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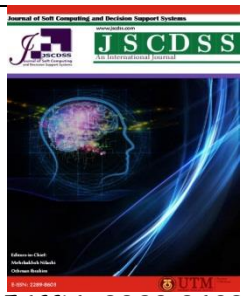

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A Method for Deploying Relay Nodes in Homogeneous Wireless Sensor Networks Using Particle Optimization Algorithm

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Abstract

There are many methods for deploying relay nodes in wireless sensor networks with the aim of increasing network lifetime and reducing energy consumption. To overcome the issue, in this research, we first set the set of probe points for the establishment of relay nodes, since our goal is to minimize the number of relay nodes and increase the coupling between relays and sensors. This problem is NP-hard, so in order to solve this problem in a short time, the particle optimization algorithm using a weighted multifunctional function as a meta-burgh solution was used. We used this algorithm for determining the number and location of the placement relay nodes to reduce the number of nodes and increase network lifetime and network performance. We evaluated this proposed method for both theoretical analysis and numerical results. The results showed that the proposed approach provide better results compared to the greedy algorithms and particle optimizations.

Keywords: Wireless Sensor networks, Relay node, Particle optimization algorithm.

1. Introduction

A wireless sensor network is a network that includes a large number of low-cost sensor nodes with limited energy, which it is responsible for receiving information from the environment, analyzing and processing them, as well as sending sensory data to other nodes. Communication between sensors is usually wireless. Each sensor works independently and without human intervention. The sensor is physically very small and there are limitations in processing power, memory capacity and power supply which these limitations create some problem. Although the use of wireless sensor networks is increasing, the design of these networks is a major challenge. To enhance the network performance, various parameters for improvement are considered including area coverage, life span and reliability (Kuila et al., 2013) which can be significantly improved with the exact deployment of the node. The problem of deploying nodes in a wireless sensor network has been solved with different methods and algorithms, in order to improve performance. In a wireless sensor network, taking into account the limitation in energy of the batteries of sensors, it is possibile for a large number of nodes to be damaged during propagation. As well as network nodes have energy constraints and cannot be recharged, therefore, optimal protocols are needed to reduce energy consumption and increase lifespan. One of the methods used in this field is the deployment of the additive relay node. This problem is solved by some optimization methods. Evolutionary algorithms are also used, in order to select optimal location for add-on sensors, which these methods increase the network lifetime (Liu et al., 2016).

2. The proposed method

We propose a method using particle optimization algorithm. There is a systematic property in particle collective intelligence particle optimization algorithm, that the agents co-operates locally in this system and the collective behavior of all agents leads to the convergence at a point close to the optimal overall solution. The strength of this algorithm is that it does not need an overal control. Each particle (agent) in this algorithm has a relative autonomy that can move across the solution space and have to cooperate with other swarms (agents). A well-known algorithm for collective intelligence is Particle Swarm Optimization (PSO).

PSO is a group of optimization algorithms that operate on the basis of random population generation. This algorithm is based on the modeling and simulation of the flying of a bunch of birds (in group) or movement a bunch of fishes (in group). A group of particle optimization in space is randomly looking for food. There is only one piece of food in the space under discussion. None of the particle optimization knows the food location. To track particles, the smallest distance to the food is the best strategy. This strategy is in fact the source of the algorithm. Each solution