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Paper

Distributed Hybrid Localization Using Received Signal Strength and Self-Organizing Maps for Wireless Ad-Hoc Networks

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Localization in wireless ad-hoc networks has been attracting much research attention for several years. Existing localization schemes can be categorized into ranging and range-free approaches. This paper proposes a distributed hybrid solution which integrates Received Signal Strength (RSS) based ranging and Self-Organizing Maps (SOM) based range-free approaches for the purpose of achieving high localization accuracy with low cost and power consumption. Distance information between the nodes is estimated using RSS ranging. Then, both RSS-based distance and nodes' connectivity information are applied to the SOM-based location learning steps. The proposed scheme also uses known information of anchors to detect and avoid obstacles or irregular network shapes and to minimize the location estimation error in anisotropic networks. For RSS-based distance estimation, a thorough empirical analysis of the radio propagation model is presented. This paper evaluates the effects of network topology, anchor placement and utilization, node density, radio irregularity and the number of learning steps over the performance of the proposed scheme. Results show that the proposed scheme achieves better localization performances than several existing schemes in most cases while reducing learning steps and anchor utilization.

Keywords : Wireless ad-hoc network, localization, hybrid, RSS, SOM