LabVIEW Simplifies Testing of Medical Instrument Sterilizer System

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NI Products Used
NI 9184 cDAQ Chassis with

- NI 9201 8-Channel Analog Input module
- NI 9203 8-Channel Current Input module
- NI 9214 16-Channel Isothermal Thermocouple Input Module

LabVIEW 2014
NI Datalogging and Supervisory Control Module

Category
Industrial Machinery & Control

The Challenge
Create a user-friendly interface to view and log data from a variety of sensors to validate medical device washer performance, integrating additional data tags from an OPC server in the device itself.

The Solution
We utilized the power and adaptability of NI cDAQ and LabVIEW DSC to pull in analog sensor data and OPC tags. The resulting application saved our customer dozens of man-hours per week, and improved their confidence in their product characterization.

Introduction
Data Science Automation (DSA) is a premier National Instruments (NI) Alliance Partner that specializes in automating and educating the world leading companies. Clients choose DSA because of DSA's deep knowledge of National Instruments products, disciplined process of developing adaptive project solutions, staff of skilled Certified LabVIEW Architects and Certified Professional Instructors, and unique focus on empowerment through education and co-development.
The customer we worked with on this project manufactures washer systems to sterilize medical devices. These washers provide an important, cost-effective solution for re-usability of instruments such as operating room surgical tools. As patient safety is at stake, they require a high degree of understanding of the temperatures, pressures, and other operating variables of these critical decontamination systems.

However they were frustrated with their current process for testing and characterization, which involved tedious manual measurements which were susceptible to human inconsistency. A technician would record DMM measurements and other readings from a wide array of sensors

around their device as it ran, while also logging into the device touch-panel HMI read off internally-tracked variables. These variables were made available the PLC-HMI via a CodeSys PLC server, but no system existed to automatically read and log such values, let alone integrate the external test sensors into that data.

In addition, the customer emphasized a need to be able to modify and expand any automatic validation system as their own washer system advanced to new revisions, and as they may come across further external sensors and/or signals they would like to integrate.

Application Overview

With the customer's goals of modularity and extensibility in mind, we chose an NI cDAQ solution for the external signals, with extra inputs as well as an extra slot that may be utilized in the future without upgrading chassis. For the software, we divided functionality into cohesive segments and split code into libraries, as well as into two separate executables that run independently on the Windows PC doing the logging and analysis/measurement.

The two LabVIEW applications in the context of the larger system are shown in Figure 1.

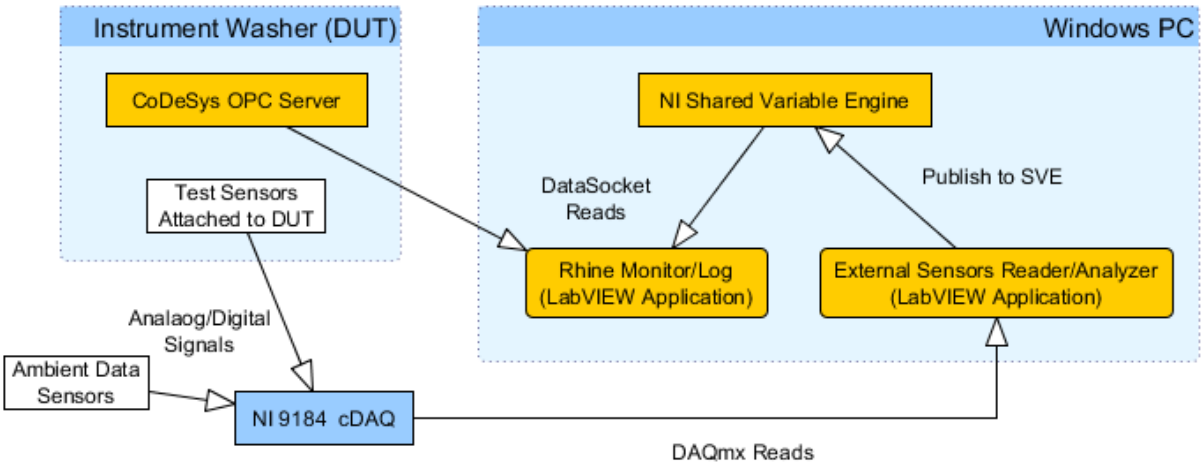

Figure 1. System architecture for Rhine test application. The DataSocket layer allows equal-footing access to either the OPC Server or the NI SVE.

The National Instruments Shared Variable Engine (SVE) allowed for an easy separation of the external sensor read and analysis into a separate executable from the logging and OPC-interactive part of the application. This distinct program utilizes NI's convenient DAQmx interface to easily read ambient sensor data (temperature and humidity) and test sensors on the Instrument Washer being tested. It then publishes that data to the NI Shared Variable Engine via native LabVIEW VIs in order to pass those tags to another executable.

The second executable, the Rhine Monitor/Log application, can then treat all of these tags equally, regardless of whether they are external sensor signals or OPC tags provided by the CoDeSys OPC server integrated into their Instrument Washer product. DataSocket read VIs allow for accessing either these sources with a configurable data URL and type specifier. Read of these via DataSocket connection are shown in Figure 2.

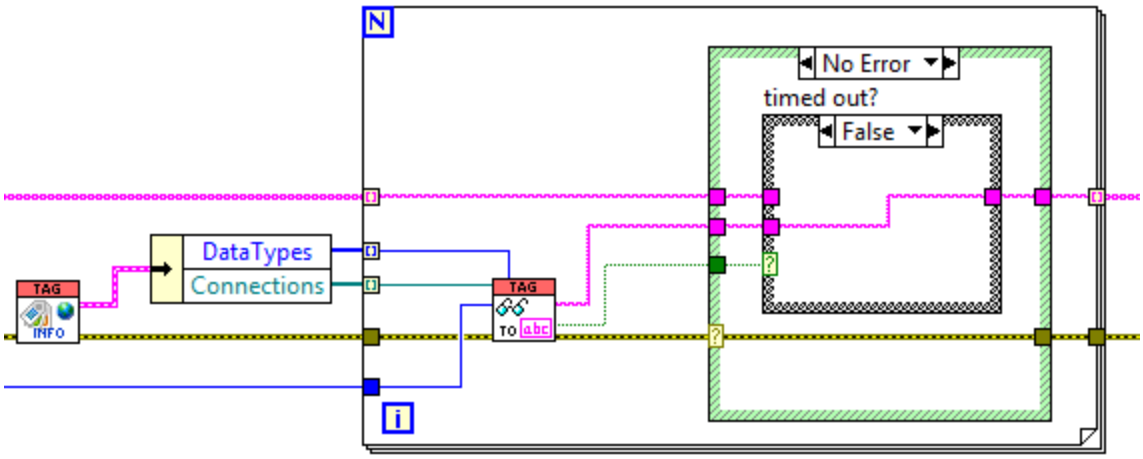

Figure 2. Tag reads in the logging and monitor application need only know the data type and DataSocket connection URL in order to update, whether OPC-sourced or from NI DAQmx.

The tag names and number of tags are easily modified by engineers on the fly via configuration files. Logging then generates files utilizing LabVIEW's excellent built-in support for spreadsheet logging. The start of data recording is triggered by a fixed OPC tag seen as going high, the name of which is also configurable through the .ini file, allowing the customer a customizable user experience on a flexible platform without changing the base deployed executable.

Finally, we accommodated the customer's wish to handle multiple DUT's in parallel on the same machine, by simply allowing multiple instances of the executable to run in separate memory spaces via the "allowmultipleinstance=TRUE" flag in the executable configuration file. Each instance would find a separate .ini file so as to vary parameters such as the address of the OPC server to use. The flexible nature of the Network Shared Variables allowed this to be easily implemented.

The delivered system proved to be highly efficient and suited our customer's validation and characterization needs. Besides increasing throughput in their test operations many-fold, they also benefited from higher consistency and clearer traceability of test measurement data. Their engineers were happy and excited to continue use and upkeep of this application.

Conclusion

The many built-in interfaces available in the LabVIEW environment allowed for an easy-to-create, easy-to-use test suite for our customer's medical instrument disinfectant washers. Using the DSC toolkit and the DataSocket layer supported by LabVIEW, we integrated data from their OPC server, as well as from hot-swappable cDAQ modules reading in analog and digital data from thermocouples and other external sensors. The result was a "win-win-win" situation – a more reliable, cost-effective test solution for our customer, a successful project for DSA, and that much more piece of mind for doctors and patients using an array of medical instruments processed by these sterilization tools.

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