

FM4017 Project

Title: SecurEL Sub-Pilot module: automated protection relay settings for dynamic grid operation

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External partner: Elvia AS

Task background:

There is a need to automatically import UK values (tripping values) from IEDs (protection relays) into SCADA to maintain an updated, real-time snapshot of the grid and understand how the UK values affect dynamic grid operations. This also makes it possible to verify that the UK values are correct according to the relay plans. By simulating these settings, one can further verify whether the actual UK settings meet the necessary functionality for detecting and isolating faults in the grid. The motivation is to utilize the grid's capacity more optimally than in current theoretical models. Having a real-time overview of the power system enables dynamic operation aimed at higher capacity. It is also desirable to adjust the UK values in the protection relay settings in the IEDs remotely from SCADA. The adjustments should be based on simulations performed in a simulation dashboard by the operator using the retrieved UK values from the IEDs, sensor measurements and switch indications from SCADA and the grid model retrieved from GIS/NIS.

Task description:

The project will build upon Elvia's existing SCADA system and design principles, while introducing extended functionality to be able to change the UK values from SCADA. The SCADA prototype can be built and designed using suitable development tools, but the solution should be similar to Elvia's existing SCADA GUI, so that the principles easily can be implemented.

The simulation dashboard prototype can also be created using suitable development tools of choice, but it should be designed as a web-based solution accessible through a standard web browser. The dashboard should have a high focus on usability for the operators.

In addition, a data flow simulator should be developed to visualize the data flow between the main components related to the project. The data flow simulator should demonstrate how the UK values from the IEDs flow upstream through the RTU, into SCADA and to the simulation dashboard. It should also demonstrate how the data flows downstream from SCADA to the IEDs. The simulator can be seen as a dynamic system sketch with some basic user functionalities such as buttons, measurements etc. Network infrastructure can be neglected in the simulator.

The outcome of the SCADA prototype and simulation dashboard prototype should serve as an inspiration for future implementation at Elvia, and the data flow simulator can be used to demonstrate the data flow to more effectively explain the project's objectives to relevant stakeholders. The data flow simulator, SCADA prototype and the web-based simulation

dashboard prototype should all be interconnected so data must be stored in a suitable location where it is accessible and kept up to date and available.
The student must establish a project organization specifying the resources that should be included in the project.

The project should result in the following outcomes:

- **Project organization** – A overview of the resources and roles required in the project.
- **Data Flow simulator** – A dynamic visualization that demonstrates how the UK values and data flow between the main components such as IEDs, RTU, SCADA, GIS/NIS, simulation dashboard etc.
- **SCADA prototype** – A prototype GUI based on Elvia’s SCADA GUI with extended functionality for retrieving and adjusting UK values.
- **Web-based simulation dashboard prototype** – A web browser tool with high usability enabling operators to perform simulations and evaluate the results of the recommended UK values.
- **Shared data storage concept** – A simple data storage solution that ensures that all prototypes share and can access the same data.
- **Technical report** – Documentation of the project work following the IMRAD structure.

Student category ITA¹ - The project is reserved for an online student employed by the company Elvia AS.

Is the task suitable for students not present at the campus (e.g. online students)? Yes

Practical arrangements:

It is a requirement that the assignment be carried out solely by the online student employed by the company (Elvia AS), as the project work potentially involves access to highly sensitive data. All types of highly sensitive data must be anonymized in the report and presentation.

Signatures:

Supervisor:

Hans-Petter Halvorsen, 2025.09.25



Student:

Knut Erland Strætkevorn, 2025.09.26



¹ ITA = IT and Automation