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Sensor Node Localization in the Presence of Limited Anchor Nodes

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ABSTRACT

Wireless sensor networks hold the promise of many new applications in the area of monitoring and control. In most applications if location information of the sensing node is not available, measured data from sensing node become meaningless. Iterative techniques are widely used to enhance localization coverage. Main problem with iterative technique is error propagation. So this research proposes a new mechanism to improve the localization coverage as well as a new technique to minimize the error propagation.

Localization coverage improvement is based on the 2 hop neighbors (referred as "New method"). When a location unknown node has only 2 anchor node in its radio range, location can't be determined. But if 2 hop anchors are available with satisfying a certain criteria location can be determined as shown in this research. In Iterative techniques once location is determined it is upgrade to anchor status. If this node upgrade is handled more carefully error propagation can be minimized. So this research proposed Distance Measurement Error based node upgrade to minimize the errors.

Simulations were carried out for three simulation scenarios to demonstrate the performance improvement of the proposed techniques. According to the simulation results obtained, 7% improvement for localization coverage and 4% improvement for localization accuracy from the DME based anchor node upgrade were achieved with respect to standard trilateration.

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LIST OF ABBREVIATIONS

Abbreviation	Description
AOA	Angle-Of-Arrival Measurements
APIT	Approximate Point In Triangle
ARD	Average Relative Deviation
CDF	Cumulative Density Function
COG	Center Of Gravity
DME	Distance Measurement Error
GDE	Global Distance Error
GER	Global Energy Ratio
GPS	Global Positioning System
ICL	Improved Centroid Localization Algorithm
LPS	Local Positioning Systems
MAE	Mean Absolute Error
MDS	Multidimensional Scaling
PIT	Point In Triangle
RSS	Received Signal Strength
RSSI	Received Signal Strength Indicator
RSSI-MLE	RSSI Maximum Likelihood Estimation Scheme

SDP	Semi Definite Programming
TDOA	Time-Difference-Of-Arrival
WCL	Weighted Centroid Localization

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