Power Systems Protection Laboratory through University-Industry Partnership

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Introduction

- The 2007 National Science Foundation workshop on "*The Future Power Engineering Workforce*"
- Process for partnership and collaboration with regional utility company
- Goals and strategy for developing the protection lab
- Student-Initiated Learning Modules
- Plans for other Innovative Modules

2007 National Science Foundation workshop

- "*The Future Power Engineering Workforce*" convened of participants from government, academia and industry
- Group identified key drivers of the projected future shortage of power engineering graduates
- Recognized lack of university support power engineering programs
- Persisting poor image of the power engineering field
- Some irrelevance in the higher education experience in relation to professional practice

- One of several recommendations is to build "*strong and ongoing industry relationships with universities to enhance educational programs*" and to support faculty teaching initiatives

Process for partnership and collaboration

- Periodic visits to utility substations
- Employment of graduates from the power program
- Representation of utility industry on the EE technical advisory board
- Review of power engineering curriculum for relevance
- Visits to assess laboratory environment
- Creation of equipment layout plan and solicitation of vendors to support initiative
- Delivery of equipment by vendors and training for students
- Setup and development of digital training modules
- Inclusion of instruction resources from utility into power systems coursework
- Commitment of funding from utility partner to continue innovation

Goals and strategy for developing protection lab

- Creating a learning environment that project an image of the future power engineer
- Making the higher education experience relevant by integration of current industry practices
- Making education more interesting by engaging students collaboratively
- Building strong and ongoing partnership with the industry

Student-Initiated Learning Modules

- RTU (SEL 3530-RTAC) / Relay configuration and development of basic substation HMI
- RTU(Novatech Orion LX) interfacing to SCADA meter and relays, and remote control of substation through Orion LX webserver HMI
- Voltage management and utility economics using ETAP
- Protective device coordination using ETAP STAR

Intro to Module 1

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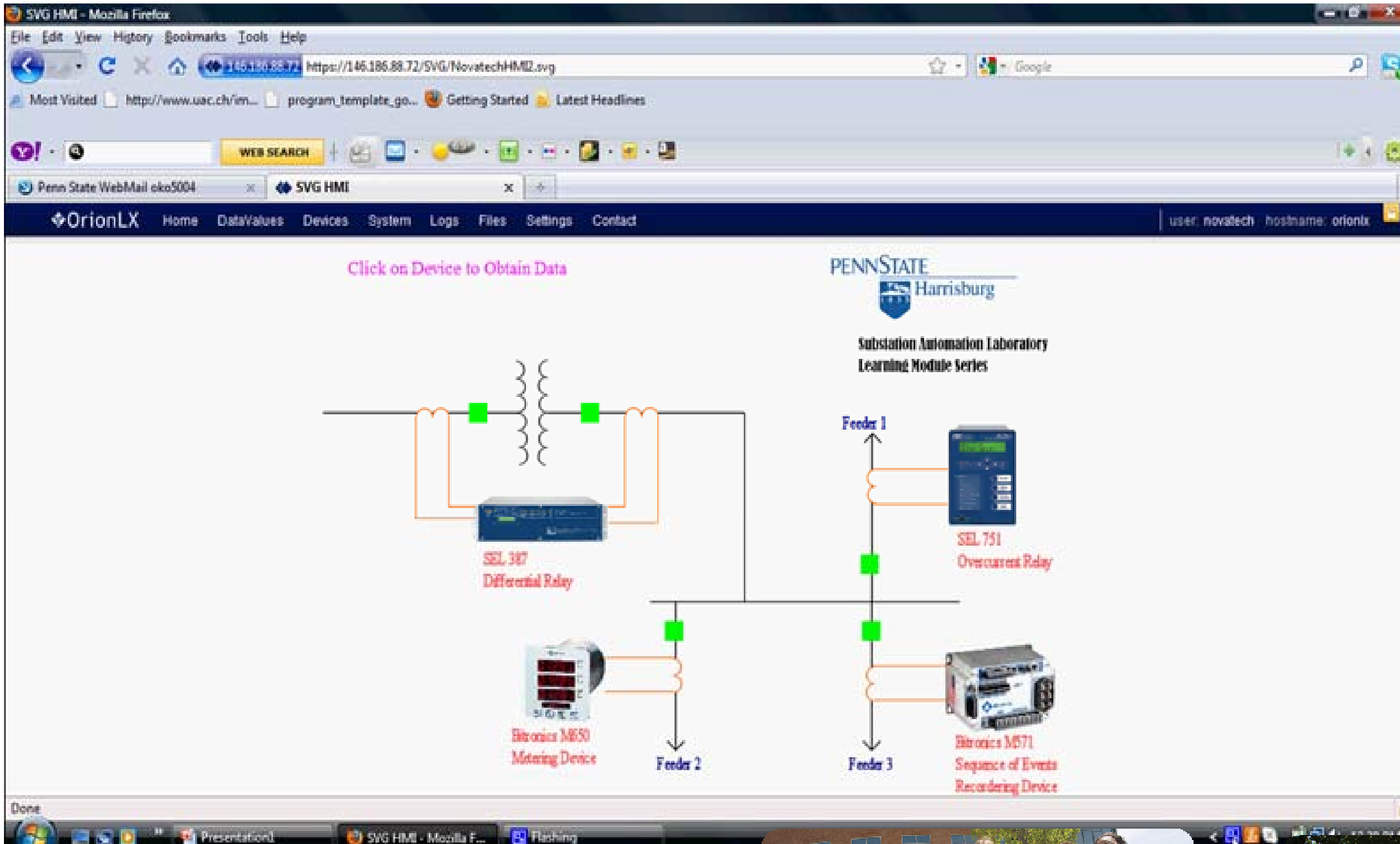
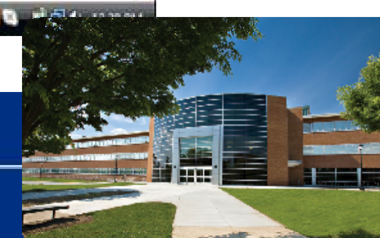
HMI for Orion LX RTU for substation automation





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Process matrix for setting engineering objectives

	Requirement Statement	Function and Application	Communications Protocols
	Process matrix for setting engineering objectives		
A.1	The system should automate data acquisition on a minimal number of platforms.	Use M650 (SCADA Meter), M571 (SER-Sequence of Event Recorder), for metering of voltage, current and phasors. Derive real and reactive power and system frequency	IEC 61850, DNP3, Modbus, SEL. Ethernet, Serial EIA232/485
A.2	The system should employ a user-friendly automation and control interface that also provides complete system situational awareness.	Create HMIs for interaction with power system using Novatech and SEL web servers.	TCP/IP
A.3	The system should provide the ability to simulate digital relay operation without the generation of actual power system fault currents.	Use SEL – 387, SEL – 751A, SEL – 421 to set up remote trip/close control of CB via web based HMI	TCP/IP, IEC 61850, DNP3, Modbus, SEL. Ethernet, Serial EIA232/485
A.4	The system should use interactive instruction methods that quickly bring students up to speed on the various software and hardware platforms.	Use CamStudio and Powerpoint to create learning modules and tutorials	
A.5	The system should provide electrical isolation from primary currents and voltages for safety.	Use CTs and PTs for current and voltage scaling	
A.6	All system RTUs (Remote Terminal Units) shall be able to integrate multivendor IEDs (Intelligent Electronic Devices).	Use Orion LX, SEL3530 RTAC –Real Time Automation Controller) as polling data concentrators to demonstrate communication via multiple protocols	UCA, IEC61850, DNP, SEL, Modbus

Tasks addressed in learning Module #1

- Use of SEL 3530 RTAC as RTU
- Specification of communication protocols for devices, connection type, communication type, speed
- Setup of power system data input and calibration
- Use of acSELerator to configure the RTU to poll data from devices for SCADA
- Setup of breaker control communication and trip code to operate circuit breaker
- Migrating data to RTAC-RTU
- Using Diagram Builder to design embedded web-based HMI
- Associating tags with icons
- User interaction with remote substation through HMI

Plans for other Innovative Modules