Monitoring Record-Setting Train Speed with NI LabVIEW and LabWindows™/CVI

Embedded LabWindows/CVI screens displayed the speed record on the train.

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- M. Philippe Kowalski, SNCF

The Challenge:
Transferring 160 temperature measurements from the TGV, the world's fastest train, for analysis and access at different points on the train.

The Solution:
Developing a data acquisition application with a client/server architecture using the NI LabVIEW graphical programming environment and NI LabWindows/CVI software.

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On April 3, 2007, the TGV V150 train broke its own 1990 record of 513.3 km/h with a new top speed of 574.8 km/h. During this record-setting test, we used LabVIEW and LabWindows/CVI inside the TGV train to measure 160 temperature channels and display the results on a human machine interface (HMI) made accessible at various locations on the train.

Implementing a Data Acquisition System Using LabVIEW and LabWindows/CVI

During the prelaunch and record-setting test, the TGV faced severe conditions, so we needed to monitor all moving units that were not designed to function at that speed.

As part of the Agence d'Essai Ferroviaire contribution to the speed test, we continually measured temperatures at the ball bearing axle box, the gear motor that transfers the rotational movement from the engine to the wheels, and the engine level. We transferred these measurements back to the laboratory on the train, where experts and managers onboard easily accessed them. During the speed test, the train engineers could monitor data, exercise control for smooth operations, and stop the test in the event of a complication.

We used a previously developed temperature measurement device to measure 80 PT100 channels and returned the data using a factory information protocol (FIP) bus. We also added 80 more measurement channels – some of them were from thermocouples. We transferred the data through a controller area network (CAN) bus using LabVIEW as the common HMI. To access data from different workstations, we chose client/server architecture. Using an integrated RS232 link, we programmed the signal from a tachymetrics pool to continually update and display the speed and mileage point. We are conducting a post-test analysis to correlate the temperature and speed information.

We were also asked to develop a dynamic client HMI with moveable controls on the front panel and options for the operator to choose which temperatures to display and move the controls on the front panel. We used LabWindows/CVI to develop the HMI so that we could use dynamic controls. An NI DataSocket link communicated between the LabVIEW server and the LabWindows/CVI clients. NI Measurement Studio software for Visual C++ onboard the TGV V150 train measured the electric information such as catenary system voltage, sink electric current, and measurements on the pantograph.

Benefits of Using the NI Platform

Due to the ease of use and flexibility of the NI platform as well as the user-friendly DataSocket implementation for the client/server communication, we successfully completed the application development in three months. In this application, two temperature measurement systems coexist – one on an FIP bus and the other on a CAN bus.

With the application, our client can display the data in real time in the laboratory and at various points on the train, and the data is saved to a hard disk. During the record-setting test, users enjoyed visualizing the data dynamically. The system will be used for additional tests with client/server architecture in the near future.

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