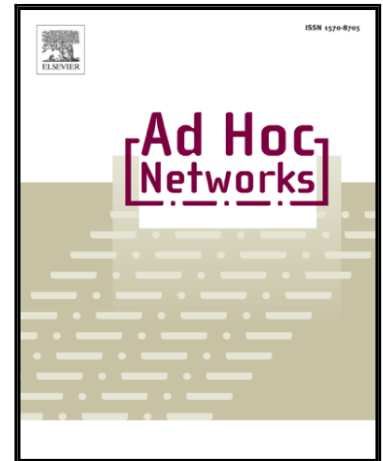


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# A Distributed Multi-path Routing Algorithm to Balance Energy Consumption in Wireless Sensor Networks

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## Abstract

A large use of applications of Wireless Sensor Networks (WSNs) pushes researchers to design and improve protocols and algorithms against the encountered challenges. One of the main goals is data gathering and routing to the base station (through the sink nodes) with lack of acknowledgement and where each node has no information about the network. Unbalanced energy consumption during the data routing process is an inherent problem in WSNs due to the limited energy capacity of the sensor nodes. In fact, WSNs require load balancing algorithms that make judicious use of the limited energy resource to route the gathered data to the sink node. In this paper, we propose a balanced multi-path routing algorithm by focusing on the residual energy and the hop count of each node to discover the best routes and to insert them into the routing table. The main idea of this algorithm comes from Ant Colony Optimization (ACO) and automata network modelization. Hence, the potential performance of the proposed algorithm relies on the best route to be selected which should have the minimum number of hops, the maximum energy and weighted energy between participating nodes to extend the lifetime of the network.

*Keywords:* Wireless sensor networks, route discovering algorithms, balancing resource consumption, Lifetime Maximization, distributed algorithms.

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## 1. INTRODUCTION

Wireless Sensor Networks (WSNs) have attracted a great number of researchers during the last decades. The relevance of this area is strongly related to the explosion of new mobile devices and wireless sensors, which provide many important functions like self-monitoring environments without human beings' intervention and energy suppliers [1],[2],[3]. Recent technological advances [4] have enabled the development of small-size (a few cubic centimetres), low-cost, low-power, multi-functional sensor devices. A WSN consists of a large number of sensor nodes with limited resource: battery power, capacity of computation, memory and

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