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An Efficient Path Detection And Direction Detection For Wsn

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Abstract- The problem of tracking signal-emitting mobile targets using navigated mobile sensors based on signal reception. The Mobile Sensor Collection node will initiate communication with other sensor nodes in the network and finds multiple measurements with respect to the target location and then the time of arrival of each signal from the sensor nodes is computed with respect to target by the mobile sensor collector node . The path which has the lowest TOA is said to be tagetory of the mobile node in the network. But this project not only computes the TOA but only measures the spatial separation with respect to degrees so that the AOA of the mobile target is also captured.

Keywords— Mobile sensor navigation, weighted tracking, TOA,crlb

1.INTRODUCTION

Wireless sensor networks (WSNs) are large collections of small sensor devices that can be an effective tool for collecting data from various environments. Each sensor sends its data to Base Station (BS), and finally BS sends these data to end user. Clustering is considered as an effective approach to provide better data gathering and scalability for large sensor networks.

WIRELESS technologies have revolutionized the world of communications. It started with the use of radio receivers or transceivers for use in wireless telegraphy early on; and now the term *wireless* is used to describe technologies such as the cellular networks and wireless broadband Internet. Although the wireless medium has limited spectrum along with a few other constraints as compared to the guided media, it provides the only means of *mobile communication*. Wireless ad hoc networking is used for random and rapid deployment of a large number of nodes, which is a technology with a wide range of applications such as tactical communications, disaster relief operations, health care and temporary networking in areas that are not densely populated. A mobile ad-hoc network (MANET) consists of mobile hosts equipped with wireless communication devices. The transmission of a mobile host is received by all hosts within its transmission range due to the broadcast nature of wireless communication and omni-directional Sensore. If two wireless hosts are not within the transmission range in ad hoc networks, other mobile hosts located between them can forward their messages, which effectively build connected networks among the mobile hosts in the deployed area. The use of wireless ad hoc networks also introduces additional security challenges that have to be dealt with.

2.Overview Of Mobile Sensor Navigation Strategy

In order to achieve the objectives of the project we need the following modules

1. Node Deployment - This is responsible for placing the nodes in a given area
2. Coverage Area Determination - This module is used to determine the nodes which are

reachable or to which a given sensor node can communicate directly

3. Picking the Next Sensor - The next sensor is picked randomly and target location is determined with respect to given sensor area.

4. Communicating the track or link - The tarck of the target is send to mobile target collector node through multiple paths.

5. Measuring the TOA - The TOA is measured with respect to the distance of the node and time of arrival of the detection packets.

6. Measuring the AOA - The angle of arrival of the signals with respect to the target is measured using kalman and CRLB approach

2.1 Maximum Margin Analyzer (MMA)

The Maximum Margin Analyzer is known as a MMA. It is also alternatively a maximum likelihood estimate of the power arriving from one direction while all other sources are considered as interference. Thus the goal is to maximize the Signal to Interference Ratio (SIR) while passing the signal of interest undistorted in phase and amplitude. The source correlation matrix R_{ss} is assumed to be diagonal. This maximized SIR is accomplished with a set of array weights given by

$$w_{mma} = \frac{R_{xx}^{-1}\, a(\theta)}{a^H(\theta)\, R_{xx}^{-1}\, a(\theta)}$$

(2.30)

Where, R_{xx}^{-1} is the inverse of un-weighted array correlation matrix R_{xx} and $a(\theta)$ is the steering vector for an angle θ . The MMA pseudo spectrum is given by

$$P_{MMA} = \frac{1}{a^H(\theta)\, R_{inv}\, a(\theta)} \quad (2.31)$$

Where, $a^H(\theta)$ is the hermitian transpose of $a(\theta)$ and R_{inv} is the inverse of autocorrelation matrix.

2.2 Kalman Method

This method finds a power spectrum such that its Fourier transform equals the measured correlation subjected to the constraint that its entropy is maximized. For estimating TDD from the measurements using an array of sensors, the Kalman method finds a continuous function $P_{MEv}(\theta) > 0$ such that it maximizes the entropy function.

The Kalman power spectrum is given by

$$P_{KALMAN} = \frac{1}{a^H(\theta)\, E_S\, E_s^{\,H}\, a(\theta)}$$ Where,

$$E_s = \max imum \;\; eigen\, vectors$$

$$a^H(\theta) = Hermitian\, transpose\, of \;\; steering\, vector$$

2.3 CRLB Filter

The goal of the CRLB [] technique is to exploit the rotational invariance in the signal subspace which is created by two arrays with a translational invariance structure. CRLB inherently assumes narrowband signals so that one knows the translational phase relationship between the multiple arrays to be used. CRLB assumes that there are M< L narrow-band sources centered at the center frequency *f*. M is number of sources and L is the number of antenna elements. These signal sources are assumed to be of a sufficient range so that the incident propagating field

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is approximately planar. The sources can be either random or deterministic and the noise is assumed to be random with zero-mean. CRLB assumes multiple identical arrays called **Doublets**. Doublets can be separate arrays or can be composed of sub arrays of one larger array. It is important that these arrays are displaced translation ally but not rotationally.

L element linear array is composed of two identical (L-1) element sub-arrays or two doublets. These two sub arrays are translational displaced by the distance d as shown in Figure 2.6.

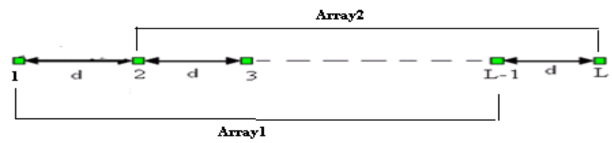

Fig: Doublet Representation

The target location can be computed as below

$$\theta_i = \sin^{-1}\left(\frac{\tan^{-1}(\lambda_i)}{kd}\right) \quad i = 1,2,3,\ldots.M$$

Where, d is the distance between antenna elements and k is the propagation constant

2.4 Target Route Discovery Path1 Algorithm

The Individual Route Discovery Module is implemented as shown in *figure*

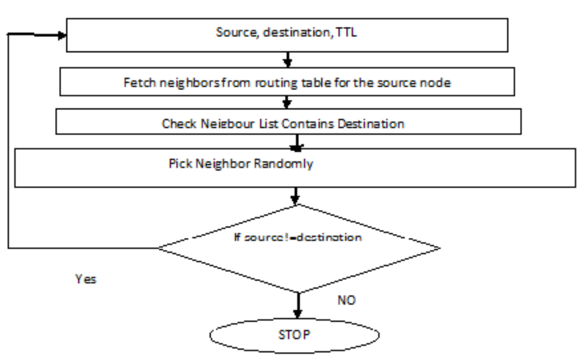

Fig Individual Route Discovery Algorithm

The steps involved in the route discovery process is as below

1. The wireless sensor node maintains a neighbor list, which contains the ids of all nodes within its transmission range.
2. It then randomly selects a neighbor for each share, and uni-casts the share to that neighbor
3. The Process is repeated until the destination in reached.

2.5 Route Discovery Path2 Algorithm

The Individual Route Discovery Module is implemented as shown in *figure*

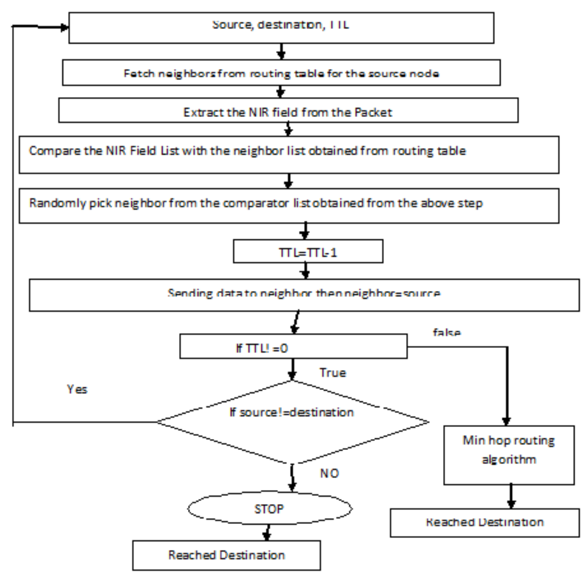

Fig: Individual Route Discovery Algorithm

The steps involved in the route discovery process is as below

1. The wireless sensor node maintains a neighbor list, which contains the ids of all nodes within its transmission range.

2. When a source node wants to send shares to the sink, it includes a TTL of initial value N in each share

3. It then randomly selects a neighbor for each share, and uni-casts the share to that neighbor

4. After receiving the share, the neighbor first decrements the TTL.

5. If the new TTL is greater than 0, then compares the ***neighbor list*** obtained from routing table with the list of nodes present in ***Node in Route (NIR Field)***.

6. After getting the set of nodes not present in ***NIR***. The neighbor is randomly picked from the neighboring nodes set not present in NIR and relays the share to it, and so on .

6. When the TTL reaches 0, the final node receiving this share stops the random propagation of this share, and starts routing it toward the sink using normal min-hop routing.

7. The Min-Hop Routing algorithm picks the farthest node of its transmission range.

The minimum Hop Routing Algorithm used in the algorithm when TTL becomes zero works as below Min Hop routing algorithm picks the neighbor which is closest to the destination node. ie farthest node which is reachable.

The Minimum Hop Routing algorithm is as shown in figure

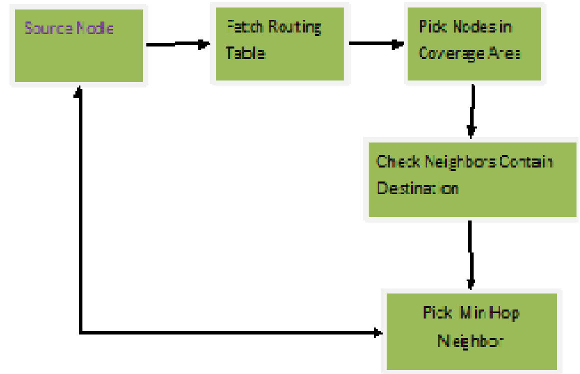

Fig Min Hop Routing Algorithm

Fig Shows the Minimum Hop Routing Algorithm. In Minimum Hop Routing algorithm the source node first fetches the routing table then fetches the neighbors within transmission range. The Min Hop Algorithm pick's the intermediate node in such a way that it is closest to the destination and farthest from the source node.

3.Conclusion

[1] From the various simulations we can find out that CRLB works best as compared to all other algorithms for various cases like Low Sensors and Widely spaced targets, Low Sensors and Closely Spaced targets, Large Sensors and Widely Spaced targets and finally Large sensor and Closely spaced sources.

[2] From the various simulations one can prove that the TOA2 algorithm works better as compared to TOA1 algorithm with respect to energy,time, power and hops.

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