Real Time Meter Data to Metrics

• Brian Brigandi
  – Automation and website

• Mark Joseph
  – LabVIEW and meters

• John Sisk
  – Automation and meters

• Olivia Trinko
  – Communications and LabVIEW

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Supervising Professor
Outline

• Past Accomplishments – Olivia Trinko
• Present Work – Mark Joseph & Brian Brigandi
• Future Plans – Johnathan Sisk
Prior Research

- LabVIEW user interface for power quality meter data
  - Input current and voltage waveforms
  - Output results graphically and numerically with alerts
  - Uses historical data
Metrics

- Asymmetry factor (even harmonics)
- Total harmonic distortion
- CBEMA compliance (voltage sag/swell)

\[ THD = \sqrt{\sum_{h>1}^{h_{\text{MAX}}} I_h^2} \]

Project Goals

• Incorporate real time data

• Three steps
  – Learn LabVIEW and research power quality meters
    • National Instruments LabVIEW training
  – Integrate real time data into LabVIEW
  – Display real time power quality metrics using existing program as a foundation
Importance

• Make power quality meter information readable
• Real time data for continuous monitoring
• Meet industry standards
• Provide reliable power
• Standardize power quality monitoring
Power Quality Meters

• Provides continuous monitoring of three phase system and following parameters
  – RMS and Instantaneous
  – Current
  – Voltage
  – Frequency
  – Real/reactive power
  – Energy use
  – Power factor
Meter Options

- EATON Xpert 8000
- Schneider Electric PowerLogic PM800

Sources: http://www.bomara.com
http://www.schneider-electric.com
Meter Options

- **EATON Xpert 8000**
  - Locations on campus and at CSU Powerhouse
  - Webpage IP compatible (on CSU network)
  - Waveform capture **IS** available online

- **Schneider Electric PowerLogic PM800**
  - Located at CSU Powerhouse
  - Webpage IP compatible (on CSU network)
  - Waveform capture **NOT** available online
Methods of Access

• **LAN Connection** - Connection to Eaton interface via Ethernet cable

• **Remote Connection** - Connection to Eaton interface via wireless connection

• **MODBUS Connection** - Connection to raw Eaton Meter data via cable connection
Semi Real-Time Metering

• Goal of our project:
  – to have a process that saves/runs a waveform sample every 10-15 seconds
    • Waveform window contains 256 samples (IEEE 1159)
    • Refreshing the waveform and saving -> ~3-4 seconds
    • Running the file and waiting for metrics -> ~6-9 seconds
  – Labview accesses the file, saves it and runs the waveform data to access the metrics
  – Continuously runs a loop of this process
  – Does all of this without user help
  – This is where AutoHotKey comes in
AutoHotKey Programming

• Free, scriptable desktop automation w/ hotkeys
• Script created in Notepad
• File saved as *.ahk
• Double click on file to activate hotkey
• When the script is active, hotkeys start the process of saving waveform data from EATON meter website
AutoHotKey Programming

This hotkey takes over control of the keyboard and mouse and starts sequence

`Sleep, 1000` ; allows for 1 second introduction
`Click 42, 365` ; clicks 'BC'
`Sleep, 1000` ; rest
`Click 41, 351` ; clicks 'AB' This resets the waveform
`Sleep, 1000` ; rest
`Click 848, 841` ; clicks save
`Sleep, 1000` ; rest
`Click 387, 339` ; clicks save in the second window
`Sleep, 1000` ; rest
`Click 106, 88` ; clicks yes
`Sleep, 3000` ; rest

'Sleep' is a pause in system commands allowing the computer to catch up
'Click' controls the mouse and clicks in the given coordinates
In the final design we will have the LabVIEW interface and EATON meter website open in half the screen as shown above.
Mouse Clicks
AN Line-Neutral Voltage (200 ms avg)

Voltage:
- AN: 282.1 V
- BN: 284.5 V
- CN: 284.0 V
- NG: 0.0 V

Current:
- Average: 126 A
- Phase A: 123 A
- Phase B: 120 A
- Phase C: 133 A
- Neutral: 0 A
- Ground: 0.000 A

Frequency: 59.97 Hz
Next Steps with automation

• Automation will include LabVIEW
• Software will be upgraded to be more efficient
• Saved to same file each loop -> saved to new file each loop
  – Ex: waveform1, waveform2, etc..
  – Allows user to access files that showed a disturbance in waveform quality
  – Will explore saving to a database/server
First Semester

1. Learn LabVIEW & Research Power Quality Meter Technology
2. Obtain Power Quality Meter Access
3. Acquiring Data From Power Quality Meter

Second Semester

1. Process Data For Last Year’s Program
2. Update Existing LabVIEW Program For Real-Time Data
3. Testing
Implementing Real-Time Data to LabVIEW

• Understanding how last year’s program works so we can make the necessary modifications

• Using the AutoHotKey program, we need to store waveform data into a file
  – Automated saving process
  – Storage of saved files

• Ask LabVIEW to read data from this file

• Test our program with last year’s data
Wireless Connection

• Currently connected to meter via Ethernet cable
• Investigating a wireless connection through the CSU server
• Current issues
  – Java Updates
  – Security Settings
What If...

• The AutoHotKey program doesn’t work?
  – Try accessing data using existing Powerhouse MODBUS connection

• We are not able to get real time data into the existing program?
  – Simulate real-time data in LabVIEW and implement it into last years project

• We finish our initial objective with time to spare?
  – Add additional metrics
    • Power Factor, C Message Index and Crest Factor
Future Project Teams

- Detailed documentation of our findings
  - Meter access instructions
  - AutoHotKey instructions
  - Contacts list
  - Basic understanding of LabVIEW program
Acknowledgements

• Dr. Sid Suryanarayanan  
  – Supervising Professor
• Schneider Electric  
  – Customer
• City of Fort Collins Light and Power  
  – Kraig Bader, Industry Mentor

• Ed Minnock, Project Plan Support
• Art Lizotte, Test Plan Support
• National Instruments, myRIO Workshop

• Colorado State University Powerhouse Energy Campus  
  – Kirk Evans, Power Quality Meter Support
  – Carol Dollard, Campus Meter Information
  – Chuck Sawyer, Campus Meter Information

• Colorado State University  
  – Olivera Notaros, Head of Senior Design
  – John Seim, Website Support
  – Ginger Morehouse, Industry Relations