

Bachelor-Thesis

Development of a Framework for Controlling Behavior of Wireless Low Power Transceiver for Teaching Purposes

Abstract

The current Communications Network Lab is structured into several blocks related to basic selected topics of the corresponding communications networks lecture. The aim of this thesis is to develop a new block, where students get a deeper inside of the physical transmission on a wireless media. Students should investigate the influence of different kinds of modulations, channel-codings, scrambling and power settings on the achievable bit error rate and throughput of the link. After analyzing the bit level communication, students should experience, how frames composed of several bits could be effectively transmitted on the medial. They will learn, how the frames size and frame components like the preamble size will influence the achievable throughput for a given frame error rate.

A basic setup exists for carrying out experiments, consisting of a "CC1200 Low power and high performance wireless transceiver" from the company Texas Instruments that is attached via the Serial Peripheral Interface (SPI) to an Single Board Computer (BeagleBone Black) running Linux operating system. On the BeagleBone Black the CC1200 device will be controlled by a Web-Server via the Socket-Interface. Thus, students are able to control the devices over the Internet by a common browser like Firefox, Chrome or any compliant variant.

In this thesis the goal is to changed and extended the basic setup by multiple browser windows that open the possibility to configure experiments and carry out measurements. E.g. given a generic frame format, students can modify the frame components (e.g. the preamble size and shape) and answer the question: How long it the optimal preamble length ? This question will be answered by measuring the frame loss rate by a given preamble length. Another question could be: Is it useful to use a combination of manchester coding and scrambling by a given bit error rate ? Therefore the new browser windows should be composed flexible as possible to allow answering as maximum questions of students.

Due to the fact, that this bachelor thesis will be used for teaching purposes, the work will be monitored by the business and employment studies faculty. This will ensure, that basis didactical approaches and concepts and are taken into consideration. This includes project-oriented methods for problem-solving learning and approaches for carrier training learning.

Content

To reach this aim the following task should be done:

- Assessment of the current setup and identify necessary changes and extensions,
- definition of experiments and their learning effect,
- developing visualizations of controller and frame components in browser windows and extending Web-server functionality,
- testing with student volunteers and documenting their time requirements and outcome (did they catch the expected learning effect by means of report writing).
- Following documents should be written:
 - * thesis documentation and
 - * writing a student script (in HTML5) including animations if necessary and
 - * describing sample solutions.

Requirements

- It would be preferable, that the Protocol Programming Lab has been successfully attended.
- Fundamental knowledge in the programming language C or C++ and Java Script.
- Basic knowledge of the Linux operating system.
- Pleasure in teaching.