technische universität dortmund

Fakultät für Elektrotechnik
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## *Research Field: Control and Automation Systems*

*Virtualization and validation of a smart grid automation system*

There is an enormous increase in the number of decentralized energy generation in the past few years, which leads to the consideration of sophisticated automation schemes for the power system in consideration. The automation and autonomous operation of components in the power system becomes an essential part of the futuristic smart grid approach. This requirement administers the need to develop smart grid algorithms and implement the control schemes using measurements acquired from several points of the grid. The goal of these algorithms is to determine optimal system configurations in real-time and execute intelligent measures guiding the grid towards the best operation point.

One of the smart grid functions has already been implemented on a CIGRE low voltage test network and successfully validated using the hardware device available at the ie$^3$ lab. The next step is to validate the working of the smart grid functions in a more complex environment. While it is not possible to use individual hardware devices at every point of measurement on the network model, the use of virtual devices becomes necessary. To successfully achieve this task, a virtual measurement device has to be implemented in the real-time simulator analogous to the hardware devices and the existing algorithm has to be optimised for complex scenarios. In order to carry out the verification of the virtualized system, a suitable test process needs to be developed.

As part of this thesis, concepts for virtualizing the smart grid automation system, in which the smart grid functions are implemented, shall be evaluated. Further, the smart grid function will be implemented on the virtualized system. To verify the functionality of the virtualized system, tests using a real-time simulator existing at the ie$^3$ lab shall be carried out. This includes the simulation of measurements at several nodes of a grid model which has to be created on the real-time simulator.

This work is recommended to be structured in the following way:

- Literature review of state-of-the-art voltage control possibilities
- Understanding the existing smart grid function implementation
- Determination of required improvements for the current algorithm
- Deploying the suitable improvements in the hardware platform
- Implementation of the virtual device on the RTS for measurement simulation
- Validation of the optimised smart grid function using the real-time simulator
- Drawing of conclusions and recommendations
- Documentation of the thesis

The result of this work is to be reported in a presentation.

- Die Arbeit kann auf Englisch oder auf Deutsch geschrieben werden

Literature:

- R. Palaniappan; F. Richter; B. Bauernschmitt; D.Hilbrich; C.Rehtanz: ***Implementation and Validation of Decentralized Smart Grid Functions using Distributed Measurement Acquisition Devices***, 6th IEEE International Conference onPower Systems (ICPS), New Dehli, March 2016

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