CO326: Industrial Networks

Lab 04 - Data Acquisition (DAQ)

Introduction

Data Acquisition (DAQ) is the process of automatically obtaining data from an instrument/circuit into a computer. This data could be either digital or analogue. Digital inputs get the data of state changes and events of a process that is being monitored in terms of presence and absence of a voltage (e.g 0 or 5 Volt). The analogue readings could be variables that continuously vary such as temperature, speed, pressure, temperature or sounds and measured as a voltage or a current. A DAQ system includes high-speed data acquisition measurement hardware (a DAQ Card/Module), input devices such as sensors connected to a computer/processor.

The DAQ card can work as an output device by giving digital or analog output.

In this lab, you will be using a National Instruments' DAQ card : PCI-6221 to create a data acquisition system to measure the voltage generated in a system with variable resistance and output that can be used to control processes. You will be using "LabVIEW" by National Instruments as the design platform to visualize the measurements.

Required Tools

You will use the following hardware to carry out this lab.

- DAQ Card (In the lab you will be using model PCI-6221)
- Potentiometer/LDR/Resistors/LEDs

You will need the following software to carry out this lab.

- LabVIEW
- NIMax

For you to try the simulation designing, you can download the software setup files from the shared space in the Tesla Server (Tip: You can use the *SCP* command)

LabVIEW -
/home/ce-shared-files/CO326/DAQ_Lab/LABVIEW2018.rar
NIMax -
/home/ce-shared-files/CO326/DAQ_Lab/NIDAQ1850f2.zip

Follow the guideline in the readme files for installation

Steps to Complete the Lab

1. Open LabView on your computer.
2. As the second step, from the starting window, select “Blank VI” from the New section.

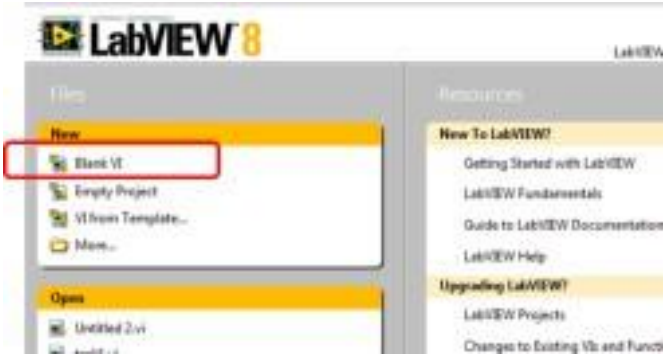

Figure 1: Starting Window of LabVIEW

This will open two windows; Block Diagram Window and Front Panel Window

3. Next, you have to insert a DAQ Assistant to the Block Diagram window. DAQ Assistant is a VI which allows the DAQ Hardware to communicate with LabVIEW.

   Right click on any space within the Block Diagram window and follow the path, Express -> Input -> DAQ Assistant.

   Place the DAQ Assistant on the Block Diagram and wait for it to initialize.

4. After the initialization, NI-DAQ Assistant Wizard is opened which allows us to configure the DAQ assistance program so that it can talk with the DAQ Hardware. a. Here you have to select “Analog Input” option as you are going to use voltage as the input

Figure 2: DAQ Assistant Wizard

b. Then in the next window, the plugged DAQ hardware model is displayed. You have to select the device as PCI-6221 and select the analog input channels from the given list in which you will be connecting the physical input to.

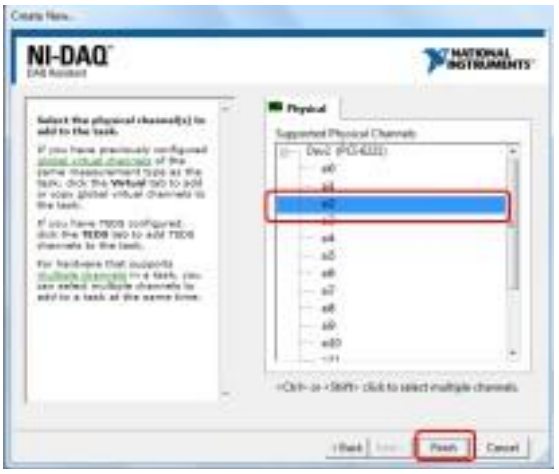

Figure 3: DAQ Assistant Wizard

c. Click Finish. Then you have to change the following configurations in the opening VI assistant program window.

- In Voltage input Setup change the voltage values to following values since we're going to measure values in the range 0-5V,
  1. MAX = 5
  2. MIN = 0
- Set Terminal Configuration to RSE (since we measure voltages w.r.t. Ground)
- Acquisition mode : 1 sample (On Demand)

After changing the configurations, click OK to build the VI.

NOTE: You can use the "Connection Diagram" option in the window to see the pins which you have to give inputs in the card.

5. In the DAQ Assistant there is a terminal called "data" terminal. You will be using that terminal to display/visualize the DC voltage being read.
   a. Right click on the data terminal of the DAQ Assistant -> Create -> Numeric Indicator. This will give you an indicator to display the voltage value. b. Right click on the Front Panel window and go to the path, Numeric -> Meter. Then drag and drop to insert the gauge.
   c. Connect the data terminal(output) of the DAQ Assistant to the meter and the indicator.

6. As the next step you have to insert a while loop to the entire block diagram. a. Right click on the block diagram and go to, Structures -> While loop. b. Draw the while loop to cover the entire block diagram.
   c. In the While loop, right click on the red dot in the right left corner and select "Create Control" to get a button to "stop" the while loop when we want.

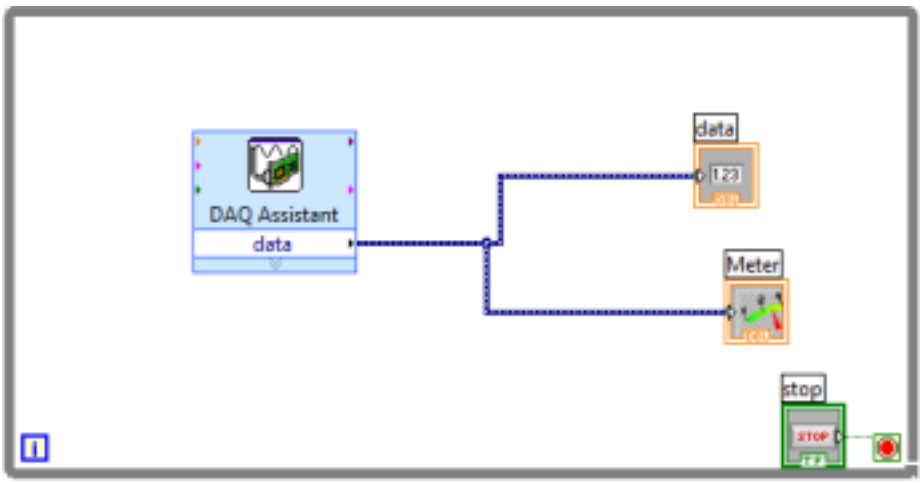

Figure 4: Block Diagram

d. Now you have to do the following potentiometer setup and connect the variable voltage input to the input channel you selected in step 4-b above (e.g. ai2). Make sure you connect GND (to be precise, you need to use AI GND since we're using analog inputs) and 5V also to the proper pins from the card.

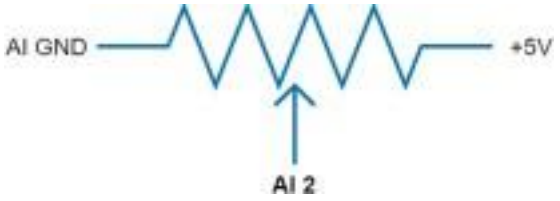

Figure 5: Potentiometer Setup

NOTE: Refer the pinout diagram of PCI-6221 in the appendix to map the pin numbers to channel numbers/names

e. Now click on the Run Button on the menu to run the Block diagram. You should see the voltage changes in the gauge as you change the potentiometer's variable resistance.

Pre-Lab

Creating a Simulated DAQ Card using NIMax

1. Open NIMAX - Measurement and Automation explorer from the Start menu. 2. Go to 'Devices and Interfaces' under 'My System' from the Configuration window. 3. Right click on the 'Devices and Interfaces' -> Create New

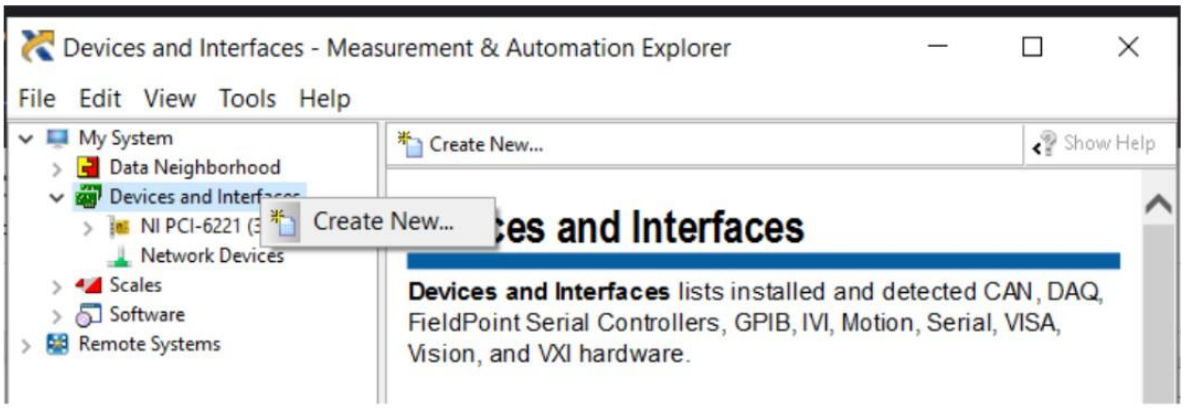

Figure 6: Measurements and Automation Explorer Window

4. Create New -> Simulated NI-DAQmx Device or Modular Instrument -> Finish 5. Search PCI-6221 from the given list and click OK to create the simulated device. 6. You can use this device from LabVIEW to create the design.

In-Lab Evaluation(before the lab)

Build a circuit that can produce an analog voltage depending on the light intensity given to it. For this, you will need to use an LDR and a suitable resistor (e.g. 10K), design a circuit using hardware components to input/get the output as appropriately. Use LabVIEW and create a project with DAQ Assistant in Block Diagram and Necessary front panel for your design

Create a report including the,

- image/screenshot of the circuit you designed (hand drawn or drawn using a tool)
- Screenshots of the BLock diagram and Front panel of LabVIEW project
- Screenshots for the DAQ assistant properties
- List of pins you wish to use in DAQ Card with the pin numbers.

Instructors will evaluate this before the lab task(4/10 Marks).

Lab Tasks

1. Use the same circuit that you built in the Pre Lab.(*Build a circuit that can produce an analog voltage depending on the light intensity given to it. For this, you will need to use an LDR and a suitable resistor (e.g. 10K)*).

   Use the DAQ card and LabVIEW software to measure this voltage and visualize it.
   a. Draw the circuit diagram (include resistor values, DAQ pin numbers, etc) - use the circuit diagram that you drawn in the Pre Lab

   b. Build the circuit, feed the voltage to the DAQ card and visualize it using a suitable meter in LabVIEW (In-Lab Completion 4/10 Marks).

Create a report including the -,

Group members, Pre Lab, List of components and devices you want, image/screenshot of the circuit you designed, Screenshots of the BLock diagram and Front panel of LabVIEW project, Screenshots for the DAQ assistant properties , List of pins you had used in DAQ Card with the pin numbers.

Report should be named GXX_CO326_Lab04.pdf where XX is your subgroup number.(2/10 Marks)

Appendix

1. Pinout diagram of NI DAQ card (PCI-6221)