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Nabsys Nanodetector Test Platform

Overview:

Nabsys is a Providence based biotech company specializing in DNA sequencing and mapping. Nabsys has developed a custom Nanodetector which enables the creation of high quality sequences and maps at a fraction of the cost and time of conventional optical techniques. Nabsys has only been able to enjoy this technological advantage because of constant improvements to the Nanodetector design. In order to make these improvements, Nabsys scientists and engineers must trial multiple designs and run countless tests to verify numerous detector parameters and ensure the design changes have the desired effect. Unfortunately, these validation experiments are generally time consuming and frequently the longest part of our design cycle. In an effort to reduce this time, Nabsys would like to work with a team of URI engineering students to develop a custom automated measurement platform capable of testing every conceivable detector parameter.

The test platform will consist of two major components: a detector measurement pcb and a data acquisition system. The detector measurement pcb will contain all of the electronics required to test the detector, interface to the data acquisition system, and power the platform. The data acquisition system will be a National Instruments cDAQ chassis complete with LabVIEW UI, which will control the test platform and display the test results.

System Diagram:

Nanodetector

NI cDAQ

Test Platform Electronics
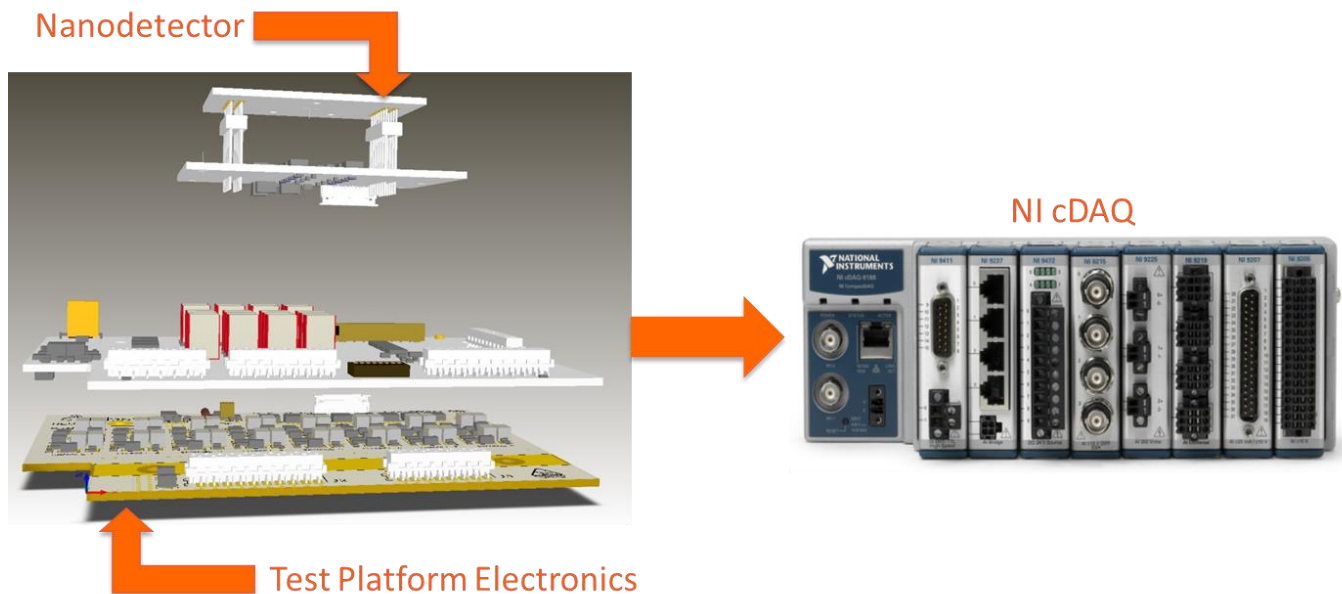
Team Description:
- Two electrical engineers and one computer engineer.
- Strong drive, independence, and initiative are a must.
- LabVIEW programming experience is a big plus.
- Knowledge of transimpedance amplifiers, oscillators, capacitance measurement circuits, relays, ADCs, DACs, DC/DC converters, AC/DC Converters, switching regulators, and digital logic circuits is beneficial.
- Familiarity with Altium or equivalent electronic design suits is helpful.
- PCB layout experience is a big plus.

Deliverables:

- Detailed electrical specification (developed interactively with Nabsys engineers).
  - Test platform specifications include: interface connectors, power consumption, test voltage levels, analog signal output levels , measureable input range, measurement accuracy, etc.
  - cDAQ chassis specifications include: measurement cards used, card position, chassis power consumption, etc.
- Detailed test specifications (developed interactively with Nabsys engineers).
  - Specifications include: Possible tests, list of user settable test parameters, test results formatting, etc.
- Bill of materials for any "off-the-shelf" components i.e. IC, connectors, converters, etc.
- Detailed circuit design & schematic capture of the test platform via Altium electronic design software.
- Functional test platform pcb.
- Functional test platform control and data acquisition software
- Final report including block diagrams, theory of operation, material cost & results of early test runs.

Team Division of Labor:

Electrical Engineer 1 (Instrumentation):

This engineer's primary responsibility will be the design of the test platforms instrumentation electronics. This engineer will be responsible for the selection or design of circuits which can measure current flow, measure capacitance, measure low level analog voltages, and apply high precision low noise test voltages. These designs may include but are not limited to transimpedance amplifiers, oscillators, analog filters, ADC, and DACs. We would like this engineer to have experience with some or all of the above mentioned circuits. Once the components have been chosen and circuits designed, this engineer will work with the group's second electrical engineer to integrate his or her electronics into the overall design. Once the integration is complete, the two engineers will work together to design, create and test the measurement platform PCB.

Electrical Engineer 2 (Platform control electronics and data acquisition interface):

This engineer's primary responsibility will be the measurement platforms digital logic, power supply and data acquisition interface. This design will require the engineer to select or design a digital logic scheme which allows any of the platforms measurement circuits to be connected to any of the Nanodetectors many test pads. This design may include, but is not limited to shift registers, logic gates, and relays. This engineer will also work with Nabsys engineers to modify one of their many power supply designs to suit the needs of the test platform. This process may require the alteration of existing switching regulator, and passive power filters. Finally this engineer will work his or her teammates to interface the output of the measurement circuits to the data acquisition system. This will require the selection of physical connectors and supporting circuitry. Once all of the circuits have been designed and the connectors selected, this engineer will work with the instrumentation engineer to integrate all of the measurement platform's electronics onto a single PCB.

Computer Engineer 1 (Test platform control software and UI):

This engineer will create the data acquisition control software and UI. Responsibilities include the selection of several National Instruments measurement cards, implementation of existing Nabsys test procedures in LabVIEW, development of test platform UI, and generation of test result files. We would like this engineer to have some familiarity with or at least an interest in LabVIEW programming and or experience with protocol automation. This engineer will work closely with Nabsys engineers to determine the number of analog and digital signal cards required to adapt his or her existing test procedures into automated LabVIEW protocols. Once the hardware has been selected this engineer will begin the process of automating the test procedures and creating the platform's UI. Along the way this engineer will also work with the rest of the team to interface the measurement platform with the data acquisition system. Finally, this engineer will work with the rest of the team to test the prototype platform and verify its functionality.

If you have any questions about the project, its objectives, or any of the roles described before our presentation please do not hesitate to contact John Czajkowski: Czajkowski@nabsys.com