Remote Control Car Dynamometer

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Category

Products Used
LabVIEW 8.0
NI USB-6008

The Challenge
The customer produces remote control (RC) car dynamometer chassis that is used as a hands-on physics lesson for high school and college courses. The customer needs a new application to acquire and calculate data for the RC car as it runs on the dynamometer chassis and display the data to the user. The challenge was to improve the current VB application by re-creating it in LabVIEW 8.0. The new application would also use National Instruments USB-6009 data acquisition card instead of duplicating the old hardware setup. The application would acquire four analog input channels to gather information on a remote control (RC) car as it is running on a dynamometer chassis. The new application would also contain some additional calculations and ease of use features.

Solution
With LabVIEW, Data Science Automation was easily able to create an application that had the same look and feel of the original VB application. Using NI's USB-6009 DAQ board, setting up and acquiring signals took only a matter of minutes thanks to the ease of use of the USB interface. The acquisition is configured to acquire 4 differential signals: a photo transistor to measure the dynamometer revolutions, a magnetic sensor to measure the RC car wheel revolutions, battery/motor voltage and a shunt resistor to measure the battery/motor current. The default acquisition rate is 12kS/s.

Details

When the application starts up it loads settings from the .ini file and is then in a idle state waiting for the user to select one of the following buttons:

-Start Acquisition
-Get Data
-Plot
-Plot XY

Start will begin acquiring data and displaying it on the user interface. When the user presses the Start button to begin acquiring they will also power the RC car motor on the chassis. The application will continue acquiring data until the user pressed the Stop button or the application sees a motor current of zero amps for a configured amount of time. While the application is acquiring, in addition to display the acquired and calculated data it is also saving this data to a .csv file which can be opened in Microsoft Excel. The data that is acquired and calculated is Time Elapsed, Dyno RPM, Wheel RPM, Motor Voltage, Motor Current, Acceleration, Motor RPM, Velocity, Torque, Mechanical Power, Electrical Power and Efficiency. The user has the ability to view any two data channels on a chart at a time by selecting the channel from a pull down above each of the two charts. They may do this at run time to switch between the channel plots at any time during the acquisition. The current and max readings for all data channels are displayed to the left of the charts.
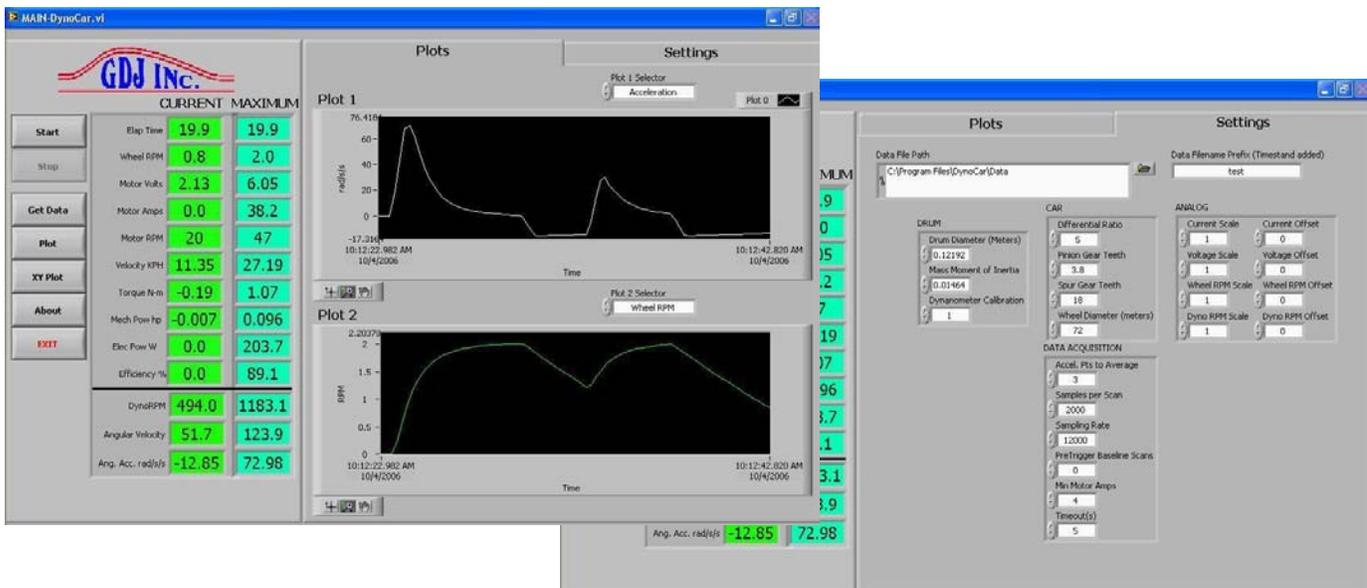
Get Data will prompt the user for a old, previously created data file and load all data contained in that file onto the charts. Plot and Plot XY will both open a new window in which the user may again load previous data files and plot all data contained in the file. The Plot window allows the user to open up to 4 previous files and compare data for a same channel between files. The Plot XY window allows the user to open 2 previous files and graph two different selected Y channels against a common X channel.
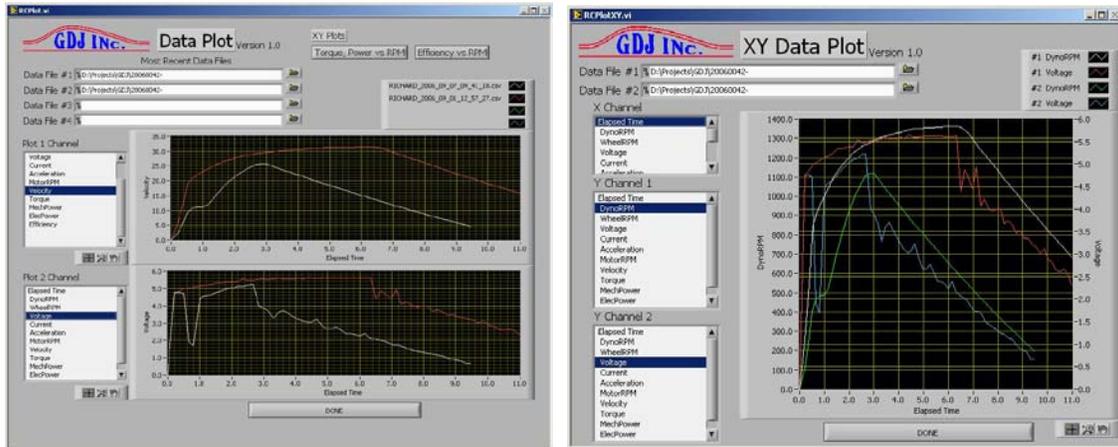
Acquisition is configurable in terms of acquisition rate and samples per acquisition for the 4 analog inputs. The application also provides configurable scaling and calibration values which along with the acquisition settings and calculation constants are saved to an .ini file when updated. This common use of an .ini file serves as a memory of the previously used settings and values such that the next time the application is run the previously used settings and values are restored and loaded into the application.

Summary
The LabVIEW application was easily built into an executable and installation package so that it can conveniently be installed on a customer machine with needing any other NI software. And since the data acquisition device chosen was from NI USB line of DAQ devices the customer will simply be able to connect the USB cable to there computer and begin acquiring data at the click of a button.