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Finding Node Location and Data Transfer Time in Wireless Sensor and Ad Hoc Networks

Mevundi Srinatha, Dr. G. Prakash Babu
Computer Science & Engineering Department,
Intell Engineering College,
Andhra Pradesh, India.

Abstract: *In this paper a theoretical Solution for the problem of network localization is provided. In the wireless ad hoc networks, it is difficult to find location of a particular node, in which some nodes know their locations and some other nodes determine their locations based on determining the Euclidean distances from its neighboring nodes. When the Euclidean distances between the nodes are calculated, the following things mentioned here under should be considered.*

1) Whether the node is localizable or not.

2) How many nodes are located in network, what are they?

For finding the distance between the nodes the k-shortest path algorithm is used. For finding node localization the RRP3 condition is used. The main aim of project is to find the accurate position of the node in the network along with the time interval whether the data is transferred or not.

Keywords: *Localization, localizability, wireless sensor network, time sense, distance between nodes, ad-hoc network.*

1. Introduction

Location service is a fundamental building block of many emerging computing/networking Paradigms. Manual configuration is one method to determine the location of a node. However this is unlikely to be feasible for large-scale deployments and scenarios in which nodes move often. GPS [10] is another possibility, however it is costly in terms of both hardware and power requirements.

Furthermore, since GPS requires line-of-sight between the receiver and satellites, it may not work well in buildings or in the presence of obstructions such as dense vegetation, buildings, or mountains blocking the direct view to the GPS satellites. Recently, novel schemes have been proposed to determine the locations of the nodes in a network where only some special nodes (called beacons) know their locations. In these schemes, network nodes measure the distances to their neighbors and then try to determine their locations. The process of computing the locations of the nodes is called network localization. 1) What are the conditions for unique network localizability? [4] Although the network localization problem has already been studied extensively, the precise conditions under which the network localization problem is solvable (i.e., has a unique solution) are not known.

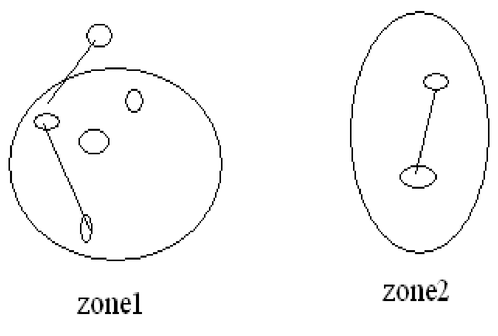

Figure 1. *Zone representation*

In the Figure 1 Zone1 is represented by few nodes whereas, Zone2 has two nodes. Zone2 nodes are localizable nodes and Zone1 are no localizable nodes. Zone1 local nodes are not local to Zone2 and same goes with zone2.

Theorem 1: To find localizability of the node in zone localization. If a zone has n nodes and if the zone region is r, if and only if n € r n is a local node to Zone1 and non-local node to Zone2 [5] The main interpretation of this work are as follows: Motivated by a real deployed sensor network, analyze the limitations of existing works on or related to node localizability, scattered over different literatures, need of the hour is to define The localizability conditions , in this, the second issue is to detect how many local and non- local nodes are present in the sensor network. The third issue is, to find out whether local nodes are connected or not in the wireless sensor network.

The rest of the paper is organized as follows: We discuss the state of the art on network localizability and graph rigidity in Section 2. Necessary and sufficient conditions are presented for node localizability in Sections 3 and 4, respectively. The prototype implementation and simulations are discussed in Section 5. The related work in both network localization and graph rigidity are summarized. Literature in Section 6 and conclusion are incorporated in Section 7.

2. PRELIMINARY

In this section the region generation is discussed. The region should be under the cover of network [8], without network this application cannot be developed. Assuming that G is a distance graph in the functionality of p , G is a connected graph and having at least four vertices, in the Euclidean space. Generally, realizations are referred to the feasible ones that respect the pair wise distance constraints between a pair of vertices i and j if the Edge(i, j) € E . That is to say, d(p(i), p(j))=d(i, j) for all (i, j) € E. G is embeddable in 2D [9] space and all pair wise distances are compatible.

A graph is called generically rigid if one cannot continuously deform its realization while preserving distance constrains. The vertex in the graph are independent, all the nodes are realization space that are rigid For a distance graph we are generating the nodes which are rigid in the space, these nodes are not unique in realization space, if it is region, we can remove any node that means that node is crash and that node can not be recovered from the sensor network. The node ‘u’ can be removed from the region of the sensor , that means that node may be removed or may not be removed from the sensor, that is necessary and sufficient condition for globally rigid nodes.

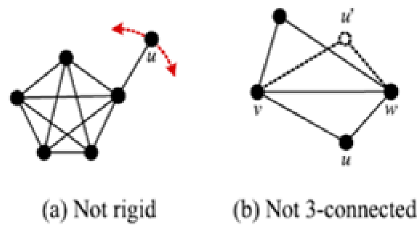

Figure 2. *Realization nonuniqueness*

Based on distance ranging techniques [1], [2], the ground truth of a wireless ad hoc network can be modeled by a distance graph G = (V, E), where V denotes the set of wireless communication devices (e.g., laptop, RFID, or sensor node) and there is an unweighted edge (i, j) € E if the distance between a pair of vertices i and j, denoted by d(i, j), can be measured or both of them are in known locations, e.g., beacon nodes.

3. FINDING NODE LOCALIZABILITY IN THE SENSOR NETWOTK

Based on the previous study of the network to find the node localizability it is very easy task. In this section it is shown through graph. To find the node localizability sensor is must then sensor will give the full information about that node.

3.1 Creation of Connection Paths

It is observed that some network is required to develop this application, when network is created then the paths of the nodes in the network can be created. With that network data can be sent from one node to another node, nodes can send the data in wireless network with path creation in the network, when network is created , the sensor have to check the nodes are local or non local, when the nodes are local then it can send the data to any node in the local, the nodes may be available in the edge of the sensor that edge of the sensor that time that node may be transfer the data or may not be transfer the data to another node.

When the data is sent from one node to another node the starting and ending time should be noted so that the actual duration of the time it takes could be known.

4. SUFFICIENT CONDITIO FOR NODE AVAILABILITY

The sufficient condition is based on the rigid of the nodes, these nodes are at a particular location in the sensor network, the location of the nodes are in the graph given below, every node have a rigid location, it is uniquely localizable [6]. The graph consists of three beacon vertices (denoted by white circles) and three non beacon vertices (denoted by black ones. In this graph floating sensor, that can transfer [9] data from one sensor to another sensor can be seen.

For simplicity, let dr (u, v) instead of d(r(u), r(v)) denote the Euclidean distance between the two vertices u and v in a specific realization r €R. Let DG (u, v) =Ur€R{dr(u,v)}. For a rigid graph G.

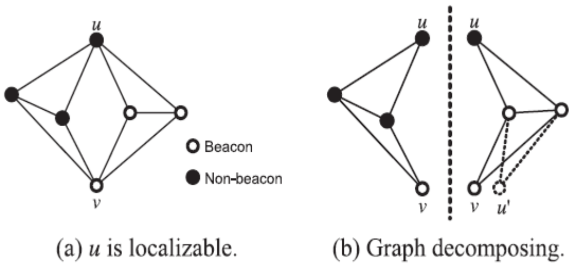

Figure 3. *Rigid Graph*

Definition1 (Inside Edge)

In a distance graph gravity G= (V, E), an edge (u, v) is inside the region if (u, v)¥ E and in all realization of G, the distance between u and v always same in the region If(u, v) are implicit edge, it is equivalent to the fact that DG(u, v) contains unique values, based on this concept of implicit edge, the file transfer time and distance between the nodes are defined.

Definition 2 (Time sense and distance graph)

When the file is sent from one place to another place, starting time is t1, and after reaching the file the time is t2, this time sensitive in two ways can be found one depends on our system time and if it is in one system.

Starting time – sending time = time sensitive

I.e. t1-t2= time sensitive (Te)

And second way selects the sending node system time, and receiver node system time, then calculates the time sensitive. Sending node can be represented as N1 and received node can be represented as N2.

Sending node time- received node time = time sensitive

This can be represented as N1 - N2 = Time Sensitive.

```
If time t1=0
{
T1 Time i=0
∑  Result= t1+t2
i<=T2 time
}

Return result;
Else
Return
Time is 0
```

4.1 Finding Shortest Path

The shortest path can be found in the application, file can be sent from one place to another place, through intermediate nodes. Intermediate node is to be found in the sensor network through which can be sent the data easily. The node selected has to be sent through the data to destination. The main aim is to find intermediate node and send the data to destination node in the less time, if any node is crashed in that time, is to be found alternate node in that time, Finding node distance N1 Distance is 10Miter from N2 and 12 Miter from N3 and 15 Miter from N3, then it will check for shortest distance is:

```
If ((N2< N3) && (N2< N4)))
{
Data Transfer to   N2;
}
Else
{
Data Transfer to N5;
}
```

In this we have to find the shortest path to the node, if shortest path is not found then we have to relevant path theory [11].

4.2 Relevant Path

In the relevant path theory another path is to be found to send the data to destination node, if shortest path node has any problem. That is the use of the relevant path theory, in this graph, there are 5 sensors and nodes, in that graph the shortest path is to be found, and through the shortest path the data can be transferred to another node. To find the shortest path it is to be known the sensor information that location [12].

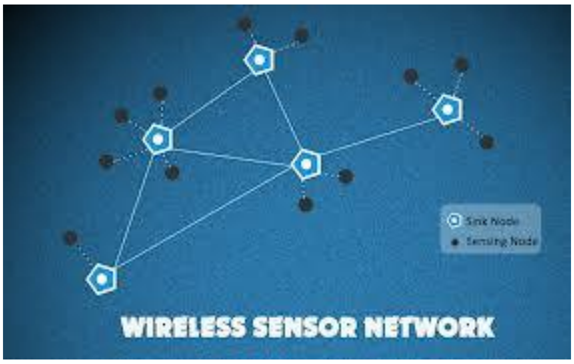

Figure 4. *Wireless sensor network*

4.3 Extended Distance Graph

If a vertex belongs to a globally rigid sub graph of G1 that contains at least three vertices in B, it is uniquely localizable in G.

4.4 Sufficiency of RR3P Condition

Theorem 3 provides sufficient conditions for the node localizability. However, it requires the knowledge of edges which incurs in number of graph partitions.

In this we propose a equaling condition to theorem 3 without actually calculate using implicit edges. In this we want to show that a vertex is localizable if it belongs to rigid component includes three vertexes disjoint paths connecting to three beacons vertices.RRP3 requires the three paths strictly residing the redundant rigid component to avoid the unexpected case. we use similar terms to show their close relationship.

Due to the necessity of redundant rigidity, it is assumed G is redundant rigid. Otherwise let G denote the component containing B. If G is 3-connected, it is trivial that all vertices are localizable since G itself is globally rigid. There exist two vertices v and w whose removal disconnects G. As a result, as shown in Fig. 6a, G can be divided into several overlapped and connected components Gi such that.

If G is 3-connected, it is trivial that all vertices are localizable since G itself is globally rigid, so we focus on the only interesting case that G is not 3-connected. There exist two vertices v and w whose removal disconnects G. As a result, as shown in Fig. 6a, G can be divided into several overlapped and connected components Gi such that

$G = \bigcup G_i$ and $V(G_i \cap G_j) = \{v, w\}$ for all $i \neq j$

as illustrated in Fig.5, is defined as edge replacement.

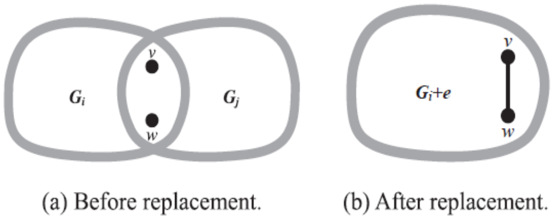

Figure 5. *Edge replacement*

5. Performance Evaluations

5.1 Experiment

In this experiment the accurate result of the node moving from one place to another place is found, when the data transferred from one node to another node the result will be displayed accurately, when node sends the data in that time, time will start and when the node will receive the data in that time will stop.

This experiment is conducted on the 100 nodes.

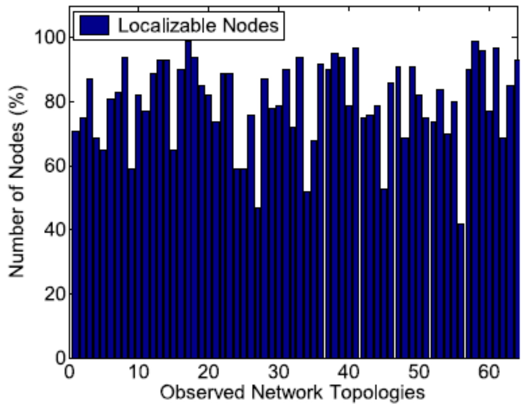

Figure 6. *A large portion of nodes are localizable*

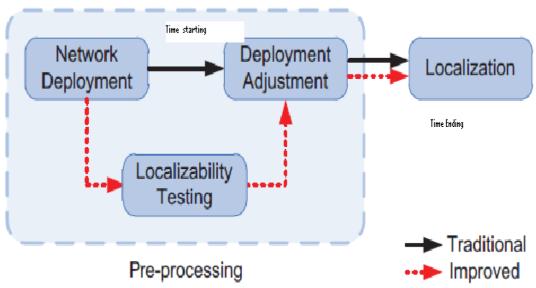

Figure7. *Localizability assists network deployment.*

In this the 90 nodes are local, and other nodes are moving from the zones, they are moved zones and are unable to send the data from one node to another node. In the experiment, distance is enhanced ranging capability through augmenting signal power. More specifically, those localizable nodes keep unchanged while increase distance ranging of non localizable ones from 5 to 25 percent.

6. CONCLUSIONS

In this paper we analyze a novel concept of node localizability by deriving the necessary and sufficient conditions. By deriving these conditions for node localizability, we can answer the questions for node localization and whether the node is in localizable network or not. We estimate that a node is localizable if and only if it is identified by a RRP3. In this we are finding the distance between the nodes, and when data is transferring from node to another node we are finding the time sensitive between nodes.

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