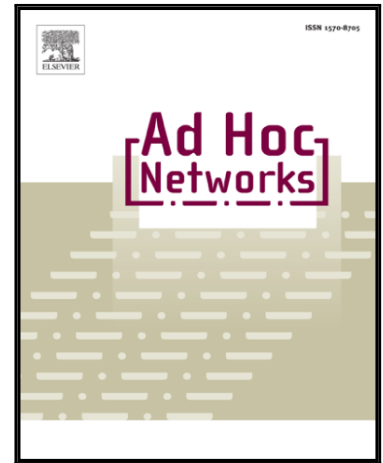


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BPA-CRP: A Balanced Power-Aware Clustering and Routing Protocol for Wireless Sensor Networks

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Abstract—Advances in sensor technology has enabled the development of small, relatively inexpensive, and low-power sensors, which are connected together through wireless medium, forming what is so called Wireless Sensor Networks (WSNs). WSNs have huge number of applications out of which military target tracking and surveillance. However, sensors operate on limited power resources; therefore, utilizing those resources has brought the attention of current researchers. In this paper, we propose a Balanced Power-Aware Clustering and Routing protocol (BPA-CRP). Specifically, we developed a batch-based clustering and routing protocol in which the network topology divides the sensor field into equal-sized layers and clusters. The clustering algorithm allows any cluster to operate multiple rounds (a batch) without any need for set-up overhead. BPA-CRP assigns four different broadcast ranges for each sensor. Not only to this extent, but rather, BPA-CRP introduces a routing algorithm in which a new node role called “*Forwarder*” which is capable of relaying the collected data from the layer, it resides in, and far away forwarders toward the base station. As a complementary to prior described protocol, BPA-CRP proposes that a batch ends when the energy of any of the forwarders dips below a certain threshold. Additionally, BPA-CRP introduces the “*Only Normal*” operation mode, which primarily prevents exhausted nodes from serving as cluster heads or forwarders any longer. In fact, all of just mentioned enhancements not only are energy-aware, but also contributes in accomplishing efficient load balancing. Finally, we put proper node death-handling rules, which guarantee that each node dies smoothly without any loss of data, neither causing disruption for the network. Simulation results showed an exceptional performance of BPA-CRP over different relevant works in terms of network lifetime and network energy utilization. The load balancing capability of BPA-CRP is validated as well.

Index Terms— wireless sensor networks; micro-sensors; clustering; routing; broadcast domain

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