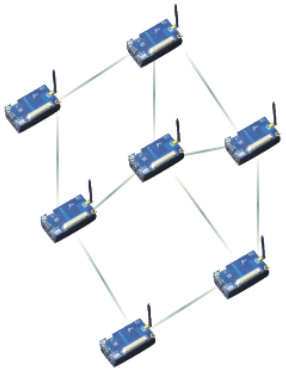
Bachelor Thesis

« Energy Simulation of Wireless Sensor Network Communication »

Overview

Communication is the most energy consuming process in wireless sensor networks. The available energy limits the lifetime of the node depending on the capacity of its battery, the hardware, the software, and the communication protocol. A prediction of this lifetime can be done analytically or in a simulation prior to physical assignment. A typical wireless sensor node consists of four main components: microcontroller, transceiver, sensor, and energy supply. Each component has a specific energy consumption, which is depending on its current state of operation. The software defines the sequence of states. However, some influences are not predictable in advance, because the node is integrated in a network, which causes communication errors and unique unpredictable timings. This is part of the simulation to gain a more reliable lifetime prediction for a wireless sensor node inside a wireless sensor network.



Work Description

The task of this thesis is to design and implement an energy model for a wireless sensor node focusing on the communication protocol. The energy model is represented using a hierarchical finite-state machine. The states of the model correspond to the states of the hardware components. Depending on the time in each state and the transitions between the states, the total energy is calculated. The aim is the simulation of multiple nodes organized in a network communicating with a data sink. The code is implemented in C++ and integrated in the OMNeT++ framework.

A sample application is given and can be extended in this thesis:

- A sensor measures temperature periodically
- Microcontroller processes the data
- Transceiver transmits the data using CSMA on a standard PHY and MAC layer
- The data sink acknowledges the packet, which triggers a retransmission in if not received by the node
- All components use sleep modes when idle
- Use of a single hop network, a single data sink and a network size of about 100 nodes

Requirements

- Experience or interest in network simulation using OMNeT++

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- C++ programming knowledge