

移动传感网络节点定位优化策略研究与分析

摘 要

无线传感器网络（Wireless Sensor Network, WSN）由众多传感器节点构成，这些节点具有低功率、低能耗、硬件结构小等特性，采用无线多跳的形式进行通信并构造自组织网络，实时地对覆盖区域的对象进行感知与监测。由于传感器节点移动特性导致算法的定位性能不是很好，因而影响到精确的采集数据。定位优化算法研究也成为无线传感网络关键技术之一。如何通过一定的算法降低无线传感节点能量消耗，减少环境背景噪声对无线射频信号的衰减，实现高效及精确的节点定位就成了当前移动传感网络定位算法中的非常重要的组成部分。

本文通过分析现有的定位算法，主要对两种定位算法分别进行了优化改进，提出对蒙特卡罗定位算法优化设计，将差分演化算法引入蒙特卡罗定位算法，对算法实现了改进。并对传统质心定位算法做出改进，通过对 RSSI（Receive Signal Strength Indication，接收信号强度指示）进一步分析，提出一种通过设置一个信号强度测量阈值，优化各个节点间的主次关系，更新无线网络中各个标记节点相对于未知节点所测得值的方法，修正最近锚节点与其他锚节点对待测节点的影响程度，来改变信号在无线网络的传输过程中会因传播距离改变导致信号损耗能力也在不断变化，定位结果呈现非线性误差的情况，以此来减小定位误差。通过仿真测试分析，优化改进的效果，以实现高精度定位算法方式。

关键词：移动无线传感器网络；节点定位；优化算法；差分演化；信号强度指示

Abstract

The Wireless Sensor Network (WSN) is composed of many sensor nodes. These nodes have the characteristics of low power, low energy consumption, and small hardware structure. They use wireless multi-hop communication and construct a self-organizing network to cover the coverage area in real time. Subject to perception and monitoring. Due to the movement characteristics of the sensor nodes, the positioning performance of the algorithm is not very good, which affects the accurate data collection. Research on positioning optimization algorithms has also become one of the key technologies in wireless sensor networks. How to reduce the energy consumption of wireless sensor nodes through certain algorithms, reduce the attenuation of wireless background signals by environmental background noise, and achieve efficient and accurate node positioning has become a very important part of current mobile sensor network positioning algorithms.

By analyzing the existing positioning algorithms, this paper mainly optimizes and improves the two positioning algorithms respectively, proposes the optimization design of the Monte Carlo positioning algorithm, introduces the differential evolution algorithm into the Monte Carlo positioning algorithm, and improves the algorithm. And improve the traditional centroid positioning algorithm, through further analysis of RSSI (Receive Signal Strength Indication, Received Signal Strength Indication), propose a way to optimize the primary and secondary relationship between each node and update the wireless network by setting a signal strength measurement threshold The method of measuring the measured value of each labeled node relative to the unknown node in the method corrects the degree of influence of the nearest anchor node and other anchor nodes on the measured node to change the signal loss ability due to the change of the propagation distance during the transmission of the wireless network In the case of continuous changes, the positioning results show a nonlinear error, in order to reduce the positioning error. Through simulation test analysis, the improved effect is optimized to achieve a high-precision positioning algorithm.

Key Words: mobile wireless sensor network; node positioning; optimization algorithm; differential evolution; signal strength indication

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