

Node Localization in Wireless Sensor Network Using Fuzzy Logic Technique

Kanika Malhotra¹ Mr. Bhushan Dua²

^{1,2} Dept. Of CSE & Doon valley inst. of Engg. KUK

Abstract--- Node localization in wireless sensor network is exigent task for providing better network performance to the wireless environment network. Using Global positioning system is very expensive and is not affordable. So sensors are self-deployed in the network. Without localization the packet cannot send to their destination correctly, loss of integrity, intrusion attack, packet lost etc has to be faced in the wireless environment. There are many challenges concerned while localizing sensors that are cost, scalability, efficiency and time. Fuzzy localization provides the fuzzy network for efficient and accurate results.

Keywords: Node Localization, Wireless sensor network, Global positioning system, Deployed, Fuzzy localization.

I. INTRODUCTION

Wireless sensor network is basically an assortment of sensors so as to deploy in the sensing environment and are organized to other nodes. They encompass competence to be familiar with and converse to one another in the wireless sensor network. The areas in which the sensing environment used are traffic monitoring, tracking mobile phones in case of thief detection, military or field purposes. In this for sensing environment if the Global positioning system is used it while cannot be affordable by everyone. Wireless sensor network desires localization after deployment for the reason that the information cannot reach the destination with accurate information that is due to the loss of integrity and privacy.

The reason because of those localizing sensors is compulsory for accurate addressing, direction-finding information, or influential the correct position for the nodes for better performance of the system. The conventional techniques worn although are the labor-intensive design and global positioning system. Uniformly the techniques are not much efficient to attain the challenges involves in wireless sensor network. Though localizing sensors in sensing environment have unusual issues that are cost of production, synchronization, protection, devise and employment, sensor blend these problems will be enhanced to get better network recital. Wireless sensor network are designed into Range free method doesn't necessitate at all distance in sequence. Range Based is more efficient than range free due to design issues involved.

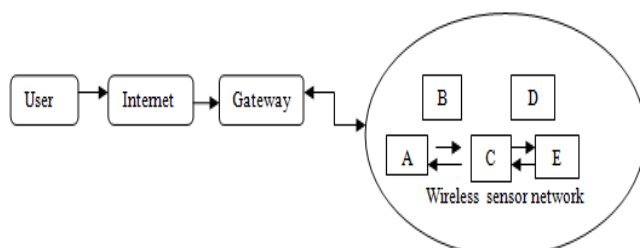


Fig. 1: Wireless Sensor Network

II. RELATED WORK

Wireless sensor network needs node localization are vigorous region of learning by means of frequent survey [2], [8], [9], [10]. However a number of fundamental techniques were not defined. Paper [2] uses RSS in the neural network for positioning sensors in the system. Paper [8] defines the localizing sensors in the harsh or inappropriate environment. In paper [10], the basic theory about node localization in wireless sensor networks and the basic principles of the artificial neural networks were discussed, as well some possibilities of the interaction between them (due to the small number of related work found by the authors). The ANNs could be applied in localization algorithms with reasonable accuracy and without the need of prior knowledge about the environment noise, unlike the techniques that apply Kalman filters. Among the artificial neural networks families mentioned, the Multi-Layer Perceptron was the most suitable for applications on embedded systems due to its good accuracy and low computational resource requirements, showing better trade-off between these items than other families. Another important characteristic of the using of ANNs is the immunity against errors of localization estimative due to non-line-of-sight environments and the irregular power transmitted by the anchors. Paper [9] dealt with the simulation of two wireless sensor network localization algorithms: the weighted centroid localization algorithm and the iterative trilateration. The algorithm was simulated using a fixed number of sensors and a variable number of anchors. Three anchor deployment scenarios were used. In order to obtain a clear picture of the algorithm results average error were calculated. After observing the average errors obtained for the uniform and random anchor placement using the WCL algorithm, an improvement solution for the random placement was obtained. This solution, called hybrid approach, leads to significant error reduction, especially when using a small number of anchor nodes. Therefore it can be concluded that by using the hybrid approach the error introduced by the random anchor placement is reduced. This makes the new approach a favourable one. LEACH [8] is a distributed hierarchical protocol which provides data aggregation for sensor networks by selecting random CHs in a distributed manner. It forms clusters based on the received signal strength and uses the CH nodes as routers to the Base Station. All data processing such as data fusion and aggregation are local to the cluster. Each node transmits to their CHs which in turn aggregate and compress the data and send to the Base Station. A stochastic algorithm is used (round by round) by each node to determine whether it can become CH in that round or not. All non CH nodes communicate to the CH in TDMA fashion as scheduled by CH. [6] proposed Power Efficient Gathering in Sensor Information Systems (PEGASIS) protocol in the year 2002 which is an enhanced version of LEACH. Instead of forming clusters, the protocol is truly based on forming

chains of sensor nodes. Author of [5] use three neural network models: the artificial synaptic network, a multilayer perceptron network and a generalized radial basis network functions were applied to the TOA localization problem.

III. CHALLENGES AND MOTIVATION OF LOCALIZATION
Wireless Sensor Networks have different challenges and motivation involves while localizing sensors in wireless sensor network are:

A. Fault Tolerance

Wireless sensor network have to be strong adequate concerning the precise positioning of personality sensors adjacent to faults or errors. The systems process has to be shore up and have to design in an active environment alongside several faults in the network design that is because of the inconsiderate surroundings, exhaustion of powers supply and exterior meddling.

B. Life time

The system life is a solemn difficulty in wireless sensor network. The sensors are succession power-driven or the control is maintenance in surroundings and as well their continuance is tough. These were predictable to be completely well-designed for extended instance. Consequently, consignment harmonizing and power reduction is supposed to be taken care of accomplishment of Wireless sensor network design.

C. Scalability

The maintenance of numerous no. of sensors in wireless sensor network is characteristically elevated. On the other hand, the balance partially basically involved on the enclosed region, the duplication of sensors, incomplete sensing exposure and function necessities. Therefore, the Wireless sensor network protocol is supposed to be capable to covenant by means of the numeral of sensor and in addition elevated density.

D. Security

The protection in wireless sensor network describes a significant function particularly for military resistance purposes and physical condition monitoring. The precautions for wireless sensor network are a hard-hitting approach to accomplish for the reason that of the inadequate possessions of sensors and instance uncontrollable procedures.

E. Cost of production

As defined earlier, the numeral sensors in WSNs are extremely huge, which results in depletion of battery. In addition, the lifeless sensors are deployed by means of the innovative ones. Consequently, intended for low-priced employment, the price of sensors is obliged to be reserved incredibly stumpy.

IV. FUZZY LOCALIZATION

In this sensing environment a variety of way is defined in regulate to construct wireless sensor network further efficient and accurate. In this manuscript we establish a localizing scheme that should work fuzzy concepts to enhance the network performance. Fuzzy logic technique is

a technique for manufacture WSN supplementary safe and sound. Phases involved are:

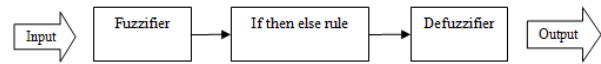


Fig. 2: Fuzzy based steps involved in the localization
The steps involved in Fuzzy based techniques are:

- Fuzzifier will take the input given and then transfer it to a fuzzy interference rule that are if then else rule for further simulation.
- Interference rule has been applied on the inputs that will work on this rule and out of which produce the results after checking in which rule the input will lie and define approximate results and efficient and precise results.
- Defuzzifier will produce an output after applying set of rules and that output is the best outcome.

V. SIMULATED RESULTS

These results are implemented on MATLAB environment. We proposed the ranged free fuzzy localization in the wireless sensor network. In this deployment we have taken the range of 20 x 20 with the no. on nodes N= 30. The basic simulated results for localization are

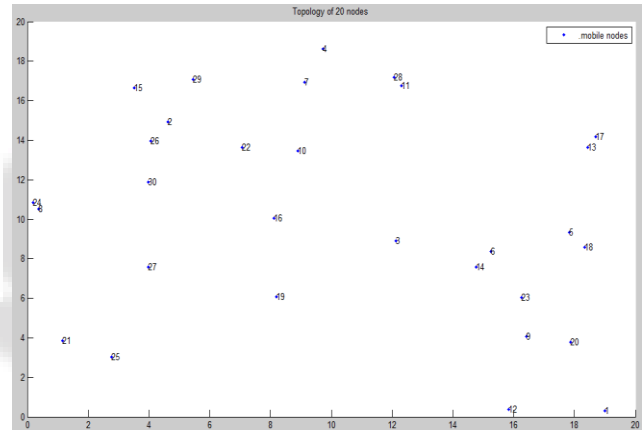


Fig. 3: Topology of 30 nodes in wireless sensor network with range of 20 x 20

In table 1, the simulated results are described through calculating time which will be defined in the deployment as the no. of nodes increases their time will get highly increased.

Table 1: Simulated result of localization

S. No	No. Of Nodes	Elapsed Time
1.	20	6.409579 seconds
2.	30	12.208268 seconds
3.	40	14.963585seconds
4.	50	18.376340seconds
5.	60	35.941867seconds

The graph shows the increase in the no. of nodes which will results in highly increase in the time as the result of which the network become less secure due to decrease in the strength of the network, loss of integrity due to improper localization of nodes of the network.

In the implementation of the fuzzy localization ranged based technique is used with the range of 1000 x 1000 dimensions with the no. of nodes 40. Using the distance estimation scheme the distances between the nodes

has been calculated in the fuzzy network and the cost of each network is calculated using fuzzy logic.

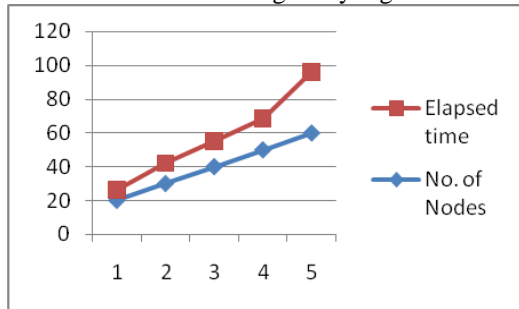


Fig. 4: Graph of No. of nodes vs. Elapsed time

Without proper localization, the nodes are unable to pass the information to their correct destination, congestion occur, it may involves the DOS attack that can harm the sensitive information of the network. The proper localization in the network prevents loss of integrity and also correct addressing of nodes. It provides the scalability to the network and also helps in determining the correct path from source to destinations. The localization is done in many ways but we are using the efficient method that is the fuzzy which deals with the approximate values to provide the better results to the network in the wireless sensor environment.

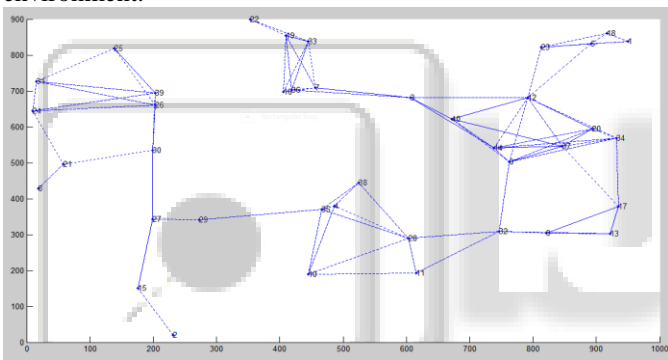


Fig. 5: fuzzy localization with range 1000 x 1000 for node = 40

In this table while using fuzzy localization time will decline as compared to previous elapsed time while localizing no. of nodes without fuzzy.

Table 2: Fuzzy localization

S. No	No. of Nodes	Elapsed time
1.	20	0.636244 seconds
2.	30	1.697310 seconds
3.	40	2.134739 seconds
4.	50	2.358970 seconds
5.	60	4.225310 seconds

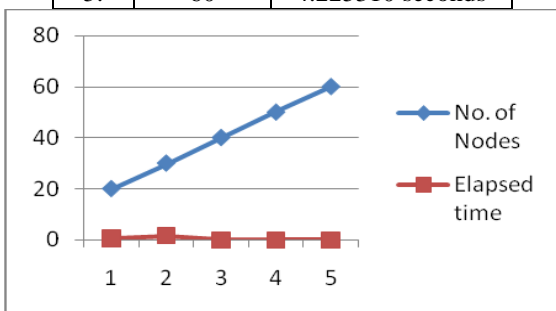


Fig. 6: Graph of Node localization using fuzzy method

In figure 7 shows comparison between the two can be defined as through the graph below that defines the deployment with the no. of increased node will increase the elapsed time but the node localization with fuzzy method reduces elapsed time with the corresponding nodes.

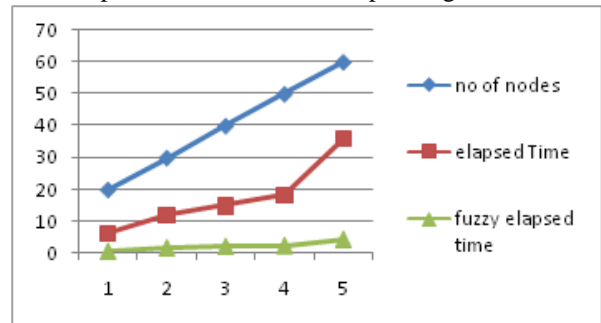


Fig. 7: Graph of elapsed time vs. Fuzzy elapsed time with respect to nodes

VI. CONCLUSION

Node localization is major concern due to less efficient node deployment. As in deployment there are many issue arise that are time, cost, security, strength etc. Various techniques have been proposed for localizing. Therefore to avoid these problems we proposed the fuzzy logic on node localization with Time of arrival to make the network more efficient and secure. Due to which network performance can be increased that degrades while deploying. With the results we have define the time, cost, distances that will gives the precise results for routing and to reduce the loss of integrity.

REFERENCES

- [1] Akyildiz, W. Su, Y. Sankarasubramaniam, And E. Cayirci, "Wireless Sensor Networks: A Survey," *Comput. Netw.*, Vol. 38, No. 4, Pp. 393-422, 2002.
- [2] Mohammad Shaifur Rahman, Youngil Park, And Ki-Doo Kim, "Localization Of Wireless Sensor Network Using Artificial Neural Network" *Communications And Information Technology*, 2009 International Symposium On Publication Year: 2009, Page(S): 639 - 642
- [3] Azzedine Boukerche "Localization Systems For Wireless Sensor Networks" *Ieee Wireless Communications*, December 2007
- [4] Raghavendra V. Kulkarni, Senior Member, Ieee, Anna Förster, Member, Ieee And Ganesh Kumar Venayagamoorthy, Senior Member, Ieee "Computational Intelligence In Wireless Sensor Networks: A Survey" Vol. 13, No. 1, First Quarter 2011
- [5] Sayed Yousef Monir Vaghefi, Reza Monir Vaghefi "A Novel Multilayer Neural Network Model For Toa-Based Localization In Wireless Sensor Networks" *Proceedings Of International Joint Conference On Neural Networks*, San Jose, California, Usa, July 31 - August 5, 2011 Pp. 3079-3084
- [6] Ergut, S.; Rao, R.R.; Dural, O.; Sahinoglu, Z." *Localization Via Tdoa In A Uwb Sensor Networkusing Neural Networks*" Publication Year: 2008 , Page(S): 2398 - 2403
- [7] Weng Yang" *Source Localization Using Tdoa Measurements With Sensor Location Uncertainty* "

- Control Conference (Ccc), 2011 30th Chinese Publication Year: 2011 , Page(S): 5068 – 5072
- [8] Gang Wang And Hongyang Chen” An Importance Sampling Method For Tdoa-Based Source Localization” Ieee Transactions On Wireless Communications, Vol. 10, No. 5, May 2011 Pp. 1560-1568
- [9] Rusnac, R.-I.; Gontean “Evaluation Of Wireless Sensor Networks Localization Algorithms” Volume: 2 Publication Year: 2011, Page(S): 857 - 862
- [10]Stephan Hermes Chagas, Leonardo Londero De Oliveira, João Baptista S. Martins “Review Of Localization Schemes Using Artificial Neural Networks In Wireless Sensor Networks” Sim 2011 – 26th South Symposium On Microelectronics Pages 177-180.

