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Energy Optimization in Wireless Sensor Networks Using Grey Wolf Optimizer

Zohreh Jabinian [a], Vahid Ayatollahitafti [b,*], and Hadi Safdarkhani [c]
[a] Department of Computer Science, Yazd Branch, Islamic Azad University, Yazd, Iran
[b] Department of Computer Science, Taft Branch, Islamic Azad University, Taft, Yazd, Iran
[c] Department of Electrical Science, Yazd University, Yazd, Iran

*** Corresponding author email address**: vahid.ayat@taftiau.ac.ir

Abstract

Wireless Sensor Network (WSN) has some great advantages such as various communication and arrangement, low power consumption and low cost. These sensors are small in size and they can carry out the process of sensing events and communicate with each other. These networks are used to detect events or phenomena, collect and process data, and send sensory information to the user. In WSNs, due to the short battery life span of sensors, optimal energy consumption has always been a challenge. In this paper, an energy optimization method is proposed using Grey Wolf Optimization and Genetic algorithms for communications. The proposed method uses different energy model to optimize energy consumption with an arbitrary set of parameters. Simulation results show that the proposed method has a good performance in terms of energy consumption and network lifetime compared with the similar method.

Keywords: Wireless Sensor Network, Grey Wolf Optimizer, Energy

1. Introduction

Wireless Sensor Networks (WSNs) have been taken into consideration in recent years due to their low cost and extensive applications such as national security, military, and environmental monitoring (Akyildiz et al., 2002). WSN consists of a large number of low power and low cost sensor nodes equipped with communication, data processing, and sensor components. The sensors in these networks use a limited power supply; as if they end the network lifetime since the resources are non-renewable (Rault et al., 2014).

To further utilizing and extending the life of these types of networks, researchers are always looking for ways to reduce energy consumption. To reduce the amount of energy consumption while transmitting roaming-based clustering protocols, using mechanisms such as selecting cluster heads from sensor nodes to cluster heads, and aggregating information in the cluster head and transmitting information from cluster heads to the main station can have a significant effect on energy reduction (Lia, 2012).

Consumers are involved in saving energy. The length of the knots is short due to the power limitation of the power supply. In addition, in some cases, the special position of a node in a network intensifies the problem. For example, a node located at a distance of one step from the centre node, on the one hand, will lose its energy very quickly due to its high workload, and, on the other hand, it will interrupt the connection of the central node with the entire network and thus cause the network to fail (Akkaya et al., 2005). The problem of early energy depletion is also true for nodes in low-density regions in non-uniform distribution of nodes. In such cases, it is appropriate to have an energy management within nodes and to provide informed energy solutions that use the least critical nodes (Rana et al., 2010).

According to the stated statements, all the algorithms and techniques used in sensor networks should consider serious limitation and should try to act with awareness of the energy level to consume the least amount of energy (Pour et al., 2016; Rault et al., 2014).

In this research, we try to optimize energy consumption in WSN using the latest meta-heuristic and intelligent algorithm designed for engineering issues, the Grey Wolf Optimizer (GWO) (Al-Aboody et al., 2016). The grey wolf optimization algorithm is one of the newest superconductor algorithms inspired by the hierarchical structure of the wolf's hierarchy of leadership and social behaviour during hunting. This algorithm is based on population and uses four types of grey wolves, such as alpha, beta, delta and omega to simulate the hierarchy of leadership. In addition,