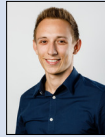




Eric Bruggmann

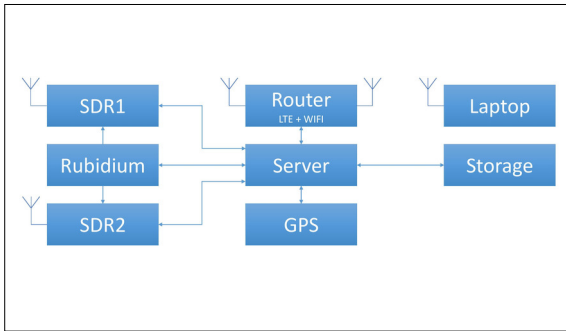


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Subject Area	Wireless Communications

Web-Based Control System for RF Measurements Using SDRs

Development and Installation in a Wireless Research Vehicle



Block diagram of the hardware

Introduction: The Institute for Communication Systems (ICOM) at the University of Applied Sciences Rapperswil (HSR) would like to combine modern mobility with state-of-the-art technology and innovation. For that the ICOM intends to extend an electric car with wireless equipment. This may be used for realisations of customer tasks or research and teaching. The car should provide signal power measurements of available radio-communication services, detection of radio interferences and measurements of radio channels spectrum occupancy for example. To this end, constructional changes at the vehicle are required. On top of that a lot of radio frequency (RF) measurement equipment needs to be acquired. Furthermore, an operational concept including a software needs to be developed. For a maximum of flexibility without changing the hardware, a Software Defined Radio (SDR) based system with a powerful computer system for data storage and processing is aspired.

Objective: The assignment of the project is to put the selected hardware into operation, to develop an operational and control concept as well as an appropriate control software. The aim is a modular, configurable system, which provides the necessary basic functions like: data entry, storage, processing, display and upload. The system needs to be expandable with modules which are easy to implement into the framework. A mandatory goal is to create at least one module to show an example measurement. At the end the system needs to be tested in the car.

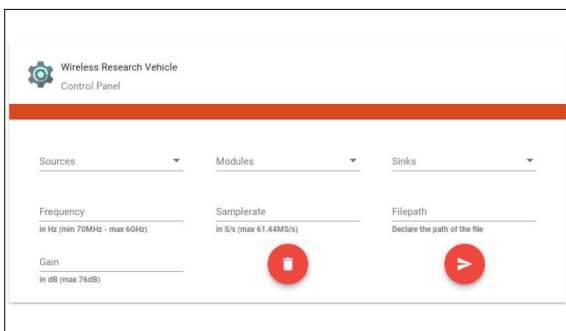


Wireless research vehicle of the ICOM

Procedure / Result: The best possibility to meet all the requirements is a web-based control system combined with two B210 USRPs from Ettus Research. The user is able to operate the SDRs over a graphical user interface (GUI) to start and stop different measurements from the passenger seat of the car. There is an internal WLAN router in the car to connect the Flask framework powered server with the client. When a measurement is started, the parameters are transmitted over this network to the car-internal server. Afterwards the server configures the SDRs and starts the measurement. When the measurement is stopped, the data is saved on the storage and is ready for post processing.

The web application permits the setting of parameters like frequency, sample rate, gain as well as the adjustment of source, sink and modules. With the modules the user has the possibility to add blocks for signal processing between the source and sink.

They can be easily created with GNU Radio Companion and translated to a Python file, which is straightforward to implement. Simultaneous measurement applications are supported by scaling hard- and software, for example with additional SDRs. Because of the usage of Material Design, it was possible to create an easy-to-use GUI, which makes it very simple to start, stop and monitor measurements. Features like allowing number inputs in scientific notation, checking valid input formats, status feedbacks and many more support the user.



Control panel for the configuration of the RF measurements