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Minimization Estimated Position Error of Nodes in WSN Using Localization Algorithm

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Abstract: In minimization estimated position error of nodes in WSN using localization algorithm and also WSN applications it is critical to accurately determine the location of the distributed sensor nodes to report the data that is geographically meaningful. Since localization and tracking existing received signal strength (RSS) algorithms have been attracting research and development attention recently but problem more error. Wireless sensor technologies a standard format wireless communications or wireless sensor network, localization is a very important area that attracted significant research interest. This interest is predicted to grow further with the rise of wireless sensor network applications. the situation of sensors remains unknown by most of the sensors themselves; this can be as a results of the restrictions created by cost, energy consumption, sensor size and deployment and therefore the environment for implementation, Each node adaptively chooses a neighborhood of sensors, updates its position estimate by minimizing a local cost function and then passes this update to neighboring sensors. Sensor network algorithm estimates the coordinates of nodes. Localization is one in every of the key techniques in wireless sensor network. The situation estimation methods are often classified into target node and source node localization and node self-localization. In objects node localization and mainly objects node base on the energy-based method. During this paper provides a summary of the measurement techniques in existing received signal strength (RSS) method. An algorithm designed by us localizes position of moving node by RSS method. At first, localization of unknown node runs in WSN. Our proposed algorithm reduces error to search out possible location of nodes in WSN. Finally evaluation of estimated position error of all nodes and set up criteria in localization wireless sensor network. Our focus in this paper is to introduce a few design our wireless sensor network goal are minimization error, the challenges and opportunities of research in the field of sensor network virtualization as well as to show a current status of research in this field.

***Keywords:* Wireless Sensor Networks, Localization, RSS, Estimation Error, AOA, Position estimation, sensor networks.**

I. INTRODUCTION

Localization is one among the foremost important topics in Wireless Sensor Networks (WSNs) since many fundamental techniques in WSNs, e.g., geographical and location-based authentication [1] require the positions of unknown nodes. Also, the positions of unknown nodes play a critical role in many WSNs applications, like monitoring applications include environmental monitoring, health monitoring, and tracking applications include tracking objects, animals, humans, and vehicles [2], It is a reality that Much research activities are developed into wireless sensor networks because to its importance. Sensors with the subsequent performance indices like inexpensive, low power consumption, small size, and multipurpose and little coverage area are direct function of the advancement in electronics and communications.

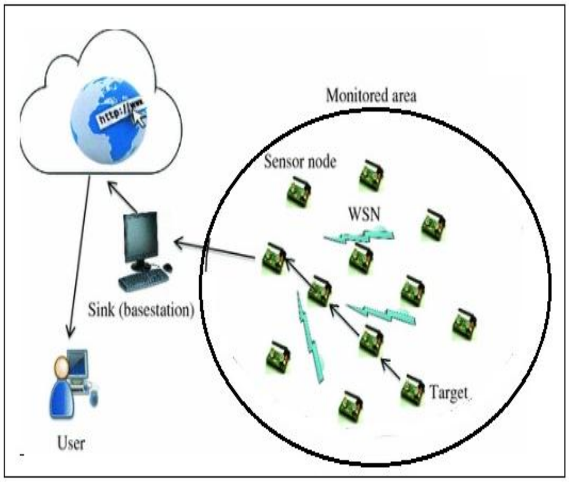

Fig. 1 .Wireless sensor network architecture

Homes, cities and general environmental control are achievable to the wireless networking of several sensors considered been smart and affordable. In military applications the broad spectrum of wireless sensors is deployed for the aim of surveillance, exploration and other applications. Information obtained via the monitoring of environmental events like agricultural precision, bush burnings, inspection and monitoring of water aren't so significant without the knowledge of the information source location. Additionally, the power to Estimate a location enhances the following: monitoring of the road traffic, health care, intrusion, inventory management, exploration and surveillance. In enterprise domain, facilities need to be delivered to places on need. Accurate position of sensor is vital for the success of those applications. To estimate the situation of a sensor which isn't known before localization algorithms utilize information like distance and absolute positions of other sensors [3].

Range based localization: The range based localization of nodes has two phases – ranging phase and position estimation phase. Within the ranging phase, each target node measures its distance from the anchor nodes using the strength of received signal or the signal propagation time. Accurate measurement of distance isn't possible because of noise. there's a loud range measurement regardless of the ranging method used whereas in position estimation phase, the knowledge acquired from ranging phase is employed to work out position of target node. It also can be estimated using geometric approach or by using an optimization algorithm. Localization is often defined because the position estimation for whole or some sensor nodes within the network specified the measurements of every locative connection among the sensors. At the present, the accurate location is that the meaning by any way of the position allocation. However, the measurements on locative connection because it could also be on the closeness the angle or distance among sensor nodes and RSS method. The sensor nodes are randomly deployed by the vehicle robots or aircrafts. While the worldwide positioning system is one among the foremost popular positioning technologies which is widely accessible, the weakness of high cost and energy consuming makes it different to put in every node. So as to scale back the energy consumption and value, only a couple of nodes which are called beacon nodes contain the GPS modules [4]. The remainder of nodes could obtain their locations through localization method. The method of estimating the unknown node position within the network is mentioned as node self-localization. And WSN consists of an outsized number of cheap nodes that are densely deployed during a region of interests to live certain phenomenon. The first objective is to work out the situation of the target, classify the localization method into target/source localization and node self-localization. And therefore the target localization will be further classified into four categories: single-target localization in WSN, multiple-target localization in WSN, single-target localization in wireless binary sensor network (WBSN), and multiple-target localization inWBSN. And node self-localization will be classified into two categories: range-based localization and range free localization. The previous method uses the measured the distance/angle to estimate the situation. And therefore the latter method uses the connectivity or pattern matching method to estimate the situation. They'll present the localization method in some special scenarios and eventually introduce the evaluation criteria for localization in WSN [5].

II. RELATED WORK

Sehgal et al. [6] determine acoustic channel capacity on short distances, increasing temperature and depth as a result gets higher channel capacity and throughput rates. Large bit error rates and large delays are characteristics of acoustic channel.

P Lazaridis et al. [7] the term partial discharge (PD) refers to a partial breakdown in an insulator which bridges two conductors. PD occurs due to insulation defects which arise as a result of high voltage stresses or insulation cracks. Continuous monitoring of PD activity can have a significant impact towards mitigating catastrophic failures. In recent times, it has become possible to detect and locate a PD activity on an automated basis using wireless sensor technology. In this paper, a novel technique for PD detection and localization using a wireless sensor network (WSN) is presented. The localization algorithm is based on received signal strength (RSS).

Y. Guo et al. [8] Thus, the movement of underwater nodes is actively restricted. That motivates researches and they provide an idea of Anchor-Free Localization Algorithm that is called AFLA. AFLA is considered for sensor networks which are actively restricted in underwater environment. Anchor node's information does not require by AFLA, and constructs employ of the association of neighboring nodes. In both static and dynamic network scenarios AFLA can be utilized. This algorithm contains a self-localization mechanism for underwater anchor-free sensor nodes. It can localize all nodes without anchor node's assisting [32]. Although, this algorithm has efficient results in underwater scenario but the localization of a freely moving node is still an open area for research. Data is only meaningful when exact location information is attached with it.

Ruz et al. [9] within the context of the Internet of Things (IoT) and the Location of Things (LoT) service, this paper presents an interactive tool to quantitatively analyze the performance of cooperative localization techniques for wireless sensor networks (WSNs). In these types of algorithms, nodes help each other determine their location based on some signal metrics such as time of arrival (TOA), received signal strength (RSS), or a fusion of them. The developed tool is intended to provide researchers and designers a fast way to measure the performance of localization algorithms considering specific network topologies. Using TOA or RSS models, the Crámer-Rao lower bound (CRLB) has been implemented within the tool. This lower bound can be used as a benchmark for testing a particular algorithm for specific channel characteristics and WSN topology, which allows determination if the necessary accuracy for a specific application is possible. Furthermore, the tool allows us to consider independent characteristics for each node in the WSN. This feature allows the avoidance of the typical "disk graph model," which is usually applied to test cooperative localization algorithms. The tool allows us to run Monte-Carlo simulations and generate statistical reports. A set of basic illustrative examples are described comparing the performance of different localization algorithms and showing the capabilities of the presented tool.

Jiang et al. [10] According to the application of range-free localization technology for wireless sensor networks (WSNs), an improved localization algorithm based on iterative centroid estimation is proposed in this paper. With this methodology, the centroid coordinate of the space enclosed by connected anchor nodes and the received signal strength indication (RSSI) between the unknown node and the centroid are calculated. Then, the centroid is used as a virtual anchor node. It is proven that there is at least one connected anchor node whose distance from the unknown node must be farther than the virtual anchor node. Hence, to reduce the space enclosed by connected anchor nodes and improve the location precision, the anchor node with the weakest RSSI is replaced by this virtual anchor node. By applying this procedure repeatedly, the localization algorithm can achieve a good accuracy. Observing from the simulation results, the proposed algorithm has strong robustness and can achieve an ideal performance of localization precision and coverage.

D. Niculescu et al. [11] .Localization has become an active research topic in WSN in recent years as exact localization information is really desirable for the performance of WSN. This problem is approached with different methods by the researchers. The localization with Ad-hoc Positioning System (APS)-distributed method in an ad-hoc network is developed by Niculescu.

Mistry et al [12]. Wireless Sensor Networks (WSNs) are most growing research area because of its low cost, infrastructure less, increase capabilities of nodes, real time and accurate. Localization is a major issue in the wireless sensor networks because it has a number of sensor nodes which are deployed at positions and they may not be fixed at their own position. In localization different techniques are used for distance and position estimation. In this paper we will focus on RSSI based localization in WSN which will show how to reduce location errors and improve accuracy by using various models and techniques. After that we will focus on how to make an algorithm scalable and improve the energy efficiency by providing authentication and key management.

E. Elnahrawy et al. [13] proposed several are abased localization algorithms using RSS profiling; these algorithms are area based because instead of estimating the exact location of the non-anchor node, they simply estimate a possible area that should contain it. Two different performance parameters apply: accuracy, or the likelihood that an object is within the area, and precision, i.e., the size of the area

P. Bahl et al. [14] Given the RSS model constructed using the procedure described; each non-anchor node unaware of its location uses the signal strength measurements it collects, stemming from the anchor nodes within its sensing region, and thus creates its own RSS finger print, which is then transmitted to the central station. Then the central station matches the presented signal strength vector to the RSS model, using probabilistic techniques or some kind of nearest neighbor based method, which chooses the location of a sample point whose RSS vector, is the closest match to that of the non anchor node to be the estimated location of the non-anchor node. In this way, an estimate of the location of the non anchor node can be obtained. The estimate is transmitted to the non-anchor node from the central station. Obviously, a non-anchor node could also obtain the full RSS model from the central station and perform its own location estimation. The accuracy of this technique depends on two distinct factors: the particular technique used to build the RSS model, with the resultant quality of that model, and the technique used to fit the measured signal strength vector from a non-anchor node into the appropriate part of the model. In comparison with distance-estimation based techniques, the RSS-profiling based techniques produce relatively small location estimation errors.

P. Bergamo et al. [15]. In sensor networks the device localization is an interesting topic due to its relationship with routing and energy consumption. We propose a scheme to perform localization, based on the estimation of the power received by only two beacons placed in known positions. By starting from the received powers, eventually averaged on a given window to counteract interference and fading, the actual distance between the sensor and the beacons is derived and the position obtained by means of triangulation. The paper shows the effectiveness of this approach in different environments, by including the possible disturbance due to fading channels and sensor mobility. Another category of distance related measurement techniques estimates the distances between neighboring sensors from the received signal strength measurements. These techniques are based on a standard feature found in most wireless devices, a received signal strength indicator (RSSI). They are attractive because they require no additional hardware, and are unlikely to significantly impact local power consumption, sensor size and thus cost.

Mesmoudi et al. [16]. Wireless sensor networks (WSNs) have recently gained a lot of attention by scientific community. Small and inexpensive devices with low energy consumption and limited computing resources are increasingly being adopted in different application scenarios including environmental monitoring, target tracking and biomedical health monitoring. In many such applications, node localization is inherently one of the system parameters. Localization process is necessary to report the origin of events, routing and to answer questions on the network coverage, assist group querying of sensors. In general, localization schemes are classified into two broad categories: range-based and range-free. However, it is difficult to classify hybrid solutions as range-based or range-free. In this paper we make these classification easy, where range-based schemes and range-free schemes are divided into two types: fully schemes and hybrid schemes. Moreover, we compare the most relevant localization algorithms and discuss the future research directions for wireless sensor networks localization schemes.

III. SIMULATION TOOL

The Performance analysis of MATLAB version i.e. used for this thesis Implementation of information mining provides processor optimized libraries for quick execution and computation and performed on input cancer dataset. It uses its JIT (just in time) compilation technology to produce execution speeds that rival ancient programming languages. It may also additional advantage of multi core and digital computer computers, MATLAB offer several multi threaded algebra and numerical perform. During this thesis, all increased economical information retrieve results were performed in MATLAB. MATLAB is that the high level language and interactive surroundings employed by variant engineers and scientists worldwide. It lets the explore and visualize concepts and collaborate across completely different disciplines with signal and image process, communication and computation of results. MATLAB provides tools to accumulate, analyze, and visualize information, alter you to induce insight into your information during a division of the time it might take exploitation spreadsheets or ancient programming languages. It may also document and share the results through plots and reports or as printed MATLAB code. Matrix laboratory could be a multi paradigm numerical computing scenario and fourth generation programming language. It's developed by scientific discipline work; MATLAB permits matrix strategy, plotting of performs and information, implementation of rule, construction of user interfaces with programs. An optional tool box uses the MuPAD symbolic engine, permitting access to symbolic computing capabilities. It's simulating on mat laboratory and for this work we have a tendency to use Intel 2.4 GHz Machine and software system window7, window-xp etc. High-level technical work out language and interactive surroundings for rule development, information visualisation, records analysis, and numeric computation.

IV. RESULTS ANALYSIS

In field of Localization in wireless sensor network is a hot area of research that has been addressed through many challenge and more error in localization algorithm (RSS). Minimization estimated position error of nodes in WSN using proposed schemes and best solution.

1. Experimentation1

(a) Set Wireless Network Simulation Parameter in Case 11-Node Experimentation Analysis

Table 1 Set Wireless Network Simulation Parameter in Case 11-Node

Description	Parameter
Network Dimension	100mX100mX100m
Number of Nodes	11
Approximate Distance	5
Approximate Angle	5
Population size	74
Maximum iteration	62

In above table1 shows set parameters in wireless network and analysis in case 11-Node.

(b) Error Analysis based in Case 11-Node in Wireless Network

Table2 Error Analysis between RSSLA and AWSNA in Case 11-Node in Wireless Network

Algorithm	Nodes	Error (in %)
RSSLA	11	19.1166
AWSNA	11	13.3248

In above table 2 shows result using 11 nodes and error analysis between RSSLA are more error and AWSNA are less error.

(c) Nodes Analysis Processing Time in Case 11-Node in Wireless Network

Table3 Nodes Analysis Processing Time between RSSLA and AWSNA in Case11-Node in WN

Algorithm	Nodes	Node Position Analysis Time (in sec)
RSSLA	11	1.7356
AWSNA	11	1.2834

In above table 3 shows result analysis using 11 nodes and time analysis between RSSLA more time and AWSNA less time.

(d) Result Graph in Case 11-Node in Wireless Network

(i)Error analysis based in case 11-nodes in wireless network in this experimentation1 RSSLA are more error and AWSNA less error.

(ii) Nodes analysis processing time in Case 11-node in wireless network in this experimentation1 AWSNA is minimal processing time compare RSSLA.

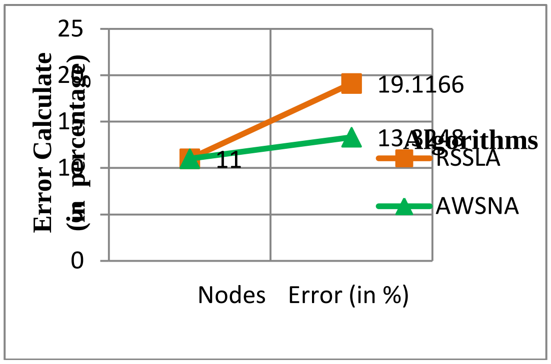

Fig.2 Error analysis based in case 11-nodes in wireless network based Graph

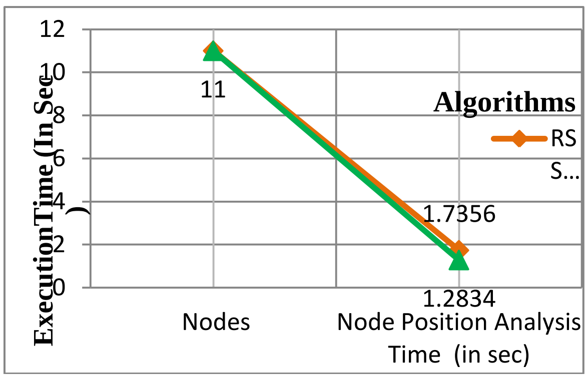

Fig.3 Nodes analysis processing time in Case 11-node in wireless network based graph

V. CONCLUSION

Localization in wireless sensor network may be a hot area of research that has been addressed through many proposed schemes. WSN supported and dependencies of the range base method are measurements of estimated position error of all nodes in WSN and also find proposal schemes. WSN are classified into two major categories: range-based schemes and range-free schemes. However, it's difficult to classify hybrid schemes which combine different methods supported connectivity information and/or range measurement techniques as range-based or range-free schemes. Improved localization algorithm supported iterative centroid estimation is proposed during this paper. During this algorithm, the centroid of the space enclosed by connected anchor nodes is taken into account as a virtual anchor node. It may be proven that there's a minimum of one connected anchor node whose distance from the unknown node must be farther than the centroid. Hence, the connected anchor nodes with the weakest RSSI are going to be replaced by the centroid. Good positioning results will be achieved by repeating the replacement procedure. WSN are simulation and implementations on MATLAB Tool. Proposed algorithm is providing the energy effecting and error minimization three-dimensional localization WSN. Designed 3D localization WSN area nodes to minimize the localization in accuracy and adverse effects on data delivery processes to localization errors. The proposed model will also excel the location precision of the nodes while performing the process of localization. Determine the performance using the proposed model will be measured the different parameters improve achievement like node positioning error, localization coverage rate, positioning coverage, positioning rate. Our proposed algorithm (AWSNA) is minimal processing time compare existing algorithm (RSSLA) and error analysis of our proposed algorithm (AWSNA) are less error compare existing algorithm (RSSLA).

REFERENCES

[1]. G. Mao, B. Fidan and B. D. O. Anderson, "Wireless sensor network localization techniques", Computer Networks 51, pp 2529-2553, 2007.

[2]. N. Patwari, A. Hero, M. Perkins, N. Correal, and R. O'Dea, "Relative location estimation in wireless sensor networks," IEEE Transactions on Signal Processing, vol. 51, no. 8, pp. 2137–2148, 2003.

[3]. Dil, Bram, Stefan Dulman, and Paul Havinga. "Range-based localization in mobile sensor networks." In European Workshop on Wireless Sensor Networks, pp. 164-179. Springer, Berlin, Heidelberg, 2006.

[4]. Shen, Xingfa, Zhi Wang, Peng Jiang, Ruizhong Lin, and Youxian Sun. "Connectivity and RSSI based localization scheme for wireless sensor networks." In International Conference on Intelligent Computing, pp. 578-587. Springer, Berlin, Heidelberg, 2005.

[5]. Zhang, Yuan, Wenwu Wu, and Yuehui Chen. "A range-based localization algorithm for wireless sensor networks." Journal of Communications and Networks 7, no. 4: 429-437, 2005.

[6]. A. Sehgal, I.Tumar, and J. Sch¨onw¨alder, "Variability of available capacity due to the effects of depth and temperature in the underwater acoustic communication channel," in Proceedings of the OCEANS '09 IEEE Bremen: Balancing Technology with Future Needs, Germany, May 2009.

[7]. P Lazaridis, U Khan H Mohamed, D Upton, K. Mistry, B Saeed, P Mather, M F Q Vieira, R. C. Atkinson , C. Tachtatzis, "Localization of Partial Discharge by Using Received Signal Strength", 2nd URSI AT-RASC, Gran Canaria, 28 May . 1 June 2018.

[8]. Y. Guo and Y. Liu, "Localization for anchor-free underwater sensor networks," Computers and Electrical Engineering, vol. 39, no. 6, pp. 1812–1821, 2013.

[9]. Ruz, Mario L., Juan Garrido, Jorge Jiménez, Reino Virrankoski, and Francisco Vázquez. "Simulation tool for the analysis of cooperative localization

algorithms for wireless sensor networks." Sensors 19, no. 13: 2866, 2019.

[10]. Jiang, Rui, Xin Wang, and Li Zhang. "Localization Algorithm Based on Iterative Centroid Estimation for Wireless Sensor Networks." Mathematical Problems in Engineering, 2018.

[11]. D. Niculescu, B. Nath, "Ad hoc positioning system (aps), in: Global Telecommunications Conference, 2001. GLOBECOM'01. IEEE, Vol. 5, IEEE, 2001, pp. 2926–2931,2001.

[12]. Mistry, Hetal P., and Nital H. Mistry. "RSSI based localization scheme in wireless sensor networks: A survey." In 2015 Fifth International Conference on Advanced Computing & Communication Technologies, pp. 647-652. IEEE, 2015.

[13]. E. Elnahrawy, X. Li, and R. Martin, "The limits of localization using signal strength: a comparative study," in First Annual IEEE Conference on Sensor and Ad-hoc Communications and Networks, pp. 406 -414, 2004.

[14]. P. Bahl and V. Padmanabhan, "RADAR: an in-building RF-based user location and tracking system," in IEEE INFOCOM, vol. 2, pp. 775–784, 2000.

[15]. P. Bergamo and G. Mazzini, "Localization in sensor networks with fading and mobility," in The 13th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, vol. 2, pp. 750–754,2002.

[16]. Mesmoudi, Asma, Mohammed Feham, and Nabila Labraoui. "Wireless sensor networks localization algorithms: a comprehensive survey." arXiv preprint arXiv: 1312.4082, 2013.

[17]. K. Lee and Y. Bresler, ``ADMiRA: Atomic decomposition for minimum rank approximation,'' IEEE Trans. Inf. Theory, vol. 56, no. 9, pp. 4402_4416, Sep. 2010.

[18]. Z. Lin, A. Ganesh, J. Wright, L. Wu, M. Chen, and Y. Ma, ``Fast convex optimization algorithms for exact recovery of a corrupted lowrank matrix,'' Comput. Adv. Multi-Sensor Adapt. Process., vol. 61, no. 6, pp. 1_18, 2009.

[19]. Z. Lin, A. Ganesh, J. Wright, L. Wu, M. Chen, and Y. Ma, ``Fast convex optimization algorithms for exact recovery of a corrupted low-rank matrix,'' Comput. Adv. Multi-Sensor Adapt. Process., vol. 61, no. 6, pp. 1_18, 2009.

[20]. J. B. Tenenbaum, V. de Silva, and J. C. Langford, ``A global geometric framework for nonlinear dimensionality reduction,'' Science, vol. 290, no. 5500, pp. 2319_2323, Dec. 2000.

[21]. C. Feng, S. Valaee, W. S. A. Au, and Z. Tan, ``Localization of wireless sensors via nuclear norm for rank minimization,'' in Proc. IEEE Global Telecommunication Conf. (GLOBECOM), , pp. 1_5, Dec. 2010.

[22]. P. Biswas, T.-C. Liang, K.-C. Toh, Y. Ye, and T.-C. Wang, ``Semidenite programming approaches for sensor network localization with noisy distance measurements,'' IEEE Trans. Autom. Sci. Eng., vol. 3, no. 4, pp. 360_371, Oct. 2006.