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Design An Effective Algorithm To Support Mobility For Mobile Wireless Sensor Networks

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ABSTRACT
One of the objectives of this paper is to present an effective localization technique such that Sensors determine their own positions after their placement and saves the constructional cost of a mobile wireless sensor network (MWSN). Existing research has focused on localization in static sensor networks where localization is a one-time or low frequency activity. In contrast, this paper considers localization for mobile sensors when sensors are mobile, localization must be invoked periodically to enable the sensors to track their location.

There is enormous research potential in the field of mobile wireless sensor network for self localization. Thus, we need to be familiar with the current research in this field. So the location techniques of sensor nodes are being important. After survey on the major topics in automated localization for mobile wireless sensor network indicating that WSN developers need to be aware of an effective technique in behavior to improve the overall performance of their mobile nodes. The suggested approach find the location of sensors implemented with concepts of functionalities and future scopes.

Keywords
Mobile Wireless Sensor Networks, MWSN, Localization, GPS, Mobile Node.

1. INTRODUCTION
Modern research on sensor networks was started by DARPA in the 1980s under the Distributed Sensor Network (DSN) program [1]. Currently wireless sensor network is considered as one of the most important techniques in the 21st century. Localization is a fundamental operation in mobile and self-configuring networks such as sensor networks and mobile ad hoc networks. WSN hold the promise of many new applications in the area of monitoring and control [4]. New technology offers new opportunities, but it also introduces new problems. Self-localization capability is a highly desirable characteristic of wireless sensor networks. The detected data are meaningless without knowing the location where the data are obtained. The Global Positioning System solves the problem of localization in outdoor environments for PC-class nodes [5]. However, for large networks of very small, cheap, low-power devices, practical considerations such as size, form factor, cost, and power constraints of the nodes preclude the use of GPS on all nodes.

Today WSN is a key technology for different types of environments and sensor networks are of particular importance when a large number of sensor nodes have to be placed in a particular location. Localization is done when there is an uncertainty regarding location of some fixed or mobile nodes. In this section we focus on the problem of localization with the following goals:

Low energy: Nodes in the network have modest processing capabilities and limited energy resources. If the algorithm uses all its energy localizing itself, it will have none left to perform its task. Therefore, we desire to minimize computation and message costs to reduce power consumption.

RF-based: We focus on small nodes that have some kind of short-range radio frequency transceiver. Our primary goal is to leverage this radio for localization, thereby eliminating the cost, power, and size requirements of a GPS receiver.

Receiver-based: In order to scale the large distributed networks, the responsibility for localization must lie with the receiver node that needs to be localized and not with the reference points.

Ad hoc: In order to ease deployment, we desire a solution that does not require preplanning or extensive infrastructure.

Responsiveness: We need to be able to localize within a fairly low response time.

Adaptive fidelity: In addition, we want the accuracy of our localization algorithms to be adaptive to the granularity of available reference points.

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2. MOBILE WIRELESS SENSOR NETWORKS

Recently, there has been a great deal of interest in sensor networks, which consist of sensor devices (show in fig 1) with communication facilities (sensor nodes) and process sensor data obtained by the sensor nodes. Here, almost all conventional studies on sensor networks aim to effectively gather data obtained by sensor nodes assuming that sensor nodes are deployed at fixed locations and do not move. Mobility is extra dimension in wireless sensor network. Sensors usually compose of four basic units: a processing unit with limited computational power and limited memory, a sensing unit/sensors (including specific conditioning circuitry), a communication unit (transceiver), and a power unit (battery) [10] [11].

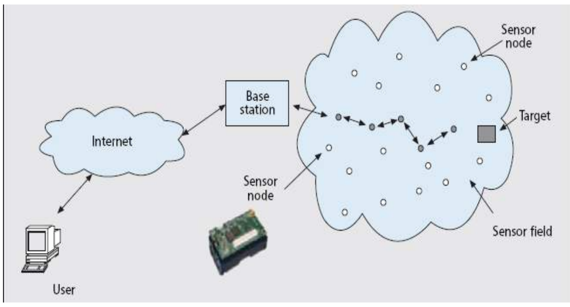

Fig 1: A Structural View of Mobile Wireless Sensor Networks

WSN operates at two levels. One is at the network level and the other is at node level. Network level interests are connectivity, routing, communication channel characteristics, protocols etc and node level interests are hardware, radio, CPU, sensors and limited energy. The important issues related to node-level are limited resource management; concurrency handling, power management and memory management where as issues related to both are self localization, inter-node communication, failure handling, heterogeneity and scalability.

3. LOCALIZATION FOR MWSN

Localization is an area that has attracted much attention in the recent years. At every localization point, the node invokes its localization mechanism (e.g., using GPS, triangulation based localization, or otherwise) to discover its current location. Location awareness is vital for wireless sensor networks since many applications like military application, environmental monitoring, vehicle tracking, object tracking and mapping depend on knowing the exact location of sensor nodes.

Recently many localization techniques have been proposed to allow the nodes to estimate their own locations using information transmitted by set of sub nodes that know their positions. After review of various research paper related to localization technique for wireless sensor network [11][12][13]14[15], we have identified that almost all the sensor network localization algorithms share three main phases:

3.1 Distance Estimation This phase involves measurement techniques to estimate the relative distance between the nodes. There are four common methods for measuring in distance estimation technique:

- ❖ Angle of Arrival (AOA)
- ❖ Time of Arrival (TOA)
- ❖ Time Different of Arrival (TDOA)
- ❖ The Received Signal Strength Indication (RSSI)

3.2 Position Computation This phase consists of algorithm to calculate the coordinates of the unknown node with respect to the known anchor nodes or other neighboring nodes. There are two common methods for position measurement:

- ❖ Leteration Technique
- ❖ Angulation Technique

3.3 Localization algorithm This phase determine how the informing concerning distances and positions, in manipulated in order to allow most or all of the nodes of a WSN to estimate their position. Optimally the localization algorithm may involve algorithms to reduce the error and refine the node positions. According to the ways of sensors implementation, we identified the current wireless sensor network localization algorithms into several categories as following:

- ❖ Centralized vs. Distributed
- ❖ Range free vs. Range based
- ❖ Anchor free vs. Anchor based
- ❖ Mobile vs. Stationary

Current researches in sensor networks have been primarily due to improvements in their performance and decrease in their cost [6]. Presently all the localization techniques suffer from a lot problems related to accuracy, range, distribution, energy efficiency, power consumption and area [7]. Many WSN applications require that sensor nodes have location information. Due to cost considerations, it is still not practical to equip every sensor node with a global positioning system (GPS) receiver..The coordinate system is then used to perform location dependent tasks, such as target tracking and position estimation [8]. Recent advances in areas like wireless communication, electronics and MEMS, have enabled the development of low cost, low power and multi functional sensor nodes that are small in size and communicate within short distances [9]. These tiny sensor nodes, which consist of sensing elements, data processing chips and communicating components, develop an idea for use of wireless sensor networks for real life [10]. Emerging applications for wireless sensor networks also depend on automatic and accurate location of thousands of sensors [16].

4. DESIGN ISSUES OF LOCALIZATION TECHNIQUE

Localization is a fundamental operation in mobile and self-configuring networks such as sensor networks and mobile ad hoc networks. There are several major design issues for localization algorithm as following:

Resource constraints: Sensor networks are typically quite resource starved. This fact has two important observations firstly the nodes must be cheap to fabricate with good power backup and secondly should be easy to deploy.

System architecture: This is the most important issue as it defines for localization algorithms based on their results [19]. Centralized algorithms are designed to run on a central machine with plenty of computational power. In contrast distributed algorithms are designed to run in the network

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which uses parallel processing and inter node communication to compensate for the lack of centralized computing power [18] [23]. The distributed algorithms use a subset of the data to solve for each position independently, yielding an approximate result to locate a particular node.

Density of node: Node density is another important parameter to which localization algorithms are sensitive. So while designing or analyzing an technique and protocols it is quite important to note the algorithm's implicit density assumptions since high node density can sometimes be very expensive if not totally infeasible.

Non convex topologies: In localization algorithms border nodes are a cause of concern (Chen et al., 2006), because less information is available through them and the information received is also of a lower quality. This problem can only be sorted, when a sensor network has a non convex shape which is always not desirable. Hence, shape of a sensor network plays a major role in collection of useful data.

Environmental design and Terrain irregularities: There are many environmental effects and irregularities that greatly affect the localization. Large rocks can block the line of sight or interfere with signals and introduce errors. Deployment on grass and sand can affect radio signals and acoustic range systems. While working indoors constructional features like walls can impede accurate measurements as well. All the above cited issues exist in real deployment of sensors therefore a mobile sensor network should be able to cope with these limitations.

5. METHODS AND EXPERIMENTAL DETAILS

In this section we proposed an effective algorithm enhancing mobility for self localization in the fields of wireless sensor network. The area for the mobile wireless sensor network is less very often when compared with other networks like fixed node networks and wired networks. This technique will localize the sensors in a well defined manner to cover a particular geographic location with sensors covering a span of maximum area.

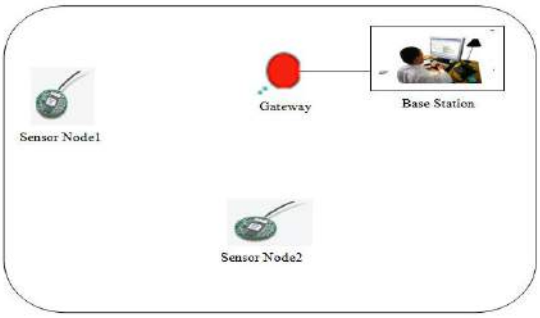

Fig 2: Sensor Nodes Randomly Placed

Procedure

Step1- Define sensor nodes: GN, SN1 and SN2
Define range: R
Step2 – Compare distance among sensor nodes
Step3 –If SN1<R, Place SN1=R from GN
Step4- Compare distance between GN and SN2 If SN2>R
Then compare distance between SN1 and SN2
Step5 –If SN2<R Place SN2 from SN1 at range R

Here one gateway node (GN) which is connected to the base station and two sub nodes (SN1 & SN2). All are randomly placed in a particular wireless sensor network area. This gateway node and pair of sub nodes is shown in Fig.2. Firstly we define gateway node GN which is the main node connected to base station. SN1 and SN2 are randomly placed sub nodes. The sub nodes represent sensors and have sensing some range. In step one, distance between GN and SN1 is compared, if it is less than the defined range, SN1 is placed at a distance R from GN. In second step distance between GN and SN2 is compared if it is greater than the defined range then the distance between SN1 and SN2 is compared, if this distance is less than the defined range R, we have to place the sub node at a distance R from SN1.Using this approach we have tried to localize the sensors as shown in Fig.3.

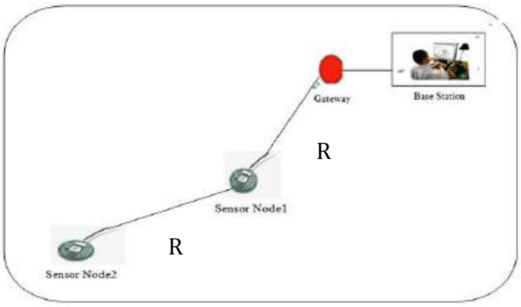

Fig 3: Placement of Sensor Nodes after applying algorithm

6. RESULTS AND ANALYSIS

On applying the algorithm successful placement of paired sensor nodes SN1 and SN2 is achieved and maximum area is covered. The work highlighted in this paper is also useful for researchers working in this field as many issues still remain to be explored in the future, including how to design an optimal WSN and improve the location precision.

In the basis of existing localization algorithm for wireless sensor networks. When we change the number of nodes to 100,150,200,250,300,350,400 and more. After the simulation using NS-2 [24] of each case we calculate the average error of each term, and find that the result is unauthentic for less than 100 nodes, when there are 100 nodes the average error becomes more stable but great, and the localization makes no sense; when the number increases to 200, the number becomes larger and larger, the average error becomes more and more stable and smaller.

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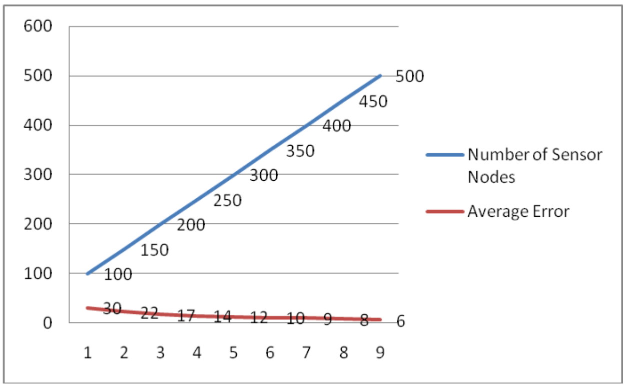

Fig 4: Average error influenced by the number of sensor nodes

In fig 4 average error influenced by the number of sensor nodes. Hence we get the result that this algorithm is vital since it requires lesser number of sensor nodes and still it can cover a larger area with self localization. This procedure is also cost effective as minimum number of sensors is used.

7. CONCLUSION

After review of various research papers we have found the existing algorithm has low location accuracy, the needs a high anchor nodes density, the density of the network is known. So we are interesting in such effective technique, that it requires less number of sensor nodes with automated localized in given wireless sensor network area.

The existing technique for localization in mobile wireless sensor network performs very well when the nodes density is high. But in case of less numbers of sensor nodes, the communication overhead will get low, which will affect the performance of the network and the average error becomes low. Our study provides a basis of whether to select an appropriate algorithm to fit on the self localization of mobile sensor node. *So the evident advantage of the technique is that it requires less number of sensor nodes and self localization.*

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