Context-based Topology Management for Wireless Sensor Networks

Jiaxi You, Dominik Lieckfeldt, and Dirk Timmermann
Institute of Applied Microelectronics and Computer Engineering
University of Rostock, 18119 Rostock, Germany
{jiaxi.you|dominik.lieckfeldt|dirk.timmermann}@uni-rostock.de

Abstract – As important components of an automation environment, sensor devices conduct the algorithm aspect of Life Science Automation (LSA) with the physical world by measuring environment conditions and converting them into digital or analog signals. Wireless Sensor Networks (WSNs) are composed of sensor nodes, which are capable of sensing physical parameters, processing data and communicating with each other wirelessly. In this work, we classify WSNs based on their scale, and apply topology management protocols in either centralized or distributed manner. Our protocols consider context information (e.g. the battery status of sensors, existence of deployment voids, etc.) as important parameters.

For a WSN of small physical dimension, nodes are statically connected in a hierarchical structure, with the data sink as the tree root. According to the context, we construct sub-trees with dynamic cluster sizes to satisfy both end-to-end delay and load balance in the network. Large networks tend to be distributed, where nodes need to be organized locally and communications are carried out over dynamic routing paths. In this case, we divide a WSN into hierarchical hexagonal cells, where only one set of the triangular sub-cells with the same relative position in the hexagons are set to be active. One node from each active sub-cell is kept active for routing activities, while the rest of nodes are in energy-saving mode. Such method not only addresses the energy conservation of sensors, but also prepares the network for efficient geographic routing algorithms.