1. LabVIEW Overview

What is LabVIEW:

LabVIEW (Laboratory Virtual Instrument Engineering Workbench), created by National Instruments (www.ni.com) is a graphical programming language that uses icons instead of lines of text to create applications.

• LabVIEW programs/codes are called Virtual Instruments, or VIs for short.

• LabVIEW is used for Data acquisition, signal Processing (Analysis), and hardware control – a typical instrument configuration based on Labview.
Fig. 1. Schematic diagram of an instrument system based on LabVIEW.

- Hardware
  - Signal Processing
    - Data Acquisition via: USB port, etc
    - Hardware Control via: USB port, etc
- Labview
- Hardware
  - Temperature sensor, etc
  - Air-conditioning, etc
2. Some Applications:

Testing and Measurement

Hardware control

Signal processing,

Image processing

.....

For example: NASA’s Jet Propulsion Laboratory LabVIEW to analyze and display Mars Pathfinder rover engineering data, including

• Position and temperature of the rover

• Power remained in the rover’s battery

• Monitor the rover overall status
3. **LabVIEW** is consisted of

- Front Panel window
- Block Diagram window

**Front Panel** window:

Front panel: controls and indicators (that is, input and output/display, respectively).

**Block Diagram** window:

Terminals (/Icons) corresponding to front panel controls and indicators, as well as constants, function, SubVIs, structure, and wires that connect data from one object to another. **Your codes are here!**

Using “**Ctrl+E**” to change between the Front Panel and the Diagram Block window.
Front Panel window
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4. A simple program

Input a numerical data \( a \) from the Front Panel (numerical control) and display the result \( b \) (Numerical Indicator) after multiplication: \( b = \text{constant} \cdot a \)

**Procedure:**

1) Find and drag the **Numerical Control** and **Numerical Indicator** respectively, to the front Panel:

   View – Controls Palette – Modern – Numeric – Numerical Control /Numerical Indicator

2) Find and drag **Multiply** an **Numerical Constant**, respectively, into the Background Diagram:

   View – Functions Palette – Programming - Numeric – Multiply/Numerical Constant

3) Wire the associated icons.

4) Running the code.
5 The Block Diagram

The components of a block diagram belong to one of the three classes:

• **Nodes**: Program execution elements.

• **Terminals**: Ports through which data passes between the block diagram and the front panel, and between nodes. Terminal is any point to which you can attached a wire to pass data.

• **Wires**: Data paths between terminals.
5.1 Nodes

There are three nodes types:

**Functions**, **subVI nodes**, and **structure**.

- **Functions** are the build-in nodes such as adding number, file I/O.
- **SubVI nodes** VIs that you design and later call from another VI.
- **Structures** control the program flow, such as For Loops and while Loops.
5.2 Terminals

- There are different terminals:
  - Control and indicator terminals
  - Node terminals
  - Constant terminals.
  - Specialized terminals on various structures.
6 Controls Palette

It consists of many sub-palettes that can be used to create front panels.

1) **Control**: Controls simulate input devices (such as knobs, push button and dials) and provide a pipeline to move data to the Black Diagram.

2) **Indicator**: Controls simulate out devices to display the output result (in chart, graph…).

- Controls Palette is available at **View** pull-down menu in the **Front Panel**.
7 Functions Palette

The Functions Palette consists of many sub-palette that contain almost all available objects that can be used to create the block diagram. It contains functions as well as many VIs or Sub-VIs that ship with LabVIEW.

- Function Palette is available at View menu in the Block Diagram Window.
8 LabVIEW Help Options

The two common help options are the Contest and LabVIEW Help. Both are located in the Help pull-down menu.

8.1 Context Help Window

• Choose Show Context Help from Help menu.

When you placing the cursor on an object (icon, terminal) on the front panel or block diagram, the Context Help Window will show the associated help information.

8.2 LabVIEW Help

• Choose Search the LabVIEW Help from the Help menu.
• Or clicking Detailed Help in the Context Help Window.