A review on comparison of Localization Schemes for Mobile Network: Range Based and range free

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Abstract - **For the majority of the applications of Mobile network, it is desirable to know the location of nodes. In Mobile network, for obtaining this kind of information we need localization schemes. Localization techniques are used to determine the geographical position of mobile nodes. The position parameters of mobile nodes are also useful for many operations for network management, such as routing process, topology control, and security maintenance. So, it is very important that every node should reports its location information very accurately. As we know that GPS is very accurate in location determination but it is expensive in terms of cost and energy of nodes, so it is not useful in Mobile network. There are so many localization techniques, including range-based and range-free, have been proposed to calculate positions for randomly deployed Mobile nodes. Accuracy of localization techniques is most important before implementing it. With specific hardware, the range-based schemes typically achieve high accuracy based on either node to-node distances or angles. Range free scheme is comparatively less accurate than range based scheme but it does not require any hardware support to calculate node to-node distances or angles. In this paper, there is comparison of range base scheme and range free scheme. Precisely, in order to helps the network designers to find out which techniques/algorithms are suitable for their applications.**

Keywords— **Anchor node, classification, localization, range based technique, range measurements, sensor node, WSN**

I. INTRODUCTION

The general goal of the Mobile network is to make Mobile network capable to compute some task and communicate with each other to attain some objective like monitoring some phenomenon, target tracking, forest fire detection, and battlefield surveillance. In the majority of the applications, location information of each node in the network is needed. However, in a large amount of cases, Mobile nodes are deployed randomly right through some region. Thus, the first task is to find out the location of the nodes. To find out the physical location of Mobile node in Mobile network operation is crucial problem. There is one easy way i.e. manual configuration but this is impractical in large scale deployment. The other possible way for node localization is to add Global Positioning System (GPS) to mobile node. However, adding a GPS receiver to each node is not viable solution because of its large power consumption, high cost, and imprecision. There are numbers of localization system and algorithms for mobile network have been reported, which are broadly classified into range based and range free schemes on the basis of location estimation mechanism. The range based schemes are defined by protocols that use absolute distance estimates for the location computation. The range free schemes make no assumptions about the accessibility or legality of such information. Due to hardware restrictions, solutions in range free schemes are being considered as cost effective substitute to the most expensive range based schemes. The taxonomy of the localization algorithms based on several distinct criteria such as: dependency of range measurements; computational model; anchor. In this paper there is comparison on range based and range free scheme
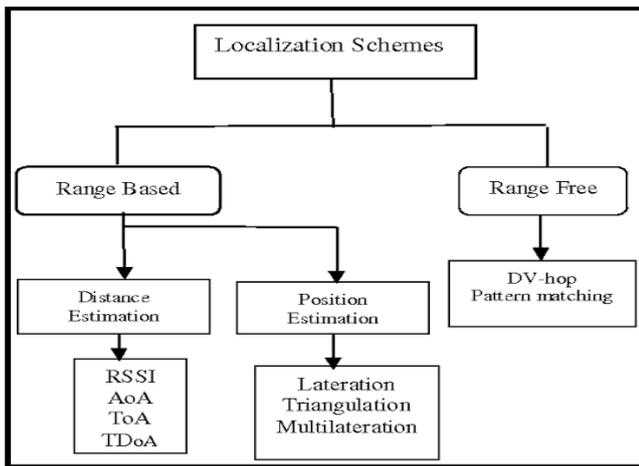
II. LOCALIZATION PROCESS

The problem of mobile node localization is to find out the location of all or some mobile nodes. Localization process localizes the mobile nodes based on input data. If there is any anchor available in the network, the common inputs are the location of anchors while other inputs are based on the measurement techniques. Localization process localizes the nodes on the basis of input data. If any anchor available in the network, the common inputs are the locations of anchors. Other inputs are connectivity information for range free techniques and distance or angle between nodes for range based techniques.
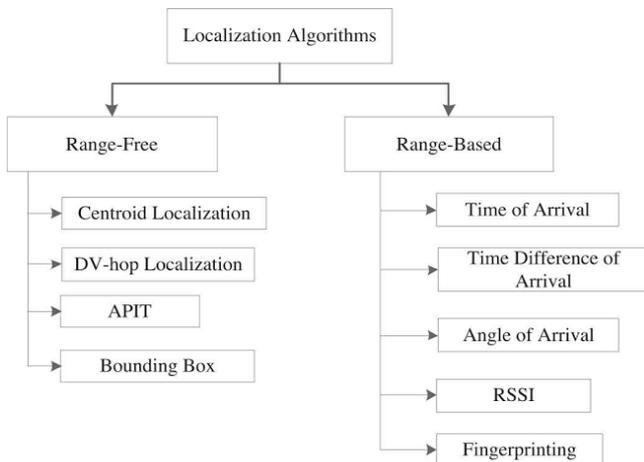
The matter of concern in all localization techniques in mobile network is low positioning efficiency that is inaccurate location information of nodes that are placed in network coverage. Another point at issue is Localization Errors .These localization errors also results in inaccurate positioning. These errors occur when nodes are unable to determine the route or pathway that is more optimal. To deal with localization error is vital as it will improve the lifetime of cluster in mobile network hierarchy.

III. CLASSIFICATION OF LOCALIZATION TECHNIQUES

There are different possibilities how to divide the computation between mobile nodes and how to choose the localization algorithms. On the basis of computation model, the localization techniques can be broadly categorized Range free and range based. The taxonomy of the localization techniques is shown in figure.

Localization Schemes

Range Based — Range Free

Distance Estimation | Position Estimation | DV-hop Pattern matching

RSSI AoA ToA TDoA | Lateration Triangulation Multilateration

Again localization techniques can be classified as follows

Localization Algorithms

Range-Free — Range-Based

Centroid Localization
DV-hop Localization
APIT
Bounding Box

Time of Arrival
Time Difference of Arrival
Angle of Arrival
RSSI
Fingerprinting

A. Range Based Localization Techniques

The range based techniques required distance (or angle) between nodes for estimating the positions. Range based techniques compute the precise distance between transmitting and receiving nodes on the basis of distance estimation methods. Thus these techniques contains diverse distance estimation methods to compute the inter node distance or range to measure their locality and then to calculate the position with help of some principles of geometry.

Range based localization schemes determine distances between Anchor nodes and Sensor nodes based on inter devices angles or device to device distances then estimates the location using different geometric methods. Position of anchor nodes are known, either using GPS or manual pre-programming during deployment, while Sensor nodes calculate their location with reference to Anchor nodes. The benefit of range based techniques is that it has a high ranging accuracy compared to range free techniques. However, the limitation of these schemes is that they need additional hardware, expensive for large systems and also its deployment is very difficult. Some well-known range based schemes are:

Received Signal Strength Indicator (RSSI), Time of Arrival (ToA), Angle of Arrival (AoA).

B. Section heading received signal strength indication(RSSI)

In RSSI, distance between transmitter and receiver is estimated by measuring signal strength at the receiver [16]. Propagation loss is also calculated, and it is converted into distance estimation. As the distance between transmitter and receiver is increased, power of signal strength is decreased.

C. Angle of Arrival

Unlocalized node location can be estimated using angle of two anchors signals. These are the angles at which the anchors signals are received by the unlocalized nodes. Unlocalized nodes use triangulation method to estimate their locations.

D. DH Hop

DV hop estimates range between nodes using hop count. At least three anchor nodes broadcast coordinates with hop count across the network. The information propagates across the network from neighbour to neighbour node. When neighbour node receives such information, hop count is incremented by one. In this way, unlocalized node can find number of hops away from anchor node. All anchor nodes calculate shortest path from other nodes, and unlocalized nodes also calculate shortest path from all anchor nodes . Average hop distance formula is calculated as follows: distance between two nodes/number of hops. Unknown nodes use triangulation method to estimate their positions from three or more anchor nodes using hop count to measure shortest distance.

E. Hop Terrain

Hop terrain is similar to DV hop method in finding the distance between anchor node and unlocalized node. There are two parts in the method. In the first part, unlocalized node estimates its position from anchor node by using average hop distance formula which is distance between two nodes/total number ofhops. This is initial position estimation. After initial position estimation, the second part executes, in which initial estimated position is broadcast to neighbor nodes. Neighbor nodes receive this information with distance information. A node refines its position until final position is met by using least square method

F. Centroid system

Centroid system uses proximity-based grained localization algorithm that uses multiple anchor nodes, which broadcast their locations with coordinates. After receiving information, unlocalized nodes estimate their positions . Anchor nodes are randomly deployed in the network area, and they localize

themselves through GPS receiver. Node localizes itself after receiving anchor node beacon signals.

G. APIT

In APIT (approximate point in triangulation) scheme, anchor nodes get location information from GPS or transmitters. Unlocalized node gets location information from overlapping triangles.

H. Gradient Algorithm

In gradient algorithm, multilateration is used by unlocalized node to get its location. Gradient starts by anchor nodes and helps unlocalized nodes to estimate their positions from three anchor nodes by using multilateration . It also uses hop count value which is initially set to 0 and incremented when it propagates to other neighboring nodes . Every sensor node takes information of the shortest path from anchor nodes.

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