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Energy Efficient Route Selection With Fuzzy Logic

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ABSTRACT

Under-water Wireless Sensor Network (UWSN) is a type of Wireless Sensor Network (WSN). Interest of UWSN is increased in recently last years. Acoustic communication technology is best used for Underwater Communication. Many proposed routing protocols, which are used for Under-water Wireless Sensor Networks different for Terrestrial Networks. In this paper, an algorithm is developed based on Fuzzy Logic, which is focuses on reduce the energy and to increase the network lifetime. This method is based on four parameters, which are end-to-end delay, jitter, throughput and energy. The simulation result is shows the better energy and life time of network as compared to the existing method.

Keywords – *Under-water Wireless Sensor Network (UWSN), Clustering, Fuzzy Logic, Networks Life Time,.*

I. INTRODUCTION

Large part of earth is covered by water. In Recent Years interest of the Under-water Wireless Sensor Networks is increased. To perform the monitoring task in given area numbers of sensor nodes are used in Under-water Acoustic Sensor Networks. For the communication RF is not good in Under-water. Acoustic communication is best for the Under-water communication. Underwater acoustic communication is a technique of sending and receiving message below water. Acoustic communication is reliable, robust and limited bandwidth. Many ways for the communication but, Hydrophones are very used for employing communication. Acoustic Waves are used in Under-water communication instead of electro-magnetic waves. Data Rates are very low in under-water communication as compared to terrestrial communication. Acoustic Waves are used in Under-water communication instead of electro-magnetic waves. At the starting of the 20th Century, some ships communicated with Under-Water Bells, the system being competitive with the primitive.

Under-Water Wireless Sensor Network connected with many number of sensors that are deployed in water environment. Sensors are having the ability of monitoring all round the underwater environment. The sensor nodes are deployed in the ocean environment in Under-water wireless sensor networks(UWSNs). They are used for together the sensed data and send to the sink. To deploy sensor nodes important challenges are the cost of network, memory, communication range, power and battery resources. Under-water wireless sensor networks consists many number of underwater wireless sensor nodes with processing, sensing and communication. To arrange the data traffic and reduce in network redundancies two

methods are used Node Clustering and Data Aggregation. Node Clustering make larger the network lifetime and makes the smaller to the network. To minimize the energy consumption by remove data redundancies used to Data Aggregation. Data Aggregation and Node Clustering techniques used to improve the performances of networks.

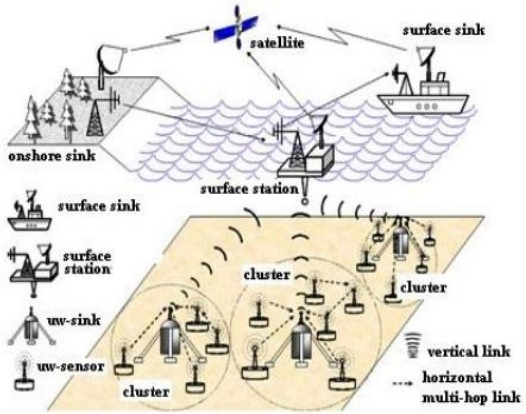

Fig 1. Underwater Sensor Network Architecture

To deliver the sensing information from sensor nodes to sink node and then transmit further analysis at the sink node is main purpose of UWSNs deployed in the underwater environments. To determine the performance of UWSNs, an important factor is Data Collection.

1.1 Comparison of Terrestrial Network's And Under-Water Sensor Network's

These Networks are very different in many factors.Terrestrial Sensor Networks use Radio Signal. UWSNs use Acoustic Signals. Terrestrial Sensor Networks less power than UWSNs. UWSNs are more power required than terrestrial sensor networks. TSNs require less memory. UWSNs require more memory. TSNs are not costly as compare to the UWSNs. UWSNs are costly because it requires additional hardware protection system.

1. RELATED WORKS

In Under-water Wireless Sensor Networks to save the energy is a big issue. Sensor Nodes are provided by batteries and to replace or recharge very difficult in harsh environment under-water. Many routing protocols have been developed in ground based wireless sensor networks. According to deployment it can be divided into following stages: Flat, Geographical, and Hierarchal routing [1]. LEACH protocol is proposed for WSN, it is the first protocol .In the case of static nodes LEACH protocol is very effective. When nodes have an energy level is equal, it gives the best performance. A disadvantage of LEACH protocol to select the cluster heads is the usage of local information. The internal architecture of UWSNs is described. It also discussed the different architecture of Underwater Wireless Sensor Network (UWSN) for Two-Dimensional and Three Dimensional [2].The gathering new development and experimental which are related to the Under-water Wireless Sensor Networks. For monitoring and control the domains of Underwater Wireless Sensor Network use the Underwater Acoustic Sensor Network [3].The new routing techniques which are focus to improve the energy efficiency, life time and also discuss the detail of protocols [4].Fuzzy Based Clustering and Aggregation techniques are designed for UWSNs. The Fuzzy Logic technique is used to performed Cluster Head Selection. The Fuzzy Member Ship functions used to residual energy, distance to sink, node density, and load are taken as input. NS-2 is used to reduce the energy and delay, it also improve the packet delivery ratio (5).

2. PRELIMANARIES

Before working on the proposed approach, the various existed approaches are explained. In existed system two algorithms are proposed which are based on Fuzzy C-Means clustering. Single Hope Fuzzy Energy Efficient Routing (SH-FEER) and Multi Hope Energy Efficient Routing (MH-FEER) are fuzzy based energy efficiency algorithms.

2.1 CLUSTERING

2.1.1 Data Clustering

In which process data elements are divided from actual images into classes or clusters is called Data Clustering. Data is depends on the nature and motive for which clustering is being used, different size of homogeneity may be used to locate the items into classes, where the same size powers how the clusters are organize.

2.1.2 Hard Clustering

In hard clustering, data is divided into different clusters, where each data element belongs to completely in one cluster. The main idea is to use radio communication for big and support traffic and regular acoustic method for small data capacity.

2.2 FUZZY C-MEAN CLUSTERING

Fuzzy Clustering is also called soft clustering. Data elements belong to more than one cluster, and related with each element is a set of membership levels. These specify the strength of the association between that data element and a particular cluster. Fuzzy clustering is a process of allocating these membership levels, and then using them to assign data elements to one or more clusters. Fuzzy C-Means Clustering algorithm. It is used the membership it describe the possibility of cluster. FCM is a local optimization algorithm.

2.3 Fuzzy Logic

Fuzzy Logic elements are Fuzzifier, Inference Engine, Fuzzy Rule Base (FRB) and Defuzzifier shown in Fig. 2

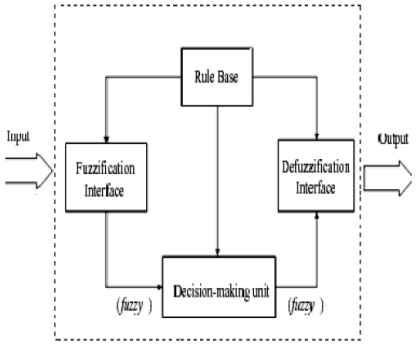

Fig.2 Fuzzification Process

3. PROPOSED METHOD

Firstly, we define the simulation metrics and simulation methodology of the proposed algorithms. We develop an energy efficient routing algorithm for such Underwater wireless sensor networks in order to attain higher lifetime of the system. To do so we apply the Fuzzy Logic this is the concept of soft computing to decide the optimal route and using that path.

We evaluate the performance of the proposed algorithm through extensive simulations under MATLAB Environment.

In this paper, we evaluate some parameters affected of the proposed algorithm. Parameters are represented in Table 1.

4.1 Simulation Parameters

Simulation Parameter	Value
Number of Nodes	500
Radius Of Node	3mm
Simulation grid size	400X400ms
Packet Size	10bits
Simulation time	39 sec
Number of Iterations	100

Table No: 1 Shows simulation parameter

4.2 Simulation Methodology

We make some assumptions of the proposed work in our simulation:

- Nodes are stationary after being deployed in the field.
- The network is considered homogeneous.
- All nodes have the same amount of energy.
- Co-ordinates of the nodes in each round are changeable.

4.3 Flow Chart

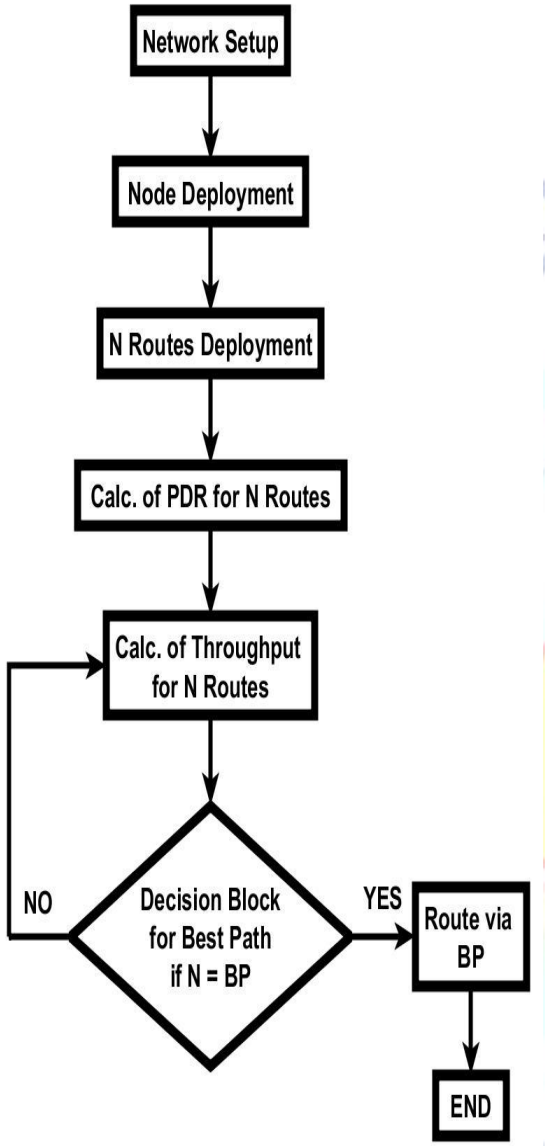

Fig: 3 .Flow chart of proposed method

4. RESULTS AND DISCUSSION

5.1 Performance Metrics

In this research different situation are taken into analysis with varying number of nodes against constant simulation time. Comparison is illustrated between two analysis techniques on the basis of End-to-End Delay, Throughput, Jitter, and Energy Left.

4.1.1 End-to-End Delay

In End-to-End Delay, it refers to time taken for a packet to be transferred over a network form source to destination. Delay of network; define how long it takes for a bit/packet of data to travel across the network from one node to other node.

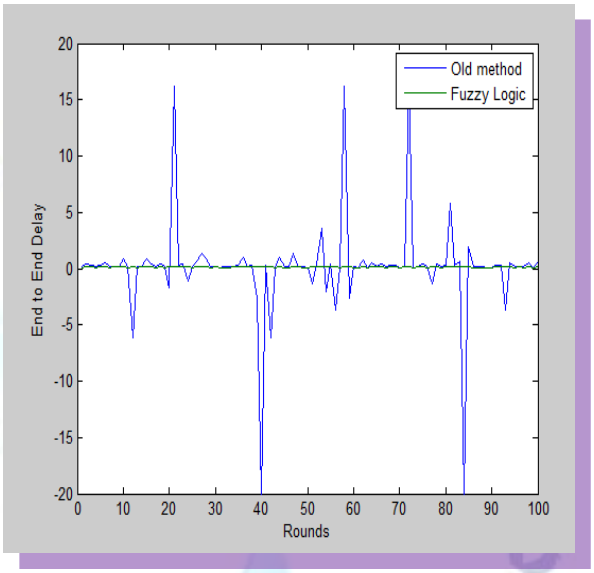

Fig.4: End-to-End Delay

Fig.4 shows the better result of average end-to-end delay. End-to-End delay is less in the proposed method as compare to old method. The packet will reach in time at destination.

4.1.2 Throughput

It refers to how much data can be transferred from one location to another location. It is an average rate of successful message distribute over a network. It is calculated in Bits/sec or packets/sec.

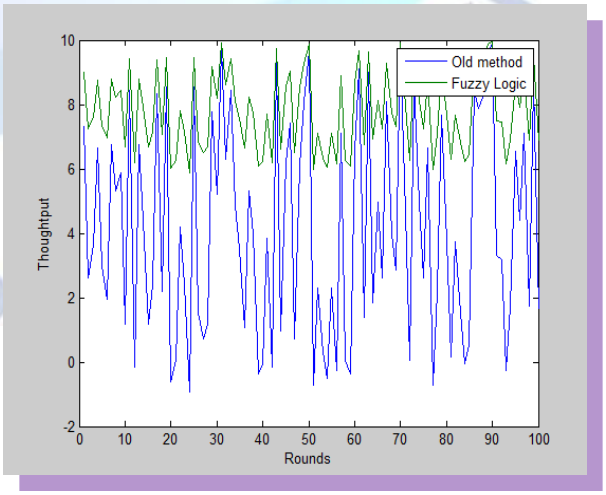

Fig.5: Throughput

Fig.5 shows that using fuzzy logic in new method is better results as compare to the old method. More number of packets will reach to the destination without any loss with the result of throughput which is improved in new method.

4.1.3 Jitter

It is clearly the difference in packet delay. In other words, Jitter is calculating time difference in packet inter-arrival time. The inter-arrival time is the time between each arrival into the system and the next.

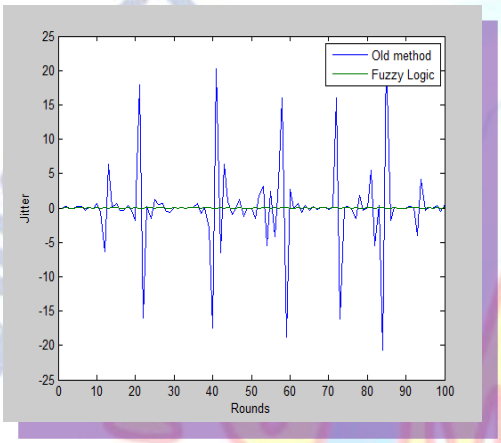

Fig.6: Jitter

Fig 6. Show that very less difference in packet delay in the proposed algorithm as compare to the old method. Jitter is very less in proposed work.

4.1.4 Energy

Battery power is limited because underwater batteries are extremely difficult to recharge.

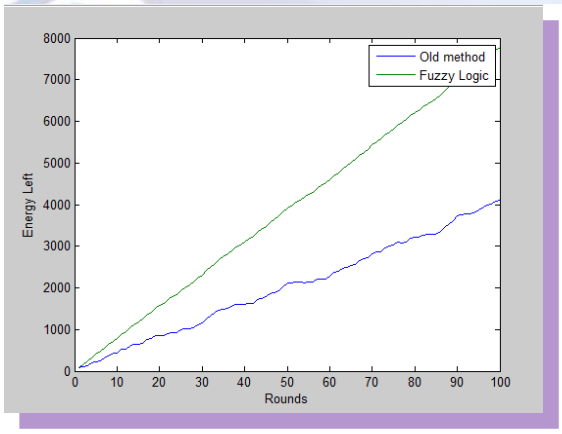

Fig.7: Energy Left

Fig 7. Shows that proposed method take very less energy with the old method.

5. COMPARISON WITH EXISTING METHOD

It is important to study about the existing methods and then compare the results of the proposed algorithm with the existing algorithms to check the improved output.

The minimum comparison is shown in Table 2 and Figure 8. The comparison graph shows the difference of output between proposed algorithm and existing algorithms.

Table 2 Comparative study of various parameters for both algorithms using 500 nodes of minimum values

Algorithm / Parameters	Existing (Min)	Proposed (Min)
Energy Left	73.2000	89.9333
End – to End Delay	0.1366	0.1004
Throughput	0.9433	8.9933
Jitter	-20.66	-0.0640

Shows the best results in proposed method than the existing method in all parameters of minimum values (Energy Left, End-to-End Delay, Throughput, and Jitter).

Comparison of Minimum Values with Existing Algorithms

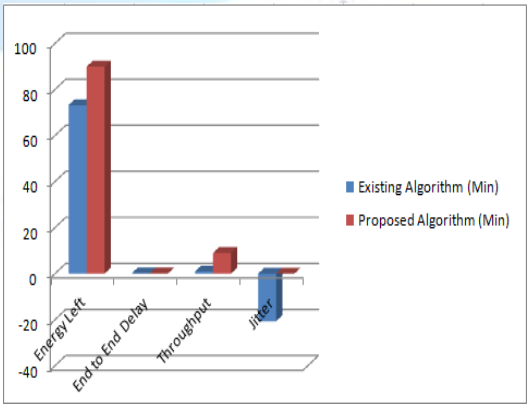

Fig 8: Comparison Graph Minimum Value

The maximum comparison is shown in Table 3 and Figure 9. The comparison graph shows the difference of output between proposed algorithm and existing algorithms.

Table 3 Comparative study of various parameters for both algorithms using 500 nodes of maximum values

Algorithm / Parameters	Existing (Max)	Proposed (Max)
Energy Left	4.1029	7.7849
End – to End Delay	16.2162	0.1698
Throughput	1.6250	6.8542
Jitter	21.9672	0.0661

Shows the best results in proposed method than the existing method in all parameters of maximum values (Energy Left, End-to-End Delay, Throughput, and Jitter).

Comparison of Maximum Values with Existing Algorithms

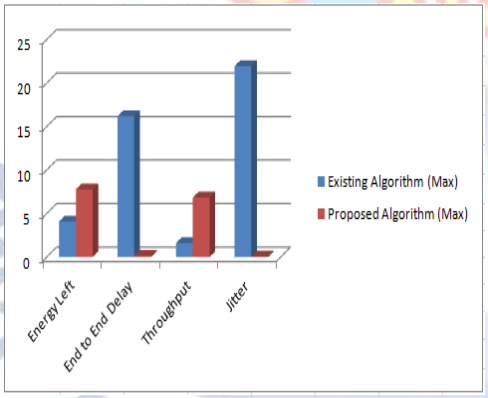

Fig 9. Comparison Graph Maximum Value

6. CONCLUSION

In existing algorithm used AODV Routing. To improve the energy efficiency of the system, develop a new routing algorithm for long time. In proposed algorithm used Fuzzy Logic AODV Routing. The results of the proposed algorithms are shown in result section and show the comparison of old and new algorithm. In the future works aim investigate intelligent algorithms such as genetic algorithm or ant colony to find the shortest path between sources to sink. We can develop the new algorithm to improve the energy for long time. It can be tested using any new algorithm.

REFERENCES

[1] Souiki, S., Hadjila, M. and Feham, M., 2015." Fuzzy Based Clustering And Energy Efficient Routing For Underwater Wireless Sensor Networks" International Journal of Computer Networks & Communications, 7(2), p.33.

[2] Jaydip M. Kavari and Dr. K.H Wandra "Survey Paper on Underwater Wireless Sensor Network" International Journal Of Advanced Research IN Electrical Electronics and Instrumentation Engineering Vol.3, Issue 2, February 2014.

[3] Mohsim Murad, Adil A. Sheikh, Muhammad Asif Manzoor, Emad Felemban and Saad Qaisaey "A Survey on Current Underwater Acoustic Sensor Network Applications" International Journal of Computer Theory and Engineering , Vol.7, No.1, February 2015.

[4] Nithya Joy and Biju Paul "Energy Efficient Routing Protocols for Underwater Sensor Networks-A Survey" International Journal Of Advanceed Research in Computer Science and Software Engineering, Volume 3, Issue 9, September 2013.

[5] Nitin Goyal , Mayank Dava and Anil Kumar Verma "Fuzzy Based Clustering and Aggregation Technique for Under Water Wireless Sensor Networks" International Conference on Electronics and Communication System (ICECS-2014), Feb. 13 - 14,2014, Coimbatore, INDIA

[6] Jennifer Yick, Biswanath Mukhrjee and Dipak Ghosal "Wireless Sensor Network Survey" Elsevier, April 2008.

[7] D Saranya and K Arthi "Underwater Wireless Sensor Networks Using Enhanced K-Mean And Clustering Approach" International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE) ISSN: 0976-1353 Volume 21 Issue 4 – APRIL 2016.

[8] Reza Khoshkangini, Syroos Zaboli and Srinivas Sampalli "Energy Efficient Clustering Using Fuzzy Logic" International Journal of Computer Science and Mobile Computing, ICMIC13, December- 2013

[9] R. Aiyshwariya Devi ,M .Buvana " Energy Efficient Cluster Head Selection Scheme Based On FMPDM for MANETs" International Journal of Innovative Research in Science, Engineering and Technology Volume 3, Special Issue 3, March 2014.

[10] Shiwei Li , Wenjing Wang and Juwei Zhang " Efficient Deployment Surface Area For Underwater Wireless Sensor Networks " IEEE 2012.

[11] Mrs Suvarna A. Patil and Mrs Pooja Mishra "Improved Mobicast Routing Protocol To Minimize Energy Consumption For Underwater Sensor Networks" International Journal of Research In Science & Engineering, Volume: 3 Issue: 2 March-April 2017

[12] Singh, Er Simerpreet, and Narwant Singh Grewal. "Impact of Various Propagation Models on Performance of On-Demand Routing Protocols." (2013).