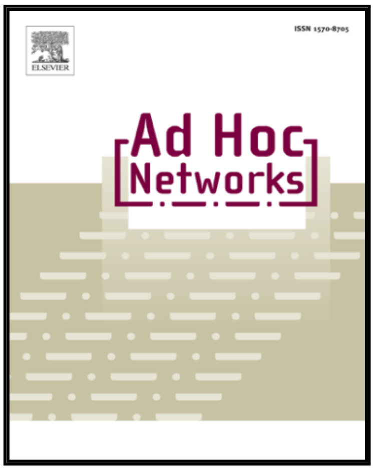
Accepted Manuscript



Maximizing the Wireless Sensor Networks Lifetime through Energy Efficient Connected Coverage

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PII: S1570-8705(17)30068-9
DOI: 10.1016/j.adhoc.2017.04.001
Reference: ADHOC 1535

To appear in: *Ad Hoc Networks*

Received date: 4 September 2016
Revised date: 22 February 2017

Please cite this article as: J. Roselin , P. Latha , S. Benitta , Maximizing the Wireless Sensor Networks Lifetime through Energy Efficient Connected Coverage, *Ad Hoc Networks* (2017), doi: 10.1016/j.adhoc.2017.04.001

Maximizing the Wireless Sensor Networks Lifetime through Energy Efficient Connected Coverage

J.Roselin, P.Latha, and S.Benitta

Abstract— Wireless Sensor Network (WSN) is an emerging technology that is gaining much importance owing to its immense contribution in various day-to-day applications. A sensor is battery-operated, unattended low-cost device with limited computing, communication and storage capabilities. Thus the network lifetime has become the key characteristic for evaluating sensor networks in an application-specific way. There are certain approaches in literature which consider the lifetime maximization problem. However, they suffer from impulsive energy hole, coverage hole and communication hole. In this paper we propose a novel Energy Efficient Connected Coverage (EECC) scheduling to maximize the lifetime of the WSN. The EECC adheres to Quality of Service (QoS) metrics such as remaining energy, coverage and connectivity. In EECC the sensor which doesn't contribute to coverage will act as a relay node to reduce the burden of the sensing node. The sensing node senses the target whereas the relaying node communicates the sensory information to the sink. The EECC forms non-disjoint cover sets using remaining energy, coverage and connectivity of every sensor. The proposed EECC outperforms similar scheduling algorithms found in the literature in an energy efficient way with the short execution time. Through simulations the constancy of EECC in extending the lifetime of WSN is confirmed.

Index Terms— Coverage, Connectivity, Energy Efficient Connected Coverage (EECC), Lifetime Maximization, Remaining Energy, Wireless Sensor Networks (WSNs)

1 Introduction

Nowadays, Wireless Sensor Network (WSN) merges a broad range of information technology with hardware, software, networking, and programming methodologies [1]-[3]. Hence the applicability of WSN in surveillance applications [4][5] is incomprehensible. The targets/points located at hostile environment, which are more prone to mishaps, are known as Critical Points (CPs), and they need more attention than the other regions [6]. Under such circumstances, the sensors are randomly deployed around the CPs by air dropping [7]. Here, all the deployed sensors may not monitor the CPs, some of them may fail due to environmental hazards and certain other sensors may fall outside the interested region. For effective coverage, the random deployment should be dense with more number of sensors. Since the condition that prevails around the CPs should be monitored for the specified period of time according to the application requirements [8].

The wireless sensors are battery-powered [9] having limited energy replacing or recharging its battery is neither possible nor cost effective. Normally the active sensors sense the environment, transmit the sensory information to its next hop neighbors, receive the sensory information from its neighbors and relay that information to the sink. According to Telosb energy model a sensor spends relatively same quantum energy for transmitting and receiving. Thus the energy of the active sensor drains quickly as the monitoring continues. This may induce the coverage hole; the lifetime of the WSN comes to an end when it encounters the first coverage hole. In [10] various energy conservation ways in WSN is discussed in detail.

To avoid rapid energy drain and to improve lifetime of the WSN the each active sensor is termed either as a sensing or as a relay node according its coverage capability [11]. The sensing node does sensing

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