Error Minimization Analysis Based on Range-Based Method in Wireless Sensor Network

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Abstract: ***Error minimization analysis based on range-based methods in wireless sensor network. Wireless sensor networks and location are also an important aspect in the field of wireless sensor networks (WSN) that have developed important research interests between the academic world and research communities. The wireless sensor network is made up of a small area , number of nodes limited, low-energy , small processing capacities and low-cost sensors that communicate with each other in ad-hoc mode, target tracking the task to determine the number of node positions or sensor nodes in WSNs , understand as location or position. Localization is one of the significant necessities in remote sensor systems for following and dissecting the detected information/occasions. In the greater part of the utilizations of remote sensor organizes the occasion data without its area data has no hugeness. This work means to decide the circumstance of the sensor hubs with high exactness and exactness of position precision for different changed applications, distinctive area strategies utilized in various applications and there are several challenges in some special scenarios such as fire detection, The initial part in this work it is applied to the location of the nodes using node or device in proposal WSN and obtaining device estimates when knowing a minimum of position values of ad-hoc network that must be remembered in absolute position values in the network where the sensor nodes not fixed in WSN but the algorithm RSSI is known as not minimum error. The analysis of the results obtained by simulation shows that the method of locating the proposed advanced error minimization algorithm (AEMA) works better than the RSSI technique in terms of probability rate blunders with a variable number of known sensors and the quest for bigger areas limiting blame and along these lines get the ideal outcome. The basic challenge during a wireless sensor network is the location. Our proposed algorithm (AEMA) primary less error and the estimation of the situation of the unknown nodes. Simulations have been conducted to show the Effectiveness of using proposed algorithm localization-based techniques when integrated into wireless sensor networks.***

Keywords: ***Wireless Sensor Network, localization, Global Positioning System, RSSI, Mobile Sensors, Sensor Node, MAE, MRE, AEMA.***

I. INTRODUCTION

In the next generation of communications networks, they need real-time location and service based on precise positioning, low cost, energy efficient and reliable. Today, wireless sensor networks (WSN) are often applied in many applications, such as investments in natural resources, monitoring objectives, where inaccessible monitoring originates. In these applications, the sensor nodes collect and transfer knowledge.

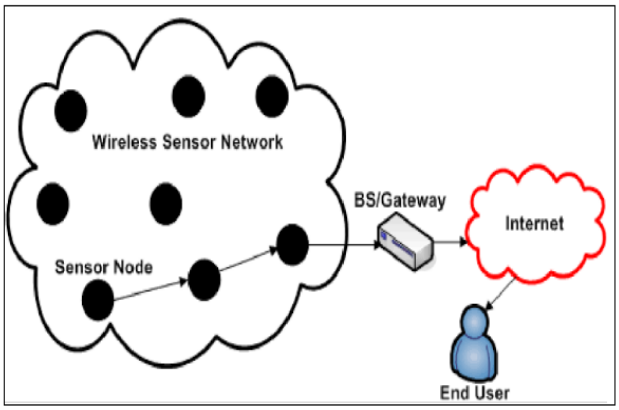


Fig1. General wireless sensor network model

Several applications request this information about the locations of the sensor nodes. In addition, situational information is additionally indispensable in geographical routing and grouping protocols [1, 2, 3] in those mentioned above, location algorithms are one of the most important topics in WSN research. Therefore, the location of the capacitive nodes is important for the operation of the WSN. The location of WSN has been studied intensively in recent years, and most of these studies are based on the condition that only a small proportion of the sensor nodes, called anchor nodes, know the exact positions of the GPS devices or manual settings Other sensor nodes estimate the distances of the anchor nodes and calculate positions with multiple lateralization techniques. These methods provide satisfactory levels of accuracy and a small proportion of anchor nodes in WSN. Sensor nodes are randomly deployed on terrain accessible by car or aircraft robots to be used in many promising applications, such as health monitoring, battlefield monitoring, environmental monitoring, protection, routing, location services, objective tracking and rescue. In the literature, numbers of location systems and algorithms for sensor networks are reported, which are broadly classified into row-based and short-range matrices according to the idea of estimating the location of the mechanism. Row-based schemes are

defined by protocols that use absolute distance estimation to calculate the situation. Quick solutions do not make assumptions about the accessibility or legality of this information. Due to the hardware constraints of the sensors, the solutions in the series of quick schemes have been considered cost-effective substitutes in mostly base-based arrays. Taxonomy location algorithms have admitted several different criteria, such as: dependence on the measurement range, computer modeling link.

1.1 Location Process

The problem with the location of the sensor is to look for the status of all or over the sensor nodes. The localization process locates sensor nodes that support input files. If ink is available in the network, the common inputs are the location of the anchors, while the other inputs support measurement techniques. General description of the localization process.

1.2. Problems in WSN

The network location sensor is an active search area and has many problems, so it still has a lot of reach

Community research A number of issues have been received that must be addressed.

Cost-effective algorithms: during the planning of the location algorithm, the designer must close one yourself hardware cost and deployment. GPS is not adequate due to its cost and size hardware

Robust algorithm for mobile capacity networks: mobile sensors are more useful in some environments

Due to the mobility and coverage of the facilities. Therefore, the development of the latest algorithms is required accommodate these mobile nodes.

Algorithms for three-dimensional space: for multiple WSN applications, location information is accurate critical More of the proposed algorithms are applicable in 2D space. A device number you need a WSD 3D presentation.

1.3. WSN Features

A wireless capacity network consists of many different components, of which a sensor node is a critical but small part. The characteristics of an honest network of wireless sensors include energy efficiency, scalability, responsiveness, reliability and mobility. A wireless capability network with these features can be very beneficial and, if not tracked or secured, can result during a network overload, which cancels your application. The normal layer approach presents three main problems.

1. Traditional layer approaches cannot share different information between different layers, since the results of each layer do not have complete information. The normal layer approach cannot guarantee the optimization of the entire network.

2. The normal layered approach does not have the power to adapt to environmental changes.

3. Due to interference between multiple users, access conflicts, fading and, therefore, changing the environment of wireless sensor networks, the traditional layered approach to wired networks is not applicable to wireless networks.

Low cost: in the wireless sensor network, practically hundreds or thousands of sensor nodes are implemented to live in any physical environment. As well as to reduce the total cost of the network, the total value of the sensor node should be kept as low as possible.

Computing power: Normally, the node has a limited computing capacity because the cost and energy had to be considered.

Communication capabilities: the wireless sensor network generally communicates via radio waves through a wireless channel. It is the property for short-range communication, with broad and dynamic bandwidth. Communications between different channels are often bidirectional or unidirectional. With the hostile and operational environment alone, it is difficult to run wireless sensor networks without problems. The materials and software used for communication must refer to security.

Energy efficiency: WSN energy works for many purposes, such as computing, communication and storage. A sensor node uses more energy compared to other nodes for communication. If they run out of installation, they often become invalid because we have no other option to recharge them. Therefore, different protocols and different development algorithms should consider the use of the installation in the design phase.

Security and privacy: each sensor node must have sufficient security mechanisms to stop unauthorized access, attack and involuntary damage to data within the sensor node. In addition, even more privacy mechanisms should be included.

Distribute some: the numbers of the sensor node numbers are scattered exactly randomly. In the wireless sensor network, each node is able to collect, classify process, add and send the data to the flow. Then distribute given the strength of the plot.

Multiple communication jumps: a gigantic number of sensor nodes implemented in WSN. Therefore, the possible way to communicate with the dive station or base is to require the assistance of an intermediate node in the routing route. If one has to communicate with the opposite

node or base station that is beyond its frequency, I must be on the route of multiple hops per intermediate node [4, 5].

Dynamic network topology: in general, the wireless sensor network can be a dynamic network. The sensor node cannot succeed due to battery overload or other conditions; communication between different channels is often interrupted also because the additional sensor node could also be additional in the network, which leads to frequent changes in the topology. Therefore, network sensitive network nodes must be integrated for the purpose of reconfiguration, self-tuning.

Self-organization: the sensor nodes in the network must have the potential to organize because the sensor nodes are implemented in an unknown way and in a hostile environment. The sensor nodes need to add collaborations to vary the algorithm and form the network automatically.

II. LITERATURE REVIEW

Balasubramanian S. et al. [7].Localization is an essential and important research issue in wireless sensor networks (WSN).Most localization schemes focus on static sensor networks.However,Mobile sensors required in some applications to acquire all the relevant dat. As such, a localization scheme defined for mobile sensor networks is necessary to track the moving nodes In this paper, they propose a localization scheme, the normal nodes without location information can estimate their own location information can estimate their own locations by gathering the positions of location aware nodes (anchor nodes) and the one-hop normal nodes whose locations are estimated from the anchor nodes. In addition, we propose a scheme that predicts the moving direction of sensor nodes to increase localization accuracy. Simulation results show that the localization error in our proposed scheme is lower than the previous schemes in various mobility models and moving speeds.

Zhang et al. [8] Localization in mobile sensor networks is more challenging than in static sensor networks because mobility increases the uncertainty of nodes' positions. Most existing localization algorithms in mobile sensor networks use Sequential Monte Carlo (SMC) methods due to their simplicity in implementation. However, SMC methods are very time-consuming because they need to keep sampling and filtering until enough samples are obtained for representing the posterior distribution of a moving node's position. In this paper, we propose a localization algorithm that can reduce the computation cost of obtaining the samples and improve the location accuracy. A simple bounding-box method is used to reduce the scope of searching the candidate samples. Inaccurate position estimations of the common neighbor nodes is used to reduce the scope of finding the valid samples and thus improve the accuracy of the obtained location information. Our simulation results show that, comparing with existing algorithms; our algorithm can reduce the total computation cost and increase the location accuracy. In addition, our algorithm shows several other benefits: 1) it enables each determined node to know its maximum location error, 2) it achieves higher location accuracy under higher density of common nodes, and 3) even when there are only a few anchor nodes, most nodes can still get position estimations.

S. Aggarwal et al. [9].Localization has become one of the mandatory services in wireless sensor networks (WSNs) while dealing with critical operations such as coverage, deployment, routing, target tracking and rescue operations. Since the necessity of WSN has increased drastically to provide best solution with accurate results of sensor nodes, it mainly depends on the WSN node localization. This paper provides an overview of different approach of node localization discovery in wireless sensor networks. A survey on various aspects or techniques of localization like localization error, parameters of localization, accuracy, bit error probability, energy consumption has been studied. Various overviews of the schemes proposed by different authors for the improvement of localization in wireless sensor networks are also highlighted.

J.P. Sheu et al. [10]. the location estimation is a fundamental and essential issue for wireless sensor networks (WSNs). In this paper, we assume that only a few sensor nodes (named as beacon nodes) get their locations by Global Positioning System (GPS) and the remaining nodes without GPS (named as normal nodes) need to estimate their own locations by gathering the nearby neighboring information. Existing works are either too costly or not accurate enough. To improve previous works, we propose a distributed location estimation algorithm for WSNs. In our algorithm, each node without location information only needs to collect the location information of neighboring nodes and use simple computation to estimate its location. Besides, we improve the accuracy of the normal node's estimative region by discarding the communication area of the beacon node (named as the farther neighboring beacon node), which does not cover the normal node, from the original estimative region. We derive some rules to adjust the estimative region according to the relative location of the normal node and the farther neighboring beacon node. Simulation results show that the proposed algorithm achieves better accuracy of estimative locations.

C. Huang et al. [11] .Location awareness is of great importance for several wireless sensor network applications. Precise and quick self localization capability is highly desirable in wireless sensor network. Localization algorithms have been developed with various approaches. A detailed survey of localization techniques is provided in. Localization techniques can be classified as range free or

range based, depending on whether the range measurement methods are used or connectivity information is used. Range based methods require range measurement information, such as Received Signal Strength Indicator (RSSI) , Angle of Arrival (AOA) , Time of Arrival (TOA) and Time Difference of Arrival (TDOA) etc. However, the measurement accuracy of these methods can be affected by the environmental interference. Though, range free methods cannot pro-vide accurate location estimation, they are cost effective and robust to noise since range measurements are not involved in it. The range-based methods have connectivity or proximity information between neighbor nodes who can communicate with each other directly.

Sichitiu et al. [12] Wireless sensor networks have the potential to become the pervasive sensing (and actuating) technology of the future. For many applications, a large number of inexpensive sensors is preferable to a few expensive ones. The large number of sensors in a sensor network and most application scenarios preclude hand placement of the sensors. Determining the physical location of the sensors after they have been deployed is known as the problem of localization. We present a localization technique based on a single mobile beacon aware of its position (e.g. by being equipped with a GPS receiver). Sensor nodes receiving beacon packets infer proximity constraints to the mobile beacon and use them to construct and maintain position estimates. The proposed scheme is radio-frequency based, and thus no extra hardware is necessary. The accuracy (on the order of a few meters in most cases) is sufficient for most applications. An implementation is used to evaluate the performance of the proposed approach

G. K. A. et al. [13]. Wireless sensor network (WSN) is composed of low cost, tiny sensor that communicates with each other and transmit sensory data to its base station/sink. The sensor network has been adopted by various industries and organization for their ease of use and is considered to be the most sorted future paradigm. The sensor devices are remotely deployed and powered by batteries. Preserving the energy of sensor devices is most desired. To preserve the battery efficient routing technique is needed. Most routing technique required prior knowledge of sensor nodes location in order to provide energy efficiency. Many existing technique have been proposed in recent time to determine the position of sensor nodes. The existing technique proposed so for suffers in estimating the likelihood of localization error. Reducing the error in localization is most desired. This work present a (Time-of-Arrival) based localization technique and also present adaptive information estimation model to reduce/approximate the localization error in wireless sensor network. The author compares our proposed localization model with existing protocol and analyses its efficiency.

S. H.Thimmaiah et al. [14]. Wireless sensor based communication system is an ever growing sector in the industry of communication. Wireless infrastructure is a network that enables correspondence between various devices associated through a infrastructure protocol. Finding the position or location of sensor node (Localization) is an important factor in sensor network for proving efficient service to end user. The existing technique proposed so for suffers in estimating the likelihood of localization error. To cater this in this work the author proposes a RSS (Received signal strength) based localization technique and also proposes an adaptive information estimation to reduce or approximate the localization error in wireless sensor network. The author compares our proposed localization model with existing protocol and analyses its efficiency.

Singh et al. [15], the continuously widening range of Wireless Sensor Networks (WSNs) applications requires exact node location which needs efficient and error free localization methods. Localization methods developed in the past are completely based on very fine numerical computation of various network parameters such as transmission range, propagation shape, transmitted or received power, sending or arrival time, connectivity information etc. These parameters are prone towards environmental situation and presence of obstacles in environment. Recently, research in localization is focused towards minimization of localization error in the available techniques. In this paper, the cause and behavior of errors in AOA and RSSI localization techniques have been mathematically analyzed. Based on the error analysis of both the existing techniques, a hybrid localization algorithm is proposed. The hybrid localization algorithm is based on existing Angle of Arrival (AOA) and Received signal strength indicator (RSSI). The algorithm is named as Minimum AOA Error with Minimum RSSI Error (MAE with MRE). Analysis of results obtained through simulation show that the hybrid localization algorithm performs better than AOA and RSSI techniques in terms of error percentage probability with varying number of known sensors, unknown sensors and shadowing effect percentage.

Tomic et al.[16]This work revises existing solutions for a problem of target localization in wireless sensor networks (WSNs), utilizing integrated measurements, namely received signal strength (RSS) and angle of arrival (AoA). The problem of RSS/AoA-based target localization became very popular in the research community recently, owing to its great applicability potential and relatively low

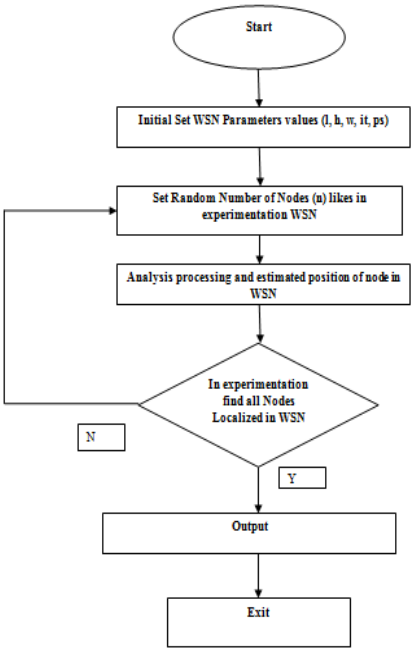
implementation cost. Therefore, here, a comprehensive study of the state-of-the-art (SoA) solutions and their detailed analysis is presented. The beginning of this work starts by considering the SoA approaches based on convex relaxation techniques (more computationally complex in general), and it goes through other (less computationally complex) approaches, as well, such as the ones based on the generalized trust region sub-problems framework and linear least squares. Furthermore, a detailed analysis of the computational complexity of each solution is reviewed. Furthermore, an extensive set of simulation results is presented. Finally, the main conclusions are summarized, and a set of future aspects and trends that might be interesting for future research in this area is identified.

III. PROBLEM STATEMENT AND PROPOSED METHODOLOGY

(i) Problem Statement : The network location sensor is an active search area and has many problems, so it still has a lot of reaches community research a number of issues have been received that must be addressed . Cost-effective algorithms: during the planning of the location algorithm, the designer must close one yourself hardware cost and deployment. GPS is not adequate due to its cost and size hardware a robust algorithm for mobile capacity networks: mobile sensors are more useful in some environments Due to the mobility and coverage of the facilities. Therefore, the development of the latest algorithms is required to accommodate these mobile nodes. Algorithms for three-dimensional space. Usually the advance approach that reduced the error in locating the coordinates of the device node (unknown node). Many researchers had approached the localization disadvantage from wholly completely different perspective. Focus on the localization technique supported distance measurements and reduced the localization error between the determinable locations of node.

(ii) Proposed Methodology:

Error minimization analysis based on range-based method and our proposed advanced error minimization algorithm (AEMA) in wireless sensor network.WSN are energy-sensitive networks, how to extend the lifetime of the network is always a vital area in the learning of WSNs. Proposed algorithm (AEMA) aiming to achieve this goal, in most cases, clustering structure is introduced into the network to guarantee cost-effective data transmission in wireless network. Thus, in our proposed algorithm (AEMA), firstly they set that the selection made by newly number of node for selecting connected objects is affected by the connectivity approximately scale and residual energy. In other words, if the existing methods (RBDA, RBAA) are more error rate and also more energy loss but our proposed advanced error minimization algorithm best less error rate.



IV. IMPLEMENTATION AND RESULT ANALYSIS

(i) Implementation Setup: The Performance analysis of implementation tool (MATLAB) used for this thesis Implementation of data mining provides processor optimized libraries for fast execution and computation and performed on input cancer dataset. It uses its JIT (just in time) compilation technology to provide execution speeds that rival ancient programming languages. It should additional advantage of multi core and computing device computers, implementation tool (MATLAB) provide many multi rib pure mathematics and numerical perform. These functions automatically execute on multiple procedure thread during very single implementation tool, to execute faster on multicourse computers. Throughout this thesis, all inflated economical data retrieve results were performed in implementation tool .implementation tool is that the high level language and interactive surroundings used by numerous engineers and scientists worldwide. It lets the explore and visualize ideas and collaborate across entirely completely different disciplines with signal and image method, communication and computation of results. Implementation tool provides tools to accumulate, analyze, and visualize info, modify you to induce insight into your info during a} very division of the time it would take exploitation spreadsheets or ancient programming languages.

(ii) Result Analysis: Research areas of wireless capacity networks and identify several challenges. Our goal is to reduce the error of localization of wireless sensor networks. The overall result achieved shows the effectiveness of our proposed location model on existing RSS methods.

(a) Set Network Simulation Parameter:

Table1 Design Simulation Wireless Network

Parameter Name	Set Parameter Values
Length(m) x Height(m) x Width(m)	103x103x103
Approximate Distance Calc. (%)	4
Approximate Angle Calc. (%)	4
Population Size	63
Maximum Iterations	71
Number of Nodes	10,15,18

(b) Performance analysis based on 10 Nodes:

(i) Error Estimation Analysis:

Table 2 Performance analysis based on 10 Nodes in E

Algorithms	Number of Nodes	Error (in %)
RBDA	10	13.0661
RBAA	10	12.4878
AEMA	10	10.9203

(ii) Error Analysis based on 10 Nodes:

Performance analysis based on 10 Nodes using three different algorithms (RBDA, RBAA, AEMA). Error analysis based on 10 Nodes and compare RBDA, RBAA, AEMA. Show in table 5.2, in RBDA 13.0661 %, RBAA 12.4878%, AEMA 10.9203%. In show figure 5.2 overall result analysis in wireless sensor network, finally our proposed algorithm best performance as compare to existing algorithm.

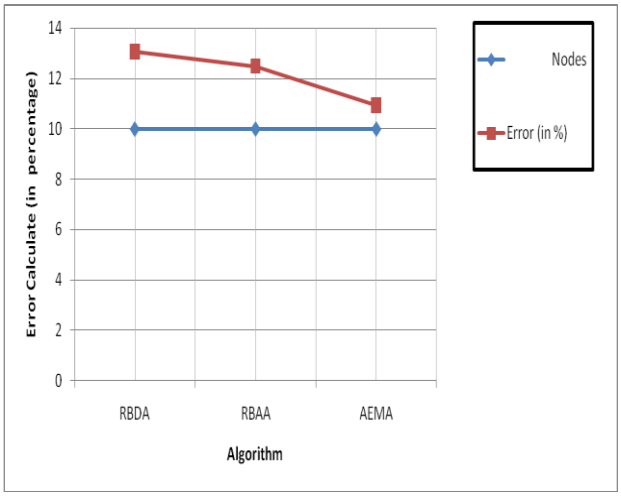


Fig2. Error Analysis based on 10 Nodes

(iii) Execution Time Analysis:

Table 3 Performance analysis based on 10 Nodes in ETA

Algorithm	Number of Nodes	Execution Time (in sec)
RBDA	10	0.86705
RBAA	10	1.1968
AEMA	10	1.7953

(iv) Execution Time based on 10 Nodes:

Performance analysis based on 10 Nodes using three different algorithms (RBDA, RBAA and AEMA).Execution time analysis based on 10 Nodes and compare RBDA, RBAA, AEMA. Show in table 5.3, in RBDA 0.86705(in sec), RBAA 1.1968(in sec), and AEMA 1.7953 (in sec). In show figure 5.3 overall result analysis in wireless sensor network, finally our proposed algorithm average time as compare to existing algorithm.

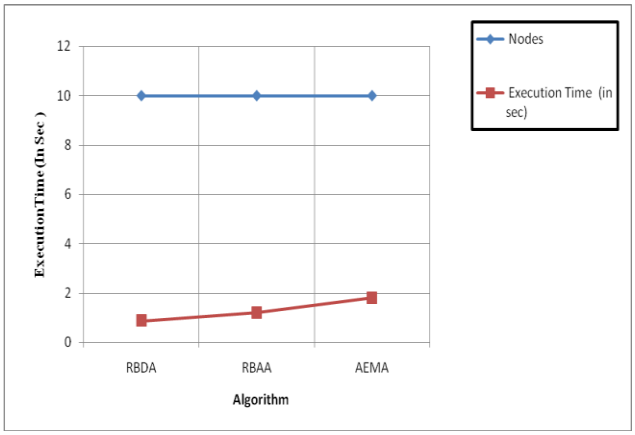


Fig3. Execution Time based on 10 Nodes

V. CONCLUSION

.Advanced Error Minimization Algorithm (AEMA) The wireless network sensor may be a network that allows correspondence between several devices associated with smaller infrastructure. Finding the position/location of the sensor node (location) is a critical consideration network to demonstrate efficient service to the end-user. The dominant location is not effective in terms of accuracy and promotes location optimization itself. This paper presents a technique based on RSS localization and also proposes an estimate of adaptive information to reduce/approximate the error in the location of wireless sensor networks. The situation information is important and challenging. The new operational contexts of military engagement have opened door for various applications of WSNs. The capability of a WSN military application depends on the type and capabilities of sensors, wireless communications

architecture, coverage, and appropriate information processing, fusion and knowledge generation. Finally, a discussion compares the previous method with the proposed method, such as reduced error and improved accuracy. Our proposed method (AEMA) goal is to reduce the error of the localization of wireless sensor networks. The overall result achieved shows the effectiveness of our proposed location model on existing RSS methods. The objective is to provide a comprehensive analysis minimization error as compare to existing localization Algorithm .

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