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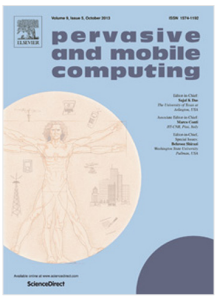

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An Energy-efficient Data Gathering Method Based on Compressive Sensing for Pervasive Sensor Networks

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Abstract:

This paper proposes an energy-efficient data gathering method called CN-MSTP (Combining Minimum Spanning Tree with Interest Nodes) for pervasive wireless sensor networks, basing on Compressive sensing (CS) and data aggregation. The proposed CN-MSTP protocol selects different nodes at random as projection nodes, and sets each projection node as a root to construct a minimum spanning tree by combining with interest nodes. Projection node aggregates sensor reading from sensor nodes using compressive sensing. We extend our method by letting the sink node participate in the process of building a minimum tree and introduce eCN-MSTP. We compare our methods with the other methods. Simulation results indicate that our two methods outperform the other methods in overall energy consumption saving and load balance and hence prolong the lifetime of the network.

Keywords: Energy-efficient, Compressive sensing, Data aggregation, Wireless sensor network

1. Introduction

With the rapid development of communication technology, more and more new networks appear to be adapted to various needs, such as delay tolerant network [1], opportunistic network [2], wireless sensor network [3] and etc. Pervasive computing aims at providing such service that people could obtain and deal messages in any way at anywhere and anytime [4]. While many networks can't satisfy these qualifications for that the batteries of nodes in some networks is usually restricted and replacing batteries is infeasible due to the large quantity of nodes, or even in some other networks, where nodes can reach power supply conveniently, but it can't always meet these qualifications due to the power of nodes can't always acquire timely supplement, which also influents the performance of networks. Therefore we should come up with other way to save energy.

Set wireless sensor networks (WSNs) as example, it is traditionally made up of a number of sensor nodes with the ability to communicate wirelessly [5], and as the improvement of wireless communication, WSNs have been widely used in a broad range of applications [6]-[11]. While due to sensor nodes are energy-restricted and replacing batteries is unrealistic, which makes it become an interest topic of how to prolong the lifetime of wireless sensor networks. An effective scheduling scheme is proposed in [12] to ensure estimation stability with the sensor using low energy, but it is not very suitable. Recent years have witnessed many ways to prolong the lifetime of networks, mainly considering from two major areas, energy harvesting and energy saving.

Known examples of harvestable energy sources for WSNs include thermal energy [13],