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Survey: Localization of wireless sensor networks: Issues and Challenges

Venkata Reddy Adama[1] G.M. Asutkar[2]

[1]*Research Scholar,* [2]*Professor*
Department of Electronics Engineering,
Priyadarshini Institute of Engineering & Technology, Nagpur, Maharashtra, India.
[1]Venkat7641@gmail.com, [2]g.m.asutkar@gmail.com

Abstract:-*The considerable driveof a sensor network is to accumulate and send data to the destination. It is also of importance to understand the location of collected data. This type of technique is often used in localization technique in "wireless sensor networks." Localization is asignificant feature in the field of WSNs thathas created considerable interest over recent years. Localization is a method to determine the location of sensor nodes, and So far, many works have been done. It is highly desirable to design low-cost, scalable, and efficient localization mechanisms for WSNs. Localization is of paramount importance in several WSN operations.This survey paper presents a comprehensive survey of challenges and problems in the localization of sensor nodes in WSNs.*

Keywords: wireless sensor network, localization, Range-free Localization Techniques, Localization Techniques Classification.

1. Introduction

A "wireless sensor network" consists of several sensor nodes, which are typically used in a two-dimensional plane to detect and transmit physical parameters. The detected physical parameters are sent to one or more wells. Each sensor comprises approximately the following units: transmitter, receiver, detection, and calculation. In the WSN, the sensor nodes are implemented in a real environment and determine the physical behavior. WSNs present many research challenges. Sensors are small devices, low cost, and low processing capacity. WSN applications have attracted a great deal of interest from researchers in recent years [1].

Wireless sensors have many applications for monitoring and control. The different WSN applications are: monitoring environmental aspects and physical phenomena such as temperature, sound and light, habitat monitoring, traffic control monitoring, patient care monitoring and underwater acoustic monitoring. WSN poses many search problems, such as media access schemes [2], implementation [3], time synchronization [4], location, middleware, wireless sensors, and stakeholder networks [5], transport layer, network layer, quality of service and network security. [6]

The location of the nodes is significant to find and determine the location of the sensor node using a specialized algorithm. Localization is the process of finding the position of the nodes [7] because the data and information are useless if the nodes have no idea of their geographical locations. GPS (Global Positioning System) is the simplest method for locating nodes, but it becomes costly if there are a large number of nodes in a given network. Many "algorithms" have been proposed to solve the problem of localization. However, most existing “algorithms” are application-specific, and most solutions are not suitable for a wide range of WSNs [8, 9].

Ultra-wideband techniques are suitable for indoor environments, while acoustic transfer-based systems require additional equipment. These are precise but expensive techniques in terms of energy consumption and treatment. Unlocalized nodes estimate their positions from tag messages of anchor nodes, which require a lot of power. Many “algorithms” have been proposed to minimize these communication costs. If a node finds the location incorrect, this error is passed to the general network and other nodes. Therefore, the erroneous information from the area of the anchor junctions is propagated. To find the position of the nodes, it is mainly based on the distance between the border node (with known location) and the non-localized node (with unknown location) — the scope of sensor networks: agriculture, military applications, weather forecasts and much more.

The rest of this paper is organized as follows:

i. Section 2 discusses the Concepts and Properties of Localization in WSN, which covers the different techniques and“algorithms” used for localization in WSNs.

ii. Section 3 deliberates the issues andchallenges in the localization process. Iii.Section 4 suggest future work

iv. Section 5 concludes the paper

2. Concepts and Properties of Localization in WSN

The term "localization" refers to the location of the node in the sensor field. For some typical WSN remote applications, such as environmental monitoring (earthquake monitoring, seismic monitoring, operations, disaster recovery, and military surveillance), the current position in the sensor node is essential. If it is a military observation program, and if the node detects motion in the sensor field to send the message effectively and without delay, the location of that node must be assigned to your group and then check as soon as possible. Also, trunk location methods may be used to improve network coverage to enhance network coverage. GPS can be connected to infrastructure nodes, but it is indeed not an ad hoc network of complex scenarios. If we use WSN mobile nodes, the location of the nodes is an essential requirement, just like the Doppler shift challenge, that is, the flow that occurs when the nodal movement changes. Research in this area tends to formulate a problem and work mathematically (NP-Hard / Heuristics) to get the right solution for the localization problems that have arisen in ad hoc wireless networks and to explore the possibilities how to apply implementation scenarios over time.

Localization system consists of three stages.

1. Distance/Angle Estimation Techniques
2. Location Calculation Techniques (Position Calculation)
3. Applying the localization algorithm

2.1 Range based techniques

2.1. Distance/Angle Estimation Techniques

Distance / Angle Estimation should specify the distance or angle between two sensor nodes. The most commonly used methods used to assess the range or angle of a particular sensor node include “Received Signal Strength Indicator (RSSI)”, “Time of Arrival (ToA)”, “Roundtrip Time of Arrival (RToA)”, “Time Difference of Arrival (TDoA)”, “Angle of Arrival (AoA)” and “Lighthouse Approach”[10] from figure (1).

2.1.1 Received Signal Strength Indicator

The “received signal strength Indicator(RSSI)”, the most common location method, calculates the distance between the transmitter (beacon) and the receiver according to the received signal strength, the knowledge of the transmitted power and the loss of propagation. RSSI is a cost-effective solution because all sensor nodes are equipped with radio, but their operation is also affected by multi-signal propagation from radio signals.

2.1.2. Time of Arrival

“Time of Arrival (ToA)” calculates the distance between the lighthouse and a specific sensor unit that depends on the time it takes to spread the signal and speed. Since the ToA is based on the exact time of the receiver and transmitter, the synchronization must be processed.

2.1.3. Round-trip Time of Arrival

It is used to prevent synchronization between nodes using timestamps that are used with the one-way distribution method. Upon receipt, the transmitter sends the receiving packet node. The receiver waits for the delay time and sends it, so the trigger time is $t_{RT} = 2_{tflight} + t_{delay}$, and we can calculate the distance from the flight and the speed of the transmitted signal. The key to this method is the clock deviation, which can slightly change the results.

Round-trip time of the signal is measured at sender device According to [11], to overcome the synchronization constraint of "Time of Arrival (ToA)", "Roundtrip Time of Arrival (RToA)" and "Time Difference of Arrival (TDoA)"have been introduced. As mentioned [11,12], the RToA calculates the distance as the difference between the moment when the signal is transmitted from one node and the time when another node of the original node repeatedly transmits the same signal. The same clock is used in RToA, but the disadvantage of this technique is that it is difficult to estimate the processing time in the receiver.

2.1.4. Time Difference of Arrival

"Time Difference of Arrival (TDoA)" is further classified into two types, i.e. "Multi-Node TDoA", and "Multi-Signal TDoA" [11]. Different nodes TDoA use ToA measurements for signals sent with multiple tags, and this method is based on time difference measurement. The TDoA multiple signals use two different types of signals with different propagation rates to estimate the distance to another node. However, this method requires additional equipment: microphone and speaker. Since the distance between the transmitter and the different receivers differs, the transmitted signal is delayed accordingly [11].

Figure 1, transformed with [13], depicts a TDOA location scenario with a group of four receivers at r1, r2, r3, r4 and transmitter at rt. Another way of evaluating the TDOA is to measure the delay between receivers when calculating the correlation of received signals [11, 13]. All of the TDoA as mentioned earlier methods show only high accuracy under direct vision [14,12].

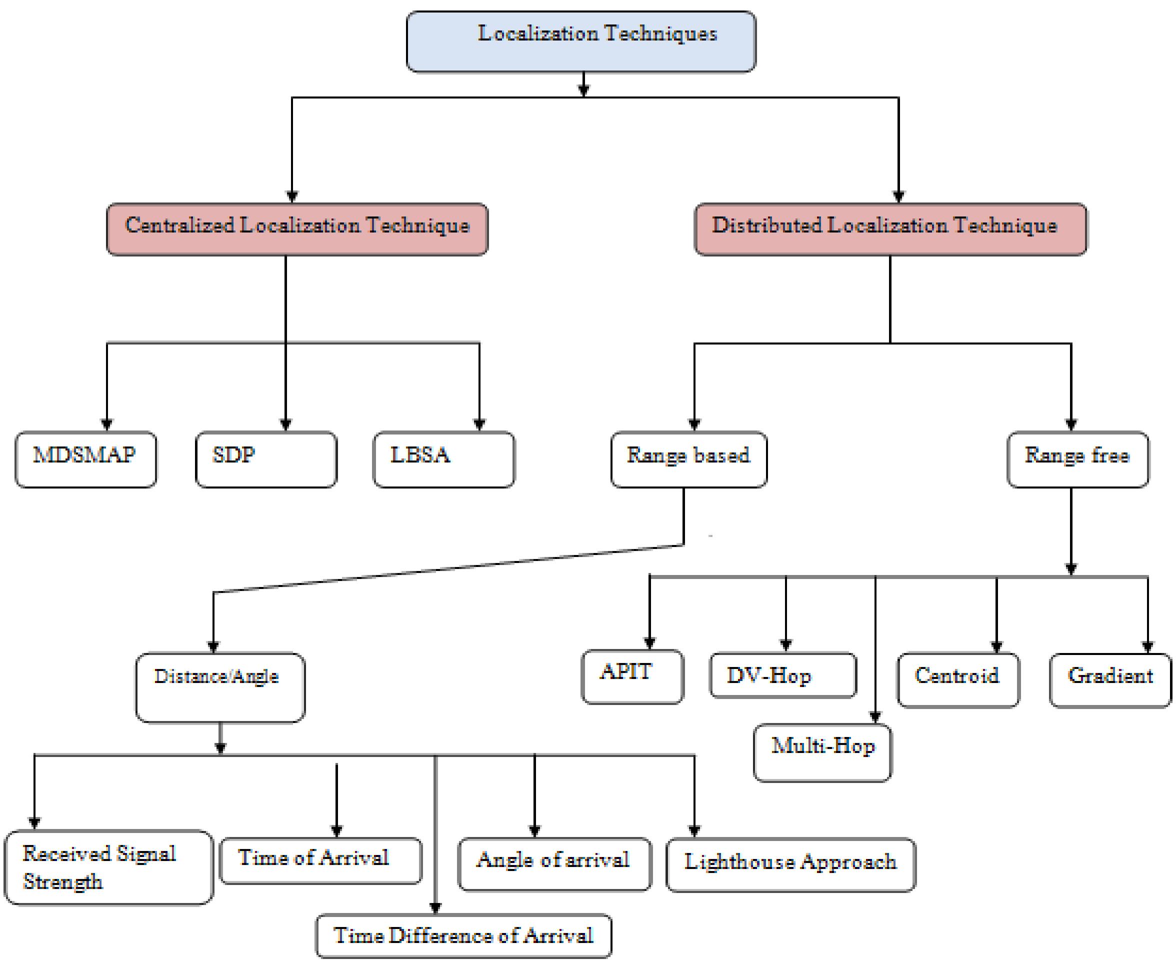


Figure 1. Block Diagram of Localizations Techniques in WSN

2.1.5. Lighthouse Approach

Lighthouse approach is a fascinating distance measurement method [13], which includes an optical receiver and a lateral rotation optical beam, and the distance is measured by the time the receiver was in the light. Specify the focus of the distance measuring beam.

2.1.6. The angle of Arrivals (A0A)

As with signal power and duration, the angle of received signals can also be used to estimate the location of nodes [12]. AoA methods, which are mainly dependent on several conventional antennas, evaluate the angle of signal reception. Then geometric formulas were used to calculate the node positions. The two subclasses in which AoA can be easily divided are those used to measure the response of the receiving antenna amplitude and those used to determine the phase response of the receiving antenna [13]. Different measurement methods are used for WSN localization and the choice of method is based on the specific application [13]. In terms of efficiency, AoA methods give greater accuracy to RSSI ways. However, the costs are high.

2.2 Range-free Localization Techniques:

Unlike range-based methods, methods that have not been achieved do not participate in absolute position estimation using previous methods such as (received signal strength, time, angle, etc.). As a result, it reduces hardware design [30], reducing costs, but still works poorly for random network topologies. There are several methods in this category, such as: " DVHop," "APIT,"“SeRLoc” (gradient) and “ROCRSSI”; where the first two techniques are the most famous of this category and are explained in two classes:

DV-hop (hop counting method): depends on the message flow between nodes, especially on small-scale networks. Each node records the number of hops in other nodes, and this counter must have a minimum number of hops to access another node. Updates are made as a result of received messages. The location of known locations of anchor points/nodes is used to determine the location as they act as bridges between target nodes and blind nodes. The “trilateration” method is used for the placement of nodes [31].

APIT (Local Methods): Unlike the hop counting methods, this type works on high-density networks. The radio signal spreads spherically, measured by destination nodes, and the location is determined by the central measurement of all nodes that access the triangle method so that a triangle of beacon nodes defines the position of each node and that the calculations are repeated with a different mark for the desired destination until accuracy has been achieved [30]. No need for a beacons/anchor equipped with GPS, but rather powerful nodes as network reference points in the main triangles [33].

Gradient: Introducing a localization solution in two steps [35]. The first phase is "positioning", where sensors listen to each other rather than determine the search area between overlapping objects (Xmin and Max, Ymin and Max), define the grid as shown in Figure (1) estimates the place [36] at the final stage of this phase.

2.3 Location Calculation Techniques

The location calculation is responsible for calculating the location of the sensor nodes based on the available information. Basic methods used to calculate localization, such as “triLateration”, “triangulation”, “Maximum Likelihood (ML)”, “Multi-Lateration” [11].

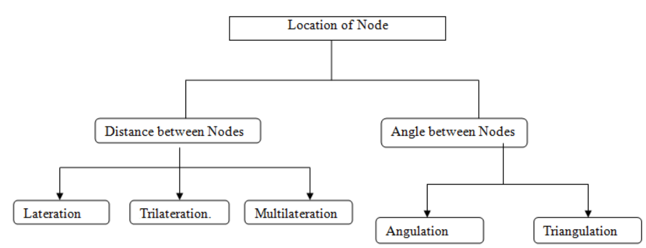


Figure 2. Localization of Nodes

2.3.1 Distance Between nodes:

2.3.1 “Lateration”

“Lateration” estimates an absolute or relative position of the object by measuring distances from multiple reference points using geometry. To use this method, at least three fixed reference points are required to determine the internal position r_1, r_2, r_3 as shown in Figure 3.

The main idea is to calculate the distances between access points and a mobile device to determine the location area. These distances can be provided using signal measurement information such as "received signal strength (RSS)," "transmitter radio signal arrival time (TOA)", the difference in "arrival time of multiple radio signals." (TDOA), the signal flight time from transmitter to receiver (RTOF), received signal phase (POA) [9]. A similar approach is based on the angular method, and the arriving signal angle measurement (AOA) is used.

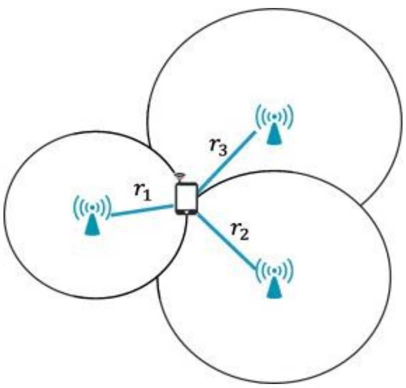


Figure 3. Example of "Lateration"

2.3.2 Trilateration

Positioning in a plane by measuring the distance between the three obvious non-collinear points in a plane is a procedure called trilateration". This method evaluates the node's position from the intersection of three circles of three beacons and the submerged node as shown in Figure 4.

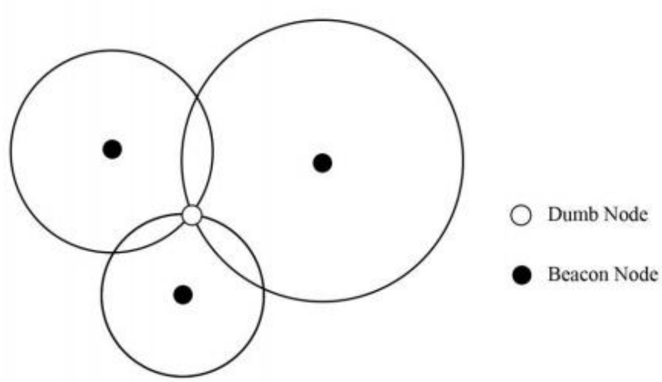
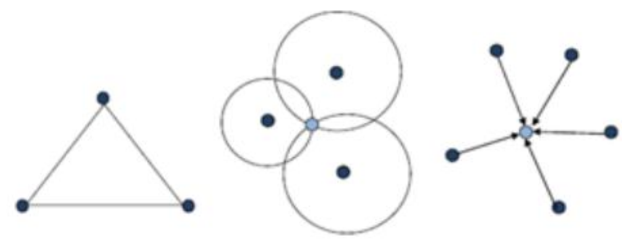


Figure 4.Trilateration" Technique

The angle method uses angle information to get the node position. The triangle vertices consist of two beacon nodes and a dumb node, and its connecting lines from the sides of the triangle. The locations of the light beacons are known, the distance separating them is known, that is, on one side of the triangle. If two angles formed by a dumb node are measured with two beacon nodes, the location of the idiot node can be calculated as the third point of the triangle. This method of locating the node is called triangulation.

2.3.3 Multilateration

It uses TDOA information and distances up to three or more reference nodes, and then collects location information by reducing the error between the estimated location values and the real one. This procedure is repeated several times for several or more references to the minimization process.



(a) "Triangulation" (b) "TriLateration" (c) "Multi-Lateration"

Figure (5) Localization Combined Techniques

2.3.4. Triangulation

As far as this technique is concerned, it is used to evaluate the corner of a node rather than the distance. Two beacon signal information, as well as specific trigonometric functions (sine and cosine), can determine the node position as shown in Figure 5, also from [11].

2.3.5. Maximum Likelihood (ML) "multilateration"

If the distance measurements are noisy, the ML "multilateration" method is used instead of trilateration", as "trilateration" in such conditions cannot give accurate results. This method evaluates the node position by reducing the distance between the distance measurements and the calculated distance as shown in Figure 5, also from [11,12].

Table I. represents a comparison between the range-based and range-free techniques that explained previously [34, 35, 36]:

Technique	Range- based		
	Accuracy	Cost	Energy Consumption
RSS	Medium	Low	Low
TOA	Medium	High	High
TDOA	High	Low	Low
AOA	Low	High	Medium
Range-Free			
DV-HOP	Medium	Low	Low
APIT	Medium	Medium	Low
Centroid	High	Low	Medium
Gradient	High	High	High

Comparing the main categories (centralized and decentralized methods) leads to greater precision of centralized methods with higher energy consumption, but, unlike the decentralized method has lower accuracy but lower energy consumption.

2.4 Localization Techniques Classification

Location "algorithms" can be divided into several classes. Under many sub-headings submitted, this is a small list that gives the impression that the localization issue cannot be solved entirely, rather than optimizing the location parameters [30].

"1. Environment: indoor vs. outdoor
2. Positioning: relative vs. absolute
3. Topology: sparse vs. dense, uniform or random
4. Accuracy: fine-grained/coarse-grained
5. Beacons: beacon-free vs. beacon-based
6. Input Data: range-free vs. range-based
7. Dynamic vs. Static: mobile vs. fixed
8. Cost: energy, price, memory, computation
9. Tracking: cooperative or passive target
10. Communication: centralized or distributed ranging "

The last classification takes place in most recent researches. At follow we will discuss ranging Communication techniques:

2.4.1. Centralized "algorithms."

Centralized "algorithms" are performed on a central computer that performs complex mathematical operations to the detriment of greater computing power. They also prevent computational problems in each node. However, the limit of centralized "algorithms" is its communication costs because the calculated positions are returned to the respective sensor nodes. Compared to centralized "algorithms," distributed "algorithms" are more efficient [11]. Several centralized "algorithms" in the host machine use a variety of data processing techniques, including multidimensional scaling (MDS) [18], Semi-Definite Programming (SDP) [16], and Localize Node-Based onSimulated Annealing [17].

2.4.2. Distributed "algorithms."

On the other hand, distributed "algorithms" perform all relevant calculations at each node, which requires the communication between nodes to function as a centralized system that corresponds to the position of the sensor nodes in the network. Distributed "algorithms" can be divided into six (6) categories [11, 14], including:

i. "Beacon Based "algorithms": According to [11, 14], theseare further sub-categorized into: Diffusion [18], Bounding Box [19], Gradient [20], and ApproximatePoint in Triangle (APIT) [21]."
ii. "Relaxation Based "algorithms"" [22,23]
iii. "Coordinate System Stitching Based "algorithms" [24]
iv. "Hybrid Localization "algorithms" [25]
v. "Interferometric Ranging Based Localization "algorithms" [26]
vi. "Error Propagation Aware Localization "algorithms."

2.4.3. Centralized Vs. Distributed "algorithms."

In [13], the authors compared the centralized and distributed location "algorithms" based on location calculations, implementation and calculation problems, as well as energy consumption.

- The distributed location algorithm is exceptionally complex than centralized: a distributed location algorithm can be used for centralized problems, but not vice versa.
- Regarding location accuracy, centralized "algorithms" are generally more accurate than distributed "algorithms," with the limitation that

the first have scalability problems and cannot be applied to sensor networks in large scale.

- Centralized “algorithms” have other advantages than overly distributed “algorithms” that require a high degree of complexity and less reliability because of the inaccuracy/loss of information collected by multi-hop wireless transmission.
- Distributed “algorithms” are more difficult to develop because there is a potentially complicated link between local behavior and global behavior (for example, locally optimal “algorithms” may not work correctly globally).
- Optimized centralized algorithm calculation in distributed deployment is usually a search problem that has not yet been resolved.
- Distributed “algorithms” usually require multiple repetitions to get a specific solution that slows down the localization process.
- The distributed algorithm will be more energy efficient than a typical centralized algorithm if the average number of hops in the central processor is higher than the number of iterations in a given array of sensors and distributed "algorithms."

2.4.4 Localization algorithm:

The primary purpose of the site algorithm is to determine the node position. However, there are some criteria that the algorithm has to be practical. The requirements usually depend on the type of application for which the location algorithm was developed. The general design goals or desirable properties of an ideal location algorithm are:

- It is highly desirable for location “algorithms” to be based on RF. The sensor buttons are equipped with a short-range RF transmitter. An efficient location algorithm uses the radio capabilities of this location in addition to the primary data transmission function.
- The “wireless sensor network” is ad hoc in nature. The site algorithm must consider the ad hoc nature of the network.
- The nodes must be able to locate them as quickly as possible so that the location algorithm has a low response time. This would allow for the faster implementation of sensor nodes.
- The condition of the sensor node found in such an algorithm should be sufficiently precise for the particular application for which this algorithm is used.
- The algorithm must be robust to operate in adverse conditions.
- The algorithm must be scalable. So, if you add or delete sensor nodes, you can still calculate the location of the nodes. In addition, the algorithm should provide acceptable results for sensor networks, ranging from a small number to a large number of nodes.
- The location algorithm must be efficient in terms of energy consumption, and it is also desirable to be aware of the energy as the sensor nodes are autonomous and usually do not have an external power supply.
- The location algorithm must be customizable to change the number of tag nodes. If the number of available tag nodes changes, the algorithm must be able to determine location estimates. However, the accuracy of node calculations will change with the number of available tag nodes. In general, a location algorithm with a higher number of tag nodes can more accurately calculate the node position estimates.
- The algorithm should be useful in calculating the location of nodes with the lowest number of possible nodes.
- The algorithm should be universal to calculate the location of nodes in all environmental and climate change situations. In particular, it should operate in a limited environment, such as in the interior and an unlimited environment, such as outdoors.

Only the ideal location algorithm can fulfill all the goals as mentioned above. In practice, local location “algorithms” will satisfy a subset of these parameters, depending on the specific application for which they are intended.

3 Issues and Challenges in Localization Of WNSs

As a result of the above, many studies have been carried out to create a WSN network and to compensate for the new WSN localization methods and “algorithms” for the inaccuracy of distance and location measurements of sensor nodes. However, some unresolved issues require more attention and research to improve the WSN localization process. These issues are discussed below:

3.1. Efficient Energy Consumption in WSNs Localization

Because WSN's scarce resources are typical, these energy savings are one of the most important design goals. In general, WSN sensor assemblies are equipped with a limited number of sources and irreplaceable energy. Limited capacity limits the system's lifetime. In addition to the main task, the main nodes perform many other tasks. These tasks include gathering information, such as location measures, neighbors' communications, and location assessments. In many WSN applications, energy consumption is one of the most critical issues. Recently, researchers have focused on energy efficiency to find WSN, but it is still challenging to develop energy efficiency localization "algorithms."

3.2. Localization in 3D WSNs

Typically, the WSN location is used to determine the location of sensor nodes in a two-dimensional (2D) plane based on many applications, such as ground-based monitoring, marine ecosystem research, monitoring, and monitoring. Space, control the environment, etc. The introduction of the WSN is in the three dimensional (3D) plane. Due to the complexity of this problem, the localization problem has not been extensively studied in the three-dimensional (3D) networks of the WSN network. According to fully distributed three dimensional (3D) location "algorithms", they need a lot of calculation. Another subject [23] is complicated to obtain range measurements that are sensitive to the sensor because there is no uneven density and uneven topology. Compared to the two-dimensional WSN (2D), but three-dimensional (3D) WSN schematic location, there are relative values. Only a few researchers have solved this problem [13] and are still under-exposed.

3.3. Localization in Mobile "wireless sensor networks" (MWSNs)

In addition to other challenges of the WSN network, the most critical considerations are maintaining connectivity and maximizing network life. Integrating mobile devices with the WSN can solve these problems. Besides, mobility can improve the features of coverage and moving targets. Location is, among other things, the biggest challenge for the MWSNs. In a static state, the estimated position of the sensor nodes is unlikely to change. Mobile sensor nodes have to evaluate their status at a given time. Recently, mobility at WSN has attracted the attention of the researcher. The author has identified the following parameters to enrich the location of MWSNs.

i. Reducing the location latency while maintaining the
ii. positions accuracy
    a. Development of more distributed localization
iii. techniques
    a. Development of new methods to expand the mobile
iv. sensing to the areas where data cannot be obtained
v. safely

3.4. Secure Localization

Secure localization has always been one of the significant issues of the large-scale network (WSN). The WSN can be deployed in a hostile environment, and the location procedure is vulnerable to many site-specific attacks. Recently, the security issue associated with the location of the WSN has attracted the attention of search engines, and some security systems have been introduced. However, the doors are open to enrich the safe place. The authors identified the following parameters to ensure the localization process.

- Location verification in "algorithms" based on free range.
- Hide the legal location of the sensor while the sensors can communicate with each other
- Secure localization "algorithms" for mobile sensor nodes
- Location in unreliable environments

3.5. The Beacon Movement Problem in WSNsLocalization

Most tag placement "algorithms" are always assumed to be trustworthy. Based on this assumption [27], a problem of Beacon Movement Detection (BMD) has been identified that unexpectedly moves to a location that is not accepted. To detect and identify such unexpected tag movements, four detection schemes are proposed: Location-Based (LB), Neighbor-Based (NB), Signal-Strength-Binary (SSB), and Signal-Strength-Real (SSR) [27]. These four diagrams do not take into account the light signals. It deserves further consideration of the proposed displacement transfer systems that could be more beneficial to the localization process.

3.6. Minimum Number of Beacons

Many of the existing methods used to find WSN are based on beacon signals that require many tag links, nodes with known locations. Locations of light beacons in signal nodes can be obtained by using the Global Position System (GPS) or by positioning them at known coordinates. According to [14], optimum technology has a minimum number of tag nodes. More research is needed to find the minimum number of beacon nodes help you see the entire network while maintaining a certain level of accuracy.

3.7. Error Propagation in Interferometric RangingBased Localization.

As a possible type of localization, WSN was offered a distance from the radio interferometry method [28]. The advantage is that the measurement can be very accurate compared to other common location methods such as Received Signal Strength (RSS), Time of Arrival (ToA) and Angle of Arrival (AoA), and only for small networks: only 17 nodes [29]. In [29], an author proposed an iterative algorithm based on interferometry that refers to the location of the largest networks. However, the simulation shows that spreading the error can be a big problem. Future location “algorithms” based on the range of interferometry must find ways to reduce the spread of errors [14, 29].

Table 2.Summary of Different “algorithms” for Localization in WSNs

Author	**The objective of the paper**	**Discussion**
“Shang et al., 2003. [17]”	“Present Centralized algorithm 'MSD-MAP' to derive the locations of the sensor nodes in the network."	“MDS-MAP uses an algorithm with the shortest routes for all pairs to estimate the distance between each pair of possible nodes." “The MDS is then used to locate the sensor node. Finally, the resulting coordinates are normalized to each node with position”.
“Doherty, et al., 2001. [16]”	“Propose feasible solutions to the position estimationproblem in WSNs”.	Method description for estimating the positions of unknown nodes The WSN is provided based on the constraints caused by the connection. Also, rectangular boundaries are placed in the grid that commits the possible positions of all unknown nodes.
“Kannan et al., 2006. [17]”	“Propose a centralized two phase localization method to address the issue of localization in WSNs."	“A Simulated Annealing based localization algorithm (SAL) is proposed based on simulated two-phase cancellation. In this method, the initial estimate of the location is prepared during the first phase. Then, during the optimization phase, the serious error is avoided due to confusion by using node information”.
S. Simic, and S.	“ Present a distributed algorithm for	“This algorithm divides the entire

Sastry, 2002. [19]	localization of sensor nodes of the random ad-hoc network."	area into different square cells. In this contract, every unknown sensor node sends a greeting message to its neighbors, and the tags respond to those signals. As a result, unknown nodes can update their position estimates."
"Bachrach et al., 2004. [20]"	"Present a distributed algorithm for achieving robust and reasonably accurate localization in a randomly placed WSN."	"An algorithm is used that uses ad hoc attributes of WSN to detect location data even when the elements are sprayed on the ground. The algorithm uses two principles:" "First, communication breaks between two sensors can tell us about an easily accessible and relatively accurate distance calculation. Secondly, a positive error can be significantly reduced by using incomplete distance calculations from many sources."
"He et al., 2003. [21]"	"Propose Range-Free localization schemes for large scale sensor networks."	"This study provides three important contributions to the localization problem WSN. He first presented a new algorithm without a rank called APIT, with
		improved performance in realistic system configurations. Second, it provides a realistic and detailed quantitative comparison of existing incomparable "algorithms" to determine system configurations in which each is optimized. Third, it provides an image of the impact of location accuracy on the performance of the application and limits An estimation error supported by programs."
"Savarese et al., 2001. [22]"	"Present distributed"algorithms" for positioning Nodes in an ad-hoc sensor."	"It offers "algorithms" for positioning nodes in an ad hoc sensor network. This significantly reduces positioning error due to inaccurate distance measurements using 7 or more reference points in three-dimensional triangular calculations."
"Priyantha et al., 2003. [23]"	"Propose an anchor free Distributed algorithm./"	"In this algorithm, nodes are modeled as points where they are connected to springs. It is, therefore, necessary to use a

		method of relaxation using force that leads to low power consumption."
"Moore et al., 2004. [24]"	"Propose a distributedalgorithm to localize the sensor nodes in a region by The use of robustQuadrilaterals."	"This algorithm works in two phases. In the primary phase, each node measures the distances of adjacent nodes and creates a group in a localized coordinate system. The second phase leads to the calculation of the coordinate transformation to include the clusters in the GPS (Global Position System)."
"Cheng et al., 2007. [25]"	"Present a distributed the algorithm, which composed of MDS and PDM."	"This algorithm also works in two phases. First, the choice of secondary anchors is made at the sensor nodes. They are localized using MD. Second, the location of normal sensor nodes is done using Proximity Distance Mapping (PDM)."
"Patwari et al., 2006. [26]"	"Propose a distributed Localization scheme based onInterferometry Ranging".	"This algorithm uses a genetic approach that leads to optimization of the localization problem. This is done with Interferometry Ranging."

4 Future Work

"Wireless sensor networks" in general and the area of localization, in particular, are still involved in many areas of research and development, such as:

- Develop new techniques that streamline the use of GPS because it is not efficient in the use of energy and that low-performance indoor equipment is costly (Line-of-sight propagation problems).
- Reduction of errors to increase the accuracy of the location of sensor nodes, including the use of geometric and mathematical relationships and the development of new measurement methods (which may be hybrid technology between old ways).
- Sensor mobility in some applications may change the network topology by creating a new search field that can keep track of changes and save your location.

5 Conclusion

In a wireless sensor network, localization is an essential task, where we can deploy for location details intended for target tracking, data classification, etc. In this connection traditional approaches like and algorithms called range-free localization algorithms and protocols in WSN not meet the requirement of several applications such as channel conditions and hostileenvironment. In recent times, several localization techniques have been proposed to attain a large number of localization techniques have been intended to come across the requirements to a certain extent. Consequently, in this paper, we have provided anextensive survey of different range-free localization algorithms, measurement techniques, and evaluation criteria for localization. In this case initially, we have been clustering the localization algorithms concerning the measurement techniques.

Furthermore, localization techniques have been classified into two basic categories: such as centralized and distributed. Majority of the applications in WSNs claim distributed localization method as they are more desirable for online monitoring than a centralized system. Both thesystem is further divided into range based and range free method. Range based methods are more precise than range free methods. However, precision in range based methods is obtained with the cost of added hardware, which in turn consumes more energy and in many applications is not suitable at all. Therefore, range free methods are more appropriate in many forms in WSNs. However, finding higher accuracy in adverse channel environments with different obstacles remains a future challenge for range free localization methods

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