Design and implementation of a traffic-adaptive medium access protocol for wireless sensor networks

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Expected duration: 6-8 weeks

Introduction

Medium access (MAC) protocols are a crucial instrument in minimizing communication and energy expenditure in wireless sensor networks. Many different protocols and protocol families exist, TDMA (time division multiple access) being one of the most widely used paradigms. In TDMA, each node is assigned its own slot during which only this node can send data. Thus, interference between nodes and packet collisions are minimal. However, the slot assignment mechanism usually only makes sure that each node has a unique slot and does not take into consideration the communication delay caused by inappropriate slot assignment for neighboring nodes. For example, if some node forwards data to one of its neighbors and this neighbor is assigned a slot just before the node's one, it will need to wait nearly a full round of slots to be able to forward the data itself. Thus, a traffic-aware and adaptive TDMA scheduling mechanism is desired.

Project Description

The goal of the project is to design and implement a traffic-aware adaptive TDMA-based MAC protocol for wireless sensor networks. The starting point of the project will be an existing TDMA MAC protocol like LMAC or SMAC. The designed protocol will monitor the routing traffic in its neighborhood and flexibly change the slot assignment to minimize delay. Machine learning techniques like reinforcement learning or decision tree learning may be used if appropriate.

Project Requirements

Atelier V: Introduction to Wireless Sensor Networks. Willingness to implement and test the protocol on a WSN hardware testbed.

Expected Outcome

An WSN testbed implementation of the designed protocol with comparative experimental results against a non-adaptive MAC protocol. The design and experimental results wil be summarized in a research publication for a workshop or a conference.

Acquired Experience/Knowledge

Excellent understanding of medium access protocols, design and implementation of communication protocol for wireless sensor networks. Research experience in independent problem analysis and solutions, design and implementation of a novel and non-trivial communication protocol.

Project Organization

The project will be under the supervision of Anna Förster and Antonio Carzaniga. Together with them you will analyze the problem, design a solution, implement it and test it on the already existing WSN hardware testbed at the Faculty of Informatics.