PhD offer at LIG/G2Elab

Smart metering for smartgrids applications

The general objective of the thesis is to set up a hardware and software infrastructure with the purpose of demonstrating various "smart grids" technologies based on smart metering. This infrastructure will make it possible to simulate a low voltage network, as closely as possible, from both the electrical viewpoint (observing e.g. voltage drops) and from the telecommunication viewpoint (taking into account e.g. signal attenuation). The tool will ultimately enable the testing of various smart grids applications of the smart metering infrastructure, such as network supervision (SCADA, state estimation, etc.) and network control (e.g. partially curtailing a charging station for electric vehicles whenever the electrical network is congested).

The experimental set-up to be developed by the doctoral student will consist of a low-voltage laboratory network, equipped with smart meters, and adequately instrumented for measurements. To limit the size, the cost and the power consumption of this device, the electrical network will have nominal voltage (230V) but with scaled-down currents. The power lines will be modeled by an aggregate circuit that is valid at both 50 Hz and, as far as possible, at 35-91 kHz, so that correct voltage drops and a realistic attenuation of the PLC signal can be observed simultaneously.

First, the student will get familiar with the modelling aspects of electrical networks, with the various technologies involved (G3 PLC, DLMS / COSEM, “Teleinformation Client”...), and with the different smart grids applications of the smart metering infrastructure (supervision, control).

Second, the PhD student will specify the elements and tools of the infrastructure:

- characteristics of the in-laboratory low-voltage network;
- characteristics of the measurement setup that will collect all the necessary data;
- specifications of the generic software blocks that will make it possible to quickly implement a wide variety of network supervision and network control strategies.

Third, this infrastructure will be implemented (with the help of the G2Elab technical support team, as far as the low voltage network is concerned) and validated. The relevance of the tools and their genericity will then be demonstrated by implementing proofs of concept of a few network supervision and network control strategies.

The partial reuse of this infrastructure is envisioned for another type of experimental setup, namely an "hardware in the loop" setup where the physics of the electrical network would be virtualized in a real-time digital simulator while the smart metering infrastructure would remain physical. Some of the tools developed during the thesis could also be validated on Enedis' experimental platforms, either in laboratory or on a real low-voltage network separated from the public grid and specifically dedicated to testing.

Keywords: electrical engineering, industrial informatics, telecommunication networks, G3 PLC, distributed programming, supervision, control, smart metering, smart grids.

Required skills

- Master's degree in Electrical Engineering.
- Some knowledge of industrial informatics, and software engineering with an emphasis on distributed programming.
- Taste for practical work.
- French and English read, written and spoken.

Would be a plus :

- A first research or publication experience would be highly appreciated.
- Experience with smart metering technologies.
- Knowledge in the field of smart grids.

Funding

This thesis will be funded in the framework of a partnership between ENEDIS and Grenoble INP. Monthly gross salary: about 2500 euros (benefits, e.g. health insurance are included) over 36 months (November 1st 2017 – October 30th 2020).

Location

Laboratoire d'Informatique de Grenoble (new IMAG building, Grenoble, France) and G2Elab (Grenoble, France), with occasional visits to the ENEDIS facilities (Paris, France).

Contacts

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Application deadline

Applications are due before October 30st, 2017.

Bibliography

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