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A Survey on Localization Measurement Techniques in Wireless Sensor Networks

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***Abstract*—Wireless sensor networks are extremely being used in different environments to perform various monitoring tasks such as search, rescue, disaster relief, target tracking and a number of tasks in smart environments. In many such tasks, node localization is fundamentally one of the system parameters. So, one of the fundamental challenges in wireless sensor network is node localization. This paper reviews different approaches of node localization techniques in wireless sensor networks. The overview of the schemes proposed by different scholars for the improvement of localization in wireless sensor networks is also presented. Many localization algorithms have been proposed for WSNs.**

***Index Terms:* WSN, localization, security.**

I. INTRODUCTION

Scientists, engineers, and researchers use wireless sensor networks (WSN) for an extensive collection of applications. Many of these applications rely on knowledge of the precise position of each node. Wireless sensor networks (WSNs) are modelling many activities in our society, as they have become the heart of universal technology. WSNs have an endless array of potential applications in both military and Conservation monitoring, wildfire detection, and traffic regulation, to name just a few.

One corporate feature shared by all of these critical applications is the energy of sensor location. The core function of a WSN is to detect and report events which can be meaningfully assimilated and responded to only if the accurate location of the event is known. Also, in any WSN, the location information of nodes plays a dynamic role in understanding the application context. In WSNs, sensor nodes are organized in real world environment and determine some physical behaviours. WSNs have many research challenges. Sensors are small devices, low costing, and having low processing capabilities. Different applications of WSNs are the following: monitoring environmental features and physical occurrences like temperature, sound, and light, habitat monitoring, traffic control monitoring, patient healthcare monitoring, and underwater acoustic monitoring.

II. LOCALIZATION IN WIRELESS SENSOR NETWORKS

Localization is to stipulate the technical fundamentals of today's localization techniques and gift the tradeoffs natural in rule style. No specific rule could be a clear favourite across the spectrum. Alternative algorithms need high – ticket hardware capabilities. Some algorithms want the way of activity off-line computation,

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whereas alternative algorithms area unit able to do all their calculations on the sensing element nodes themselves. Localization remains a brand new and moving field, with new algorithms, hardware, Associate in Nursing applications being developed at an excited pace; it's arduous to mention what techniques and hardware are rife within the finish.
To establish the physical coordinate of a gaggle of sensing element nodes during a wireless sensing element network (WSN).Due to application context, use of GPS is unrealistic; thus, sensors got to self-organize a frame of reference. Localization is calculable through communication between localized node and unlocalized node for formative their geometrical placement or position. Location is decided by suggests that of distance and angle between nodes.

III. LOCALIZATION MEASUREMENT TECHNIQUES

- The ***distance estimation*** phase involves measurement techniques to estimate the virtual distance between the nodes.
- The ***Position computation*** consists of algorithms to calculate the coordinates of the strange node with respect to the known anchor nodes or other adjacent nodes.
- The ***localization algorithm***, in general, determines how the information relating to distances and positions, is manipulating in order to allow most or all of the nodes of a WSN to estimate their position. Optimally the localization algorithm may involve algorithms to decrease the errors and refine the node positions.

There are four common methods for ***measuring in distance*** inference technique.

1. The a*ngle-of-arrival (AOA)* measurement techniques can be further divided into two subclasses: those making use of the receiver antenna's amplitude response and those building use of the receiver antenna's phase response. Beam forming is the name given to the use of anisotropy in the response pattern of an antenna, and it is the basis of one class of AOA measurement techniques. The measurement unit can be of small size in comparison with the wavelength of the signals. The accuracy of AOA measurements is limited by the directivity of the antenna, by surveillance and by multipath reflections. How to obtain accurate AOA measurements in the presence of multipath and shadowing errors has been a subject of intensive research.
2. *Time of arrival* method tries to estimate distances between two nodes using time based measures.
3. *Time different of arrival* is a method for determining the distance between a mobile station and nearby synchronized base station.
4. *The received signal strength* indicator techniques are used to translate signal strength into distance.

Position computation consists of algorithms to calculate the coordinates of the unknown node with respect to the location of known anchor nodes or other neighbouring nodes Triangulation, multilateration, and proximity are some techniques that are used for location sensing. It uses the geometric properties of triangles to calculate node locations. Triangulation is classified into Lateration (techniques based on the precise measurements to three non collinear anchors with more than three anchors called multilateration), using distance measurements and angulation (based on information about angles instead of distance), using is airing angle information. In 2 dimensions to calculate the node location using lateration distance information from 3 orientation points is required and using angulation 2 angle measurements and 1 distance information is required.
Localization algorithms determines how the information concerning distances and positions, is manipulated in order to allow most or all nodes of WSN to estimate their position. Optimally the localization algorithms may involve algorithms to reduce the errors. Various localization techniques can be classified as follows

Anchor Based versus Anchor Free:

In anchor based scheme, with the help of known anchor nodes, the position of unknown nodes can be determined. In anchor free scheme, no anchor nodes will be there. So only the relative positions of the unknown nodes can be determined instead absolute positions.

Fine Grained/Course Grained:

In fine grained schemes localization algorithms the received signal strength feature of nodes is used where as in course grained schemes it does not.

Stationary Sensor Nodes versus Mobile Sensor Nodes Localization Schemes:

In stationary sensor nodes all nodes are static and fixed at one place. There are many applications available

for which mobile sensor nodes are used. In mobile sensor nodes are not static.

Figure 1: Localization Schemes

Centralized versus distributed:

Centralized localization algorithms forward all the node measuring quantities to a central base station where the final computation or processing is carried out to derive either absolute or relative positions of the nodes but in distributed localization algorithms every node is responsible for performing computations to derive its position.

Range based versus Range free:

In range based algorithm fine grained information such as the distance between node pair is exploited to compute the node locations. In range free localization methods [2][3][4] neighbourhood information such as node connectivity and hop count is used to determine node locations. Range - free methods do not require additional hardware, but they generally only work well when networks are dense.

CONCLUSION

This study provides two key guiding principle for network designers and users of wireless sensor networks when choosing anchor node positions or assessing the quality of localization results. Localization is an important issue to be considered in wireless sensor networks. This process is a combination of data acquisition, position estimation and mapping i.e. procedure of linking estimated positions to real world locations.

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