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"UNDERWATER ACOUSTIC WSN: ROUTING PROTOCOL"

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Abstract- ***An innovative and evolving Sparsity-aware energy efficient clustering protocol (SEEC) is proposed to provide an improved energy efficiency cluster system which can also capable of handling cluster-head and mobile sensor node connectivity failures. In addition, to develop, implement and test modified SEEC, a new simulator called USNeT (Underwater Sensor Network simulation Tool) has been designed, developed and implemented. This USNeT simulator follows the object-oriented design style and all network entities are implemented as classes in the C++, encapsulating thread mechanisms. Initially significant adjustments have been made in order for the algorithm to become more energy efficient. Some of these alterations are: transmission range management, recluster process activation for each group separately, sensor node sleeping mode and unwanted information rejection. All the simulation results which were implemented against Sparsity-aware energy efficient clustering protocol (SEEC) protocol indicate a small but significant improvement in the performance of the SEEC especially in energy efficiency. This study also suggests that system Cluster Head (CH) failures could be further minimized when simultaneously a CH (primary CH) and a backup CH are selected. Thus, when a primary CH fails due to an irreparable fault, a backup CH will take its place and it will operate as a head node. Therefore, the modified- SEEC is redefined and optimized to be able to handle this issue and also to diminish any communication link establishment interruptions. The analysis of the simulation results shows that the redefined SEEC (modified-SEEC) is more energy efficient and can effectively enhance the network survivability capacity in the event of cluster-head failures, than the scheme with the non-optimized algorithm SEEC and the modified- SEEC protocol. Thereafter, the modified- SEEC is used again, to address sensor node connectivity failures. In case of a mobile sensor node that is close to a cluster but not in the range of a CH, modified- SEEC changes the status of the nearest sensor node to a CH and then it establishes a communication link between them. Simulation results show once more that the new cluster based routing algorithm ensures the connectivity of the network without sacrificing the energy efficiency of the network.***

Keywords : **Cluster Head, Sparsity aware energy efficient(SEEC), Threshold Bucket,**

1.INTRODUCTION

Underwater sensor networks are envisioned to enable applications for oceanographic data collection, pollution monitoring, offshore exploration, disaster prevention, seismic monitoring, equipment monitoring, assisted navigation and tactical surveillance applications. Multiple Unmanned or Autonomous Underwater Vehicles (UUVs, AUVs), equipped with underwater sensors, will also find application in exploration of natural undersea resources and gathering of scientific data in collaborative monitoring missions. To make these applications viable, there is a need to enable underwater communications among underwater devices. Underwater sensor nodes and vehicles must possess self-configuration capabilities, i.e., they must be able to coordinate their operation by exchanging configuration, location and movement information, and to relay monitored data to an onshore station.

Wireless underwater acoustic networking is the enabling technology for these applications. Under Water Acoustic Sensor Networks (UW-ASNs) consist of a variable number of sensors and vehicles that are deployed to perform collaborative monitoring tasks over a given volume of matter. To achieve this objective, sensors and vehicles self-organize in an autonomous network, which can adapt to the characteristics of the ocean environment. The above described features enable a broad range of applications for underwater acoustic sensor networks.

Fig.1 Underwater networking

2. RELATED WORK ALGORITHM

Input:

N: the wireless sensor network
nn: the total number of nodes in N
R: the expected number of clusters for each round

e: e node in N

C: a randomly selected value for becoming a CH candidate

chance (e): the chance of the node to be CH, calculated based on current Energy and distance from BS probability(e): true for the node which has chance(e) value above threshold bucket

(e): the node a is a member for random selection of CH candidate (e): a is a candidate for cluster head

Output: cluster

(e): the CH of the node, which is a node from among nn nodes

Function:

broadcast(data, range of distance);
send(data, receiver);
minmax(currentEnergy, distance);
findMinDist(nodesX1[], nodesY1[], nwSize1, nodesX2[], nodesY2[], nwSize2,
nodeIndex, clusterIndex) ;

FOR EVERY CLUSTERING ROUND

Clustering procedure this procedure is responsible for forming the cluster scheme by using the clustering algorithm. The basic idea of this algorithm is that each sensor node, when the deployment is finished, sends a control packet seeking for a CH. If the sensor node accepts an ACK then it connects to the specific CH otherwise it enters a different state such as the retry or the sleeping (suspension) state.

1 start
2 start timer t1
3 initialize a packet retry counter (C_count)
4 repeat
5 send a control packet cont_C */ control packet is the request packet
6 if no ACK then 7 C_count=C_count+1
8 if C_count>limit then */ limit: maximum transmission retries a packet can do
9 sensor sleep */ suspension time
10 endif
11 else
12 calculate sensor distance from head
13 if (sens_dist<=max_dist) and (sens_dist>=min_dist)
14 then
15 sensor is a head
16 else
17 sensor is a client
18 endif
19 endif
20 to t1>T1 * // T1: maximum time for the cluster procedure
21 end

A sensor node can spend a significant amount of time seeking a CH. Therefore, to avoid the total consumption of the sensor node's energy, after the retry state, where a sensor node retransmits the control packet, it enters in a suspension mode. The suspension time is the period where a sensor node sleeps without sending or receiving any signals and therefore without spending any energy. For further research, the suspension time can be altered by the user.

Communication procedure

Generally a communication procedure has to deal with the receiving, gathering and sending data. However, it must take into account the two states that a sensor node can be: the client state where a sensor node is a simple node, gathering data from the environment and the cluster head state, where a sensor node is a CH gathering data from both the environment and the other sensor nodes of the cluster team.

1 start
2 call gather data procedure
3 call transmit data procedure
4 if no ACK then
5 call cluster procedure
6 endif
7 end

This procedure is also responsible for the time period where a sensor node is allowed to wait for an ACK until retransmission and how many retries a sensor node can do. The number of retries it is not limited but it can be changed by the user for a further research purpose. The time period which a sensor node is allowed to wait for an ACK must be greater than the Round Trip Time (RTT). In our case, RTT is the length of time it takes for a packet to be sent plus the length of time it takes for an ACK of that packet to be received.

1 start
2 call check buffer procedure
3 if control packet received then
4 if target_id==sensor_id then // target_id, sensor_id : sensor's packet fields
5 ACK received
6 else
7 if target_id=-1 then // if -1 is the value of the field, then the sensor is a head
8 sensors is a cluster head - Send an ACK
9 else
10 discard data
11 endif
12 endif
13 endif
14 end

3. CONCLUSION

a) Average Delay:

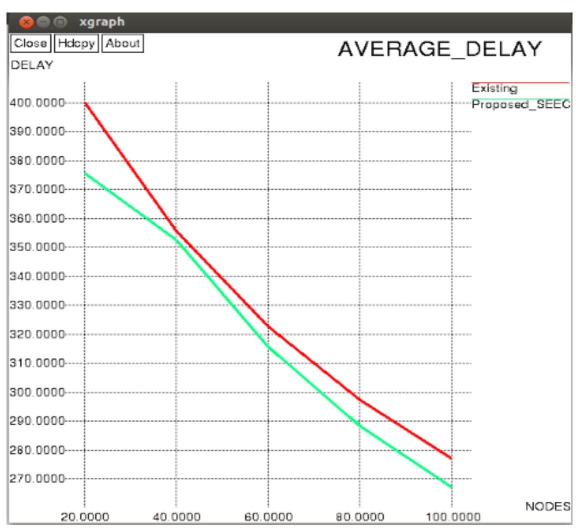

Fig 5.1 Average end to end delay

b) Drop Packet:

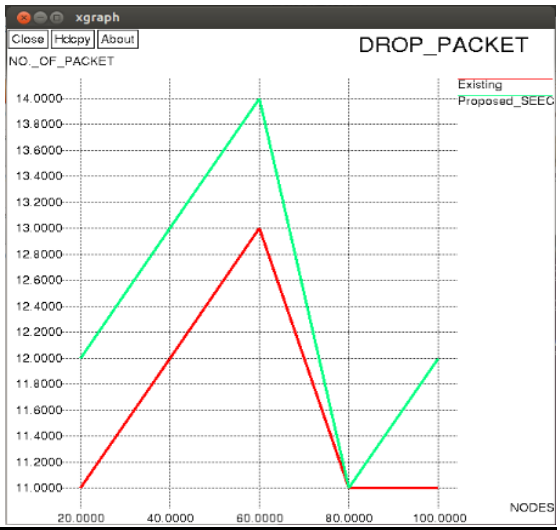

Fig 5.2 Number of Dropped data

c) Energy Consumption

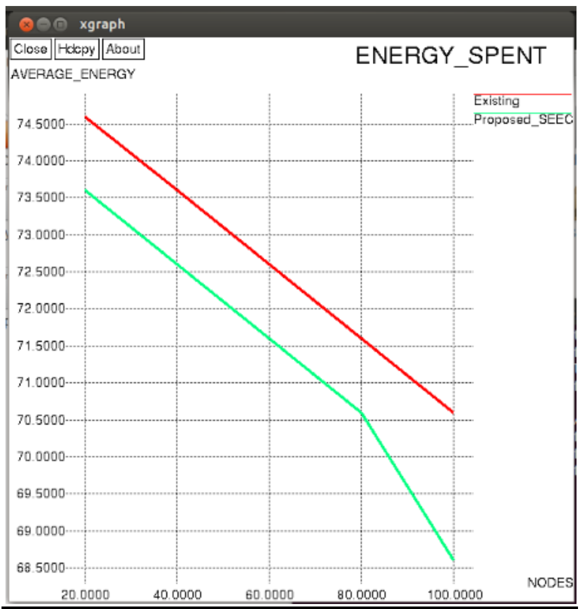

Fig.5.3 Energy Consumption

d) Normalized Routing Load

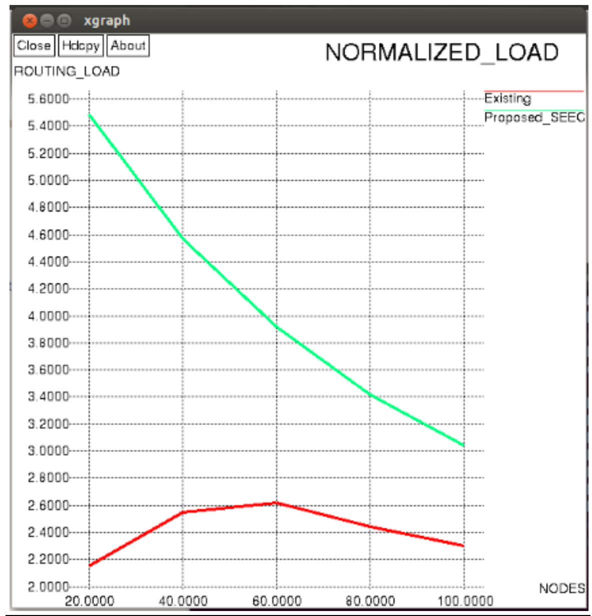

Fig 5.4 Normalized Routing load

e) Packet Delivery Ratio

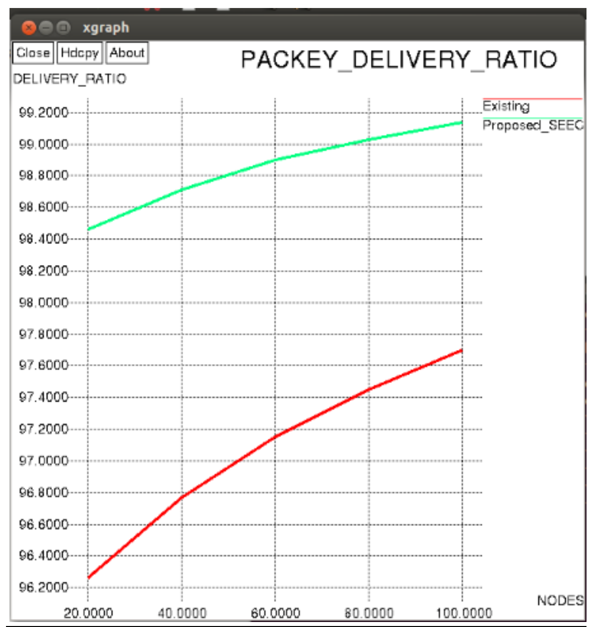

Fig 5.5 Packet Delivery Ratio

f) Average Throughput

Fig 5.6 Average Throughput

In this Dissertation are: transmission range management, re-cluster process activation for each group separately, sensor node sleeping mode and unwanted information rejection. The simulation results show that the proposed Cluster Based Routing Protocol (SEEC) achieved a better performance than Base protocol, in terms of metrics such as the network's throughput, the packet delivery ratio, the average routing overhead, the offered load and the average energy consumption for data transmission. Thus the feasibility of the SEEC for UWSNs is verified.

The next step of this research was to investigate the assumption of further optimization of the SEEC. During the evaluation stage of the SEEC it was found that the algorithm cannot efficiently manage CH transmission with the Monitoring services. Moreover it was also found that both proposed and base algorithm cannot properly operate when sensor nodes are placed outside of the predefined cluster boundaries.

The analysis of the simulation results shows that the Ad-SEEC is more energy efficient and can effectively enhance network survivability capacity in the event of cluster-head node almost successfully achieve but performance is not satisfied , than the scheme with the optimized algorithm of SEEC and the base algorithm.

In the final stage of this study, Ad-SEEC with the support of the bridge CH activation process was used again, to address the second issue described above. In the case of a mobile sensor node that is close to a cluster (near to ordinary sensor nodes) but not in the range of a CH, the Ad-SEEC changes the status of the nearest sensor node to a CH (bridge CH) and then it establishes a communication link between them. Simulation tests show that once more the Ad-SEEC ensures the connectivity of the network without sacrificing the energy efficiency of the network.

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