

Senior Design Project Description for FALL 2016

Project Title: Meter and Device Placement for Volt/Var Control in Distribution Systems (DUKE_METER)

Supporter: Duke Energy

Supporter Technical Representative: ASSIGNED

Faculty Mentor: ASSIGNED TBD (check one)

Single Team Dual Team (check one)

Personnel (EN/ET): 3 E, 2 Cp, Cv, M, SE

(Complete if the number of students required is known)

Expected person-hours: (250 per student)

Description of Project:

Increased electrical energy usage and network intricacy has mandated a change in how electric utilities model and monitor their system. A transition from manual modeling using paper maps to electronic Geographic Information Systems (GIS) to keep accurate models of the transmission and distribution networks has been needed to keep up with this complexity. Telecommunication improvements and implementation of Smart devices have given the utilities increase in data from the devices and control of the devices using Supervisory Control and Data Acquisition (SCADA) software. The leveraging of GIS data and communication and control of devices on a distribution network has given rise to applications to help observe and operate the grid optimally called Distribution Management Systems.

A relevant application of advanced Distribution Management Systems (DMS) is their use in managing voltages in distribution feeders with high penetration of utility-scale distributed photovoltaic (PV) sources. Specifically, this project will investigate applicability of using Integrated Volt/Var Control (IVVC) strategies to mitigate voltage variations caused by high PV penetration. The objective will be to define the monitoring and control devices needed, and where in the system they should be placed, in an attempt to minimize number of monitoring points (and data accumulation) while maximizing system visibility to achieve IVVC for voltage management.

Initial Project Requirements (e.g. weight, size, etc.):

This project will use the Alstom Integrated Distribution Management System (IDMS) software to manage voltages in a distribution system with high PV penetration. The project objective will be to identify critical monitoring points in the distribution system and to investigate most optimal placement of metering/monitoring and control devices as needed.

Software platforms used:

- Alstom E-terradistribution
- Python for E-terradistribution
- RSCAD (for RTDS)
- Hardware devices to interconnect to RTDS software



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Expected Deliverables/Results:

- Equipment Specifications (Bill of Materials)
- Installed and Configured IDMS software
- Distribution Power Flow and Bus Load Allocation convergence of all stations from provided model
- Modeling of utility-scale PV
- Selection of days with a wide array or variation representative of a year Baseline simulation of power flow on the distribution network for the subset of days using python for e-terradistribution
- Investigation of critical monitoring points and optimum locations of meters and control devices
- Evaluated results on voltage management with devices connected at various feeder locations
- Integrated DMS and IVVC management architecture connected to SCADA platform

List here any specific skills or knowledge needed or suggested (If none please state none):

Recommended:

- Taking (or having taken) power system analysis courses
- Power and energy concentration
- Basic programming skills
- Knowledge of power system analysis tools and software

Specific skills required

- Ability to work in a team – while this may seem obvious, it is rather important.
- Computer Engineering Majors should be able to work with an embedded system and be comfortable with the Linux operating system.