

ABSTRACT

Wireless Sensor Networks (WSNs) are becoming popular due to its usage in various civilian and military applications. The energy-constrained sensor nodes deplete energy at different stages, namely, sensing, computing and communication. Thus, improvement of energy efficiency is an issue in sensor network for the improvement of the lifetime of a network. Moreover, sensor nodes operate in a highly unreliable wireless medium. The energy efficient routing protocols or data forwarding mechanisms need to be designed while providing reliability in WSN in terms of protection of data against link failures. Network coding is a technique by which an intermediate node encodes the data packets which are received from its neighboring nodes before retransmission. Network coding technique reduces the amount of traffic and improves the efficiency of a multi-hop network. Furthermore, assessments of network lifetime have received considerable interest in recent years. As the radio consumes most of the energy in a WSN, reduction of transmissions in a network improve the energy efficiency of the whole network.

The thesis focuses on the analysis of energy efficiency in wireless sensor networks using network coding. The issues of energy efficiency and network lifetime have been addressed while considering reliability in terms of protection of data against link failures. Network coding based data propagation strategies have been proposed for different traffic patterns and deployment strategies. Firstly, an energy efficient network coding based probabilistic routing protocol has been proposed to facilitate the local decision making in a WSN. Secondly, a duty cycle based WSN has been analyzed with a proposed network coding based algorithm. The network coding based paradigm has been proposed for data communication near the Sink to improve the performance of the WSN. Thirdly, the energy efficiency of a cluster based WSN has been analyzed and the network lifetime has been estimated. An adaptive data aggregation strategy has been proposed with usage of network coding based communication in clusters. Finally, a directional antenna based communication approach has been analyzed with a network coding based data forwarding strategy for the improvement of energy efficiency in WSN. Performance evaluations of the proposed approaches have been performed through theoretical analysis and simulations.