



Master Thesis

The group [Smart Grid Testing](#) (OFFIS R&D division Energy) has an announcement for an immediate master thesis.

Resilient Communication Architecture for ensuring the Reliability of Home Energy Management Systems (HEMS)

BACKGROUND:

The number of active consumers has been growing in the distribution power systems. Home energy management system (HEMS) plays a main role as a central system in monitoring, controlling, and communicating the distributed energy resources (DERs) units of active consumers. These DERs' potential can be utilised for congestion management at low voltage (LV) systems. Direct control of the DERs over a controllable local system (CLS) using a demand response (DR) algorithm can be realized in HEMS. Reliable communication between DERs and HEMS is essential for managing the flexibilities effectively. In case of faults in the communication, the flexibilities could not be utilized as planned and could have cascading effects to the upper level e.g., congestion management could not be done using these planned DER units.

OBJECTIVE:

This master thesis will investigate on the communication protocols for home energy management systems such as EEBUS, OpenADR, etc. Additionally, detection algorithms of faults in communication and/or resilient communication architecture will be developed and implemented to ensure reliable communications between HEMS and DERs. Communication models will be developed and tested using control hardware-in-the-loop (ChiL) for testing the control algorithm with industrial hardware.

Your tasks are the following:

- > Literature review and research on communication protocols of HEMS
- > Develop a communication model, detection algorithm, and redundant communication to ensure the reliability
- > Defines use cases for the evaluations (will be discussed with the supervisors)
- > Perform and evaluate the ChiL test with real hardware devices in the laboratory
- > Compilation of the experiment performance analysis into a master's thesis report.
- > Depending on your interest and the quality of the thesis, the work can also be disseminated into a conference paper or a journal.

The prospective master's thesis must be described in a proposal agreed upon between scientific advisors and students as well as following the guidelines of the University.

YOUR PROFILE:

- > Electrical engineering or computer science background
- > Good knowledge of at least one programming language or the ability to learn this quickly is required such as C++ and/or Python
- > Good knowledge of MATLAB Simulink and/or experience with RevPi
- > Willingness to acquire knowledge of using a real-time simulator and communication protocols
- > Ability to work independently and be a team player
- > You have good communication and writing skills in English (German is a plus)

OUR OFFER:

- > You will have the opportunity to gain experience as an assistant researcher and participate in interesting and innovative industrial project
- > You will be supported by a team of researchers from various scientific fields as well as technical infrastructures of the OFFIS Energy Laboratory
- > A pleasant working environment within a highly competent and international team
- > An opportunity for a WiHi position during your master thesis ca. 39 hours per week

If you are interested, please simply write an e-mail to the address below.

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