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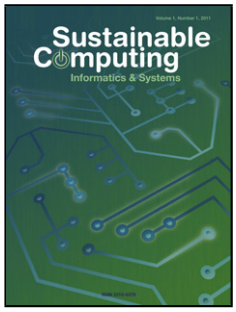

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PII: S2210-5379(17)30170-1
DOI: http://dx.doi.org/10.1016/j.suscom.2017.08.001
Reference: SUSCOM 178

To appear in:

Received date: 8-5-2017
Revised date: 18-7-2017
Accepted date: 8-8-2017

Please cite this article as: Shengchao Su, Shuguang Zhao, An optimal clustering mechanism based on Fuzzy-C means for wireless sensor networks, Sustainable Computing: Informatics and Systemshttp://dx.doi.org/10.1016/j.suscom.2017.08.001

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An optimal clustering mechanism based on Fuzzy-C means for wireless sensor networks

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Highlights

- An optimal clustering mechanism has been proposed to balance the node's energy consumption and prolong the lifetime under energy-constrained wireless sensor networks.
- The optimal number of cluster heads is estimated based on node's density.
- Definition of the objective function based on the distance and the weight presented.
- An improved Fuzzy-C means clustering algorithm is proposed to divide the sensor nodes into a specified number of clusters.
- Simulation and performance evaluation provided for the proposed mechanism.

Abstract: In order to balance the node's energy consumption and extend the lifetime under energy-constrained wireless sensor networks, an energy-efficient clustering algorithm based on Fuzzy-C means for wireless sensor networks is proposed. Taking into account the uneven distribution of the sensor nodes and the uncertainty of the radio channel, the cluster formation process of nodes is modeled as a fuzzy partition of sample space in this paper. Firstly, the overall energy consumption of the networks is analyzed, and the optimal number of cluster heads is estimated based on node's density. Secondly, in the design of the objective function, the distance from the node to the cluster head and the weight of the membership values are considered. Then, the improved Fuzzy-C means clustering algorithm is proposed to divide the sensor nodes into a specified number of clusters. Finally, a single hop communication mode is used for intra cluster communication, and inter cluster communication adopts a multi-hop communication mode. The simulation results show that the proposed algorithm can obtain uniform spatial distribution of cluster heads and balance the energy consumption of network effectively.

Keywords: wireless sensor networks; Fuzzy-C means; multi-hop; routing transmission mechanism; energy-efficient

1. Introduction

By deployment of various micro sensors, wireless sensor networks (WSNs) can perceive, collect and process the information of the area, and then send it to the observer. As a new type of autonomous self-organized network, it forwards the sensed information to the destination terminal in single or multi hop manner, which connects the logical world and the physical world effectively [1]. In general, the number of nodes in WSNs is huge and the resources are severely limited. In order to reduce the energy consumption and extend the life of the network, it is very important to

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