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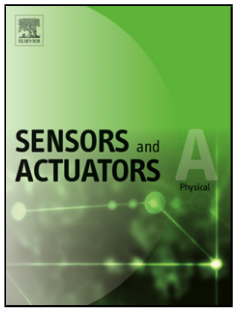

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Localization Improvement in Wireless Sensor Networks Using a New Statistical Channel Model

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Abstract

In this paper, a statistical channel model is proposed based on the second moment of Received Signal Strength Indicator (RSSI) in an outdoor communication channel. The medium under study is a grass field where the RSSI data are collected in different distances and orientations using a set of in-house built transmitter-receiver sensors. The validity of the constructed sensors is confirmed since the first moment of RSSI data follows the well-known Friis model. The proposed model presents an additional relationship between the variance of RSSI data and distance. To demonstrate the application of this statistical relationship, we have investigated the localization problem of a hidden node using extended Kalman filter (EKF). Compared to the conventional EKF in which the covariance matrix of measurement noise is fixed, this matrix can be updated online using the proposed model. The experimental and simulation results of two different scenarios, which are fixed hidden node and mobile hidden node, show that the proposed model improves the accuracy of RSSI localization from 10 to 22 percent in different situations.

Keywords:
Localization, Channel Modeling, Measuremnet noise, Wireless sensor network, Extended Kalman Filters

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