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基于相似度的温室无线传感器网络定位算法

Greenhouse wireless sensor network localization method based on similarity

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中文摘要:

针对温室移动节点定位简单、易实现要求，提出了一种基于相似度的温室无线传感器网络定位方法。该方法主要包括虚拟网格划分、测量距离修正、节点定位3个阶段。首先，汇聚节点根据信标节点的分布信息，将温室区域等分划分虚拟网格，并返回除区域边界外的网格顶点的坐标；然后，汇聚节点通过比较信标节点间测量距离与真实距离的偏差，获得各信标节点的误差系数，用以修正传感器节点与各信标节点间的测量距离，并按序组成距离向量；最后，量化该距离向量与所有除区域边界外的网格顶点到各信标节点的距离向量之间的相似程度，选取相似度最高的网格顶点的质心为传感器节点的估计位置。仿真试验表明，该方法充分考虑测距误差、虚拟网格、信标节点数量对定位误差的影响，具有较高的稳定性和定位精度，能够满足网络定位成本受限的温室定位需求；将该方法与支持向量机定位算法进行比较，2种算法的定位误差均值分别为2.5407、2.9195 m，定位算法平均运行时间分别为0.2326、2.3719 s，表明该方法具有更低定位误差和计算复杂度。

英文摘要:

Abstract: With the development of horticulture facilities technology, a single greenhouse area is constantly expanding, which is advantageous to save material, reduce costs, improve lighting efficiency, and improve cultivation efficiency, but at the same time, it means there is the need to deploy a large number of sensor nodes in order to guarantee the coverage of environmental monitoring. Dynamic monitoring of a greenhouse environment using mobile nodes, cannot only reduce the number of sensor nodes, but also ensures the comprehensiveness of greenhouse environmental information. The mobile node localization is the basis of the application. Node localization information is accurate or not directly related to the validity of the data collected. As a greenhouse mobile node has to compute and complement easily, a kind of greenhouse wireless sensor network localization method based on similarity was presented. The approach mainly included three stages: grid partitioning, measure distances amendment, and node localization. First, according to the distribution information of the beacon node, a greenhouse area was clustered into equal parts as virtual gridding and coordinates of gridding vertices inside the area boundary were returned to sink node. Secondly, by comparing measured distance and actual distance between each beacon node, sink node could get beacon node error coefficients, which was able to modify the measured distance between sensor node and each beacon node, and then form distance vectors in sequence. Finally, the similarity of distance vectors obtained in a second procedure and the distance vectors between gridding vertices and each beacon node was quantified, afterwards choosong the barycenter of gridding vertices with maximum similarity as a sensor node estimated position. The simulation experiment result showed that the greenhouse wireless sensor network localization method was fully considering the effect of distance measurement error, virtual grid partitioning, and the number of beacon nodes on localization errors. The method has a high ability of stability and precision, and meets the practical needs of greenhouse localization. In the same case of beacon node number and arrangement, the greenhouse wireless sensor network localization method and support vector machine (SVM) algorithm was compared. The average localization error was 2.5407 m and 2.9195 m respectively, the average elapsed time of localization algorithm was 0.2326 s and 2.3719 s respectively, and the localization error range was 3.5496 m and 4.0617 m respectively. The comparison results showed the method had a lower localization error and computational complexity.