Prof. Dr. Falko Dressler
Distributed Embedded Systems – CCS Labs

PADERBORN UNIVERSITY

CCS

Bachelor Theses

Environmental Monitoring for Vehicular Networks

A common application for wireless sensor networks is environmental monitoring in a distributed and energy efficient fashion. In such a scenario multiple nodes equiped with a variety of sensors are deployed over a target area and then measure different properties of the environment. The measured data then has to be aggregated and transmitted to a central node that collects and stores these information. In a final step the data has to be analyzed and visualized.

Typically the nodes of such a sensor network are battery powered and should therefore be optimized for low energy consumption. Also the location of the nodes does not change such that routing information can be assumed to be static.

Instead of using fixed nodes, we want to create a network of mesurement nodes that are attached to cars [1]. This has the advantage, that measurements can be obtained from a wide range of locations with fewer nodes, but it complicates the communication between nodes due to the mobility. Since a car has a large battery that is recharged during driving energy consumption is not the limiting factor for such a scenario.

■ Goals of the thesis

The goal of this theses is to create such a network of mobile sensor nodes to monitor the air quality and noise emmissions within Paderborn.

First a suitable communication protocol using a store-and-forward approach has to be implemented and evaluated in a simulation environment. This protocol design should be conducted using the Veins simulation environment that supports a large number of driving cars in a city and also simulates the communication over a wireless channel.

After the communication protocol has been evaluated, a prototype using existing hardware has to be built to show the feasibility of the simulated approach. As hardware platform we use TelosB nodes that run Contiki as operating system and have a IEEE 802.15.4 compatible chip for wireless comunication. This prototype can then be used to collect real world measurements in Paderborn that can then be visualized using a heatmap.

■ Keywords

C, C++, OMNeT++, Hardware

[1]   D. Hasenfratz, "Enabling Large-Scale Urban Air Quality Monitoring with Mobile Sensor Nodes," PhD thesis, ETH Zurich, 2015.

Contact:
Johannes Blobel <blobel@ccs-labs.org>