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UCT Journal of Research in Science, Engineering and Technology

UCT. J. Resea. Scien. Engineer.Techno. (UJRSET)

Volume 5 ,Issue 2

14-29 (2017)

ISSN 2382-977X

Routing based on maximizing Output in underwater sensor networks

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Original Article:

Received 10 Jan. 2017 Accepted 10 April 2017 Published 20 May. 2017

ABSTRACT

In this study we want to optimize routing in underwater sensor networks through considering the spatial distribution of network's sensor nodes and their energy consumption limitation such that the overload of layer routing protocol (including the number of message passing specified to routing operation and waiting time for upper layers) on network output will be decrease, The main feature of this study is simultaneously considering the model of underwater channel, geometric distribution of network and transaction of network layer and MAC sub layer is solving routing problem. In this study we present a routing mathematical model with the capacity of sink movement in wireless sensor networks. We introduce an algorithm to compute the DS in certain modeled networks as a graph. Through simulation, presented design will be evaluated and investigated ,Our presented design is Depth and Energy Aware Dominating Set based Algorithm (DEADS) (an algorithm based on depth and energy) . In this study we applied MATLAB software for simulation. Finally we conclude that the durability and the trend of active nodes in each period of our presented design is better suggesting that the applicability and capacity of our plan was improved, Also the energy consumption of our design is as a result of more transfer number. Also, head-to-head delay is lower and partially it is followed from the same paradigm.

Keyword:

Routing; Output, Sensor network, Node

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Peer review under responsibility of **UCT Journal of Research in Science, Engineering and Technology**

1.INTRODUCTION

Routing is wireless sensor networks is a challenging operation and it is due to the operational and procedural, communicational and energy source limitations in wireless sensor nodes . So routing protocols should be designed in a way that the present the lowest operational complication and the lowest information and communicational overload which these limitations will result due to inclusion and comprehension of operation in various environments and no intervention of network user . Routing protocols must be distributional and have decentralization in each node, so each node, locally, can perform independently and have separate decisions for responding to changes in external environments, Today researchers and engineers in wireless sensor network field are faced with some challenges which forced them to present new approaches in their designing and methods for routing. First, they must apply bandwidth optimally in order to minimize the delay between receiver and sender and second , the tolerance and resistance against stable errors is an important factor that they must pay attention to it, In addition, another approach could be developing routing protocols based on ensuring service presentation required for a certain process.

Industrialists and the networks managers could opt different routing protocols with respect to requirements, process type , geographica location and power management in their wireless sensor networks . With respect to these mentioned views and their importance, designing routing protocols performs with different classification method which are with respect to process type, network dimension. geographical location and service quality and so on, so energy consumption will be optimized and minimized and from the other side, they send network traffic safely, with high quality and low cost[8].

Due to the lack of general address for network nodes (Like IP based networks) and presence of an final node(or destination) in the name of Sink, routing protocols are different from their traditional versions. On one side, in most environmental or military ,applying these underwater sensor networks is necessary. While, underwater wireless channels has different features from terrestrial networks which are results of the presence of several routes and continuous changes in the location of nodes. Besides, the high cost of its implementation and development , in combination with limitations of energy consumption in underwater sensor networks, make underwater telecommunication protocols designing, an unique fact.

Routing protocols, especially in infra-structured networks and IP-based were investigated extensively , but this study, through considering the ad-hoc feature of network's model with Random geometric distribution, underwater channel model and investigating the routing effect on network output (MAC layer) , will challenge other proposed routing protocols in this field.

Dominant set is a set of V vectors, so each node in V set , is at least one node in dominant set, Dominant set formation will help to organize nodes, so it is optimal for shared routing. Dominant set is displayed as main column which is a subset of nodes which can perform special things and can apply nodes which are not in the main column. This main column will decrease communication overload, increase bandwidth , reduce total energy consumption and increase network lifetime of wireless sensor networks, In addition to acting as main column dominant set sends effectively data towards MS which are placed next to the predefined optimal routes, With these two different criteria for selection, selecting partner node will be compared according to depth threshold, PNS SNR -DTRE ratio. In selecting partner node based on depth threshold and remaining energy and signal to noise ratio,, remaining energy in nodes and its depth threshold will be calculated(d_t). In our study, d_{th} is different in each node and it depends on nodes which are next to the adjacent.We consider partner node selection based on depth threshold, remaining energy and SNR, with remaining energy and depth threshold.

2.Research Methodology

In this study, shared communication is presented as an useful alternative to reduce signals fading and other disorders in link. In this method we apply Scattered nature of wireless transmission which transferred signal in it, will be added by proposed sensor nodes . In this chapter , we summarize applied methods with reference.

Creative and innovative solution for the physical layer of physical layer in shared communications is defined in [2], where the possibility of power cut and Compression capacity of UAC are derived from AF water relay performance and DF. In addition, we propose receiver design to mitigate the damaging effects of Doppler . In [3], CUWA-MIMO is recommended through applying DF. Here , each node in network apply its nearest adjacent node as shared virtual antenna. This operational process will help system with spatial diversity to improve . Lu et al [4] , studied cooperation in MAC and proposed CT-MAC which is Medium access control of regulated transfer for MIMO network communication underwater. This design, in addition to long delay in propagation, defines crash among controlled packs in UAC[5]. Two examples of sending design: AF and DF are implemented, analyzed and compared. This design presents relay selection based on delay in propagation for underwater acoustic network [6]. In this design, optimal relay number will be selected based of variable condition. Delay in inter-nodes propagation of relay is considered as a criteria for propagation partner selection . In addition to relay selection criteria to obtain more improvement , more results will achieve. In [8] ,shared routing with sink movement in network layer will be implemented and analyzed. For shared routing, nodes will be selected based on depth and energy information. There is a mobile Sink, data directly will be sent towards it by shared method. When there is no sink , data will transfer towards partners . In [9], routing based on common depth will present which obtain output efficiency and data reliability, Potential relays are selected based on their depths. Data resulted from source node , will be transferred through relay nodes to destination and their output will increase and in comparison to DBR, decrease pack (set)decline.

Increasing network lifetime is an important challenge. A possible way is applying movable sink. Some proposed protocols in this field are adaptive strategies which are in [1] and guarantee the least energy consumption through applying sink reconstruction . To overcome this problem, sink rearrangement to find a new location will be started, In coordinating plan, sink movability will apply to collect data in underwater sensor networks which is introduced in [10] and increase energy efficiency and reliability of communication. In [11], an underwater model for data collecting will present which have various MS to reach to high Capacity temporary fix. In [12], the movability of sink increases network lifetime . The radius of location will develop 3D networks, so increasing network lifetime and effective applying of nodes' energy in very important. Predefined route in [13] applied movable sink. AUV reduces total number of data transfer [14] through applying AURP and MS which leads to High levels of delivery . In AEERP protocol, a MS collects data from gate's nodes through applying automatic underwater networks. Nodes of gate are selected based on remaining energies . Non-co-axial depth protocols present new routing protocols called depth-based routings without any need to underwater wireless sensor networks localization which applies the depth of sensor nodes as a criteria for routing and send data by greedy method towards sink. In [17],effective energy routing protocol called EEDBR will present. In depth-based protocols, depth and remaining energy in sensor nodes are applied as routing criteria, so network will improve. In adaptive mobility of destination improved nodes in depth-based routing [18] ,routing designs based on Forward transfer function will be introduced. This method is initial sample of a network which has no need to localization and flooding for underwater functions.

3.Proposed Method

In this section we describe proposed method. Each source node modulates its data by Binary Phase Shift Keying (BPSK) . Overall channel of each node in each modulated data which are transferred has Rayleigh swings and Additive White Gaussian Noise (AWGN). Following equations show the relation between those signals which send and received by source nodes , destination nodes and Rayleigh [26]. X_s is the main and initial signal, Y_{sd} and Y_{sr} are received signals in Rayleigh nodes and destination . Y_{rd} is received signal in destination of Rayleigh node. n_{sd} and n_{sr} are noises of channel related to source to destination and destination and from source to Rayleigh. n_{sd} is the noise in existing channel related to Rayleigh to destination. g_{sd} and g_{sr} are the gains of existing channel from source to destination and source to Rayleigh. g_{rd} shows the gain of existing channel from Rayleigh to destination .Received signals in Rayleigh and destination nodes are as follows:

$$Y_{sr} = X_s g_{sr} + n_{sr}$$

$$Y_{sd} = X_s g_{sd} + n_{sd}$$

Received signals in destination node which are sent from Rayleigh are as follows :

$$Y_{rd} = Y_{sr} g_{rd} + n_{rd}$$

3.1. Mathematical model of proposed method

In proposed method, nodes develop in underwater environment. According to figure 1, all nodes have a predefined transfer range . Here in initial stages , nodes have no data about depth and remaining energy in adjacent node. These data will be obtained in propagation stage . IN this step , all nodes share remaining energy and depth data with adjacent active nodes . Different rules and views will be presented as follows:

Rule 1: Network is divided in to 4 distinct areas with subset $\left(R_k \middle| k = 1-4\right)$ based on depth (D), including subset of all nodes in group one(hop) which are separate and have special transfer in each transfer range, Following figure , shows rule1 by separate nodes of hop within each subset: $D(R_1)\rangle D(R_2)\rangle D(R_3)\rangle D(R_4)$

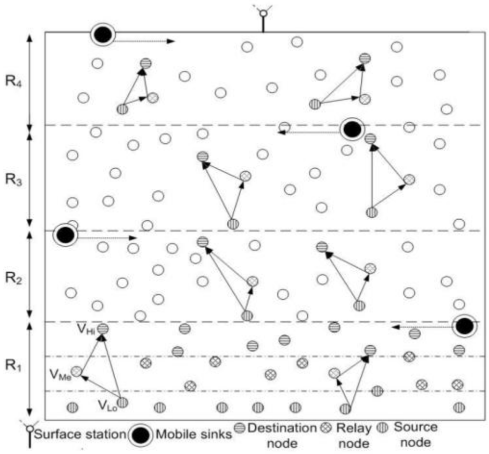

Figure 1 : separate nodes of hop within each subset

Rule 2: In each R_k, vertices divide among separate groups Here, V_{Hi} is the upper part of the depth in a subset and V_{M_e} shows the middle part of a depth in subset and V_{Lo} is the lower part of subset.

A DS for each R_k is formed based on special criteria. We describe DS as follows:

DS: DS is a subset of upper part of V in each R_k which each vertex that is not in DS , is adjacent to each vertex in DS.

DS is calculated for consistent routing based on depth and remaining energy data in sensor networks. Nodes which have the lowest depth and highest remaining energy in each R_k a DS like all nodes in R_k, at least are related to one node in DS,

Rule 3: Source nodes , Rayleigh and destination in each R_k belong to V_{L0}, V_{Me} and V_{Hi} so $D_D \langle D_R \langle D_S$

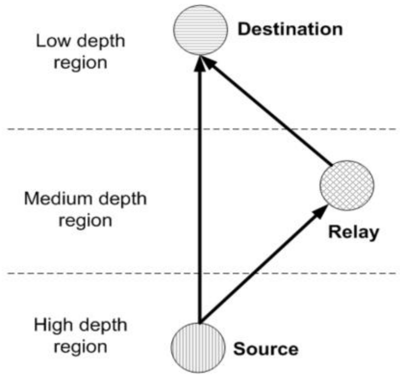

Figure 2: Consistent routing based on depth and remaining energy data in sensor networks (Rule 3).

Here, D_D, D_R and D_S shows respectively the depth of destination, Rayleigh and source nodes, This relation shows that destination, Rayleigh and source nodes in areas with high.medium and low depth are placed in R_k. Rule 3 is showed in above figure . Here we assume that MSs transfer periodically radio signals because each node should be kept its dynamic paradigm and according to it , will keep its forward data. In depth-based routing , depth threshold applies to prevent from flowing which this doesn't perform from creating limitation in transfer links for each non-received packs. In protocols iAMCTS,EEDBR,DBR which are depth-based, were investigated in UWSN . In all protocols, d_{th} changes based on volumetric data of network. Here we present a method for d_{th} changes which prevents from displacement in controlling packs.

Rule 4: d_{th} value will be changed based on the number of adjacent active nodes :

$$\forall i \in V \ : d_{th_i}(t) \propto N_i(t)$$

Here , $N_i(t)$ is adjacent active nodes which includes ith node in t time constant

$$N_i = N(i) = j \,|(i,j) \in A$$

$$\uparrow N \rightarrow \uparrow d_{th}, \downarrow N \rightarrow \downarrow d_{th}$$

This equation shows that increasing the number of adjacent active nodes will lead to increasing the value of d_{th} vice versa. In this method , nodes only need to an adjacent node (hop), instrad of need to whole information of network. d_{th} plays an important role in rayleigh and destination node selection. Adjacent nodes determines DS potential and CC based on d_{th} Based on the following figure, rayleigh and destination method are related to CC and DS node.

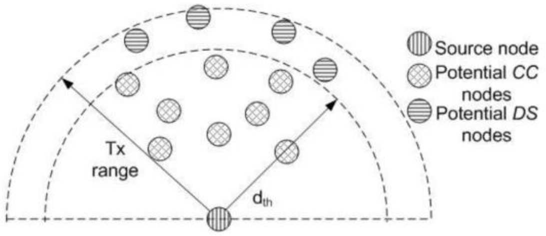

Figure 3: Depth threshold selection(The highest d_{th})

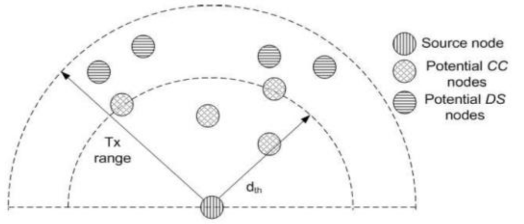

Figure 4: Depth threshold selection (Medium d_{th})

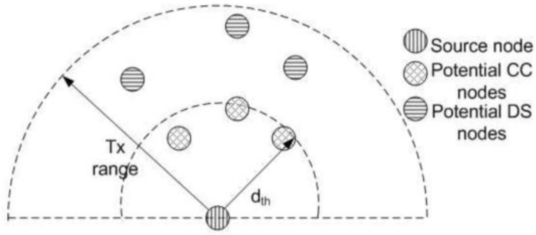

Figure 5: Depth threshold selection (the lowest d_{th}

According to above figure , the number of existing nodes within transfer range of source node is high due to the high volume of it d_{th} node . If the volume of node in range decreases , d_{th} also will decrease .

Rule 5: adjacent node to ith node will be obtained as follows:

$$N(i) = N_{outd_{th}}(i) \cup N_{ind_{th}}(i)$$

$N_{outdth_{(i)}}$ shows the adjacent nodes ofith nodes which are outside predefined boundary

$N_{outdth_{(i)}}$ shows the adjacent nodes ofith nodes which are inside the predefined boundary

$$N_{outd_{th}} \in V_{Lo}, N_{\text{ind}_{th}} \in V_{Me}$$

$N_{outdth_{(i)}}$ and $N_{indth_{(i)}}$ are the medium and the lowest depth in each R_k

Rule 6 : For each R_k , DS potential of nodes is as follows:

$$DS_k \subset N_{outd_{th}}(V_{Hi}) \forall V_{Hi} \in k$$

First for each R_k, the depth of adjacent nodes (N_{outdth}) which have been showed by V_{Hi} is a desirable factor for the capacity in DS.

Decreasing DS size lead to message destruction and improvement of routing output. With decreasing DS size, additive nodes will decrease with their remaining energy.

Rule 7: Since the possibility of P_s each I node selection dependant to V_{L0} is considered as DS , so:

$$\forall i \in V_{Lo} : \begin{cases} Ps \propto R_e(i) \\ Ps \propto 1/D(i) \end{cases}$$

SP for DS nodes, SP_{DS} is a function of depth and remaining energy of node:

$$SP_{DS} = f(D, R_e)$$

SP for DS nodes in time t , $SP_{DS}(t)$ is as follows:

$$SP_{DS}(t) = R_e(t) / D(t)$$

$R_e(t)$: Remaining energy in each DS node in t time is based on J

D(t): The depth of each DS node in time t is based on meter .

Increasing the amount of $SP_{DS}(t)$ for each certain node, will provide more opportunity for DS capacity and vice versa. The highest energy which V_{Hi} will show is considered as a desirable factor which is applied as CC. CCs are Rayleigh nodes which applied in consistent routing, They are related to source nodes and beside DS node, will replace through one route.

Rule 8 : For R_k , CC nodes are as follows:

$$CC_k \subset N_{ind_{th}}(V_{Hi})\forall V_{Hi} \in k$$

Rule 9: Nodes with highest energy , are CCs for consistent routing.

$$\forall i \in V_{Me} : Ps \propto R_e(i)$$

So selected parameters for CC groups, SP_{CC} , are functions of remaining energy in nodes

$$SP_{CC} = f\,(R_e)$$

SP for CC in time t is as follows:

$$SP_{CC}(t) = R_e(t)$$

Increasing SP_{CC} for each node belonging to V_{me} will improve opportunities for CC node capacity and vice versa

Rule 10: All medium depth of CC and non-CC in each Rk send directly their data towards lower depth of non-DS or will reach to consistent position (Depending on the capacity of node existence)

$$\forall i \in V_{Me} \left| i \in CC_k .R = j \in V_{Me} \right| j \notin CC_k \;\&D = l \in V_{Lo} \left| l \notin DS_k \right.$$

$$\forall i \in V_{Me} \left| i \notin CC_k .R = j \in V_{Me} \right| j \notin CC_k \;\&D = l \in V_{Lo} \left| l \notin DS_k \right.$$

Similarly all non-DS lower depth in each K subset send directly their data towards MSs :

$$\forall i \in V_{Lo} \left| i \in DS_k , D = MS \;\& R = j \in V_{Lo} \right| j \notin DS_k$$

$$\forall i \in V_{Lo} \left| i \notin DS_k , D = MS \;\& R = j \in V_{Lo} \right| j \notin DS_k$$

Here D and R shows destination and Rayleigh nodes. For this section , D and R apply instead of DS and CC because D and R belong to DS and CC node.

DS calculations will perform in constant time t , so energy consumption during network output will regulate . The main advantage of DS based on routing is restricting sink routing process which mainly is related to DS (According to rules 6 and 7)

3.2. DEADS design introduction

to ← predefined time
interval in seconds
Tmax ← Network lifetime in seconds
N ←Number of a node's neighbors (N1 > N2)
Dth ←Depth threshold
Dth1,Dth2,Dth3 Optimal values of depth threshold (Dth1 > Dth2 > Dth3)
for T = 1 : to : Tmax do
if N _ N1 then Dth = Dth1
else if N1 > N _ N2 then
Dth = Dth2
else if N < N2 then
Dth = Dth3
end if
end for

Here we study our proposed method which is based on depth and data about existing energy. Flowchart of this method is as follows. In this figure we see the steps of selecting Rayleigh and destination nodes, All nodes adjacent to a hop have regular intervals t0. Here their d_{th} will de described through following rule 4. After d_{th} selection, adjacent nodes among $N_{ind_{th}}$ and $N_{outd_{th}}$ are different based on Rule 5.

Nodes belonging V_{Hi} use rules 6 to 9 for selecting DS and CC. CC and N_{indth} are the least depth. Nodes related to V_{me} and VLo follow rule 10 for selecting destination and Rayleigh nodes. If adjacent node belonging to V_{me} is special in each subset, so each type of node (non-CC) is selected as Rayleigh and each non-DS node is considered as destination node .

A chart is showed in figure 6 and we investigated it for describing DS structure . For each vertex A , we present its adjacent as $N(A) = b \in v | ab \in A$. Here $b \in p$ (p is the whole number of nodes in network).

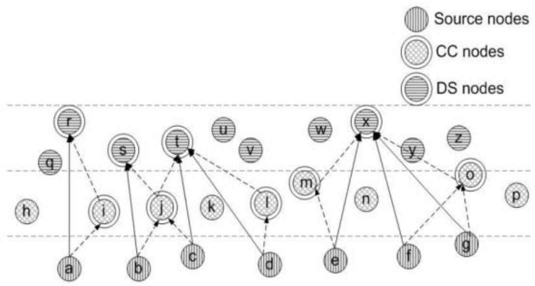

Figure 6: depth and energy in DS structure

Here, each source node includes a series of hop adjacent and d_{th} is a base. In this subset , acceptable nodes are DS nodes, $N_{outd_{th}}$ and CC and $N_{ind_{th}}$ acceptable nodes and CC and $N_{ind_{th}}$ .For example , node a , has nodes h , I , j,q.r and s in its transfer range . After finding its d_{th} , a will divide into two adjacent series.

Here nodes from CC to DS are as follows:

N(a) = h, i, j, q, r, s,Nindth(a) = h, i, j,Noutdth(a) = q, r, s,
N(b) = i, j, k, r, s, t,Nindth(b) = r, e, h, i,Noutdth(b) = r, s, t,
N(c) = j, k, i, l, s, t, u, v,Nindth(c) = j, k, i, l,Noutdth(c) = s, t, u, v,
N(d) = k, l,m, t, u, v,Nindth(d) = k, l,m,Noutdth(d) = t, u, v,
N(e) = l,m, n,w, x, y,Nindth(e) = l,m, n,Noutdth(e) = w, x, y,
N(f) = m, n, o,w, x, y, z,Nindth(f) = m, n, o,Noutdth(f) = w, x, y, z,
N(g) = n, p, o, x, y, z,Nindth(g) = p, n, o,Noutdth(g) = x, y, z,

When nodes gain information about their adjacent nodes, they observe environmental features through applying consistent route. According to rule 6,DS forms and through applying SP_{DS} in rule 7, select appropriate destination which belong to DS nodes, Similarly , according to rule 7, CC series will form and through applying rule 9, an appropriate Rayleigh node will be selected which belongs to CC nodes . CC , non-CC and DS nodes show their data through applying rule 10:

```
S ← Sensed attribute
Hth ← Hard threshold
Sth ←Soft threshold
P ← Data packet
Re ← Residual energy
F ← Flag
if S _ Hth AND Re > 0 then
send P set F = 1
else if Sth _ S < Hth AND Re > 0 then
send P
set F = 0
else
no transmission
end if
```

DS nodes and DS destinations nodes perform the highest MRC in received copies and will transfer it to its adjacent MS.
In this section, we compare our proposed method with the other approaches. We use MATLAB software for simulation. Parameters which are applied in simulation, are listed in table. Evaluation rate is 10kb/s. Power of a node in transfer , receive and inactive case are 2 watt , o.1 and 10 mili watt .

Table 1: Applying parameters in simulation

parameters	value
nodes number	225
sink number	4
area	500m X 500m
communication rate	100m
intitial energy	10J
data package	1600bit
control pack	48bit

In this section, we investigate performed methods and compare them with routing method based on depth including DBR and EEDBR.
In DBR method only depth will consider but in EEDBR , depth will be considered with remaining energy . In our proposed method , energy consumption and LSNR in network are in balance which will lead to increase and lengthening stability period in formation of covering gaps.
According to figure 7, stability period in EEDBR and DBR is short. Although DBR stability period is better than EEDBR , this is due to gradual increase of energy consumption in DBR.

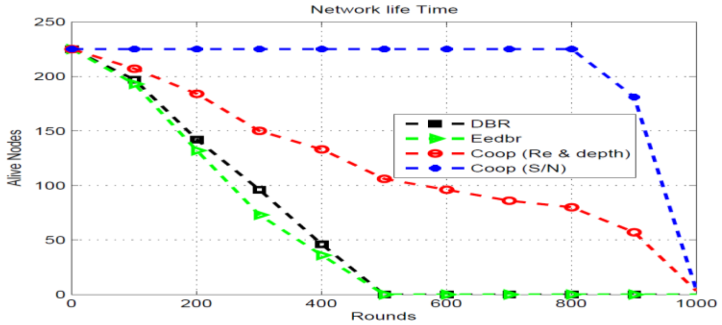

Figure 7: Active nodes comparison in a network with dynamic short sin

When network becomes more compact and smaller, the number of adjacent nodes will decrease which this will lead to network instability .In DBR , low depth nodes will destroy in first step which is due to high forwarding rate of data and fixed depth threshold . DBR will ignore energy and d_{th} based on consistency criteria, nodes will destroy sooner because remaining energy is not a reliable criteria and doesn't generate any data about long-term stability . Because SNR allows different links and depth remaining energy of nodes and link situation so it has negative effect on network output . The number of lost nodes will lead to sharpness in EEDBT, so energy consumption of nodes will increase. About remaining usage which prevent from formation of covering holes and finally will lead constant output during network lifetime.

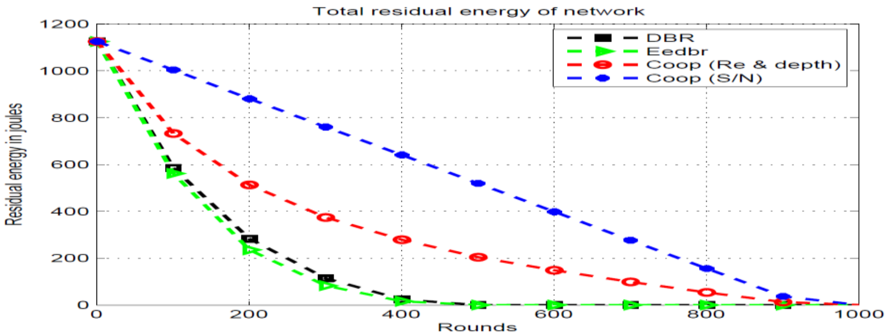

Figure8: comparison of network whole energy to hole activity pattern in short sink

DBR shows better energy management than EEDBR. In DBR, remaining energy decreases uniformly and this is when desirable amount of adjacent nodes become inactive besides networks concentration. About remaining energy and d_{th} based on consistency criteria . a sudden decrease in remaining energy will occur during initial time periods, Then, energy consumption will decrease because nodes have error in finding Rayleigh nodes due to the decrease in network volume. SNR based on its criteria, has approximately more constant energy during network lifetime than the other criteria . Because forward node is better and performs organized functions better which includes different depth and energy.

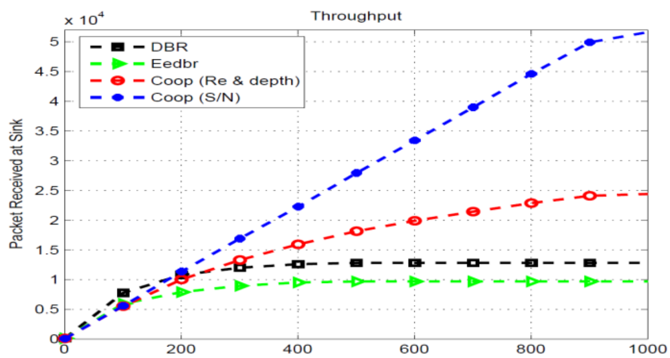

Figure 9: Comparison of received packs in MSs to dynamic samples of short sink

According figure 9, DBR and EEDBR output will decrease rapidly due to decrease in network which are not appropriate for delay tolerance applications. In our approach, unnecessary data transfer which decrease output will prevent . In comparison DBR and EEDBR in deposited energy and d_{th} based on output consistency will decrease rapidly . Due to rapid decrease in network volume , energy consumption will decrease uniformly.

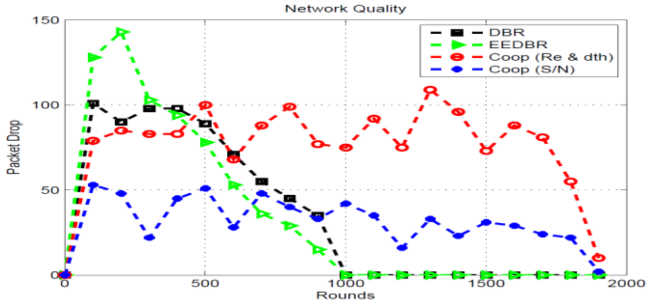

Figure 10: comparison of packages reduction with dynamic samples of short sink

In figure10, pack reduction is showed. DBR and EEDBR high reduction is due to single link which often had weak link. Whenever H_{th} and S_{th} are present, packs will generate by nodes. Sink only accepts packs which have acceptable SNR. Charts indicate that remaining energy and d_{th} based on criteria have more reduction in packages because link quality will be not considered.

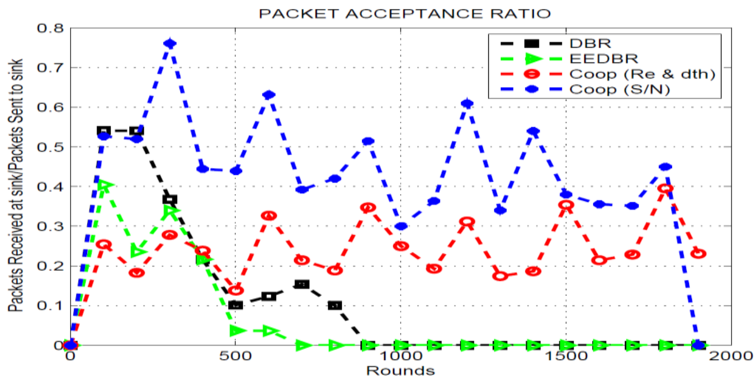

Figure 11: comparison of PAR with dynamic samples of short hole

PAR is the ratio of received packs in sink to all generated packs by nodes . According to figure 11, DBR and EEDBR have the least PAR. Because the number of received data in sink is low, due to weak link in single link.

4.Investigation and comparison of different methods

In this section we compare proposed method with the other approaches, Our proposed method is DEADS which is compared with existing protocols , that is DBR, EEDBR and iAMCTD. Here we have 225 sensor nodes which randomly are placed underwater in 500*500*500 m. Four MS s are placed under water in different depth which follow from oval and linear movement. Each sensor node has 5j initial energy and its transfer range is 100m , The size of data framework and its control framework are 200bite and 9 bite . Energy consumption in a node in transfer , receive and standby condition are 2W , 0/1W and 10mW . In iAMCTD , 4 static will apply , in our approach also there are 4 MSs . We excluded four static sinks in iAMCTD . Routing protocols are DBR , EEDBR and CODBR , while iAMCTD and DEADS ate reactive routing protocols. Analyzing proposed protocols and their parameters are in table 2-5 . In DBR and CODBR , depth be studied. In DDEBR , depth and remaining energy will be investigated and in iAMCTD connection in SNR periods , depth and remaining energy will be investigated as final factor of node .While in DEADS , depth a d remaining energy in nodes are the factors for determining nodes .

Table 2:Analysis of proposed protocols based on various parameters

Protocol	d_{th}	Sink Movement	Route	Parameters for receiver 's node selection
DBR	Constant	Constant	Routing multi-hop	Depth
EEDBR	Constant	Constant	Routing multi-hop	Depth and remaining energy
CoDBR	Constant	Constant	Shared routing	Depth
iAMCTD	Variable	Constant	Routing multi-hop	Depth and remaining energy link SNR
DEADS	Variable	Constant	Shared routing	Depth and remaining energy

5. Simulation results

We implement simulations in MATLAB and compare our approach with iAMCTD. The number of sensor network s is 225 and are placed randomly under water in 500X500m area.4 sinks are placed on the surface of water which 100 m. Each node has 5j initial energy and the magnitude of constant transfer is 100 m . Data pack size is 50bite. Power consumption of node in senders , receivers and trial modems are 10milivolt, 0.1 and 2 volt . During network implementation , nodes select depth threshold . After each 100 rotation distance , each node calculates active adjacent and changes it depth. Following chart shows the loss of wave propagation based on frequency and vertical axis based on dB /km.

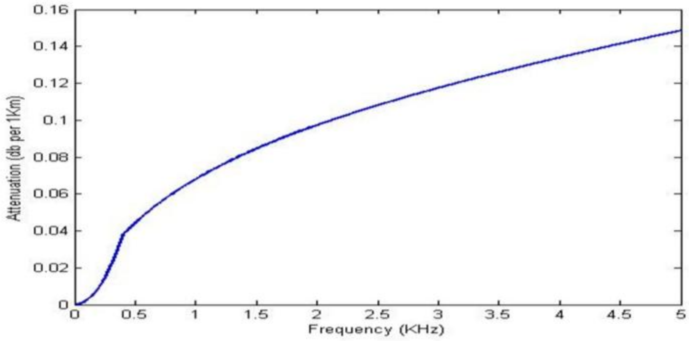

Figure 12: wave propagation loss based on frequency

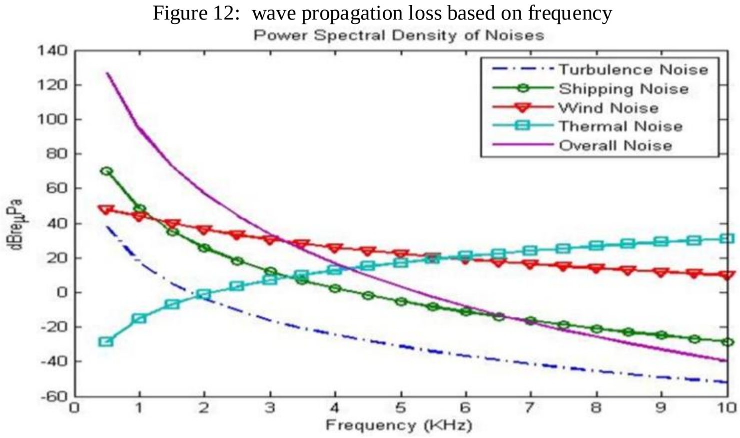

Figure 11-5 different spectrum for noises in proposed approac

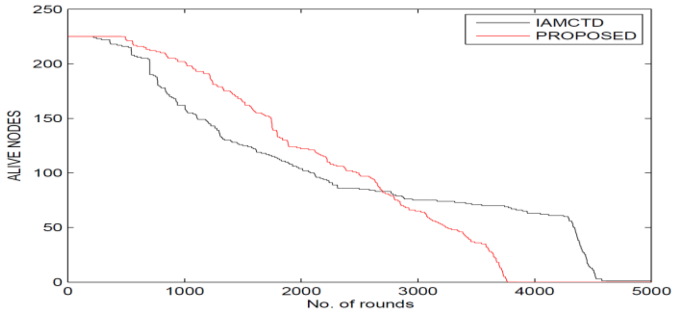

Figure 13: Comparison of active nodes in network

According to figure 13, the stability duration and the trend in active nodes in our approach are better. Node compaction in each step, is more than 2800 rotations which shows a network which gradually distributes and reliability of network will improve.

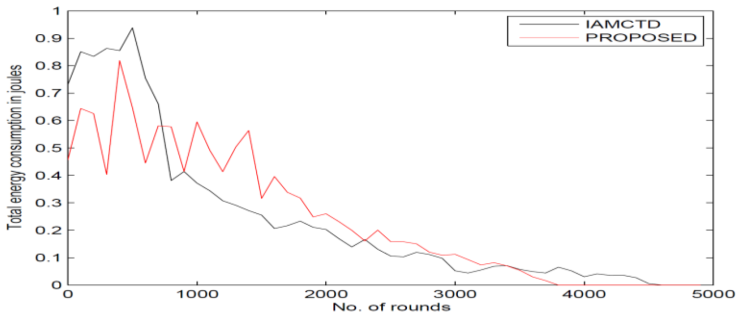

Figure 14: comparison of average of nodes' energy in network

Figure 14 shows the comparison of energy consumption in network. Energy consumption in our approach is due to more transfer

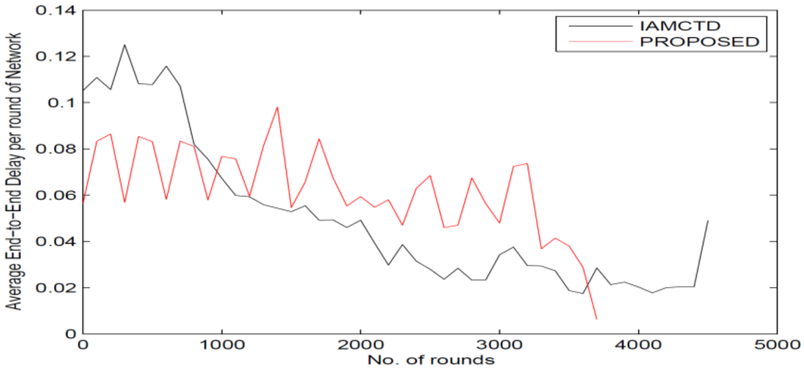

Figure 15: Comparison head to head delay in proposed design

According to figure 15, almost similar trend will follow during the lifetime of network . Since output in our approach is better , head to head delay is lower than 1100 rotation and there is also the same pattern and in iANCTD it is about 600 rotation.

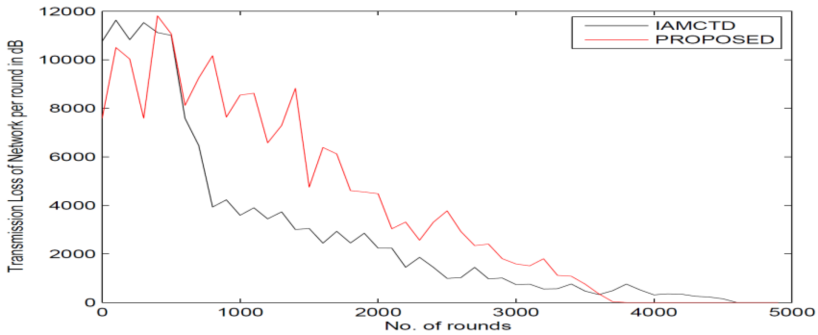

Figure 16: network transfer loss in network

Transfer losses depend on distance. Figure 16 shows that output are more than transfer losses . The number of transfer between source and sink nodes increase in our design.

6.Conclusion

In this study we presented a routing algorithm based on DS in combination with active sink in order to increase network performance.Our proposed method is based on depth and remaining energy . This algorithm implements in 3 steps . The first step is neighbor selection. The second step is formation and third step is routing and data evaluation. In neighbor selection step , source nodes select their d_t , find their neighbors and obtain data about depth and remaining During CC and DS formation , source nodes use obtained data in previous step. We implement our proposed method in MATLAB and compared its performance with DBR , EEDBR iAMCTD regarding to network lifetime , power , PAR and energy consumption . Based on simulations we observed that our attempt about network lifetime is better and EEDBR and DBR .In comparison to three protocols based on depth , we obtain more power , lower reduction in packs and PAR.

Data and information are reported to sink. So source node sends data to destination node. About data transfer, destination node commands to node to prevent from more data flow. In the absence of destination node , source node, send data to its neighbors. In our approach , horizontal variable displacement is applied which is constant in whole network. Each node source modulate data through applying BPSK, whole channel in each modulated data have Rayleigh swings and AWGN. Through simulation, we studied our proposed method. Here DEADS-SRC and DEADS-MRC are compared with depth-based protocols such as DBR , EEDBR and iAMCTD. There are 225 nodes in sensor which are placed randomly underwater. with 500*500*500m.

Four MSs are placed under different depths which follow oval and linear patterns . Each sensor node has 5j initial energy and transfer range constant is 1000m. data framework and control framework are 200bite and 8 bite. Energy consumption of a node in transfer , receiving and standby are 2W, 0.1W and 10mW . In iAMCTD , four static sinks and four guid node are presented for information. Although there are 4MSs in proposed protocols , we excluded 4 static sink in iAMCTD. In DBR and CODBR , depth will be studied , In DDEBR , depth and remaining energy will be studied and iAMCTD , link form, depth and remaining energy will be studied . While in DEADS, depth and remaining energy in nodes are inverstiagted as determining factor. To study DEADS , evaluation of dimensions will be studied.

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