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DATA DELIVERY WITH MOBILITY CONTROL IN SPARSE WIRELESS SENSOR NETWORKS

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Abstract. *This paper proposes a sensor mobility control scheme for data delivery in sparse wireless sensor networks. All sensor nodes remain static once they have been deployed but are capable of moving in a controlled manner. Based on periodic beacon messages, local node locations are known to all nodes but are subject to coarse-grained localization error. Each sensor node has a fixed radio range. When a sensor node cannot forward data to a sink, the sensor node solicits aid from neighbors to move suitably to relay the data. If no neighbors can assist, the mobile sensor physically carries the data toward the sink node, the direction being estimated by source node and sink node location data. The mobile sensor does not stop moving until it reaches a neighbor as recognized by periodic beacon messages. The effectiveness of the scheme is evaluated in a series of numerical investigations using the ns-2 simulator. Simulation results indicate that the proposed scheme outperforms previous methods for varying conditions. Furthermore, the proposed scheme achieves a high degree of robustness toward node position errors and can support networks with multiple sink nodes.*
Keywords: Wireless sensor networks, Mobility control, Position-based routing

1. **Introduction.** Rapid technological advance in wireless networks and communication paradigms have led to the emergence of wireless sensor networks (WSN) as a major research topic [1]. Typical WSN contain two basic devices: sensor nodes, which collect and disseminate event information; sink nodes, which gather data acquired by sensor nodes. Several routing protocols have been proposed for WSN [2]. The routing protocols have three main categories: data-centric, hierarchical and position-based schemes. For scalability and power-efficiency issues, the position-based routing protocols [3, 4, 5, 6, 7, 8, 9, 10] have attracted more attentions in the sensor network community. However, traditional routing protocols are designed on fully connected sensor networks assuming persistent end-to-end connectivity between any two nodes.

As the result of node crash, limited radio range, deployment in unattended and hostile environments or other physical factors, sensor nodes might not communicate with others. For example, the wide physical range of the deployed area will prevent full coverage due to the cost issue. Sensor nodes thus may be out of radio range of others. Under these environments, most existing routing protocols will fail to deliver data packets to their destinations since no route is found due to network partition. Such protocols either simply wait for the route to be re-established or directly drop data packets. This kind of passive approach results in unpredictable transmission delays and data loss, thereby, degrading system performance considerably. This raises an important problem of how to deliver data in a constantly disconnected network. This kind of partitioned sensor networks would not be uncommon in practice, e.g., in battlefield, disaster recovery and