Range Based Node Localization Scheme in under Water Acoustic Networks

Bharat, Dr. Ravinder kumar
GNDU Amritsar

Abstract- The underwater acoustic network is the type of network which is deployed under the deep sea oceans to sense water conditions. Due to dynamic nature of the network, node localization is the major issues of underwater acoustic networks. The node localization techniques are broadly classified into angle based range based scheme. This research work is based on to increase performance of range based scheme for node localization. The proposed improvement in range based scheme is implemented in MATLAB. The results shows increase in percentage of node localization

Keywords- Node localization, Range based scheme, Angle based Scheme

I. INTRODUCTION

The base station and sensor nodes are contained in the wireless sensor networks. In the basic architecture of the sensor networks, the sensor nodes have very low power, very less memory and computation power. In the wireless sensor networks the sensor nodes are distributed randomly which sense the conditions and pass it to base station. The base station is the deployed on the central location for the data aggregation. The sensor nodes monitor the environmental conditions in it are deployed and pass the collected information to the base station. The base station is deployed on the central location of the environment [1]. The base station has the large computation lower and has very much high storage capacity; it means it can process very information in least amount of time. The gateways are the units which provide interface between the internal environment and outside environment. In the wireless sensor networks, the base station pays role of gateway. In order to provide communication underwater there are networks deployed which can help in transmitting important information from such areas. High-speed communication in the underwater acoustic channel is challenging due to limited bandwidth, extended multi-path, refractive properties of the medium, severe fading, rapid time-variation and large Doppler shifts. Here, the electromagnetic waves also propagate poorly in sea water. The communication techniques were originally developed for terrestrial wired and wireless channels due to which there is need to do significant modifications to make it suitable for underwater channels. The node localization is the critical issue of the wireless sensor networks due to its dynamic nature. The node localization means sharing the location of the sensor nodes among various sensor nodes for the efficient data communication [2]. The data aggregation issue can be resolved by designing efficient solution to the node localization problem. The wireless sensor network is deployed to perform various talks such as monitoring the environmental conditions, target tracking, in the felid of defense and so on. The node localization is the important requirement to fulfill all the application of the wireless sensor networks. The wireless sensor networks have the issue of node localization due to its dynamic nature. The node localization is the process which performs the task of gather node coordinates of the unknown nodes [3]. The node localization can be done by the distance techniques and also by the coverage area of the sensor nodes. The node localization is important to generate queries from the sensor nodes for various events, transmit data in the groups, routing data from the source to destination. To localize the position of the sensor nodes, the anchor nodes are deployed in the network for the localization distance between the sensor node and anchor is calculated which estimated value not the real value is. To estimate the extract position of the sensor nodes, various optimization techniques need to implement on the anchor nodes. The major issue of the node localization is the ranging errors which need to reduce for the exact position estimation of the unknown nodes [4]. When the positions of the unknown nodes are identifies than the mean square error get reduced. The mean square error is the fitness value of the optimization problem which needs to reduce to estimate exact location of the sensor nodes. The wireless sensor network has the major issue of the position estimation as sensor network has various applications like area monitoring, as the network is deployed in the large amount of area. In the past years, various node localization algorithms are designed and efficient node localization algorithms can leads to estimate the accurate node position and also identification of the sensor nodes. When the data need to base station from the sensor node then the localization plays important role [5]. The accurate node location estimation leads efficient route establishment and also save energy while data the data transmission from source to destination. To estimate the location of the unknown nodes in terms of their coordinates, node identification is called node localization. The wireless sensor network has some of the unique and critical applications like to maintain the consist

throughput, maintain quality of service, provide security to some area, military applications to spot targets, check activities of the object and so on. The node localization is the critical issue which can create two serious problems in the network [6]. The first problem is the route establishment problem means to establish secure and efficient path from source to destination. The second's problem is the range problem which defines coverage area of the sensor nodes. The solution of these two problems is the node localization. In this chapter, various problems which are raised due to node localization and also various applications of the node localization and solutions are discussed.

II. LITERATURE REVIEW

Ranjit Kaur, et.al, (2017), in this research work, author suggested that the localization is the important issues of the wireless sensor networks. In the localization scheme the location of the sensor nodes are estimated on the basis distance. The estimated value is not real, it is just the approximation. When the node position is not estimated correctly, then it is difficult to generate useful information from the base station. The node localization has the complex issue due to high size of the sensor networks. The node localization is the optimization problem. The author proposes nature inspired optimization technique for the node localization [7]. The performance of the various optimization algorithms are compared like FPA, FA and GWO. The performances of these algorithms are compared in terms of accuracy and computational time.

S.R.Sujatha, et.al, (2017), author proposed dynamic weight based algorithm for the node localization. The proposed method will be based on hybrid technique for the node localization in wireless sensor networks. The bit error rate will reduced when the estimated and measured node positions are almost equal. The anchor nodes are used to gather the node locations accurately. The author proposed the DE algorithm for the localization which directly increases accuracy of localization [8]. The simulation results shows that the proposed method performs well in terms of accuracy and execution time.

Meng JooEr, et.al, (2016), author highlights the issue of node localization in wireless sensor networks.The density of the network should be high for the accurate estimation of the node position. The node density affects the accuracy of node localization. When the density of the nodes in the area is reduced then the number of hops in the network reduced which reduce accuracy. The author proposed node density based estimation technique to node localization [9]. The anchor nodes calculate the node density and according to node density the anchor node divided regions in the sub-regions. The distance between the anchor node and the sensor node is calculated for the estimation of node position. The simulation results show that the proposed HCED algorithm performs well as compared to other density based algorithms in terms of accuracy and execution time.

Eva Tuba, et.al, (2016), the position estimation is the important part of the wireless sensor network. The node localization is the concept in which the location of the unknown nodes is estimated. The RSSI is the technique in which the distance between the anchor nodes and the sensor nodes are calculated for predicted the location of the sensor nodes. The author proposed node location method which is based on the optimization algorithm called fireworks swarm intelligence [10]. In this algorithm, the estimated data is collected from the various anchor nodes is given as input to the algorithm. The proposed algorithm performs well as compared to other algorithms in terms of accuracy and execution time.

Chin-Shiuh Shieh, et.al, (2016), the author describe about the node location problem and also about the various issues of the node localization. When the position and identifications of the sensor nodes are not estimated then it is difficult to gather correct data from the network. Due to estimation of the node position, the node localization is the optimization problem [11]. In this research paper, author compared various optimization algorithms for node localization. The author compares genetic algorithm, Particle swarm optimization algorithm, grey wolf optimization, firefly algorithm in terms of accuracy and execution time. The author analyzed that firefly is the algorithm which performs well as compared to other algorithm in terms of accuracy and execution time.

Suman Bhowmik, et.al, (2016), author describe the problem of node location in their research work. When the position and node identification is unknown then it is difficult to aggregate useful information from the network. In the RSSI technique, the node position is estimated based on the received signal strength. In this research paper[12],author proposed the fuzzy logic based node location technique. In the technique of fuzzy logic the fuzzy rules are derived on the basis of distance parameters. The distance is calculated between the anchor node and sensor nodes. The calculated distance follow which define rule will leads to position estimation. The simulation of proposed algorithm is done in Omneet++ and it is analyzed that proposed algorithm has high accuracy for the node localization

III. RESEARCH METHODOLOGY

In order to identify the location coordinates of the unknown nodes within the network, the node localization process is used. The information related to distance as well as the radius of wireless communications being held is utilized for this process. The events are to be originated, the group query of sensors is also to be assisted and the queries related to coverage of networks are to be computed in this process. There is no real value achieved by the distance measured amongst the unknown node and the anchor node. As a type of

optimization, the unknown node position estimation can be considered here through which the target function of the localization error caused in the anchor node can be reduced. This can help in computing the position coordinates of an unknown node within the network. A ranging error is the major factor through which the location error of an unknown node can be affected. The accuracy of localization can be enhanced by reducing the maximum error of the network. Thus, one of the major challenges found within the WSNs is the node localization. On the basis of distance threshold mechanism, a technique is proposed within the research work. There are several beacons inserted within the network through this technique. Within the network, the beacons signals are flooded by the beacons along with there is a defined range of beacon signals also provided. A response is provided back to the beacons as per the nodes that exist within the range of each other. The node is declared as a localized node once the beacons receive the response message from the two nodes. There is an increment in the node localization at steady rate with the increase in threshold distance as per the evaluations made within the research work. The angle of trajectory is evaluated with the distance within the technique proposed in the base paper. There are beacons flooded within the network and with the help of defined angle and the range of nodes; the nodes that are available can be localized here. There is minimization of time required for node localization within the underwater acoustic networks on the basis of proposed technique.

Proposed Algorithm

Input: Number of nodes, Number of beacons
Output: Localized Nodes
1. Deploy wireless network with finite number of sensor nodes
2. N=number of beacons in the networks
3. R=Range of beacon
4. Calculate Distance ()
    4.1 For i=1 to n
    4.2 For j= i+1 to n
    4.3.Distance(i)= $\sqrt{((X1-X)^2)-((Y1-Y)^2)}$
5. For i=1 to n
    5.1 If (Distance (i)> R)
    5.2 Localization (i)=Node (i)
    5.3 else
    5.4 Node(i)=Node(i)
6. If (Localized(i)== for two beacons)
    6.1 Node localized =Node localized+1;
    6.2 else
` 6.3 Node localized=Node Localized
7. end

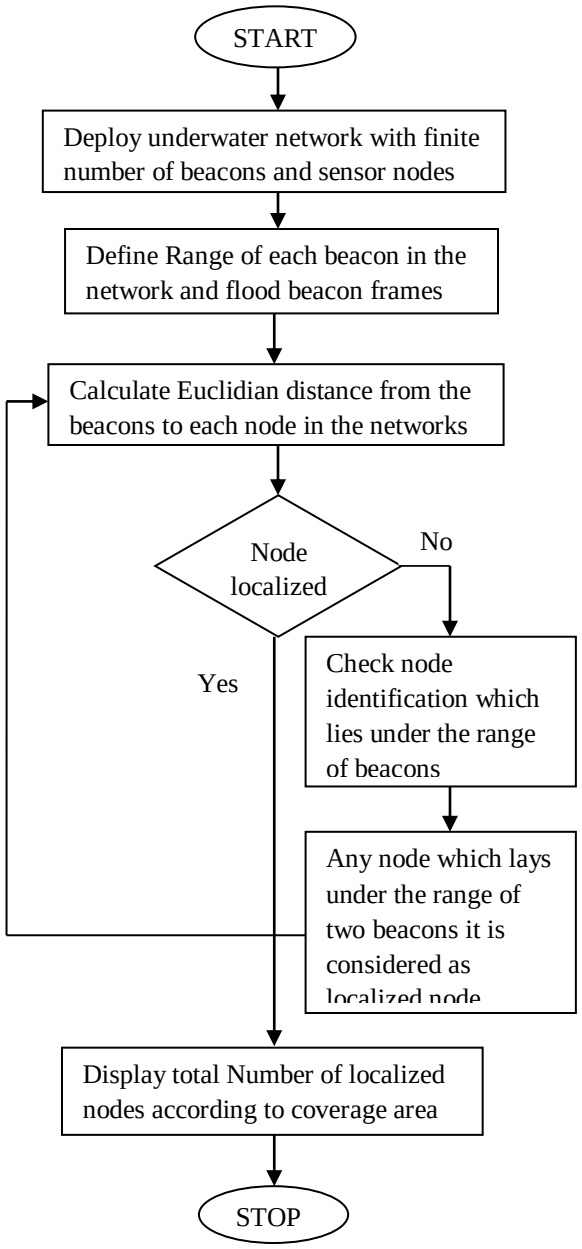

Fig.1: Proposed Flowchart

IV. EXPERIMENTAL RESULTS

The proposed algorithm is implemented in MATLAB and the results generated are shown below that evaluate the performance of this algorithm.

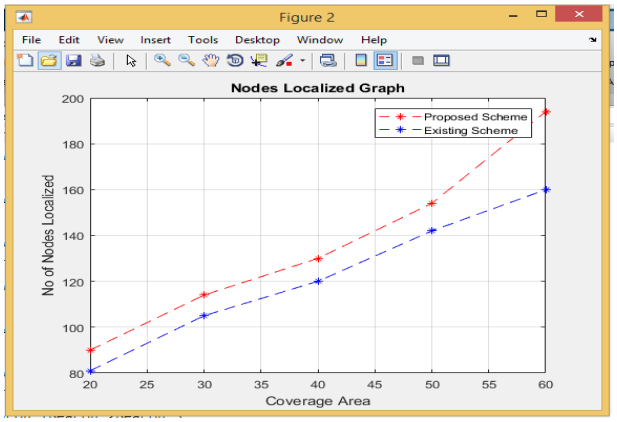

Fig.2: Performance Analysis of proposed technique

As shown in figure 2, the performance of the proposed technique is analyzed and it is been analyzed that when the coverage area of the beacon get increased then the node localization is increased at steady rate.

V. CONCLUSION

The wireless sensor network is the decentralized type of network in which sensor nodes sense and pass information to the base station. The nature of the sensor network is very dynamic due to which it is very difficult to estimate exact location of the sensor network. To estimate location of unknown nodes and their identification is called node localization. In the existing approach, the RSSI technique is proposed in which anchor nodes send beacon messages and each node will revert back. On the basis of received messages, the locations of the nodes are estimated. In this research work, the technique of threshold is proposed which estimate location of the sensor nodes. The simulation of the proposed and existing technique is compared in terms of accuracy and execution time. It is analyze that accuracy of proposed method is more as compared to existing methods.

VI. REFERENCES

[1]. Avinash Kaur, SonuAgrawa, "Location detection in wireless sensor network using classical optimization methodology," 2012, IJCST, vol. 3, pp.108-115.

[2]. Asma Mesmoudi, Mohammed Feham, Nabila Labraoui, "Wireless sensor networks localization algorithms: a comprehensive survey", 2013, International Journal of Computer Networks & Communications (IJCNC) vol.5, pp. 112-120.

[3]. Z. Mary Livinsa, Dr. S. Jayashri, "Performance analysis of diverse environment based on RSSI localization algorithms in wsns", 2013, Proceedings of 2013 IEEE conference on Information and Communication Technologies, vol.3, pp.627-628.

[4]. A. Nasipuri and K. Li, "A directionality based location discovery scheme for wireless sensor networks," 2002, In Proceedings of ACM WSNA, vol. 4, pp.105-111

[5]. D. Niculescu and B. Nath, Ad Hoc Positioning System (APS) using AoA," 2013, In Proceedings of IEEE INFOCOM '03, vol. 3, pp. 1734-1743

[6]. M. Broxton, J. Lifton and J. Paradiso, "Localizing a Sensor Network via Collaborative Processing of Global Stimuli," 2005, IEEE Workshop on Wireless Sensor Networks, vol.5, pp. 321-332.

[7]. Ranjit Kaur, Sankalap Arora, "Nature Inspired Range Based Wireless Sensor Node Localization Algorithms," 2017, Springer, vol.4, pp7-17

[8]. S.R.Sujatha, Dr.M.Siddappa, "Node Localization Method for Wireless Sensor Networks Based on Hybrid Optimization of Particle Swarm Optimization and Differential Evolution," 2017, IOSR-JCE, vol.19, pp.7-12

[9]. Meng JooEr, Shi Zhang, Baihai Zhang, Chiang-Ju Chien, and Feifan Wang, " A novel localization approach towards anchor to node in wireless sensor networks," 2016, IEEE, vol.4, pp.143-148

[10]. Eva Tuba, Milan Tuba, Marko Beko, "Node Localization in Ad Hoc Wireless Sensor Networks Using Fireworks Algorithm," 2016, IEEE, vol.3, pp. 130-137

[11]. Chin-Shiuh Shieh, Van-Oanh Sai, Yuh-Chung Lin, Tsair-Fwu Lee* , Trong-The Nguyen and Quang-Duy Le, "Improved Node Localization for WSN using Heuristic Optimization Approaches," 2016, IEEE International Conference on Networking and Network Applications, vol.3, pp.95-98

[12]. Suman Bhowmik, Rajib Kar, Chandan Giri, "Fuzzy Node Localization in Wireless Sensor Network," 2016, IEEE WiSPNET 2016 conference, vol.8, pp.1112-1116