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Analysis of Node Localization Techniques of Underwater Acoustic Networks

Manjeet Singh

er.manjeet1987@gmail.com

M.Tech Student, Electronics & Communication Engineering, Guru Gobind Singh College of Modern Technology, Kharar

Ms. Mandeep Sharma

hodece.ggscmt@gmail.com

HOD, Electronics & Communication Engineering, Guru Gobind Singh College of Modern Technology, Kharar

Abstract: Under the deep sea to sense ocean conditions such as pressure etc are the underwater acoustic network which is a type of network that is deployed. It is difficult to perform high-speed communication within underwater acoustic channels because of the presence of limited bandwidth, higher multi-path, higher fading, huge time-variations as well as Doppler shifts. The propagation of electromagnetic waves is very poor within the sea waters. The communication techniques were designed originally for the terrestrial wired and wireless channels. There is a need to modify these techniques in order to make them appropriate for underwater channels. In this paper, various techniques of node localization have been reviewed in terms of certain parameters.

KEYWORDS: Node Localization, Firefly, Artificial Bee Colony, Localization Error.

Introduction

Wireless sensor network is the network that consists of several sensor nodes for the gathering of the information. In these networks the power, memory and also the computational capacity of sensor nodes are very less. Within these networks there is a random distribution of the sensor nodes for the sense of the surrounding conditions. To the base station of the network the important data can be further forwarded. Within this wireless network the base station is deployed centrally to aggregate the data. In these networks the environmental conditions are monitored from the sensor nodes [1]. All such data can be collected through the centrally localized base station. There is high in the computation power and the storage capacity of the sensor node. In such amount of the data, there is a need of very less amount of time for the process. Through the gateway an interface between the internal and external environment of these networks will be provided. The base station plays the role of the gateway. Due to the recent advancements made in the technology the feasibility of wireless sensor networks is possible. Within the issue of the WSN several applications are presented in it and huge research development is provided. Therefore, the researchers face several technical issues [2]. WSN faces various issues and challenges that re mentioned in this. For providing communication such as the important data can be easily transmitted across regions through the networks deployment underwater. Within underwater acoustic channels it is difficult to perform high-speed communication because of the presence of limited band width, high multi-path and high fading and a huge time variations and also the Doppler shifts. The propagation of electromagnetic waves are very poor within the sea waters. The communication techniques were designed

actually for the terrestrial wired and wireless channels. There is a need to modify these techniques in order to make them for appropriate for the underwater channels. One of the major issues that arise due to the dynamic nature of WSNs is referred to as the node localization. The location of the sensor nodes is shared by the node localization mechanism for the ensuring efficient data communication [3]. Resolution of the data aggregation issue is made through the proposing efficient solution to the node localization issue. WSNs are deployed in various applications for performing several tasks like tracking of target, monitoring the environmental conditions. An important requirement fulfillment of the various applications of WSN is known as the node localization. The major issue for the node localization is due to the dynamic nature of these networks. Node localization is the task where the coordination of the nodes is gathered for the identification of the unknown nodes. With the coverage area in which sensor nodes are deployed the distance approaches can be used for the performance of this technique along [4]. Within this technique the queries are generated from sensor nodes for several events to forward information within the groups and routing the data. The position of the sensor nodes are localized through the anchor nodes deployment within the network. Amongst the sensor node and anchor an estimated value is calculated for the determination of the localization distance. For the estimation of the exact position of sensor nodes several optimization approaches are implemented on anchor nodes. There should be the decrease in the exact position for the estimation of unknown nodes as the ranging errors is the major issue of node localization. Due to the identification of position of the unknown nodes there is a decrease in the mean square error [5]. Mean square error is known as the need of minimizing the optimization issue using the fitness value for the estimation of the exact location of the sensor nodes. Due to the node localization problem there are two major issues which exist within the network. Route establishment issue refers to the establishment of the secure and efficient path from source to destination which is the final issue. The secondary issue is the range issue that explains the coverage area of the sensor nodes. The solution for these two issues is the node localization. With the solutions applicable to, there are several issues that arise within the node localization presented in this chapter along with the solutions [6]. Within the node localization mechanism several techniques are proposed through different researchers. A stochastic mechanism is proposed has high flexibility based on the mobility and nature of swarms is known as the Particle swarm optimization (PSO). Biogeography-based optimization (BBO) is known as the algorithm used for the optimization of the functions through the enhancements of candidate solutions in stochastic and repeated manner. Using Bee Optimizations Algorithm (BOA) the sensor nodes of WSN are localized. For the various topologies through the conduction of several tests the normal allocation of time of arrival (TOA) measurements and received signal strength (RSS) measurements are utilized.

Literature Review

Ranjit Kaur, et.al, (2017), presented within the sensor networks related to the node localization that play a very important role. Within the localization approach based on the distance the estimation of the location of sensor nodes is done. in case if the estimation of position of node is not correct the necessary data from the base station is very difficult for the generation. The complexity of node is very high due to the huge size of the sensor networks. The node localization is caused by the optimization issue. The author proposed a nature inspired optimization approach for the node localization [7]. With respect to accuracy and computation time provided by them is to identify appropriate mechanisms as comparisons made amongst several optimization algorithms.

S. R. Sujatha, et.al, (2017), proposed in WSN a novel dynamic weight based mechanism for the node localization in this paper. Achievements in the improvements of a hybrid approach are proposed through the researchers. The bit error rate is decreased when there is equality of the estimated and measured position of nodes. The anchor nodes are utilized for the collection of the exact locations of nodes. The accuracy of localization is increased with the DE algorithm proposed by the author for the localization [8]. Te proposed algorithm provides better simulation results with respect to accuracy and execution time.

Meng Joo Er, et.al, (2016), presented the requirement of the high density for providing high accurate position of nodes and presented research related to the node localization within WSN's. Due to the node density the accuracy of node localization is directly affected. In the area when the density of nodes is decreased there is a minimization of number of hops of network. Minimization of the accuracy of network is also done here in this proposed approach. On the basis of the node density estimation approach proposed by the authors provides node localization [9]. Based on the node density of anchor node the node density is calculated for anchor nodes and regions within the division of the sub-regions. The distance amongst the anchor node and sensor node is computed for the estimation of the position of nodes. The performance of proposed approach is shown to be better as per the simulation results in comparison with the already existing approaches.

Eva Tuba, et.al, (2016), presented the node localization is the mechanism is in which the location of unknown nodes can be estimated. The node localization technique is proposed in this paper based on the firework swarm intelligence optimization algorithm [10]. The information is provided to the system from several nodes as the collection of the estimated data is done using this algorithm in the form of input. The algorithms perform in three different phases. Within the final phase the comparison in the location of each node is done. Within the second step the best location is computed further. Within the final phase the value of MSE is estimated for node localization. The performance of proposed algorithm is better in already existing approach which is observed through the comparisons in respect with the accuracy and execution time parameters.

Chin-Shiuh Shieh, et.al, (2016), presented a major issue a study related to the node localization. In case when the position as well as the identification of sensor nodes is not estimated the collection of the information becomes difficult from the network. Due to the estimation of positions of the nodes the optimization the optimization issue faced within WSN's node localization [11]. In comparison to each other within this research for the evaluation of the performance of each other various optimization algorithms are proposed for node localization. With respect to the accuracy and also the execution time various optimization algorithms were compared. In comparison to other algorithms it was observed as per the simulation results the firefly algorithm performed better.

Suman Bhowmik, et.al, (2016), presented within WSN the study related to node localization issue. An efficient technique be applied received signal strength for node localization, an efficient technique is to be applied. Within RSSI technique the position of the node is estimated based on the received signal strength. In this research work the author proposed a fuzzy logic based node localization approach [12]. Within the fuzzy logic approach fuzzy rules are generated using the distance parameters. The distance is computed amongst the anchor nodes and sensor nodes. Using the calculated distance that follows define rule the position estimation is done. The simulation of proposed algorithm is done, within the Omneet++. When proposed algorithm is applied evaluation in the accuracy of node localization is also done.

Author's Name	Year	Description	Outcomes/ Results
Ranjit Kaur, Sankalop Arora	2017	presented within the sensor networks related to the node localization that play a very important role	With respect to accuracy and computation time provided by them is to identify appropriate mechanisms
S.R.Sujatha, Dr.M.Siddappa,	2017	proposed in WSN a novel dynamic weight based mechanism for the node localization in this paper	The accuracy of localization is increased with the DE algorithm
Meng Joo Er, Shi Zhang, Baihai Zhang, Chiang-Ju Chien, and Feifan Wang	2016	presented the requirement of the high density for providing high accurate position of nodes and presented research related to the node localization within WSN's	The distance amongst the anchor node and sensor node is computed for the estimation of the position of nodes
Eva Tuba, Milan Tuba, Marko Beko	2016	presented the node localization is the mechanism is in which the location of unknown nodes can be estimated	The performance of proposed algorithm is better in already existing approach which is observed through the comparisons in respect with the accuracy and execution time parameters.

Chin-Shiuh Shieh, Van-Oanh Sai, Yuh-Chung Lin, Tsair-Fwu Lee* , Trong-The Nguyen and Quang-Duy Le	2016	Presented a major issue a study related to the node localization. In case when the position as well as the identification of sensor nodes is not estimated	In comparison to other algorithms it was observed as per the simulation results the firefly algorithm performed better.
Suman Bhowmik, Rajib Kar, Chandan Giri	2016	presented within WSN the study related to node localization issue	When proposed algorithm is applied evaluation in the accuracy of node localization is also done.

Conclusion

In this work, it is concluded that node localization is the major issue of underwater acoustic networks. The various techniques have been designed for the node localization. The techniques of node localization are reviewed in terms of certain parameters. The common techniques of node localization RSSI, Time of arrival etc. In this work, various techniques are compared in terms of certain parameters

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