Research Project and Seminar


Motivation
In the past years, the field of sensor networks with energy-neutral-operation (ENO) has drawn considerable research interest. Apart from using harvested energy directly, ENO systems also store energy to bridge time spans with low energy income to ensure uninterrupted operation. For budgeting stored energy, numerous variants to adapt the duty cycle or to schedule tasks of a sensor node exist. However, modern sensor nodes offer MCUs with high computation power and often multiple sensors or radio modules. This allows for advanced processing of sensor data but consequently requires more complex energy-aware task scheduling, since various dependencies between components exist.

Often, different program flows have similarities, e.g. monitoring temperature and fine dust requires transmitting data over the radio interface at the end. If these program flows are scheduled independently from each other, energy is wasted because the radio interface is used twice although the data of both sensors might have fitted in one data packet. For efficient energy-aware scheduling of more complex sensor nodes, it is key to find these dependencies.

Work Description
Based on the low-power STM32L0 MCU, a framework for program flow description is implemented. The STM32L0 acts as energy-scheduling co-processor for a more powerful main processor. Based on the existing communication interface, program structures are exchanged and analyzed.

This embraces definition of task activities, automated analysis of program flows and extracting unique task schedules. Additionally, minimal and maximal distances between tasks as well as energy budget influence the resulting task schedule. At the end, the approach is evaluated to quantify achievable energy savings.

Prerequisites
The following skills are expected for a successful thesis completion:
- Practical experience with programming in C
- Experiences with STM32 micro controller series (beneficial)
- Profound reading and understanding of English texts
- High degree of autonomous working and self-motivation

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