Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **13 (2006)** 1-20

Cellular Energy Density Vector Routing for Improving Lifetime in Wireless Sensor Networks

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Abstract. Wireless sensor networks have unique features which mobile ad-hoc networks do not have. Considering them in this paper, we propose a cellular energy density vector (CEDV) routing protocol specifically designed for wireless sensor networks. Its clustering technique divides a sensor field into uniform cells thereby alleviating energy consumption caused by sensor flooding. Energy density, a novel routing metric, is used to avoid forwarding packets to the subarea of lower residual energy of nodes. CEDV makes monitoring stations keep monitoring each subarea for a longer time using fair energy consumption of sensor nodes. The time that elapses until a subarea depletes its all energy, called lifetime, is measured in the simulation. Simulation results show that CEDV has a longer lifetime than several existing routing protocols for wireless networks or sensor networks. Also, it is proved that CEDV guarantees the maximum hop count without suffering unpredictable delay regardless of the node density.

Keywords. wireless sensor networks, lifetime, energy density, routing protocol, cell, hop count.

1 Introduction

Recent advances in wireless communication and micro-sensor technology made it possible to develop the wireless network of low-cost, small-sized sensor nodes [1]. The sensor nodes are deployed in physical environments to collect useful information around themselves, e.g. acoustic, light, seismic information, etc., in an autonomous manner [2]. Some examples of application areas are surveillance, rescue efforts in disaster areas, collecting military intelligence, and so on.

As one of the most important features of wireless sensor networks, a sensor node is equipped with a limited energy of battery that *cannot* be replenished. That is because intrinsically immobile sensor nodes are embedded in physical structures and *unattended* after thrown into an inhospitable terrain. This is different from mobile ad hoc networks (MANET) in that the battery can be replenished and replaced by the user. Since using up the battery means