematic feature of the data processing. It is also very effective in the packet losing model. The underwater concept is introduced in this mechanism for the data that should be implemented in-depth process. Here the process mechanism carried out in the previous mechanism was not guaranteed. It can be work by the respected sink through which it should be used. The process mechanism can be maintained for the depth storage knowledge. The previous mechanism focused on the GEADAR protocol. It could be avoided by maintaining the system with simple process through which it could be determined. All the process can be changed with the upcoming technology of the EGOUR routing mechanism. The EGOUR routing is well balance load balancing mechanism for transmitting the data. Thus the data send by this proposed model will never loss the packet during the data transmission. The main scenario of this model is, it increases the performance and enhance packet Delivery ratio. The time latency is concerned in this project.

The future enhancement could be extended by the function of the real-time routing model. The bandwidth model is not performed in this system. This should be overcome by implementing the systematic feature of the feasible mechanism through which it can be maintained.

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