Non Uniform High Density Anchor Nodes Scheme for Localization of sensors in WSN

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Abstract:
Wireless Sensor network are tiny nodes which are distributed in nature. Programming of the sensor nodes use to done in such a way that it can cover as larger area as possible. The position of the sensor nodes varies according to the application on which they are implemented. Localization of the sensor nodes are difficult and challenging area to work on. Especially in case of military applications, it is very important to position the wireless sensor node as it is based on sensitive and strict constraints. Lots of other applications are related to location information. The cost of the hardware on WSN nodes hinder the application of distance based localization technologies that depend on absolute point-to-point distance measurement. When sensor nodes have directionality, the network localization problem must be extended to consider each sensor's orientation as an unknown parameter, to be estimated along with position as it is very important to perform the localization for better utilization of the network.

Point in triangle method is efficient way to judge the accurate positioning of the sensor node. Anchor nodes help the localization process so in this research, focus is on anchor nodes and point in triangle technique for localization process of sensor nodes. As point of triangle scheme is accurate by have some issues such uncertainty in finding target nodes so in this research, anchor nodes will be used to increase the probability of localization process. The simple vision is to use the anchor nods for finding estimated location and then use of cluster head's RSSI value for exact position locking of the target nodes. Finally performance analysis will be done based on point in triangle and proposed scheme.

Keywords: *Wireless Sensor Nodes, Anchor Nodes, Cluster Head, Point in Triangle. Approximate Point in Triangle*

1. Localization of Wireless Sensor Network

The ultimate goal of sensor networks is to remove the need for extensive network topology planning and thus the need for knowledge of node location when deploying. [1] Localization is the process by which sensor nodes determine their location. In simple terms, localization is a mechanism for discovering special relationships between objects. In node mobility four different scenarios arise. First, both sensor and beacon nodes ate static. Second, sensor nodes are static while beacon nodes move. [2] Third, sensor nodes move while beacon nodes are static. Fourth, both sensor and beacon nodes move. In localization models that use GPS as the source, the localization process is straightforward. However, in a localization model that uses beacon nodes to help sensor nodes with location discovery, the beacon nodes are either manually configured with their location or equipped with a GPS receiver which they can use to determine their location. Beacon nodes then provide their location information to sensor nodes and help them in computing their location. The idea of beacon-based localization is presented in Figure 1. Sensor nodes are represented by hollow circles and beacon nodes are represented by shaded circles.

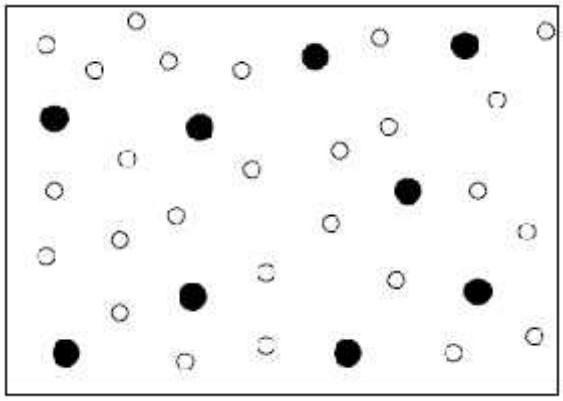

Figure 1: Beacon nodes for wireless nodes

2. Point in Triangle Concept

The theoretical method used to determine whether a point is inside a triangle or not is called the Point-In-Triangle (PIT) test. The PIT test can be carried out only under ideal physical layer conditions, when every node in the network is mobile can move around its own position. [9]

The basic idea of APIT (Approximate Point in Triangle) algorithm is to simulate the mobility of node M in PIT algorithm through the information exchange between node M and its' neighbor nodes, which can be shown in Figure 2. [2] APIT algorithm requires anchors in a single hop, high nodes' density and anchors' uniform distribution. Yet nodes' density is seldom high and nodes' distribution is uneven in actual WSN networks, in which the accuracy of APIT only reaches to about 35% [3].

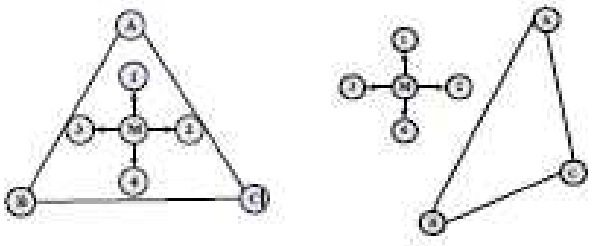

Figure 2: APIT Algorithm [2]

Due to the limited number of nodes in WSN, APIT can only judge in finite directions and make wrong judgment in some cases [4]. Two typical misjudgments in APIT can be shown in Figure 3.

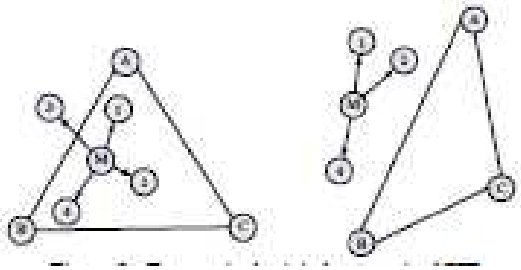

Figure 3: Two typical misjudgments in APIT [2]

Further research has been proposed for enhancement of APIT algorithm with area based localization for wireless nodes as shown in figure 4. First, SS (Signal Strength) information must be exchanged among the nodes within a single hop, that is, the participated anchor nodes and ordinary nodes must be within one hop from the test node and APIT demands there exists at least three anchor nodes within one hop distance. [2]

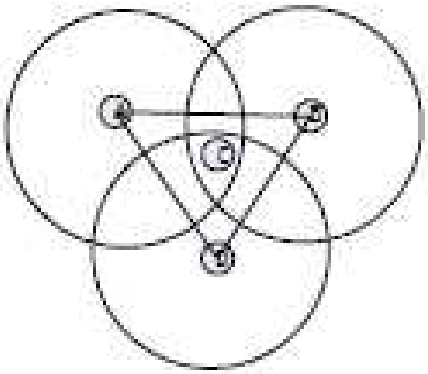

Figure 4: Central based localization with enhanced APIT

3. Proposed Work

In our research we are focusing on the finding the localization of the non located nodes by implementing point in triangle algorithm. We will consider the high density of anchor nodes by converting ordinary nodes to anchor nodes which are lies in between point in triangle area. Main focus is to solve the issue when anchor nodes are unevenly distributed. To solve this issue, we will use cluster head approach to find the cluster heads which can be anchor nodes and neighbor nodes will become the part of cluster head automatically. After finding cluster heads

and child to the cluster head, point in triangle will be used to find the exact location of the non located node as non located node will be the part of one of the cluster heads. This will solve the problem of non uniform distribution of anchor nodes for finding the non located nodes accurately.

4. Research Methodology

We will start experimentation of localization of wireless sensor nodes by implement sensor grid area. Starting will be done by locking the anchor nodes for finding the hidden nodes. After finding anchor nodes, various information will be checked like RSSI value for anchor nodes. More anchor nodes will be required for finding target node so we will match the range of the anchor nodes and if target node is inside the range then we will convert ordinary node to anchor node. Accuracy in finding the targeted node will be the parameter to compare.

5. Conclusion and Future Scope

This paper explains different localization techniques based on point in triangle method for finding location (position) of the wireless nodes. This process is hugely required in military applications as exact location is required sensed by sensor nodes for launching missiles and other weapons. Moreover for accurate routing and quality, it is required to have exact positioning of node. In our continuous work, we are focusing on enhancing APIT (Approximate Point In triangulation Test) algorithm with help of anchor nodes so that to find exact location of wireless nodes. It is expected that Proposed Scheme will provide better results than APIT algorithms for localization process of wireless node.

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