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MAXIMIZING REUSABILITY IN PROPULSION SYSTEM TESTING: A MODULAR DATA ACQUISITION SYSTEM USING NATIONAL INSTRUMENTS PXI HARDWARE AND LABVIEW

Abstract

The rapid usage of diverse propulsion technologies and test stands necessitate a critical review of data acquisition systems (DAQ) used in testing. Current systems often fall short in efficiency, cost-effectiveness, and versatility needed required to meet the demands of varied propulsion test stands. To address this issue, we propose in this paper the design of a DAQ based on National Instruments PXI hardware and LabVIEW software, offering a flexible solution for any propulsion test stand configuration. Initially, this system is specifically aquire for the testing of a 2U propulsion system within a 6U CubeSat project conducted by the YahSat Space Laboratory at Khalifa University. The proposed DAQ system significantly reduces development costs compared to conventional, test-specific setups, while offering superior performance, accuracy, real-time processing capabilities, and synchronization features. LabVIEW, a powerful graphical programming environment, facilitates intuitive and efficient software development. The software's modular architecture permits easy customization, allowing for component reuse across diverse testing scenarios. The DAQ's versatility extends its utility beyond core propulsion system testing. It demonstrates its adaptability in a wider range of automated testing applications, including thermal cycling tests for simultaneous testing set of Attitude Determination and Control System modules, GPS receivers, star trackers, and other subsystems. This versatility justifies the investment in PXI technology by offering a greater return on investment. The paper delves into the technical considerations for building a PXI-based system. It provides guidance on the selection of PXI chassis, controller, and the most suitable modules, including analog input and output, digital input and output, counter and timer modules, along with specialized options for temperature measurement, strain gauge, vibration, and switching functionalities. the paper presents also practical case studies that showcase the system's adaptability and reusability on diverse propulsion test stands and automated testing setups.