Hindawi Publishing Corporation
International Journal of Distributed Sensor Networks
Volume 2013, Article ID 457874, 3 pages
http://dx.doi.org/10.1155/2013/457874

Editorial

Localization in Wireless Sensor Network

Long Cheng,[1] Carsten Maple,[2] Chengdong Wu,[1] and Wei Meng[3]

[1] *College of Information Science and Engineering, Northeastern University, Shenyang 110819, China*
[2] *Computer Science and Technology Department, University of Bedfordshire, Luton LU1 3JU, UK*
[3] *School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore 639798*

Correspondence should be addressed to Long Cheng; chenglong8501@gmail.com

Received 3 September 2013; Accepted 3 September 2013

Wireless sensor networks that consist of thousands of low-cost sensor nodes have been used in many promising applications. Localization is one of the most important subjects because the location information is typically useful for coverage, deployment, routing, location service, target tracking, and rescue. Hence, location estimation is a significant technical challenge for the researchers. Obviously, there are some challenges for locating sensor nodes needed to be solved. The first challenge is the energy consumption and localization accuracy problem. The second challenge is the NLOS ranging error problem. The third challenge is localization in low beacon density.

The main objective of this special issue is to explore innovative, exciting, and fresh ideas for node location estimation algorithms and localization systems. Out of 30 submissions, 12 exceptional contributions were finally selected after several rounds of review by the invited reviewers and the guest editors.

The paper by J.-R. Jiang et al. proposes the AoA localization with RSSI differences (ALRDs) method to estimate angle of arrival (AoA) by comparing the received signal strength indicator (RSSI) values of beacon signals received from two perpendicularly oriented directional antennas installed at the same place. The experimental results showed that a sensor node can estimate its location by using only four beacon signals within 0.1 s with an average localization error of 124 cm. Hence, ALRD conserves the time and energy spent on localization. They further propose two methods, namely, *maximum-point minimum-diameter* and *maximum-point minimum-rectangle*, to reduce ALRD localization errors by gathering more beacon signals within 1 s for finding the set of estimated locations of maximum density. Such estimated locations are then averaged to obtain the final location estimation. Experimental results obtained demonstrate that the two methods can reduce the average localization error by a factor of about 29% to 89 cm. Hence, ALRD is suitable for mobile sensing and actuating applications, as it allows a sensor node to quickly localize itself with lower localization errors.

In the paper "*A survey of localization in wireless sensor network*," the authors classify the localization methods into target/source localization and node-self localization. In target localization, they mainly introduce the energy-based method. Then they investigate the node-self localization methods. Since the widespread adoption of the wireless sensor network, the localization methods are different in various applications. So there are several challenges in some special scenarios. They present a comprehensive survey of these challenges: localization in non-line-of-sight, node selection criteria for localization in energy-constrained network, scheduling the sensor node to optimize the tradeoff between localization performance and energy consumption, cooperative node localization, and localization algorithm in heterogeneous network. Finally, they introduce the evaluation criteria for localization in wireless sensor network.

The paper by P. Gao et al. proposes a path-planning, a location predicting method (PPLP) for indoor mobile target localization. They firstly establish the path-planning model to constrain the movement trajectory of the mobile target in indoor environment according to indoor architectural pattern. Then, they use MLE approach to get one certain location result of the target. After that, based on the path-planning model and some previous localization results of the target, the best possible position of the target in the next time interval can be predicted with the proposed predicting approach. Finally, the MLE result and prediction result are weighted to obtain the final position.

In the paper "*Localization with single stationary anchor for mobile node in wireless sensor networks*," the authors propose a localization algorithm named LSARSSI for mobile node based on received signal strength indicator (RSSI) between locating sensor node with inertia module built-in and the single anchor. In order to avoid errors from directly mapping absolute RSSI values to distances, they obtain the geometrical relationship of sensors by contrasting the measured RSSI values. They then design a novel localization scheme, LSARSSI, which has a better accuracy and low overhead. The simulation results show that the proposed schemes perform high accuracy and feasibility, even in large-scale environment.

In the paper "*Range-free localization scheme in wireless sensor networks based on bilateration*," the authors propose a low-cost yet effective localization scheme for wireless sensor networks (WSNs). The proposed scheme uses only two anchor nodes and uses bilateration to estimate the coordinates of unknown nodes. In this scheme, two anchor nodes are installed at the bottom-left corner (Sink X) and the bottom-right corner (Sink Y) of a square monitored region of the WSN. Sensors are identified with the same minimum hop counts pair to Sink X and Sink Y to form a zone, and the estimated location of each unknown sensor is adjusted according to its relative position in the zone. Simulation results show that the proposed scheme outperforms the DV-Hop method in localization accuracy, communication cost, and computational complexity.

The paper by Y. Wang et al. proposes a prior knowledge-based correction strategy (PKCS) to locate the robot. They firstly investigate the RSS-based NLOS identification method using the recorded measurements. Then the ratio of NLOS present in the record of measurements and the expectation of the NLOS errors are used to mitigate the NLOS errors. Kalman filter is employed to improve the estimated range. Finally, they use the residual weighting algorithm to estimate the location of the robot. Simulation results show that the PKCS has much better performance than those methods without the correction method and significantly improves the localization accuracy.

The paper by S. Zhang et al. proposes a human motion tracking approach for daily life surveillance in a distributed wireless sensor network using ultrasonic range sensors. It uses cheap range sensor nodes in wireless sensor networks by jointly selecting the next tasking sensor and determining the sampling interval based on predicted tracking accuracy and tracking cost under the UKF frame. Simulation results show that the new scheme can achieve significant energy efficiency without degrading the tracking accuracy.

In the paper "*On the joint time synchronization and source localization using toa measurements*," the authors consider the problem of estimating the clock bias and the position of an unknown source using time of arrival (TOA) measurements obtained at a sensor array to achieve time synchronization and source localization. The mean square error (MSE) analysis is firstly performed for the case where the source is localized via TOA positioning when assuming the source clock bias does not exist, but in fact it is non-zero. Comparing the obtained source localization MSE with that from joint estimating the source position and clock bias, they derive a condition under which ignoring the source clock bias may provide a smaller localization MSE. Computer simulations are conducted to corroborate the theoretical development and illustrate the good performance of the proposed algorithm.

The paper by D. Arbula and K. Lenac presents Pymote, the library that provides support for simulation and analysis of distributed algorithms built on top of comprehensive Python environment. Pymote is designed to allow rapid interactive testing of new algorithms, their analysis, and visualization while minimizing developer's time. It supports both interactive algorithm simulation and automation of experiments and provides visualization tools for both. It has been deliberately kept simple, easy to use, and extensible.

The paper by E. Navarro-Alvarez et al. presents a new adaptive method to calculate the path loss exponent (PLE) for microcell outdoor dynamic environments in the 2.4 GHz industrial, scientific, and medical (ISM) frequency band. The main contribution of this method is the formulation of a parametric mathematical model which improves the PLE accuracy by using the *equivalent isotropic radiated power* (EIRP) and *effective antenna aperture* (EAA) parameters calculated before obtaining the PLE. A second contribution is the combination of GPS data and RSSI readings in order to identify the RSSI long term behavior.

In the paper "*A novel lightness localization algorithm based on anchor nodes equilateral triangle layout in WSNs*," the authors present a novel equilateral triangle localization algorithm (LETLA) that is a lightweight approximate localization algorithm and could provide better precision with less power consumption. The LETLA is an approximate localization based on the concept of substituting the approximate coordinates for the real coordinates, which could result in less accuracy and save more energy. In order to avoid the ranging ambiguities arising from the interference of noise, the LETLA adopts the order of ranging results to represent the location relationship of unknown node and anchors. Simulations show that the LETLA performs better than other state-of-the-art approaches in terms of energy consumption with the same localization precision.

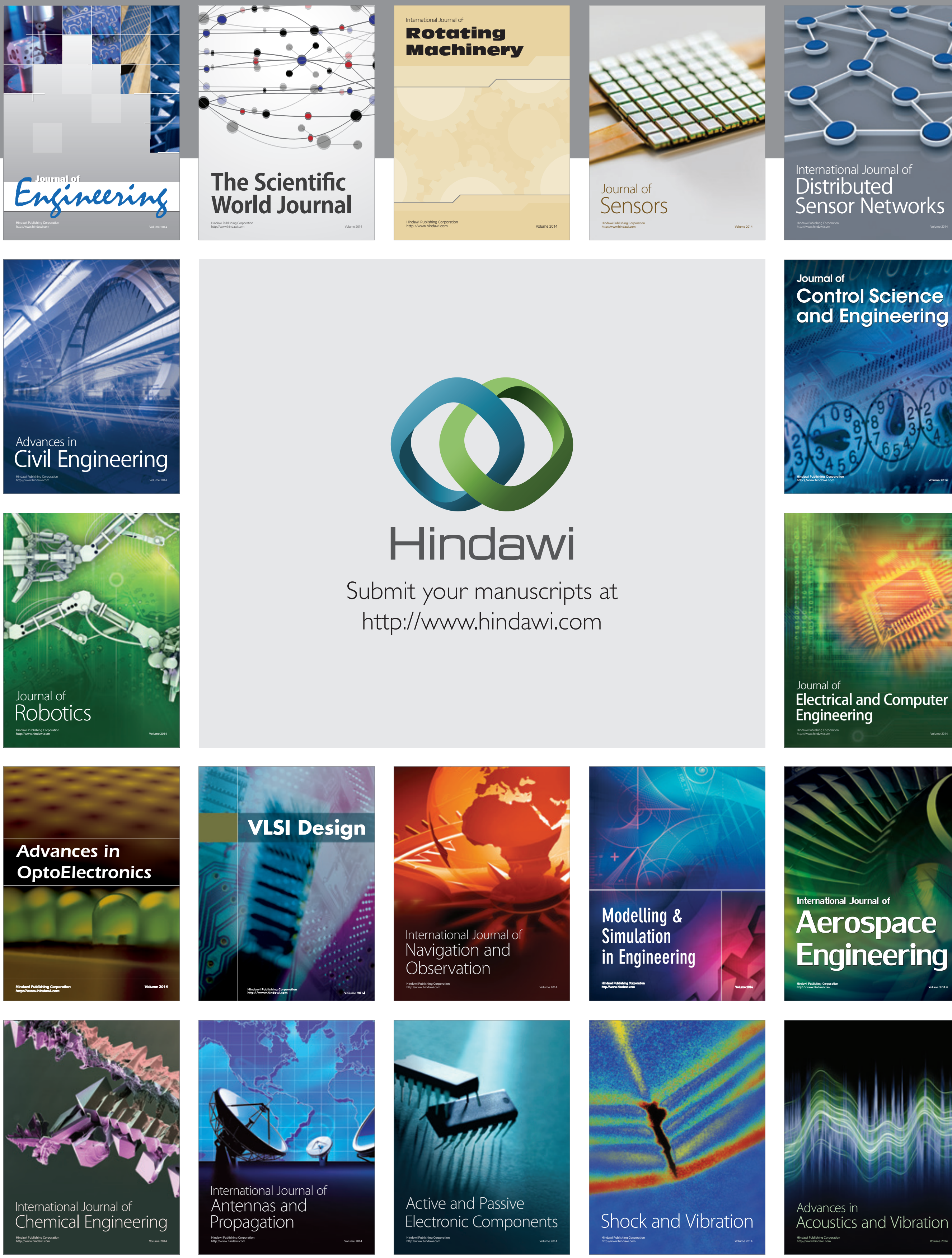
The paper by X. Qu et al. presents minimax estimation fusion method in distributed multisensor systems. This method aims to minimize the worst-case squared estimation error when the cross-covariances between local sensors are unknown and the normalized estimation errors of local sensors are norm bounded. The simulation results illustrate that the proposed fusion method is a robust fusion in localization and tracking and more accurate than the previous covariance intersection method.

Acknowledgment

The guest editors would like to acknowledge the contributions of the many experts who submitted their works.

We thank all the reviewers for their helpful feedback and suggestions to improve the quality of each paper.

Long Cheng
Carsten Maple
Chengdong Wu
Wei Meng


Journal of Engineering
The Scientific World Journal
International Journal of Rotating Machinery
Journal of Sensors
International Journal of Distributed Sensor Networks
Advances in Civil Engineering
Hindawi
Submit your manuscripts at
http://www.hindawi.com
Journal of Control Science and Engineering
Journal of Robotics
Journal of Electrical and Computer Engineering
Advances in OptoElectronics
VLSI Design
International Journal of Navigation and Observation
Modelling & Simulation in Engineering
International Journal of Aerospace Engineering
International Journal of Chemical Engineering
International Journal of Antennas and Propagation
Active and Passive Electronic Components
Shock and Vibration
Advances in Acoustics and Vibration