ALSET Lab's Research Tools

Powered by National Instrument's Technologies

LEAD
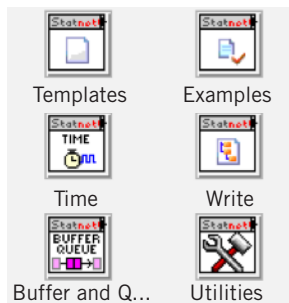**Professor Luigi Vanfretti**

https://github.com/ALSETLab/

WHAT WE DO

ALSET stands for Analysis Laboratory for Synchrophasor and Electrical Energy Technology. This lab focuses on a time-sensitive and real-time simulation-based hardware and software development and testing platform for cyber-physical power systems, aka the smart grid!

Our research is performed using a real-time hardware-in-the-loop platform that allows us to interface a real-time simulator with new applications that implement novel concepts using computer systems, embedded systems, and software for the digital grid of the future.
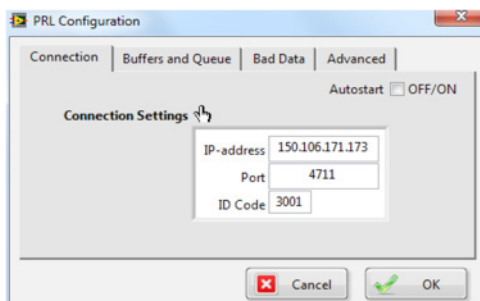
AN NI CASE INNOVATION CASE STUDY!

First published in a conference paper and as an NI Case Study (http://sine.ni.com/cs/app/doc/p/id/cs-16049), the S3DK has now matured into a stable and reliable toolset distributed as open source software. Some of the features of the S3DK LabVIEW palette can be seen next:

Templates   Examples

Time   Write

Buffer and Q...   Utilities

Example PDC Reader.vi
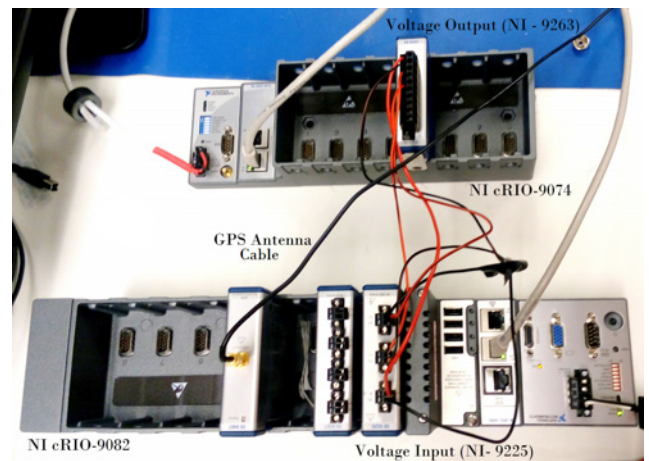

error in
(no error)   error out

Use this template to build a producer/consumer design pattern with events to product queue items. Use this design pattern instead of the User Interface Event Handler pattern for user interfaces when you want to execute code asynchronously in response to an event without slowing the user interface responsiveness.

National Instruments' hardware and software are being used extensively in our research. From software development, hardware prototyping, and algorithm design, to testing and verification, NI infrastructure is used everywhere.

Some of the major projects/deliverables maintained and owned by ALSET Lab that use NI Technology are STRONgrid (interfacing low-level protocols with LabVIEW), Khorjin (interfacing low-level protocols with NI's cRIO), the S3DK (a LabVIEW palette with an array of graphical functions to prototype synchrophasor applications), and Audur (a template for real-time control on NI's cRIO using synchrophasor measurements).

S3DK

The Smart Grid Synchrophasor Software Development Kit (S3DK) is a LabVIEW palette used to implement real-time PMU/Synchrophasor applications using LabVIEW.

With this development toolkit, a developer is able to manipulate the numerical values of the different signals contained in a synchrophasor data stream in the LabVIEW environment.

The software is comprised of two main parts: (a) a real-time data mediator that parses and handles PMU data (implemented in C++), and (b) a LabVIEW User Interface (UI).
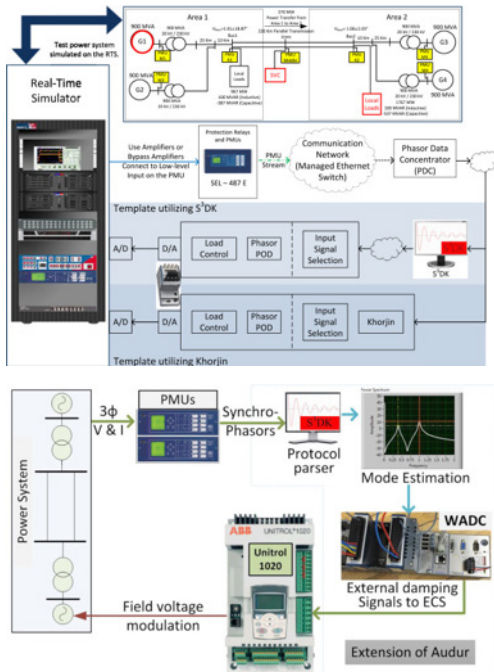
See more at:

https://alsetlab.github.io/S3DK/

REAL-TIME MONITORING AND CONTROL

STRONgrid and Khorjin are two NI Compliant
Libraries developed/maintained at ALSET Lab.

STRONGRID

It is a modular and extensible C++ library for IEEE
C37.118.2 compliant synchrophasor data mediation.
The STRONgrid library packages all the necessary
components to let the researchers focus on the
development of synchrophasor applications in LabVIEW.
The library provides LabVIEW specific functions for easy
integration. See more at: https://www.sciencedirect.com/
science/article/pii/S2352711018301705

KHORJIN

An IEC 61850-90-5 Gateway for Synchrophasor Data
Transfer with support for IEEE C37.118.2. The source
code was implemented using standard C libraries,
allowing their deployment in any NI cRIO platform.
Learn more at: https://github.com/ALSETLab/Khorjin-
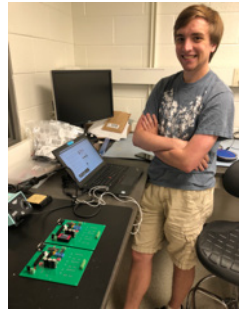IEC61850-90-5

AUDUR

Audur is a software platform for Synchrophasor-
Based Power System Wide-Area Control System
Implementation. It provides a LabVIEW package for
developing custom power system networked control
system implementations using the NI-cRIO FPGA based
platform.

The software includes damping algorithms implemented
in the FPGA, with a control architecture defined in layers
within a template using different LabVIEW technologies.
See more at: https://www.sciencedirect.com/science/
article/pii/S2352711018301730

OPENPMU

Having worked with Queen's University of Belfast since
2010, ALSET Lab has recognized the educational and
teaching potential of the OpenPMU project.

With new versions of the OpenPMU design moving to
other hardware platforms, ALSET Lab contributes to this
effort as the caretaker, maintainer, and developer of this
low-cost entry-level device so that NI products users in
education and research can still benefit from its simple
design. See more at: https://alsetlab.github.io/S3DK/
docs/Main_Single_Phase.html

NEXT STEPS!

Further research at ALSET Lab seeks to *exploit NI's technologies* –
from the application of the Time-Sensitive Protocol for networked
power system control, to the development of **automated testing of
real-time instruments and controls** using advanced platforms, such as
NI's PXI.

Collaborating with NI would allow ALSET Lab to pioneer the
development of the core technologies for the digital grid of the future!

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