AN ENERGY EFFICIENT ZONE BASED ROUTING PROTOCOL IN UNDER WATER SENSOR NODES

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Abstract-In the underwater wireless sensor networks (UWSNs) energy is the main issue. In wireless sensor nodes in underwater network they have limited source of energy (batteries) and replacement of their batteries is very difficult and costly. Hence, energy efficiency has always remained as a major concern in under water sensor network. The variation in energy consumption of nodes reduce the network lifetime and creates network holes. The data transmission through shorter distance path by hybrid routing protocol between multi-hop and direct transmission decrease the energy between nodes. The more energy is consumed like data is when transmitted through shorter distance nodes. The energy of shorter distance nodes decrease and their become holes in the network which result in energy loss. And less life time of network. In an energy efficient zone based routing protocol in UWSNs we have introduced the EEHC protocol which works on high energy cluster nodes. We have divided the network into 3 regions, low energy region, intermediate energy region, and high energy region. The low energy region is directly connected to the sink then in middle there is intermediate region then high energy region. The high energy cluster nodes send data to the sink which result in larger life time of network. Simulation shows important improvement in the network and energy consumption of the network.

I. INTRODUCTION

The Sensor network that are utilized underwater are usually called Underwater Wireless Networks(UWSNs).Despite having a similar functionality with terrestrial networks, UWSNs exhibit several architectural differences which are mainly due to the transmission medium characteristics and the acoustic signals to transmit data. Routing in UWSNs is very challenging due to specific characteristics that distinguish UWSNs from other wireless networks such as wireless ad hoc networks or cellular networks. Many new algorithms have been proposed, taking into consideration the inherent features of UWSNs along with the application and architecture requirements. Based on the network structure adopted, routing protocols for UWSNs can be classified into flat network routing, hierarchical routing location based network. Clustering protocols can reduce signaling overhead since they do not have to manage the mobility pattern or location of sensor nodes. As A result, it allows nodes saving more energy leading to a longer network lifetime. However, with some applications such as animal tracking, search and rescue activities this assumption is not very realistic: hence there are raising demands of clustering protocols to support mobile nodes. Clustering network is efficient and scalable way to organize UWSNs. A cluster head responsible for conveying any information gathered by he nodes in its cluster and may aggregate and compress the data before transmitting it to the sink. However, this added responsibility results in a higher rate of energy drain at the cluster heads.

II. RELATED WORK

Mudassir Ijaz et al. [1] has proposed Energy Efficient Hybrid Clustering Routing Protocol for UWSNs. In this paper author proposed for energy efficiency till now by proposing Energy Balance Mechanisms and by deploying low energy consuming sensor nodes in underwater networks. As the residual energy of a node is consumed, the node dies and creates energy holes in the network which results in partition of UWSN. These energy holes can interrupt the on-going data flow of the network. EEHC is the enhanced version of DBEBH protocol that contributes towards the enhancement of network lifetime by decreasing the number of transmissions and data aggregation. The simulation and results proves that EEHC has increased network lifetime, throughput with less energy consumption and end-to-end delay.

Muhammad et al. [2] had proposed Energy Efficient Hybrid Routing Protocol for UWSNs. The proposed protocol is a hybrid between multi-hop and direct transmission to the neighbors residing in the sub neighbor region. In this paper the direct transmission distance is decreased and it is refined to a sub neighbor region, which increases the network lifetime and reduces the energy consumption of the network. There are 4 regions of different radii from the sink created in our proposed protocol. The regions are in the form of semi circles beneath the sink node. Equal number of nodes is deployed randomly in each region. Neighboring lists are created by the nodes on the basis of their optimum distance to the sink. The nodes in region 1 and 2 (nodes which are deployed near to the

sink) are overburdened, so we increase their energy, hence the network lifetime extended and energy consumption of the network reduced.

I.Snigdh et al. [3] presents development of a lifetime prolonging algorithm for underwater sensor networks. The proposed algorithm takes into account the balanced energy consumption by nodes, with the varying parameters related to the sensing field like energy, attenuation, and path loss component. The aim is to prolong the node lifetime and hence network lifetime. The simulation results show that OEB strategy can achieve balanced power consumption per node throughout the network and hence maximize the lifetime of networks considering the different levels of sea.

Syed Zarar et al. [4] had proposed Increased Throughput DB-EBH Protocol in Underwater Wireless Sensor Networks. Author suggest to utilize the energy of the nodes remain a key aspect in the advancement of underwater wireless sensor networks. In this paper author check for all the conditions are satisfied, the node multi-hops the data to that particular neighbor. This technique helped us save a lot of energy wasted in direct transmissions. This way, the nodes avoid the usage of directly transmitting to the sink for as long as possible thus saving their energy, resulting in increased network lifetime and better throughput compared to DBH and DB-EBH.

Fatemeh Fazel et al. [5] had proposed Random Access Compressed Sensing for Energy Efficient Underwater Sensor Networks. The proposed scheme is suitable for long-term deployment of large underwater networks, in which saving energy and bandwidth is of crucial importance. During each frame, a randomly chosen subset of nodes participates in the sensing process, and then shares the channel using random access. Due to the nature of random access, packets may collide at the fusion center. To account for the packet loss that occurs due to collisions, the network design employs the concept of sufficient sensing probability. With this probability, many data packets as required for field reconstruction are to be received. The random access compressed sensing scheme prolongs network lifetime while employing a simple and distributed scheme which eliminates the need for scheduling.

Tayyaba Liaqat et al. [8] had proposed Depth-Based Energy-Balanced Hybrid Routing Protocol for UWSNs. In this paper, author concludes that energy is the main constraint of wireless sensor networks. Less energy consumption by the UWSNs cannot solve the problem as a whole, as the uneven energy consumption of nodes also creates problems by producing the energy holes which results in network partition. Hence this can interrupt the data flow in network. DB-EBH is the enhanced version of EBH protocol that contributes towards the balancing of energy consumption of the nodes. As well as in comparison of EBH, DB-EBH also improves the lifetime of a network, lowers the overall energy consumption of the system due to its hybrid communication technique, and it has also been proved that overall data transmission burden over the nodes is highly reduced which is clearly shown in the simulation results.

III. METHODOLOGY AND PROCEDURE

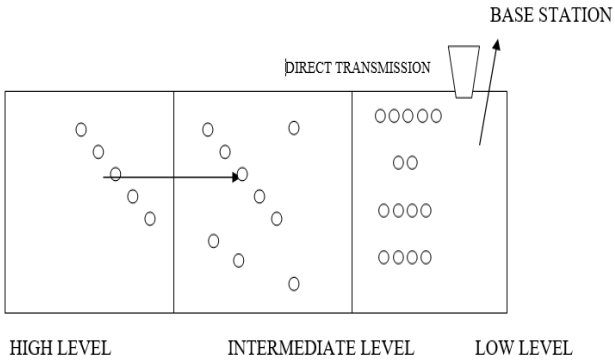

Fig.1:Network architecture

In this section we will describe our proposed network architecture. In this we have defined our architecture and operation. In our proposed work the network is divided in logical regions based on energy, some are High energy nodes, Intermediate Energy nodes and Low energy nodes. The nodes are allowed to perform switching between levels, as per threshold energy. When the energy of a node in higher level decrease below intermediate level, the node switch to low level and another node from intermediate level switch to higher level. This methodology provides an immune system and nodes survival time will be higher. More survival nodes results in enhancing overall network performance.

The proposed work is carried out using MATLAB Simulator. The Matlab provides enhanced and robust module for wireless communication. The proposed work is quite feasible to carry out using Matlab as all required modules are available and work is pure coding based. The results derive are almost equivalent to real world implementation as simulator simulates real environment.

A. The proposed protocol has following heterogenous levels:

1) Normal energy node:-
They have energy=E0
E_0=0.5joules

2) Medium energy level:-
$E_{med}=E_0(1+\mu)$

3) Highest energy level:-
$E_{high}=E_0(1+\alpha)$

B. Formula for Cluster Head (CH) selection:-

a) Level A=

$$Prob_a = \frac{prob_{opt}}{1+P_r.\alpha + b.\mu}$$

where $prob_{opt}$ is=0.1 and p_r is=probability of high node and b is =fraction of nodes in level b..

b) Level B=

$$Prob_b = \frac{Prob_{opt}(1+\mu)}{1+P_r.\alpha+b.\mu}$$

where $prob_{opt}$ is=0.1 and p_r is=probability of high node and b is =fraction of nodes in level b..

c) Level C=

$$Prob_c = \frac{Prob_{opt}(1+\alpha)}{\mu.P_r.\alpha + b.\mu}$$

where $prob_{opt}$ is=0.1 and p_r is=probability of high node and b is =fraction of nodes in level b.

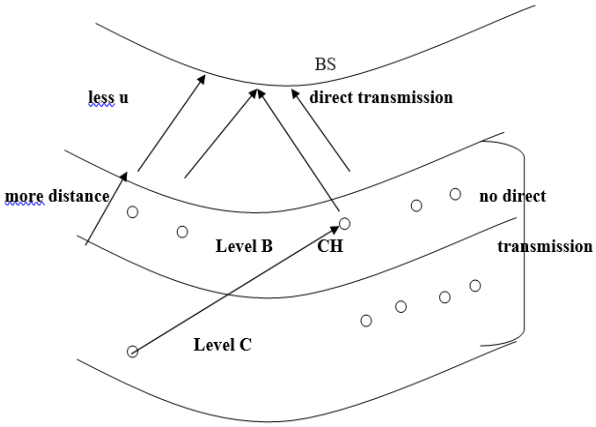

Fig.2: Network Division of proposed network

IV. RESULT AND DISCUSSION

Two networks architecture's work we will discuss in this section. One is EEHRP(Energy efficient hybrid routing protocol) and other is based on EEZBRP(Energy efficient zone based routing protocol). In these two networks we will discuss about the Percentage of dead nodes and Alive nodes on the Graph.In figure 5.1 and 5.2 the life time of EEHRP and EEZBRP is compared.First we will discuss about EEHRP. In EEZBRP the network architecture is divided into three parts. High level, intermediate level, low level region. Sink node is attached on low region so that it can esaily send data to the sink because of low energy.

In EEHRP network architecture they divides nodes homogenously in each regions. but we will distribute nodes in heterogeneous way. Like 20 nodes to high energy level, 50 to intermediate level and 30 to low energy level. The low energy level will send its data to sink node directly and high energy level will send data through intermediate level. High energy level will use cluster nodes to send data to the sink through intermediate nodes. Though there is more burden on high level so its energy is high because it is far from sink node so it require high energy to send data.. The sensors sense the data continuously but will send the data when hard threshold is less than sensed data. only then the transmission takes place otherwise network only sense the data The no of nodes in this architecture used is 100. And they are heterogeneously distributed in network. Due to less transmissions the energy is consumed less and it results in more lifetime of network. Thus the lifetime of the network will increase. It is shown in fig 5.1 as.

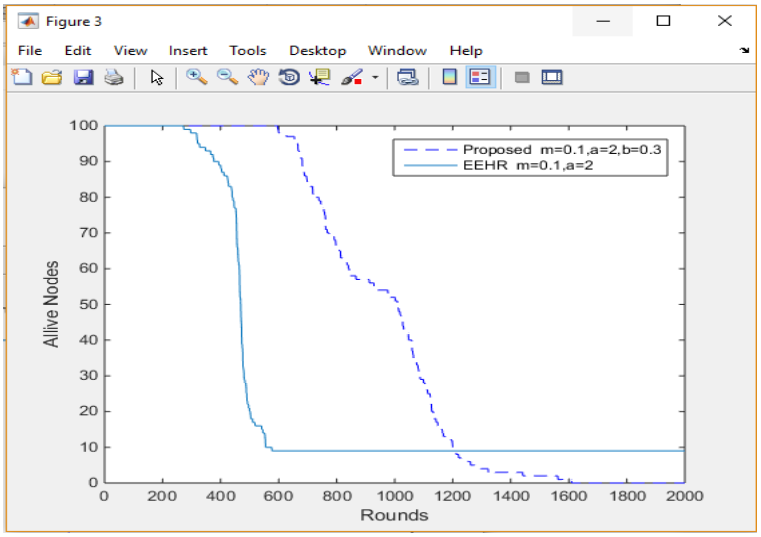

Fig.5.1:Alive nodes per round

Rounds	EEHR(joule)	Proposed(joule)
200	100	100
400	85	100
500	10	100
600	0	100
1000	0	55
1600	0	0

Figure 5.2 shows the per round energy consumption comparison of EEHRP and EEZBRP. Clearly we can see that in this network model, the energy consumption of EEHRP is more than EEZBRP in early rounds. The reason is that of high

energy dissipation in case of frequent transmissions from nodes to the sink through shortest distance path.

In our protocol instead of frequent transmissions of data packets to sub neighboring regions in the neighbor regions we introduce the concept of threshold. When the sensed data is greater than threshold only then the data transmission takes place otherwise it continuously sense data.

So the no of dead nodes percentage is shown as in figure 5.2

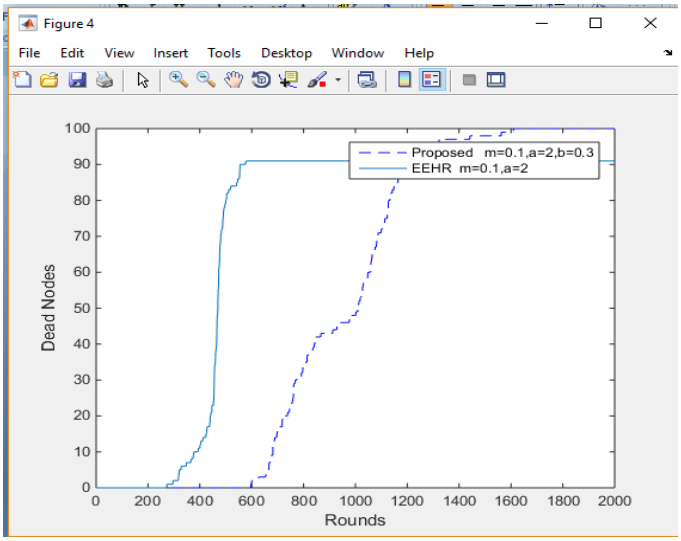

Fig.5.2: No of dead nodes per round

Rounds	EEHR(joule)	Proposed(joule)
200	0	0
300	20	0
400	100	0
1000	100	55
1600	100	100

Here in this graph the lines are shown out of which dotted line shows our proposed protocol's dead nodes per round which goes to 600 rounds and dead nodes are 100. on the otherside the other line show previous papers dead nodes per round which is less than our proposed work. In EEHRP the nodes are dead at 200 rounds which indicate less lifetime of network. our proposed work shows more lifetime of network.

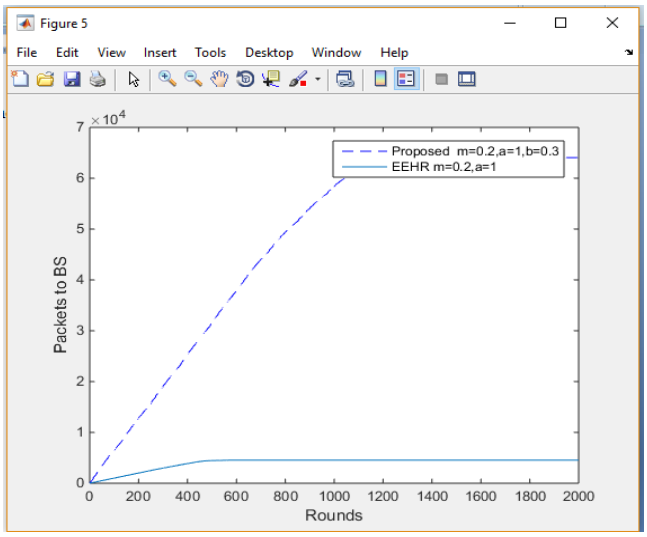

Fig.5.3: No of packets to base station

Rounds	EEHR(joule)	Proposed(joule)
200	0.3×10^4	1.2×10^4
400	0.5×10^4	2.3×10^4
1000	0	5.5×10^4
1600	0	6×10^4

V. CONCLUSION

By Study of various clustered based underwater wireless routing protocols this paper formulate the problem statement of increasing the lifetime of underwater sensor network. We proposed an energy efficient threshold based technique for proficient routing in wireless sensor networks. That increase the lifetime of network up to 600 rounds. We implemented proposed threshold based algorithm that decrease the energy consumption problem in under wireless sensor networks and enhance overall performance by decreasing unwanted transmissions in network. We compare the Performance of proposed threshold based routing protocol with any existing routing protocol in term of alive nodes, dead nodes and energy consumption which shows better results for our proposed network.

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