DSA
DATA SCIENCE AUTOMATION

Gas Mask Canister Production Monitoring and Reporting

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Category:
Biotechnology/Life Sciences

Products Used:
LabVIEW 8.2
Datalogging Supervisory and Control Module
Database Connectivity Toolkit
NI ENET/232
Kepware KepServerEx OPC Server
Mitsubishi FX series PLCs
Keyence BL-600 Barcode Reader
VideoJet 2000

The Challenge:
Developing a system to collect data from each of the sixteen stations (twelve controlled by Mitsubishi PLCs) to provide lot control, in-line data analysis, and reporting for the production of gas mask canisters. The lot control and tracking will protect the client in the advent of a part recall by providing the ability to pinpoint the recall defects to specific lots of the parts that the canisters consist of.

The Solution:
The customer hired Data Science Automation, Inc. to develop a LabVIEW application that would communicate with 12 PLCs via an OPC server to collect data from each station as a part is assembled in the line. The application would need to track the part as it moves from station to station and then store all data for a part into a database and reference the part with a unique serial number.

Abstract:
Data Science Automation used a third-party OPC server provided by Kepware because it supported Mitsubishi FX series PLCs, which were the type present in the assembly line. The data registers of the PLC that needed to be collected were documented in the PLC code, so all that was needed was to create tags in KepServerEx OPC server for the data registers in question. To then interface LabVIEW with the OPC server, National Instruments' Datalogging Supervisory and Control (DSC) module was used to bind tags that were created in KepServerEx to Shared Variables. The application took advantage of the functionality of DSC and created value change events for each of the Shared Variables created.

The Details:
The approach of using the shared variable value change event meant the application is not continually polling the value of the shared variables inside a loop. Instead, DSC will trigger LabVIEW to read the value of the shared variables whenever they change in value. The application used a separate event structure for each PLC to

monitor value changes in the data registers for each station's PLC. Each PLC contained a register to signal to the application that the part has arrived or completed assembly at that station. This would trigger the application to store information on a part to the database.

The parts were tracked as they proceeded through the assembly line by a labeled barcode. At every station there exists a Keyence barcode reader that outputs the barcode read through a serial port. The LabVIEW application would read the barcode from each station to track the parts as they are assembled. To handle having a barcode reader at every station, four NI-ENET/232 Ethernet to serial converters were installed. They integrate seamlessly with each port of the converters assigned a COM port on the PC running the LabVIEW application.

The labeled barcodes were applied to the pallets (or travelers) which the canister sat in as opposed to the individual canisters. Because of the dark color of the canisters it would have decreased the ability of the barcode readers to read the barcode reliably. So the canisters were assigned a pallet upon entering the first station in the assembly line and when they exit the last station in the assembly line there are assigned a serial number from the database based on the pallet barcode read. The pallets are then recycled to carry other parts through the process. To further complicate the traveler logic, at one station the canisters are taken off the pallet and put into test machinery. When the part returns to the main production line it is placed on a different pallet with a different barcode. The LabVIEW application keeps track of what pallet it was on before this station and what pallet it is placed onto when it exits this station and links this information together in the database.

The final step in tracking the parts was to apply a unique serial number to the complete canisters at the end of the assembly line. For this, the customer supplied a VideoJet printer which communicated with LabVIEW through a serial interface. To be consistent, an open port of one of the NI-ENET/232 converters was used. Once the part arrives at the last station of the assembly line (having passed all in-line quality tests), the unique serial number is generated by the database and sent to the VideoJet, which prints a part description and serial number on the outside of the canister.

All data about raw material lots, operators, time of day, and the production parameters is stored in a backend database that is used to report production statistics (Figure 1) and provide individual inventory tracking. The SQL database was normalized to provide efficient insert and search capability.
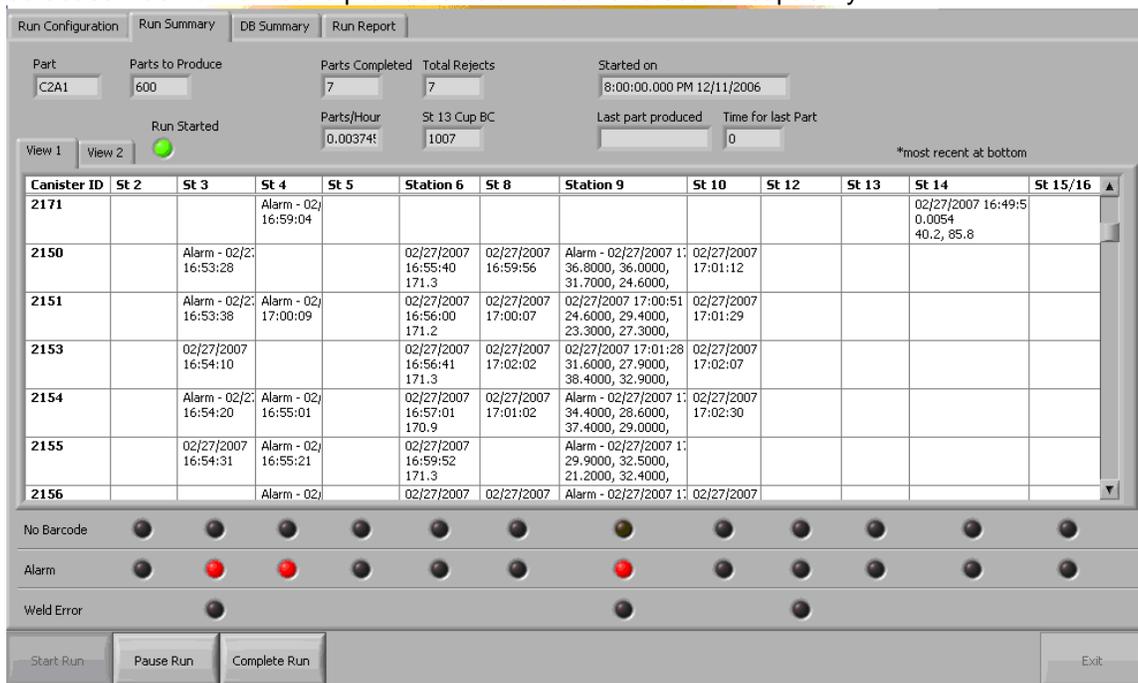

Figure 1. Production Run Report

The LabVIEW application was also built to provide individual canister and run statistics to indicate to the operators the quality of the product being produced. The analysis took data collected by the PLC and correlated test results with process data to ensure proper product quality. The resulting graphs (Figure 2) were displayed on the production floor providing real time feedback to the operators.
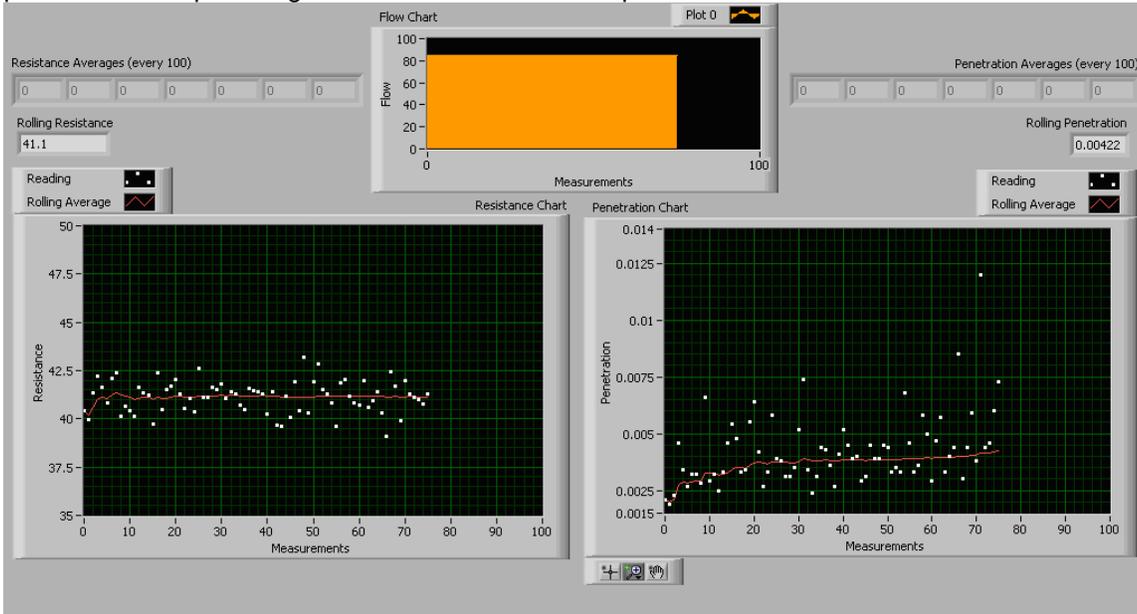

Figure 2. Sample Data Collection

The resulting solution was a cost effective, flexible serialized production tracking system that allows the customer to compete with established product vendors by providing new product offerings.