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Redundant Rigidity of the Node Using Wireless Sensor Networks

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***Abstract*:** Location awareness is highly difficult for wireless sensor networks. To localize the node using GPS, it is observed that the network is not entirely localized and also can't identify the number of nodes can be located within a network. Node localizability testing cannot be achieved. This problem can be overcome by using sensor. A new scheme called as Euclidean distance ranging techniques for the node localizability is proposed. It can identify the number of nodes can be located within a network configuration. When localize the node, the nodes can be utterly localized and also the path can be identified using three vertex disjoin path. Node localizability provides useful guidelines for network management and other location based services. This leads to power consumption and cost will be reduced. This concept can be applied for oceanography, aircraft and for any critical situation.

Keywords: *Localization, localizability, graph rigidity, wireless sensor networks, ad hoc networks.*

I. INTRODUCTION

The abundance of mobile computing devices and local-area wireless networks has endorse the claim for context-aware functions, in which location is observed as one of the most important contexts. A number of methods have been proposed in the literature.

One method to determine the location of a device is through manual arrangement, which may not be feasible for large-scale Deployments. Another possibility is Global Positioning System (GPS), it is not suitable for indoor environments and suffers from high hardware cost [1]. Recently, several approaches have been proposed for in network localization, in which some particular nodes such as beacons know their global locations and the rest determine their locations by measuring the Euclidean distances to their neighbors.

Based on distance ranging techniques, the position accuracy of a wireless ad hoc network can be modeled by a distance graph. For localization, an essential question occurs as to whether or not a network is localizable given its distance graph. This leads to network localizability problem [3], [4], [11]. The network localizability problem is closely related to graph rigidity. Based on rigidity theory, the necessary and sufficient condition for network localizability and design a polynomial algorithm for localizability testing. This work is motivated by the observation from an ongoing sea monitoring project. We launched a working sensor network consisting of a hundred of nodes continuously collecting scientific data.

Due to the hardware limitations and energy constraints of wireless communication devices, range-less approach are costless alternative. Most previous range-free approaches largely depend on connectivity measurements with a high density of starting point, however, would fail in anisotropic network deployments, where holes exist among nodes[4], [9].

In anisotropic networks, the Euclidean distances between a pair of nodes may not correlate closely with the hop counts between them because the path connecting them may have to curve around intermediate holes, resulting poor localization accuracy. Previous studies have shown that the network localizability problem is closely related to graph rigidity.

Based on rigidity theory, the necessary and sufficient condition for network localizability and design a polynomial algorithm for localizability testing. Experimental results show that being aware of node localizability provides useful guidelines for network deployment and other location-based services.

II. RELATED WORK

Localization is essential for many environment monitoring. In existing system, using RADAR, a radio-frequency (RF) based system is used for locating and tracking users inside buildings. The purpose of this system is to recording and processing the signal strength information at multiple base stations positioned to provide overlapping coverage.

It combines observed measurements with signal transmission modeling to determine user's locality and thus enable location aware services and applications. We present experimental results that exhibit the ability of RADAR to estimate user location with a high degree of accuracy. Although less attention is given for situating and tracking a mobile users, particularly in in-building environments [2].

In the precise forest record and real time observation for ecosystem management in Green orb, a wireless sensor network system and its purposes for canopy closure estimation. Both the hardware and software design of Green Orbs are adapted for sensing in wild environments without human management, including a certain weatherproof attachment of sensor modes and a light-weight system for node state examining and data collection[2],[7]. Even though, ground measurement approaches have two common restrictions. Initially, various aspects can often interfere in the expected results, such as the subjectivity of the evaluator, the landform, and the undergrowth and also they can only measure a small portion of forest, and thus lack scalability in large-scale applications [10].

The next technique is the aerial measurement. In this satellite imaging is the latest application for canopy closure estimation, but has not so far reached an established approach. It overcomes the drawbacks of aerial measurement, but still undergoes many difficulties. For example, in a satellite image, it is hard to accurately categorize the layer from the undergrowth [8].

In the experimental representation based on information appear to be the most efficient approach since there is no need of accurate definition of the construction interiors. On the other hand, such models can failed in irregular indoor situations where more specific site-specific model should be used, e.g. ray trace. Such a anomalous case small protected hallway inside a room - was considered. Even though there are many studies dealing with observed models for indoor propagation the results can be hardly used for city of Prague without modifications.

For the measurement operation a special measurement device set was calculated. The measurement system consists of the measurement transmitter and the receiver with preset data collection. It presents the parameters as 900 MHz signal is adjust by 1 kHz was transmitted by a vertically polarized quarter-wavelength monopole omni directional aerial at a height of 2 m above the floor. Folded dipole is the mobile receiver feeler was twisted for 45 grades from vertical direction to receive both vertical and horizontal division and to suggest mobile phone position. The mobile projection was moving in a walking speed at a height of 1.5 m above the floor. Although, the signal gets varies and gets as distorted signal [2], [10].

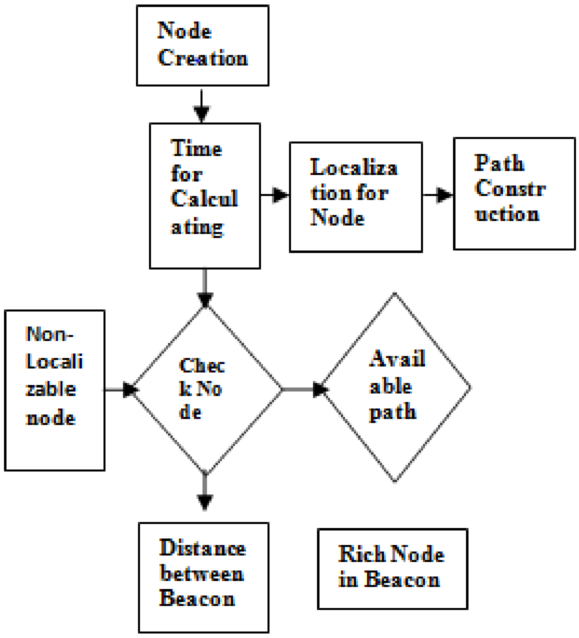
Existing solutions has two kinds. Suppose in range-based approaches, nodes are able to measure internode distances, while range-free ones simply used in proximity information. Many localization algorithms are range-based adopting distance ranging a signal attenuation model, whereas TDoA measures the signal propagation time for distance calculation. RSS-based ranging measurements contain noises on the order of several meters [1], [3], [10]. The majority of localization algorithms assume a dense network such that iterative trilateration can be conducted. Besides, some works study the relationship between network localization and rigidity properties of ground truth graphs. Eren et al. propose the concept of localization in subnetworks, which is weaker than the RR3P condition. The ongoing implementation is expected to provide a strong execution of a localized node [1], [3], [4], [11]. Graph rigidity has been well studied in mathematics and structural engineering, having a surprisingly large number of applications in many areas. In rigidity, many efforts have been made to explore the combinatorial conditions for rigidity [1].

III. PROBLEM DEFINITION AND SYSTEM ARICHITECTURE

A. Problem Definition

The network localizability problem is closely related to graph rigidity. Based on rigidity theory, Jackson and Jordan first present the necessary and sufficient condition for network localizability and design a polynomial algorithm for localizability testing. This work is motivated by the observation from an ongoing sea monitoring project. We commence a working sensor network consisting of a hundred of nodes continuously collecting exact data. Due to tide and wind under natural conditions, the network topology is extremely active. By examine the gathered network trace, to our disclosure and frustration, we find that more or less constantly the network be ineffective to be localizable. Consequently, localizability test merely gives the “disastrous” response [5]. The situation recurs for static sensor networks: a theoretical analysis signifies that, if not networks are highly dense and regular, in the majority cases, it is suspect that all nodes in a network are localizable, but a (huge) portion of nodes can be uniquely situated.

B. System Design



IV. TECHNIQUES

A. Euclidean Distance Ranging Technique

In mathematics, the Euclidean distance or Euclidean metric is the “ordinary” distance between two points that one would measure with a ruler. It is given by the Pythagorean formula. By using this formula the distance can be represented as, d (√ pq). In general this technique can be used as,

$$d(p,q) = \sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2 + \dots + (p_i - q_i)^2 + \dots + (p_n - q_n)^2}.$$

Using this formula, the graph has been drawn using Euclidean algorithm can be used.

B. Redundant rigidity three vertex-disjoin paths

It is observed that some conditions essential to network localizability are no longer necessary to node localizability. To deal with the exception propose the first nontrivial necessary condition: if a vertex is localizable, it have three vertex-disjoint paths towards three beacons. It represents such a situation as 3P for short. Suppose a vertex have just two vertex-disjoint paths to beacons. It is easy to find a graph in which some nonlocalizable vertices satisfy the 3P condition [5].

Theorem:

Let G^I denote the extended distance graph of G (V, E) which has a set $B \subset V$ of $k \geq 3$ vertices at known locations. If a vertex belongs to a globally firm subgraph of G^I that contains at least three vertices in B, it is uniquely localizable in G [1].

This theorem provides so far the best sufficient condition for the node localizability. But it requires the knowledge of inherent edges which incurs combinational number of graph partitions. It proposes an equivalent combinatorial condition to theorem without actually calculating and using implicit edges.

Particularly, it wants to show that a vertex is localizable if it belongs to the redundantly rigid component that includes three vertex-disjoint paths connecting it to three beacon vertices. It is shortly represents by RR3P or RR-3P.RR3P requires the three paths strictly exist in the redundantly rigid component to avoid the unexpected case [3]. Due to the necessity of redundant rigidity, let G denote the redundantly rigid component containing B. If G is 3-connected, it is trivial that all vertices are localizable since G itself is globally firm, therefore we focus on only interesting case that G is not 3-connected. There exist two vertices v and w whose removal disconnects G.

As a result, it can be divided into several overlapped and connected components Gi such that,

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

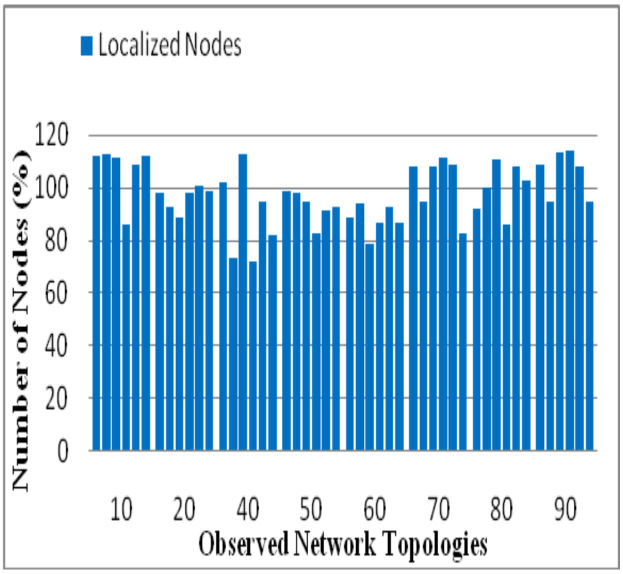
For any specific Gi, we replace other components Gj (j≠ *i)* by an edge e = (v, w). This operation is defined as edge replacement. Redundant Rigidity Three Vertex-Disjoin Paths to identify the distance between the node and the base station. The whole idea is mainly based on range-based localization in which the ground truth of network deployments can be modeled by distance graphs.

V. PERFORMANCE EVALUTION

To look at the efficiency we implement the proposed node localizability testing on the data trace collected from the ongoing sea monitoring system. The system consists of 100 wireless sensors that propose on the surface of the sea and collect environmental information such as temperature, moisture, sea depth, etc. While Localization, the system also collects the arrangements of networks that is active due to ocean current.

We provide a small portion of nodes with GPS receivers and adopt the RSS-based ranging technique. Our proposed localizability algorithm is based on any particular localization approach or any particular ranging technique.

Graph 1: A Large Portion of Nodes Are Localizable



By using the derived conditions, we are able to discover the localizability of the network arrangements of the network almost all the time the network is partially localized. But, a large portion, on average nearly 80 percent of nodes is actually localizable.

Particularly, 90 percent of network topologies have at least 60 percent of nodes localizable and more than 25 percent of topologies have at least 90 percent of nodes localizable. These outcomes propose the importance of the node localizability. But in the proposed system, while localize the node, we identify about 97 percent of nodes are localized and 50 percent of networks are identified. As a result, more than 93 percent of power consumption is saved.

VI. CONCLUSION

The traditional system suffers from the problem of identifying the network localizability and also the node localizability. This leads to poor localization accuracy and RSS based ranging technique. To avoid this problem the Euclidean distance ranging technique can be used. It is expected to identify the path between nodes and also the distance between the pair of nodes. It has to find which is indeed localizable in a network. If the node can be localizable then uses RR3P condition.

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REFERENCES

[1] Zheng yang, Member, IEEE, and Yunh0ao Liu, Senior Member, IEEE Transactions on Mobile Computing, " Understanding Node Localizability of Wireless Sensor Networks", VOL11, NO. 8, Aug 2012.
[2] Bahl. P and Padmanabhan V.N, "RADAR: An In-Building RFBased User Location and Tracking System," Proc. IEEE INFOCOM, 2000.
[3] Jackson. B and Jordan. T, "A Sufficient Connectivity Condition for Generic Rigidity in the Plane," Technical Report TR-2008-01, Operations Research Dept., Eotvos Univ., Budapest, 2008.
[4] Goldenberg. D, Krishnamurthy. A, Maness. W, Yang Y.R, Young. A, Morse A.S, Savvides. A and Anderson. B, "Network Localization in Partially Localizable Networks," Proc. IEEE INFOCOM, 2005.
[5] Lederer. S, Wang. Y and Gao. J, "Connectivity-Based Localization of Large Scale Sensor Networks with Complex Shape," Proc. IEEE INFOCOM, 2008.
[6] Liu. J, Zhang. Y and Zhao. F, "Robust Distributed Node Localization with Error Management," Proc. ACM MobiHoc, 2006.
[7] Mo. L, He. Y, Liu. Y, Zhao. J, Tang. S, Li. X.-Y, and Dai. G, "Canopy Closure Estimates with GreenOrbs: Sustainable Sensing in the Forest," Proc. ACM Seventh ACM Conf. Embedded Networked Sensor Systems (SenSys), 2009.
[8] Priyantha N.B, Chakraborty. A and Balakrishnan. H, "The Cricket Location-Support System," Proc. ACM MobiCom, 2000.
[9] Savvides. A, Han. C, and Strivastava M.B, "Dynamic Fine-Grained Localization in Ad-Hoc Networks of Sensors," Proc. ACM MobiCom, 2001.
[10] Seidel S.Y and Rappaport. T.S, "914 MHz Path Loss Prediction Models for Indoor Wireless Communications in Multifloored Buildings," IEEE Trans. Antennas and Propagation, vol. 40, no. 2, pp. 209-217, Feb. 1992.
[11] Xue. F and Kumar. P, "The Number of Neighbors Needed for Connectivity of Wireless Networks," Wireless Networks, vol. 10, no. 2, pp. 169-181, 2004.
[12] Y. Shang, W. Ruml, Y. Zhang, and M.P.J. Fromherz, "Localization from Mere Connectivity," Proc. ACM MobiHoc, 2003.
[13] Z. Yang, Y. Liu, and X.-Y. Li, "Beyond Trilateration: On the Localizability of Wireless Ad-Hoc Networks," Proc. IEEE INFO COM, 2009.
[14] T. He, C. Huang, B.M. Blum, J.A. Stankovic, and T.F. Abdelzaher, "Range-Free Localization Schemes in Large Scale Sensor Net works," Proc. ACM MobiCom, 2003.
[15] Y. Wang, J. Gao, and J. Mitchell, "Boundary Recognition in Sensor Networks by Topological Methods," Proc. ACM MobiCom, 2006.

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