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Location Detection in Wireless Sensor Network using Triangle Grid Scan Algorithm

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Abstract

Localization is an essential issue in wireless sensor networks because many applications require the sensor nodes to know their locations with a high degree of precision. Localization is an important process in wireless sensor networks (WSNs). In this paper, we present a localization algorithm based on triangle grid scan (TGS) method. Various localization methods based on mobile anchor nodes have been proposed for assisting the sensor nodes to determine their locations. Accordingly, this paper presents a triangle grid scan, which guides the mobile anchor to move along an efficient path and ensures that the path is finding effectively.

Keywords: *Wireless Sensor Network (WSN), Localization, TGS Location Discovery (LD).*

1. Introduction

a wireless sensor network (wsn) consist of hundreds or thousands of sensor nodes and a small number of data collection devices [1]. the sensor nodes have the form of lowcost, low-power, small-size devices, and are designed to carry out a range of sensing applications, including environmental monitoring, military surveillance, fire detection,animal tracking, and so on. the sensor nodes gather the information of interest locally and then forward the sensed information over a wireless medium to a remote data collection device (sink), where it is fused and analyzed in order to determine the global status of the sensed area. in many wsn applications, the sensor nodes are required to know their locations with a high degree of precision, such as tracking of goods, forest fire detection, and etc. For example, in forest fire tracking, the moving perimeter of the fire can only be traced if the locations of the sensors are accurately

Developing a good deployment and path planning algorithm is one of the most important issues for an efficient WSN. In the literature, we propose a localization algorithm with a mobile anchor node based on trilateration in WSNs. Existing sensor node can be classified into three categories: stationary sensor, mobie sensor, and mobile robot. Trilateration method uses distance from nearby AP with known Media Access Control (MAC) addresses, calculated from signal strength values, to approximate the distance to the user. In most cases, Sensor Network only needs to know the distance between each other to operate relative applications in network. As a result of this, if we have an algorithm to calculate the relative distance of sensors, we can apply it to sensor network in order to avoid interference of uncertainties and achieve practical value. This is also the reason why the position algorithm without sensors of known nodal coordinates gradually wins its own spotlight.

LOCATION DISCOVERY

The task of determining the node locations using distances between two nodes which combined with a set of known node locations is referred to as location discovery (LD) [6]. The main drawback found in LD is the presence of distance assessment errors, which result in node positioning errors [4-5]. Location Discovery problem is the type of optimization problem where we have to find a set of solutions in such a way so that location error is minimized. Here, we consider an optimization technique which is used to find the location of a node with respect to seven beacon nodes and 63 unknown nodes in a (300,300) distance area [6] as shown in Fig. 1. (0,300) (300,300)

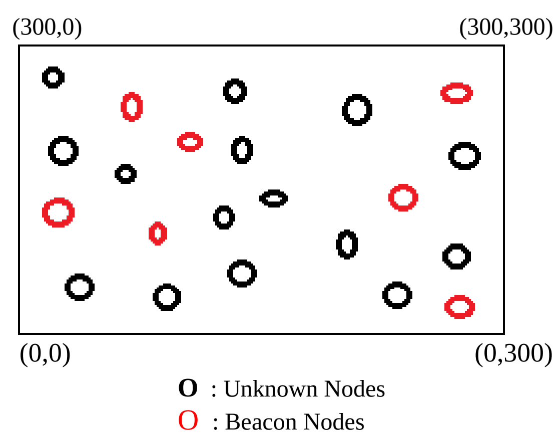

Figure:1: Location Discovery

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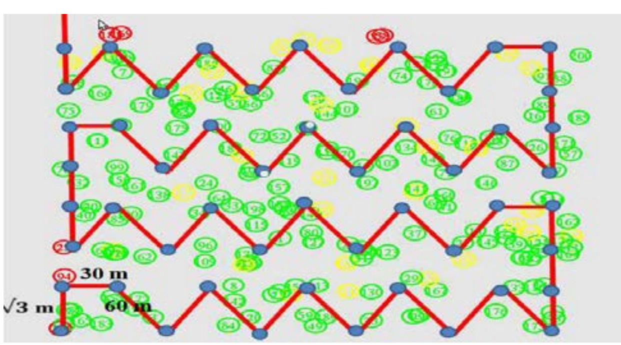
2. Proposed Methodology

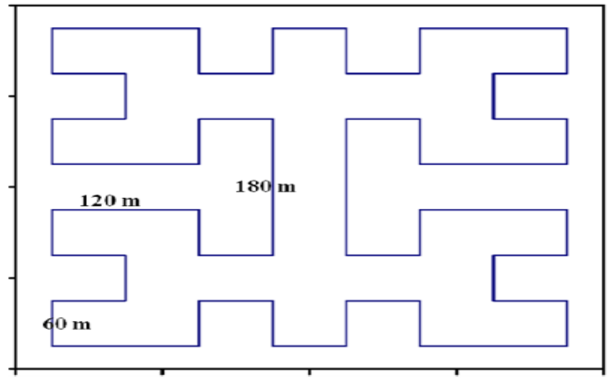
TRIANGLE GRID SCAN ALGORITHM

The Wireless Sensor Network surrounding has the size if consider is W*H. All sensor nodes and the mobile anchor node have the same communication radius r. In [3], In this the square anchor placement and triangle anchor placement, & they find that positioning of sensors in a WSN can be done by observing the properties of a triangle. we adopt the triangle grid to design the path which mobile anchor move along, as shown in Fig. 3.

In Triangle Grid Scan Algorithm [5] algorithm, the overall network is divided into many non-overlapping triangle cells (Fig. 3). In each cell a group of N, nodes is maintained. Generally, nodes in each cell reside according to some probability distribution function (PDF). Here, in each cell nodes are uniformly deployed. A trilateration system also consists of a series of joined or overlapping triangles. However, for trilateration, the lengths of all the sides of the triangle are measured and few directions or angles are measured to create azimuth. Trilateration has become feasible with the development of electronic distance measuring (EDM) equipment which has made possible the measurement of all lengths with high order of exactness under almost all field conditions. TGS method is compared with SCAN, LMAT[1] and HILBERT[2] algorithms.



(a)



(b)

Fig. 2 (a)LMAT and (b) HILBERT method for path planning process

TGS-Path Selection Procedure [5]

Triangle grid Input: Map w*h &Triangle grid size
Output: beacon locations and TGS-path
1 choose the triangle grid size: r
2 set the triangle grid into map
3 let snake-like path start from the initial node to end node
4 if the planning path meet the obstacle
5 move along the obstacle and back to next TGS point
6 mobile anchor track the snake-like path and transmit beacons when it is on
7 END

3. Triangle Grid for Trilatertion

Trilatertion-based approaches, however, recognize only a subset (called trilateration extension) of globally rigid graphs. As a compromise, trilateration is proposed for testing localizability based on the fact that the location of an object can be determined if the distances to three references are known. Accordingly, it is possible to identify localizable nodes in a network by iteratively applying trilaterations.

- **Analysis**.

The map has the size width (W) * height (H) and the radio range of sensors is R, so we can decompose it into two parts. So, The length of TGS in width will be[6]:

[W/(√3/2*R) xR] x (H/R-1) +1/2* (√3*R) xW/(√3*R). (1)
In the another hand, The lenth of TGS in height can be:
(H/R)xR or (H/R-2) +2ΔL (2)
,where ΔL is defined .

- **Coverage.**

Coverage reflects how well a sensor network observes the physical gap. So, it can be viewed as the quality of service of the sensing function. Previous designs fall into two categories. The probabilistic approaches analyze the node density for ensuring appropriate coverage statistically, but essentially have no guarantee on the result. In distinguish; the geometric approaches are able to obtain accurate and reliable results, in which locations are essential. TGS method provides fine graph coverage for mobile anchor in the environment of WSN.

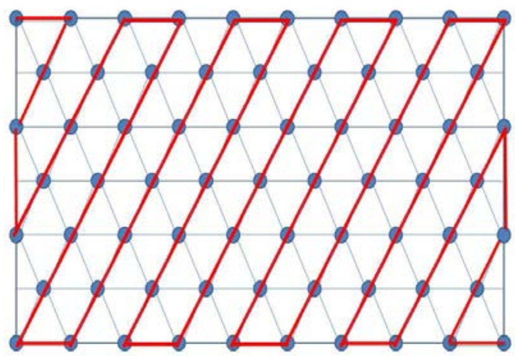
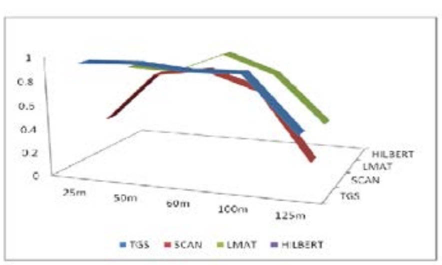


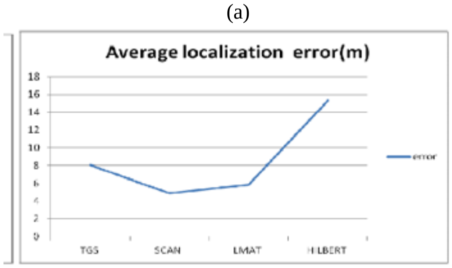
Fig.3 TGS method of design process

4. Experimental Setup & Comparison

As per experimental setup concern, we can do the simulation in any simulator, here we use Network Simulator. We can test algorithm using the simulation tool & then compare the result to that of SCAN, HILBERT, and LMAT, as seen in Fig. 4 below. A number of 200 sensors are to be deployed in the square area.



(a)



(b)

Fig. 4 (a) Comparative the percentage of localizable nodes and (b) Localization error

In the scenario, a number of 200 sensors are deployed in a area conforming to a random distribution. Again, the map size is 500*433 m2. As shown in Fig. 4(a), we test different radio range for four methods. In Fig. 4(a), we run several simulation experiments using different sensor radio range that ranges from 25m to 125m. The row means radio range which is multiple of 25 meter. It is obvious that the percentage of localizable nodes of TGS is better than other methods, and the percentage of localizable nodes by TGS is 95%. TGS outperforms other by recognizing a larger number of localizable nodes. About localization error, Fig. 4(b) show the average localization error, and the average localization error by TGS is 7.49m.

V. CONCLUSION

In this study, we have provided a general overview about the mobile anchor node scanning algorithm using triangle grid Structure. But unfortunately, the Location identification is yet to complete and accordingly in the research hot topic, if compared in terms of proposing and validating specific applications and in terms of developing a theoretical framework. Localization has two important metrics: efficiency and accuracy. In the initializing phase of the sensor network, we introduce path planning and scheduling mechanism. The location in turn of mobile sink node is received by the TGS method.

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