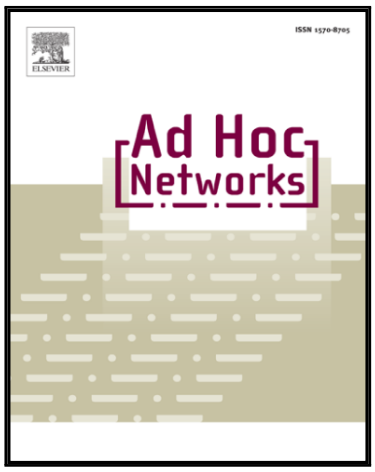

Energy-Aware Distributed Routing Algorithm to Tolerate Network Failure in Wireless Sensor Networks

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Energy-Aware Distributed Routing Algorithm to Tolerate Network Failure in Wireless Sensor Networks

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Abstract: Wireless Sensor Networks are prone to link/node failures due to various environmental hazards such as interference and internal faults in deployed sensor nodes. Such failures can result in a disconnection in part of the network and the sensed data being unable to obtain a route to the sink(s), i.e. a network failure. Network failures potentially degrade the Quality of Service (QoS) of Wireless Sensor Networks (WSNs). It is very difficult to monitor network failures using a manual operator in a harsh or hostile environment. In such environments, communication links can easy fail because of node unequal energy depletion and hardware failure or invasion. Thus it is desirable that deployed sensor nodes are capable of overcoming network failures. In this paper, we consider the problem of tolerating network failures seen by deployed sensor nodes in a WSN. We first propose a novel clustering algorithm for WSNs, termed Distributed Energy Efficient Heterogeneous Clustering (DEEHC) that selects cluster heads according to the residual energy of deployed sensor nodes with the aid of a secondary timer. During the clustering phase, each sensor node finds *k*-vertex disjoint paths to cluster heads depending on the energy level of its neighbor sensor nodes. We then present a *k*-Vertex Disjoint Path Routing (kVDPR) algorithm where each cluster head finds *k*-vertex disjoint paths to the base station and relays their aggregate data to the base station. Furthermore, we also propose a novel Route Maintenance Mechanism (RMM) that can repair *k*-vertex disjoint paths throughout the monitoring session. The resulting WSNs become tolerant to *k*-1 failures in the worst case. The proposed scheme has been extensively tested using various network scenarios and compared to the existing state of the art approaches to show the effectiveness of the proposed scheme.

Keywords: **Wireless sensor network, network failure, fault and link failures**.

1. Introduction.

In recent years, advances in microelectronic fabrication technology have reduced the manufacturing cost of portable wireless sensor nodes. As a result, a large number of portable low cost smart wireless sensor nodes are currently deployed in Wireless Sensor Networks (WSNs) for various remote monitoring applications [1-4]. They enhance the importance of WSNs as a remarkable technology for monitoring different critical tasks. Nowadays, WSNs play a vital role in many applications including gas detection, habitat surveillance, home automation, military operations, medical treatments, agricultural crop monitoring, environmental and industrial monitoring [5-9]. In such applications, sensor nodes are usually deployed into the field of interest without any preconfigured infrastructure in a stochastic manner. After deployment, sensor nodes organize themselves into an ad hoc network using a nearby nodes discovery process.