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https://goo.gl/eMMkeA

LabVIEW

Download: Prodotto: NI Student Edition Software: English

https://www.ni.com/it-it/support/downloads/software-products/download.labview-student-software-suite.html#333367

(Windows)

Community Edition (free):

https://www.ni.com/en-us/support/downloads/software-products/download.labview.html#370001

(Windows, Mac, Linux (No Ubuntu, ricompilare i pacchetti da .rpm a .deb con alien))

Introduzione a LabVIEW (Materiale Didattico)

http://www.ni.com/getting-started/labview-basics/i/

LabVIEW @ I&M

1. **IN/0021 - MISURE ELETTRICHE ED ELETTRONICHE (Castello, Muscas)**
2. **70/LM-0064 - MISURE PER L'ENERGIA ELETTRICA (Sulis, Muscas)**
3. **IN/0026 - MISURE SUI SISTEMI DI POTENZA (Sulis)**
4. **70/LM-0088 - SISTEMI AUTOMATICI DI MISURA (Pegoraro)**
5. **IA/0153/EN - DATA ACQUISITION TECHNOLOGIES (Castello, Pegoraro)**
6. **IN/0232 - LABORATORIO DI LABVIEW (Sulis)**
7. **Corso dottorato - Sistemi di acquisizione dati e strumentazione virtuale (Castello, Sulis)**

SpaceX

We work on everything from large-scale web applications to tiny embedded computing platforms. We build tech stacks on C#/MVC4/EF/MSSQL via REST to Javascript/Knockout/Handlebars/LESS, C++/Embedded Linux, Python, LabVIEW… which all together enables us to build, launch, and monitor stuff that goes to space.

The Ground Software team is about 9 people. We primarily code in LabVIEW. We develop the GUIs used in Mission and Launch control, for engineers and operators to monitor vehicle telemetry and command the rocket, spacecraft, and pad support equipment. We are pushing high bandwidth data around a highly distributed system and implementing complex user interfaces with strict requirements to ensure operators can control and evaluate spacecraft in a timely manner.

https://systemscue.it/spacex-il-software-che-ha-permesso-limpresa/13662/

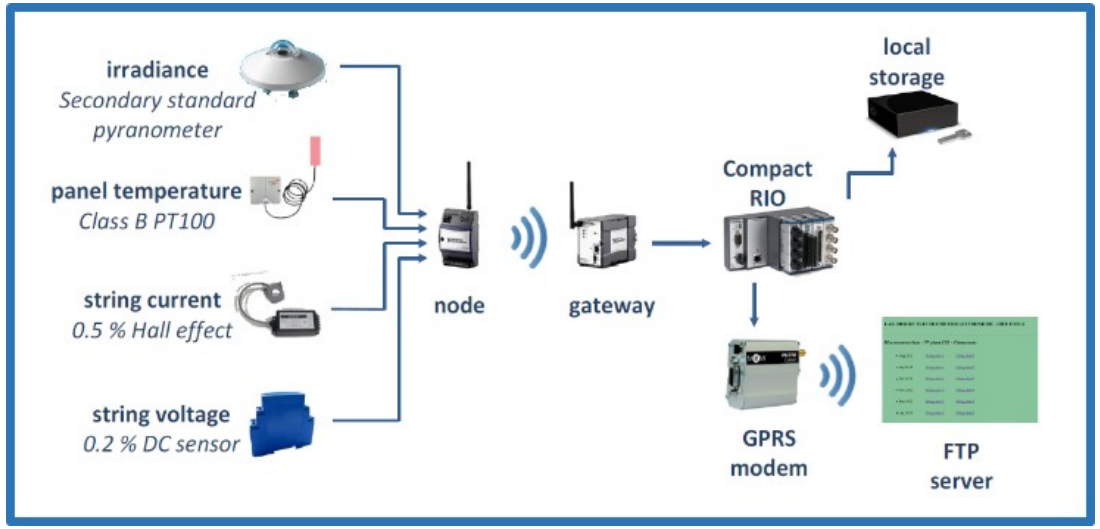
https://www.businessinsider.in/Engineers-Explain-What-It-Takes-To-Get-A-Job-At-Elon-Musks-SpaceX/articleshow/21369111.cms

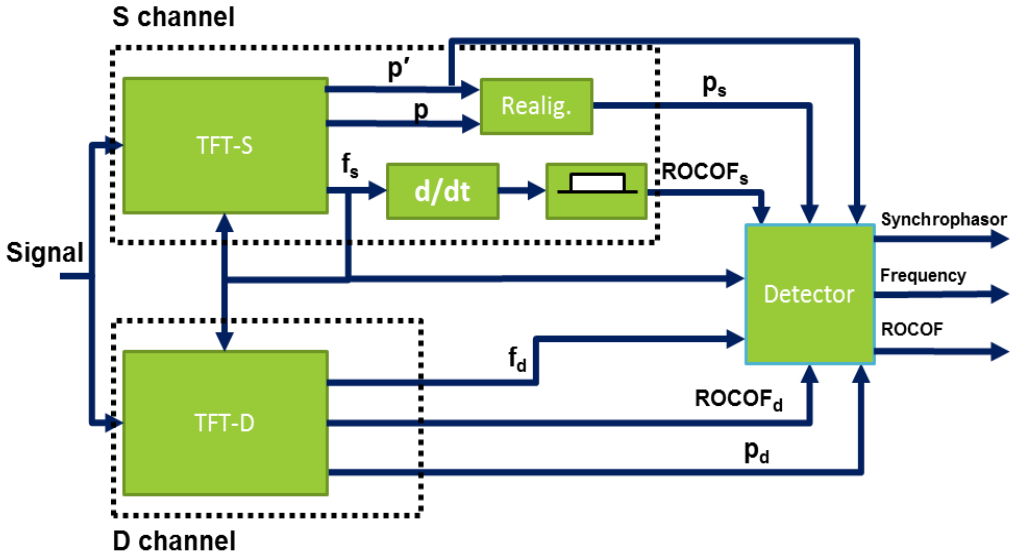
Progetto ERAS – European MaRs Analogue Station for advanced technologies integration – Italian Mars Society

Università degli Studi di Cagliari

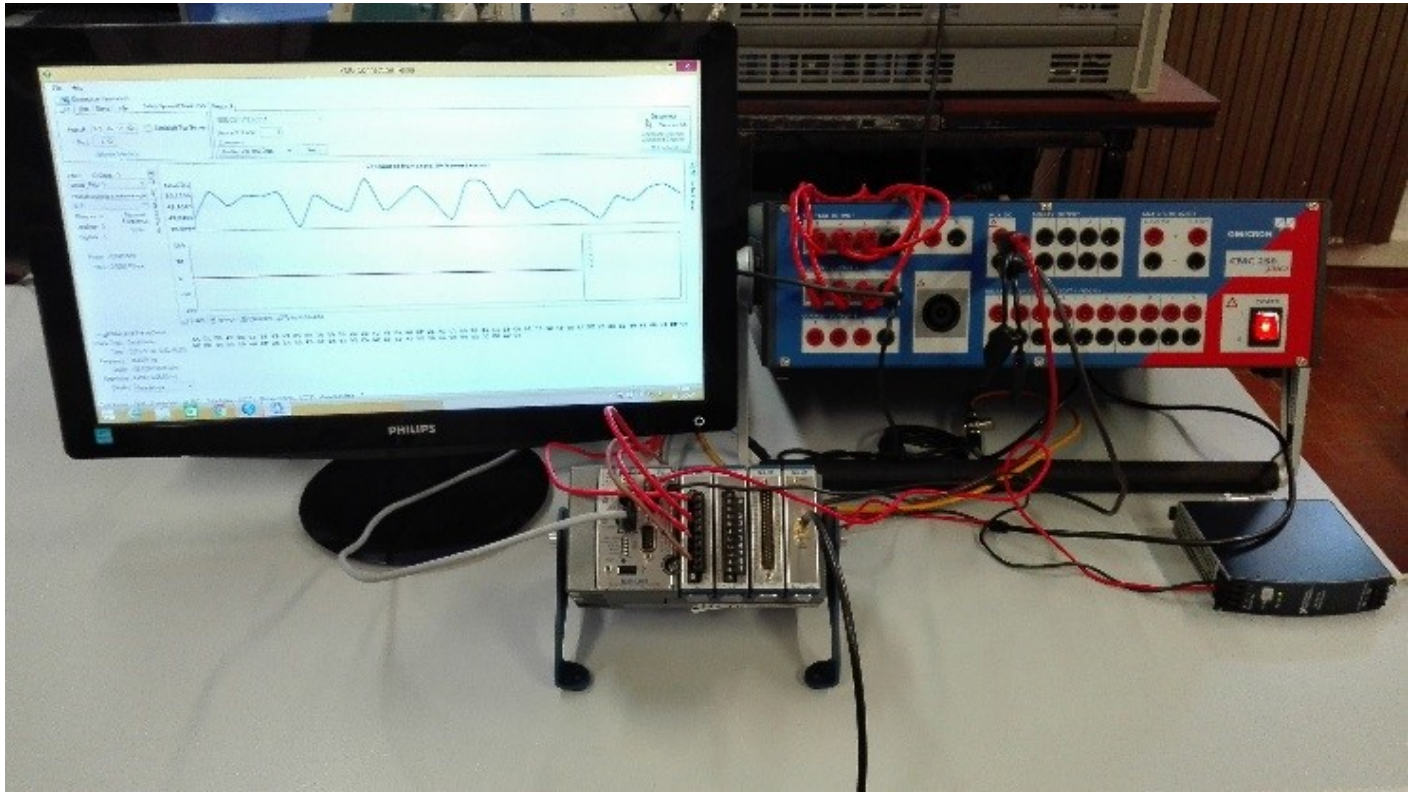
COSMIC

Sistema di monitoraggio di un impianto fotovoltaico





Strumento di misura specifico per le reti di distribuzione
PMU (Phasor Measurement Unit)



LabVIEW

- Laboratory Virtual Instrument Engineering Workbench
  - Programmazione grafica
  - VI virtual instrument – elemento base

LabVIEW

- Nasce nel 1983
- Prima versione 1986 (Macintosh)
- Linguaggio G (Graphic Language)
- Programma VI
  - generato in forma grafica, viene salvato in formato binario
- Editor Grafico (Icone, blocchi, connettori, etc.)
- Programmazione molto simile ad uno schema a blocchi

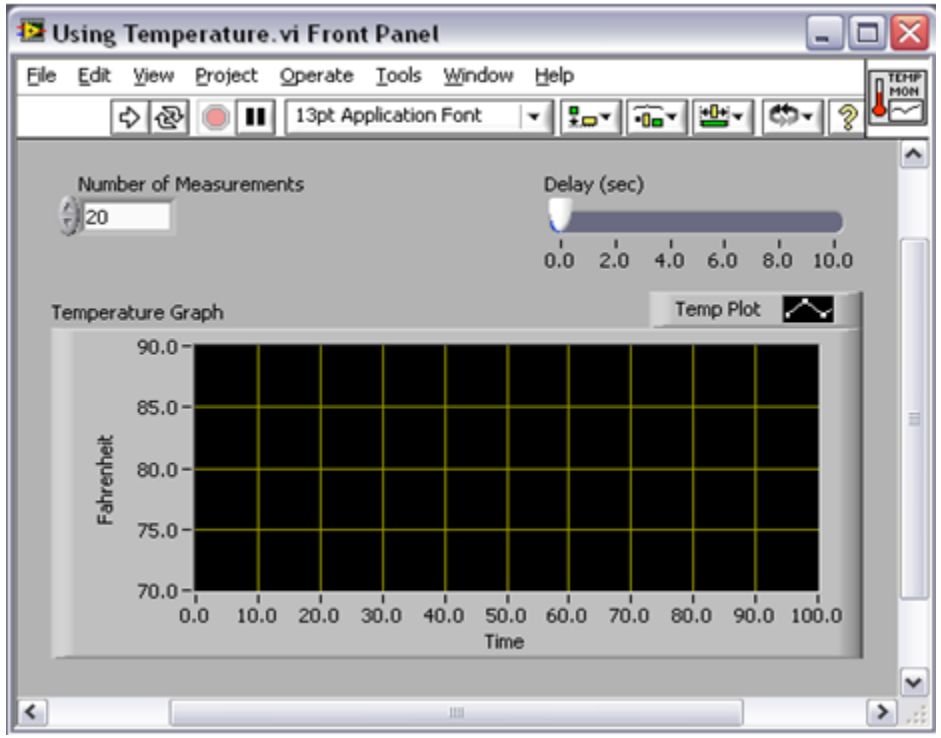
LabVIEW

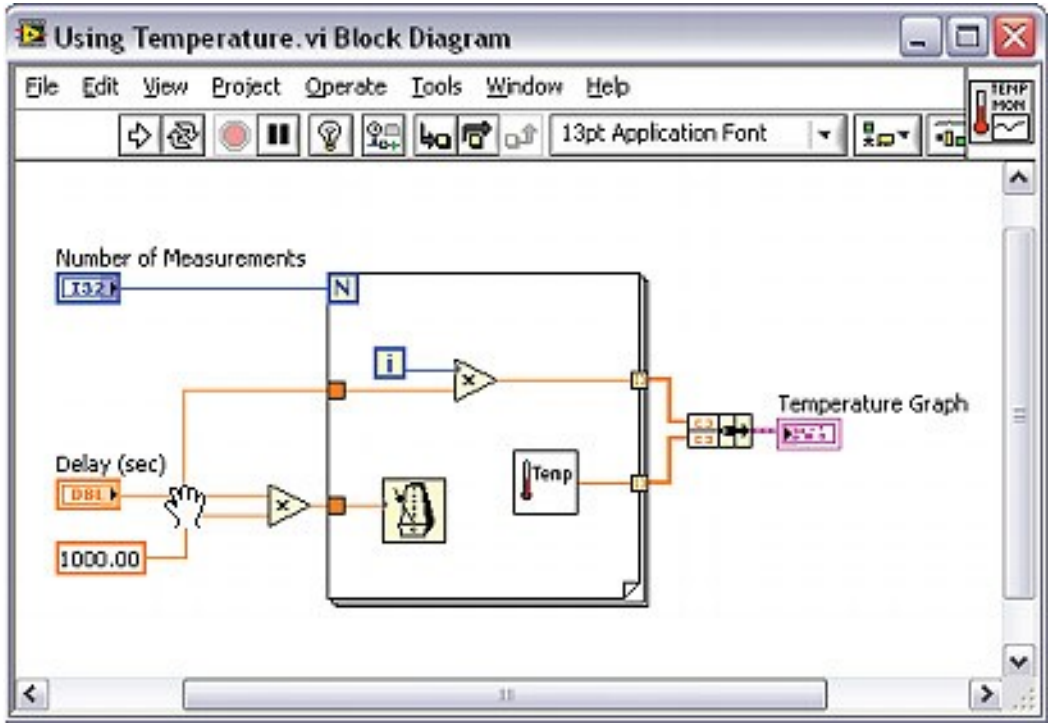
- Supporto nativo per prodotti NI
- Esteso ad altri produttori
- Sistemi embedded (Raspberry Pi, FPGA, etc.)
- Integrazione con altri linguaggi
  - DLL scritte in C
  - Matlab, Python, etc.

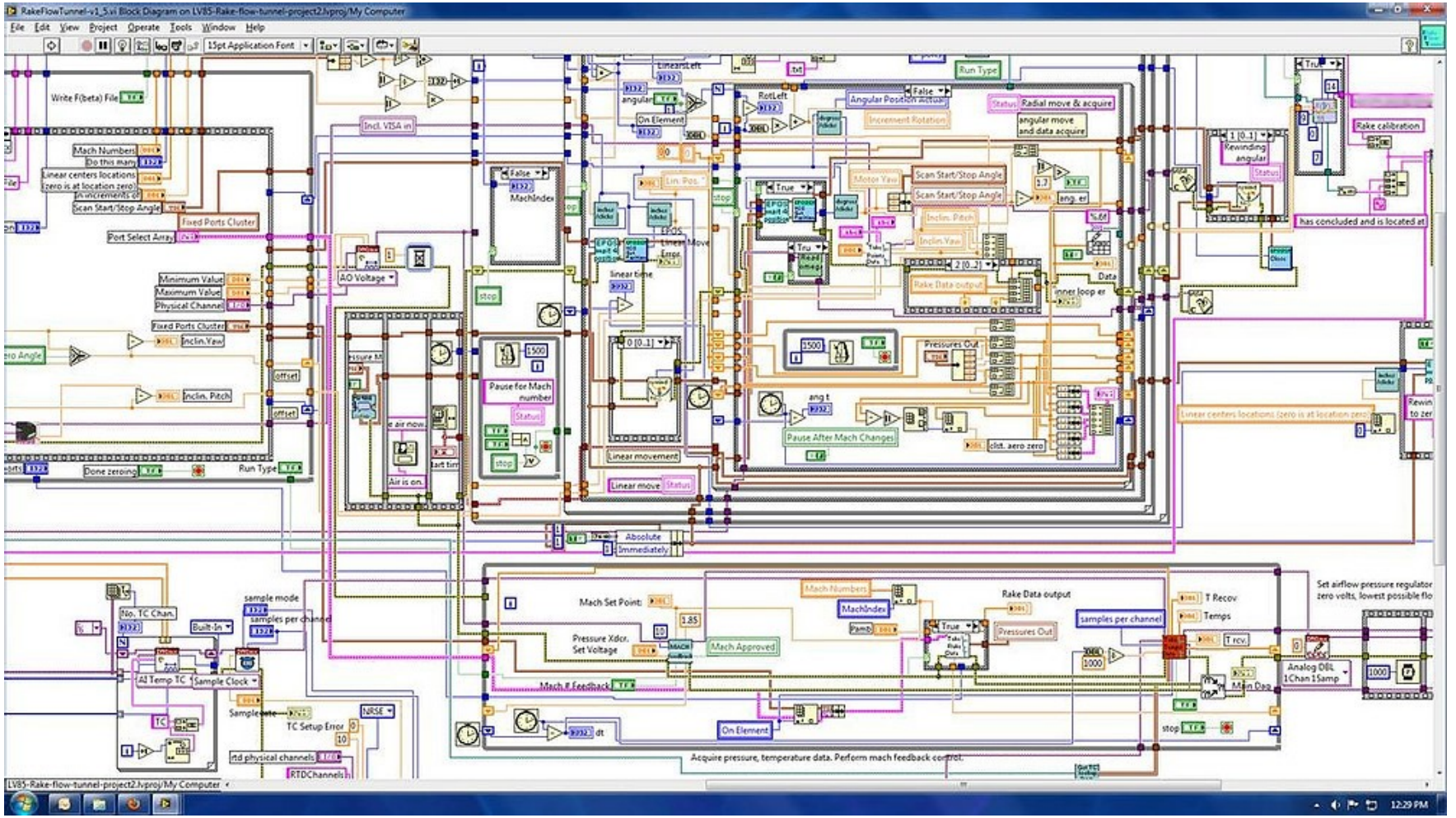
Ambiente di sviluppo

- Progetto
  - Contenitore VI
  - Sub VI
  - Eseguibili
  - Interfacciamento con HW
  - Tutti gli oggetti sono accessibili nello stesso momento

VI (Front panel & Block Diagram)

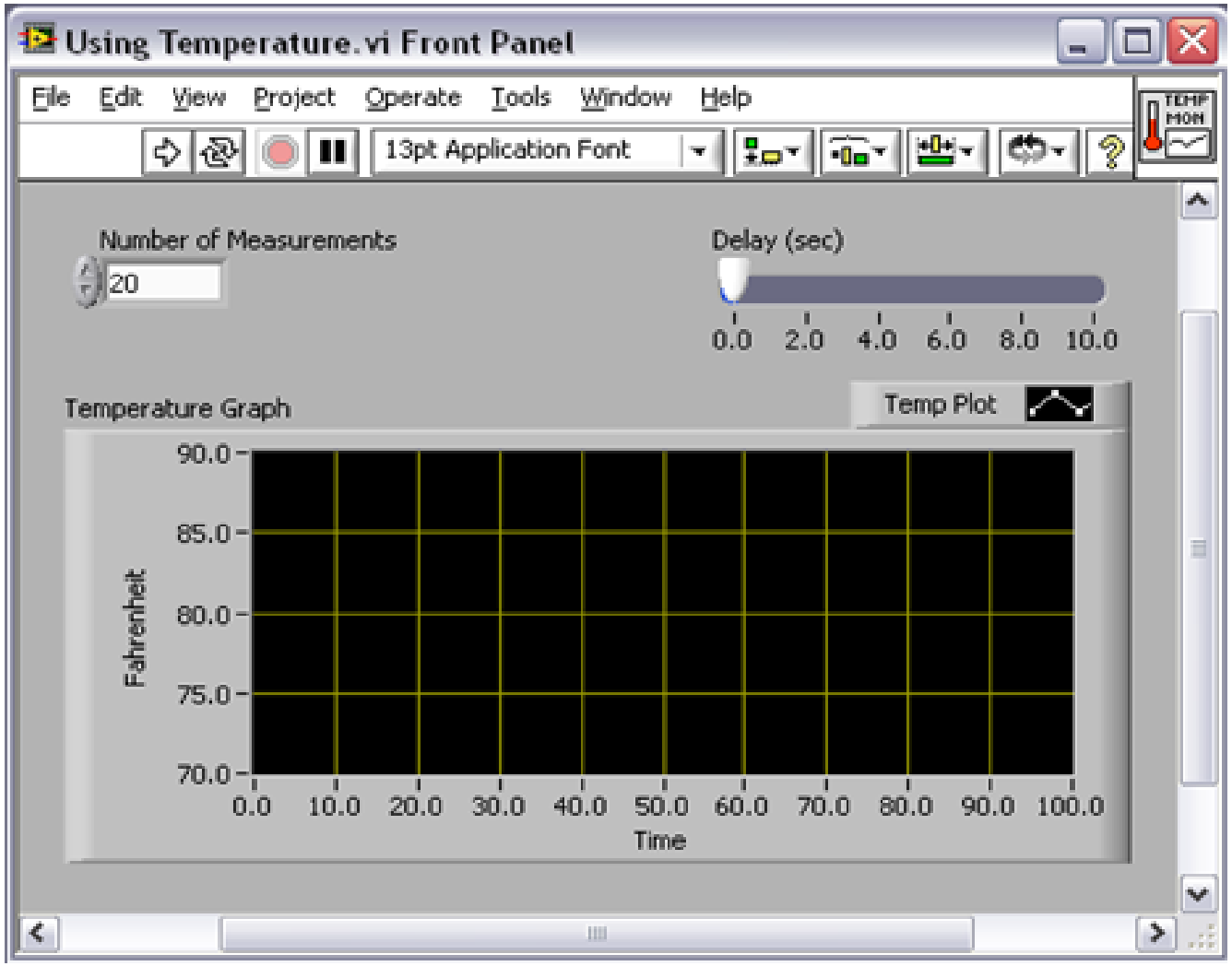





RakeFlowTunnel-v1_5.vi Block Diagram on LV85-Rake-flow-tunnel-project2.lvproj/My Computer
File Edit View Project Operate Tools Window Help
Write F(beta) File
Mach Numbers
Linear centers locations (zero is at location zero)
Scan Start/Stop Angle
Fixed Ports Cluster
Port Select Array
Minimum Value
Maximum Value
Physical Channel
Inclin.Yaw
Inclin. Pitch
Done zeroing
Run Type
Incl. VISA in
AO Voltage
Pause for Mach number
Linear movement
Linear move
Air is on.
Pause After Mach Changes
Rake Data output
Pressures Out
Angular move and data acquire
Radial move & acquire
Scan Start/Stop Angle
Rake calibration
has concluded and is located at
Absolute
Immediately
Mach Set Point
Pressure Xdcr. Set Voltage
Mach Approved
Mach # Feedback
On Element
Rake Data output
samples per channel
T Recov
Temps
Set airflow pressure regulator zero volts, lowest possible flo
Analog DBL 1Chan 1Samp
No. TC Chan.
Built-In
sample mode
samples per channel
All Temp TC
Sample Clock
TC Setup Error
RTDChannels
Acquire pressure, temperature data. Perform mach feedback control.
LV85-Rake-flow-tunnel-project2.lvproj/My Computer
12:29 PM

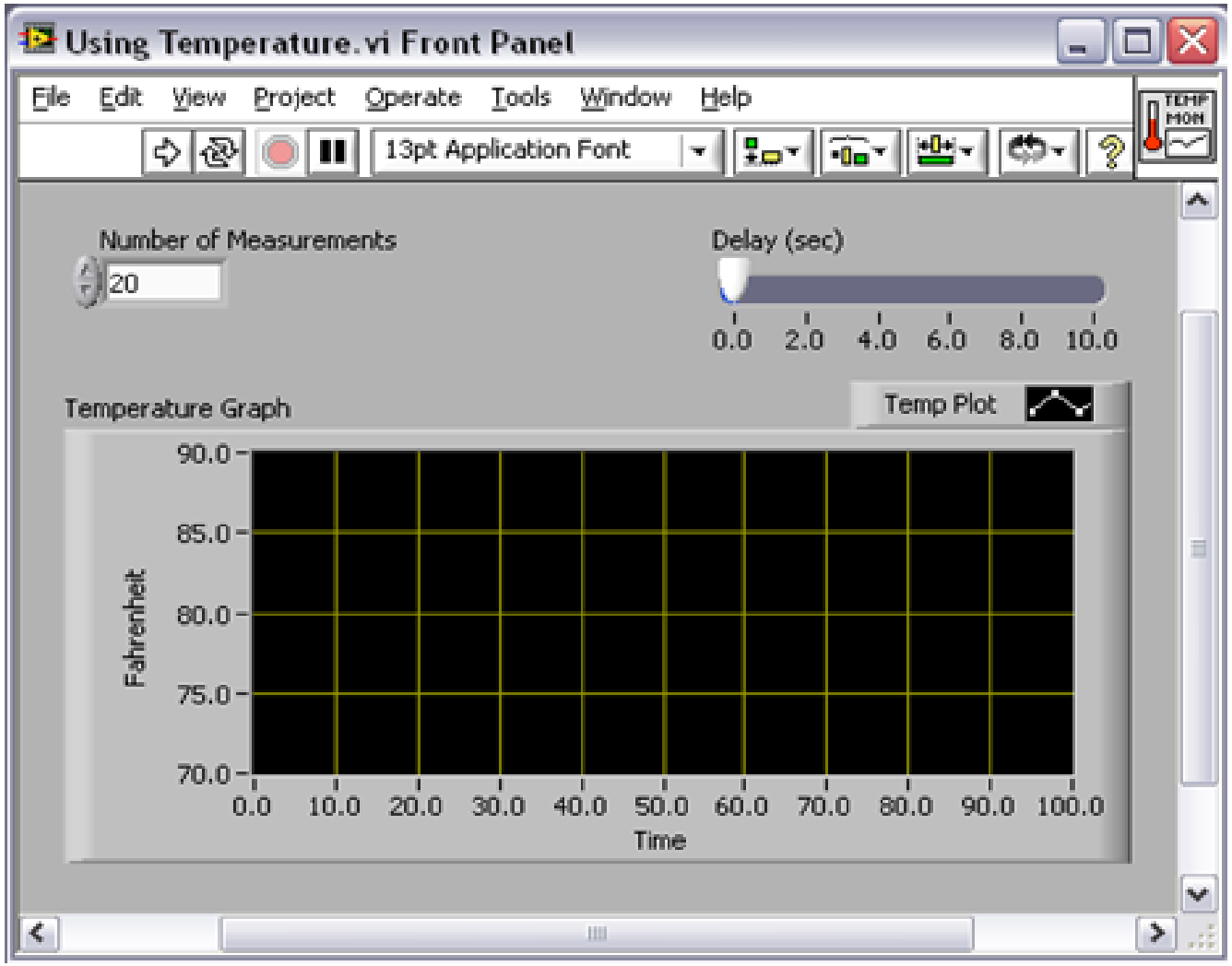
Front Panel

- Interfaccia utente
- Indicatori, controlli (Input e Output)
- Foglio di lavoro
- Toolbar
- Control palette



Front Panel

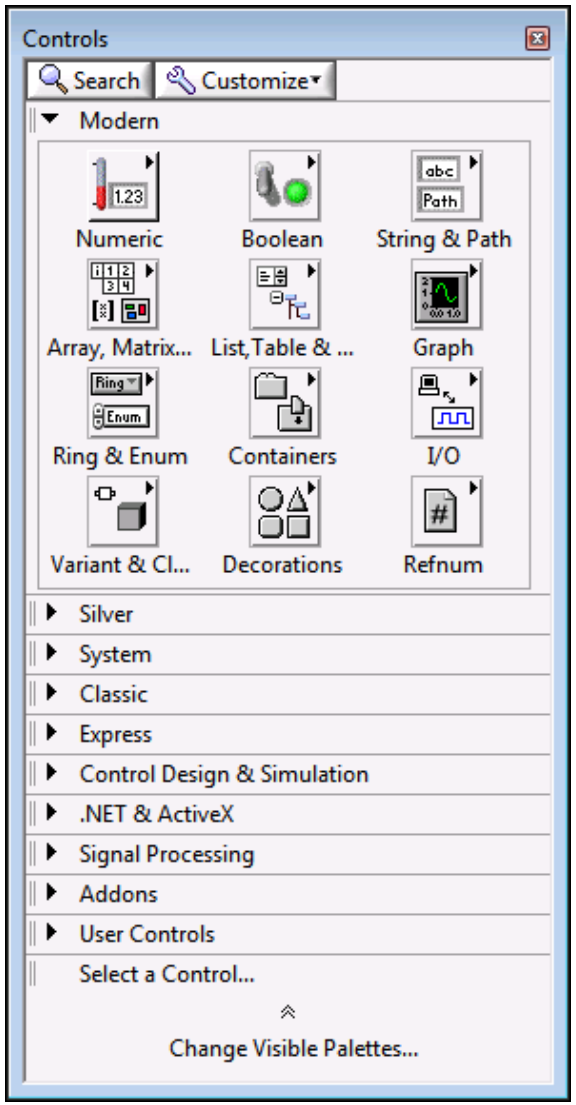
- Interfaccia utente
- Indicatori, controlli (Input e Output)
- Foglio di lavoro
- Toolbar
  - Run
  - Run continuously
  - Abort execution
  - Pause
- Control palette



Front Panel

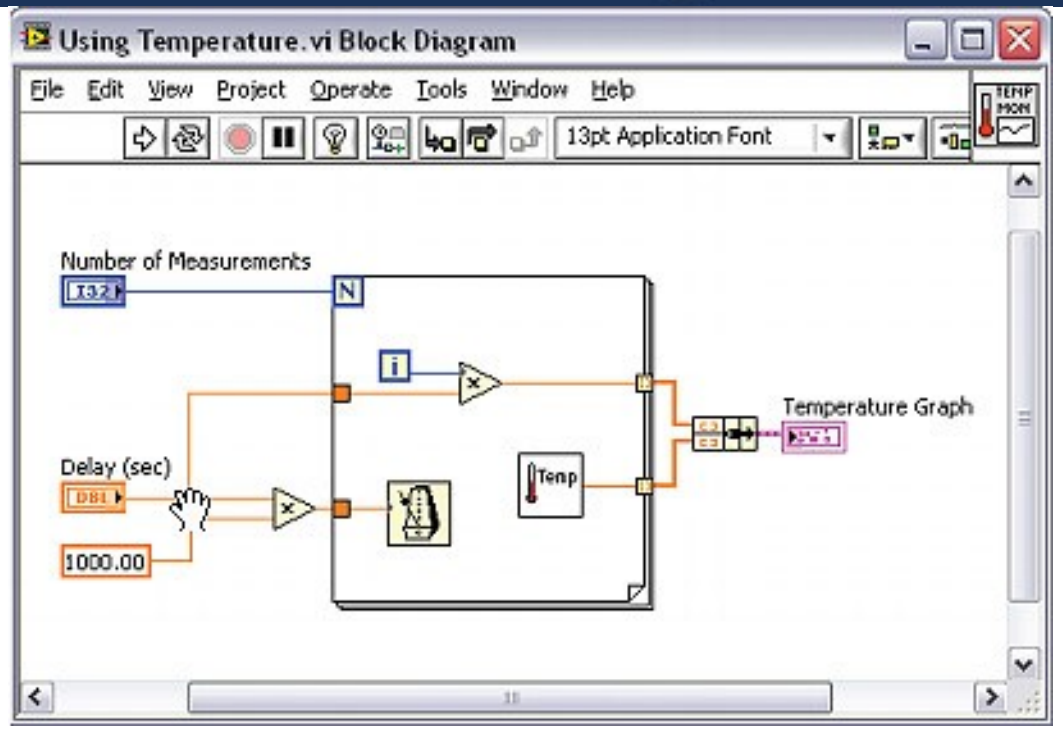
Control palette

- La palette Controls contiene i controlli e gli indicatori utilizzati per creare il pannello frontale. È possibile accedere alla palette Controls dal pannello frontale selezionando View»Controls Palette oppure **cliccando col tasto destro su uno spazio vuoto sulla finestra front panel**. La palette Controls è suddivisa in varie categorie; potete visualizzarne alcune o tutte le categorie sulla base delle vostre esigenze.



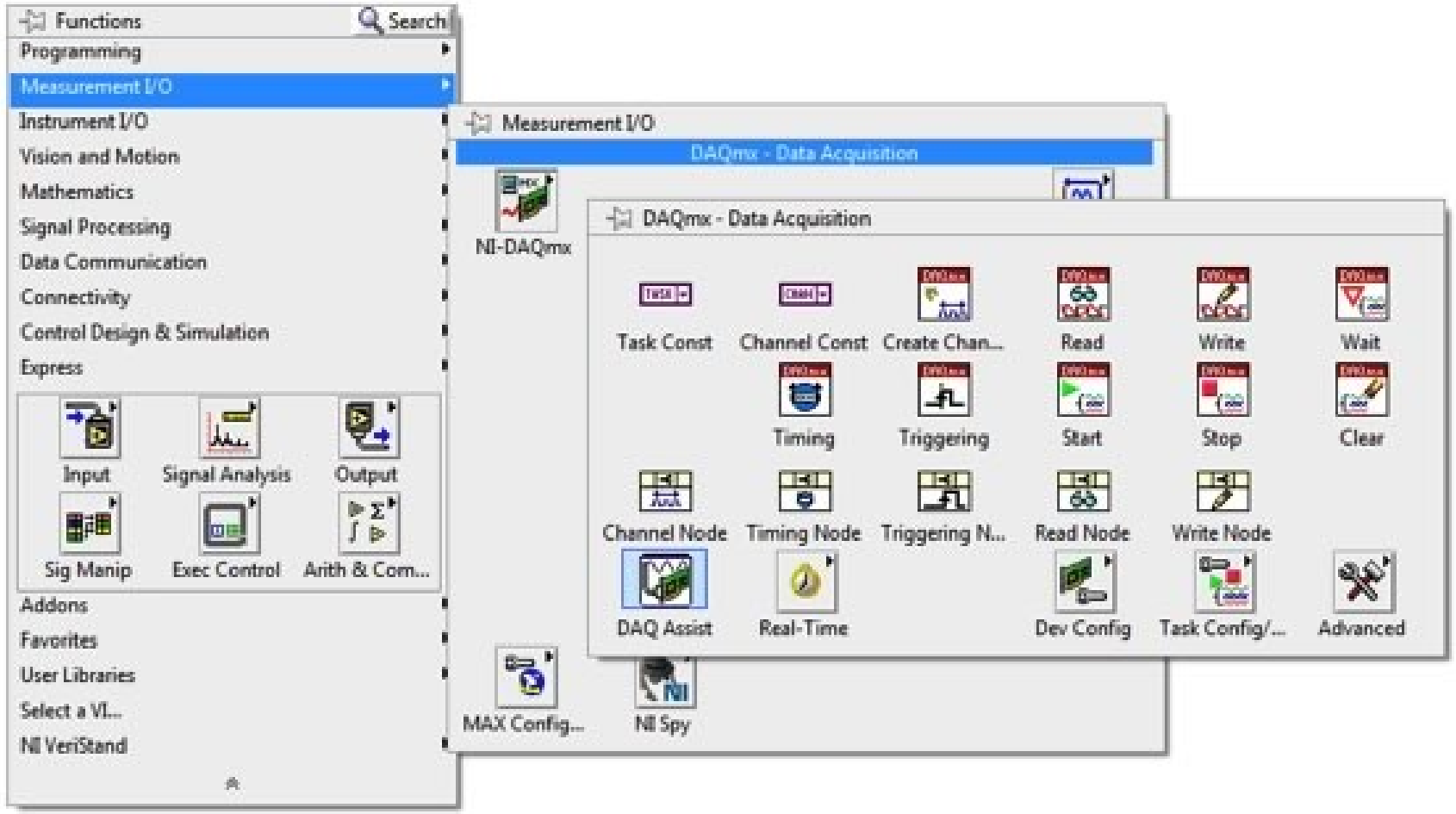
Block diagram

- Interfaccia di programmazione
- Linguaggio G
  - Simile ad un diagramma a blocchi
- Area di lavoro
- Toolbar
- Function palette



Block diagram

- Function palette

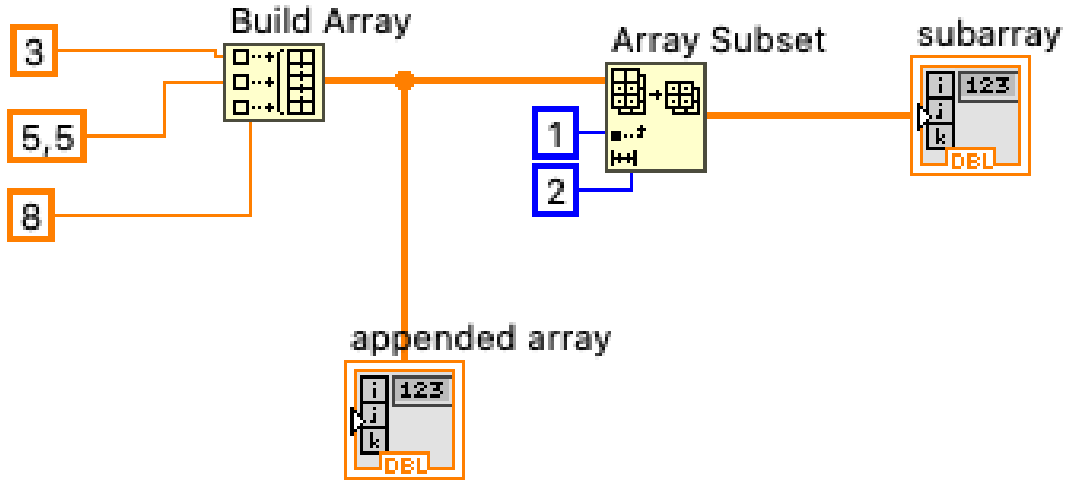


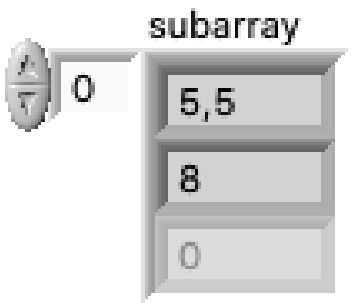
Tipi di dato

- Interi, con segno o senza, da 8 a 32 bit
- Floating point: precisione singola (sgl) doppia (dbl) o estesa (ext)
- Stringhe di testo
- Boolean (0 - 1)

Strutture dati

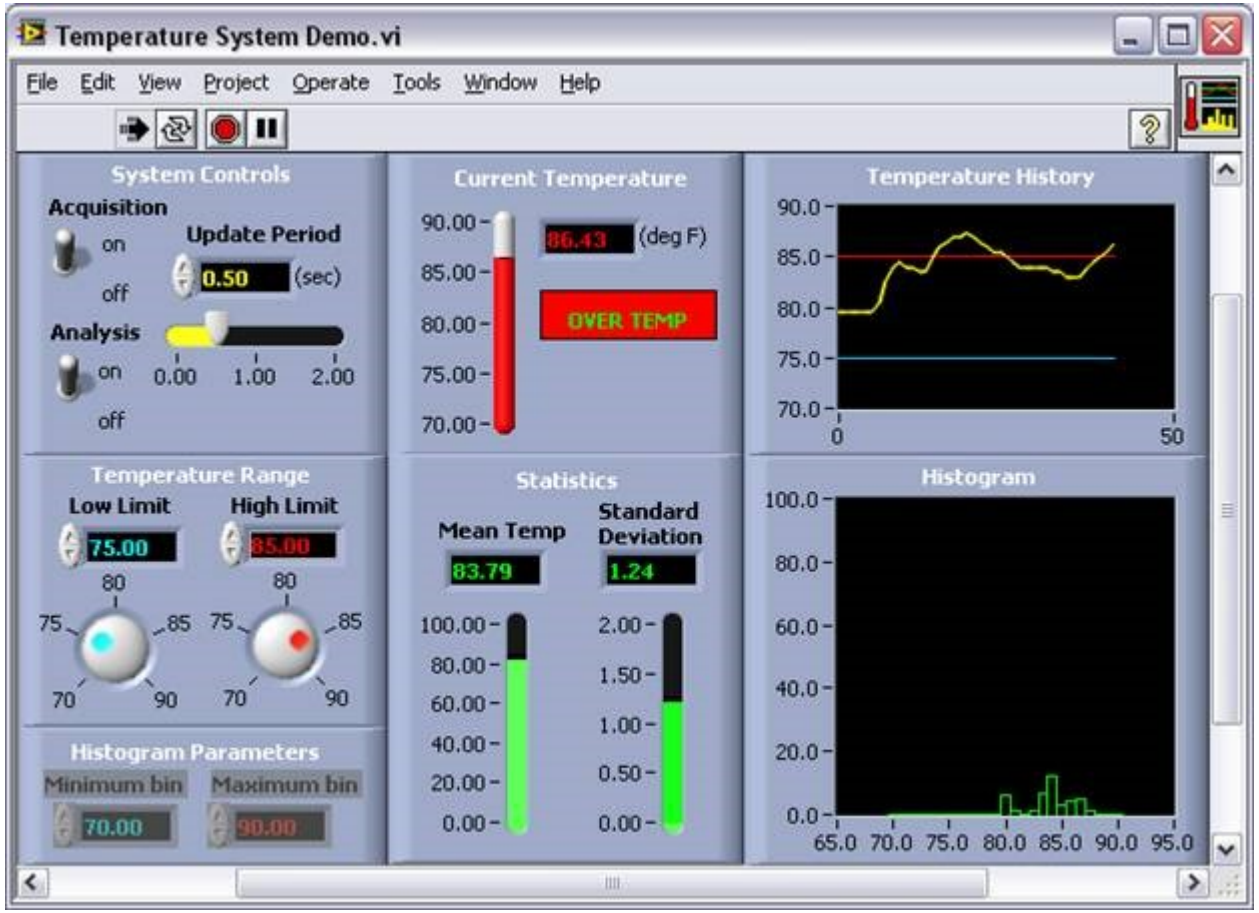
- Array: insieme di dati omogenei con indice.
  Monodimensionale (vettore) o bidimensionale (Matrice)
  - Attenzione allo spessore della linea!
- Cluster: macrocontenitore con dati diversi





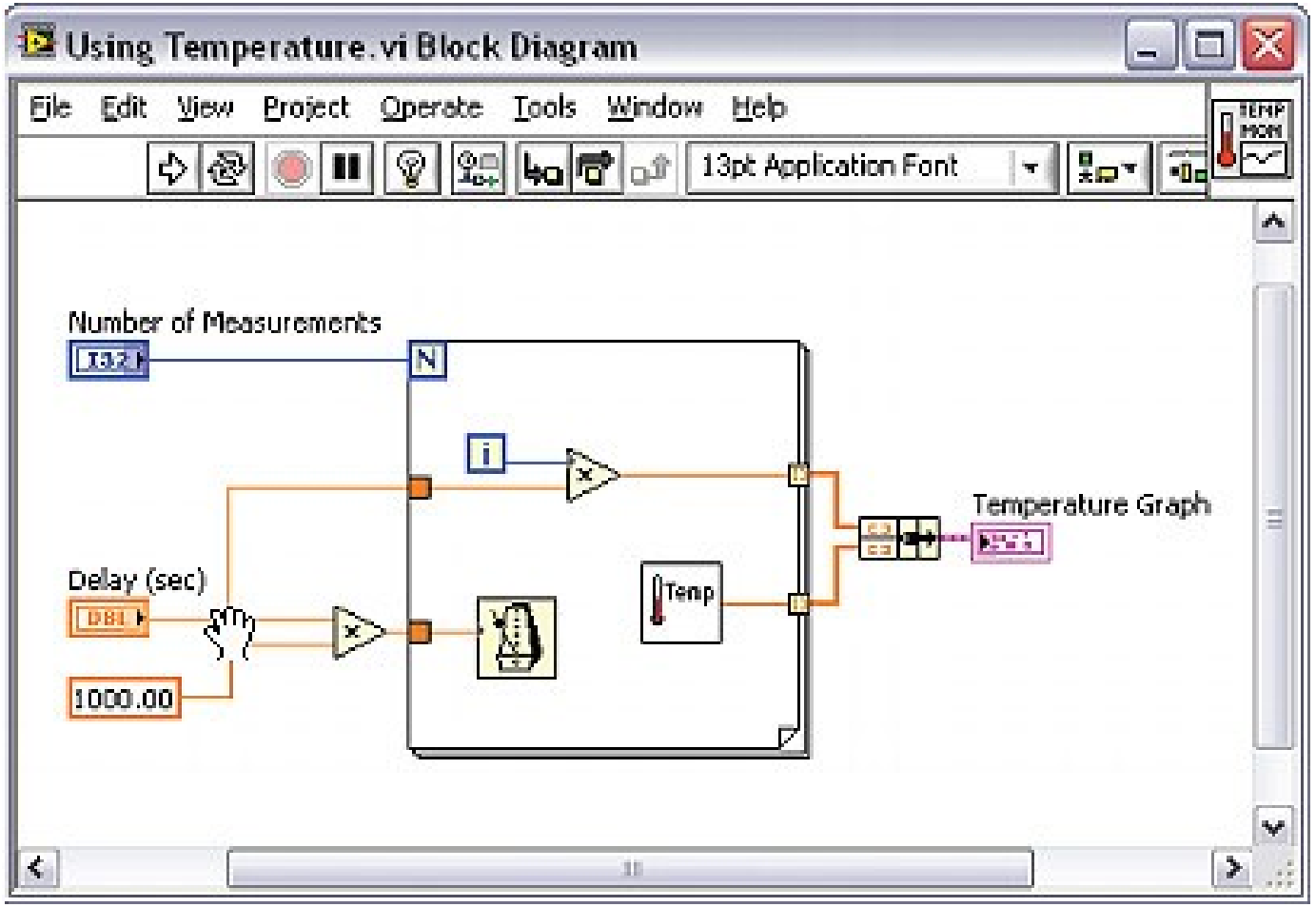
Controlli e indicatori

- Led
- Grafici
- Controllo numerico
- (nomi assegnati automaticamente)



Controlli e indicatori

- Led
- Grafici (freccia verso l'interno)
- Controllo numerico (freccia verso l'esterno)
- (nomi assegnati automaticamente)



Cicli

- For
- While
- Case

Ciclo For

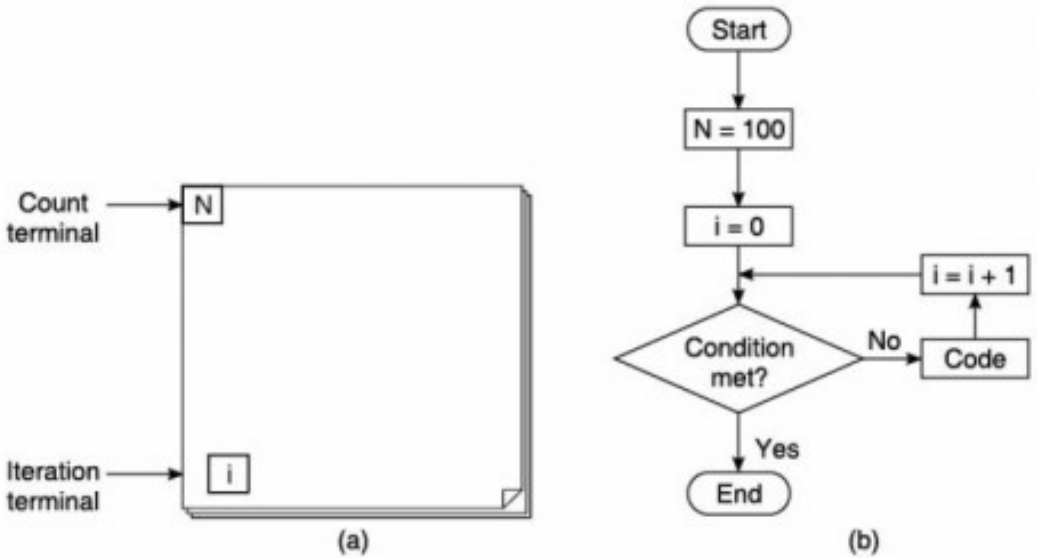
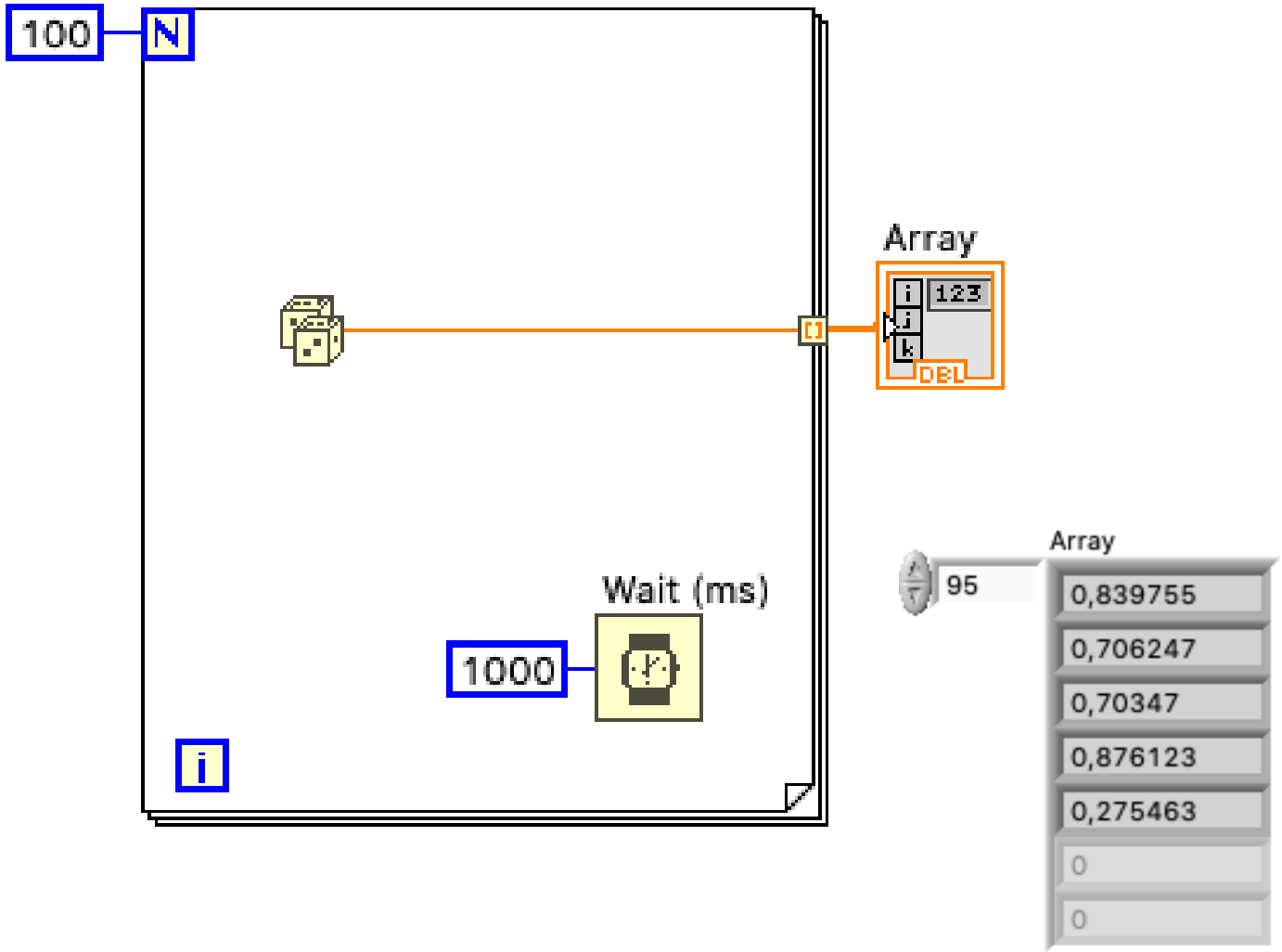
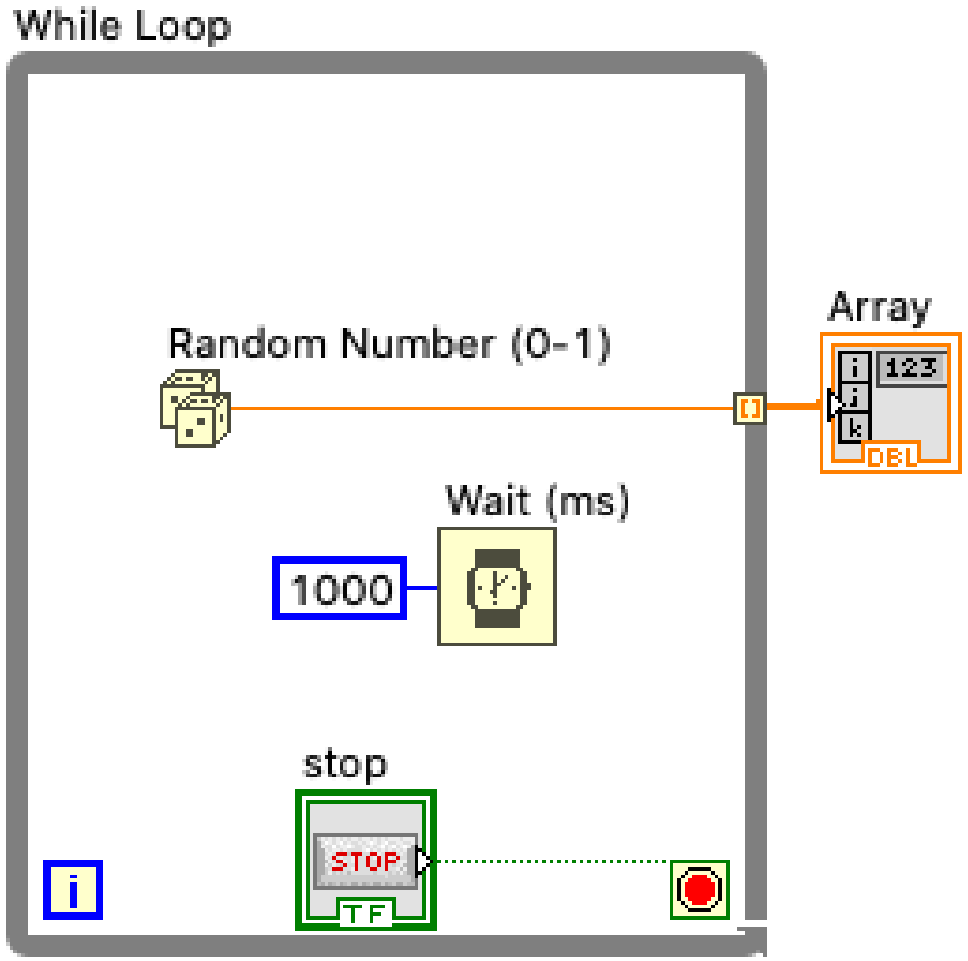


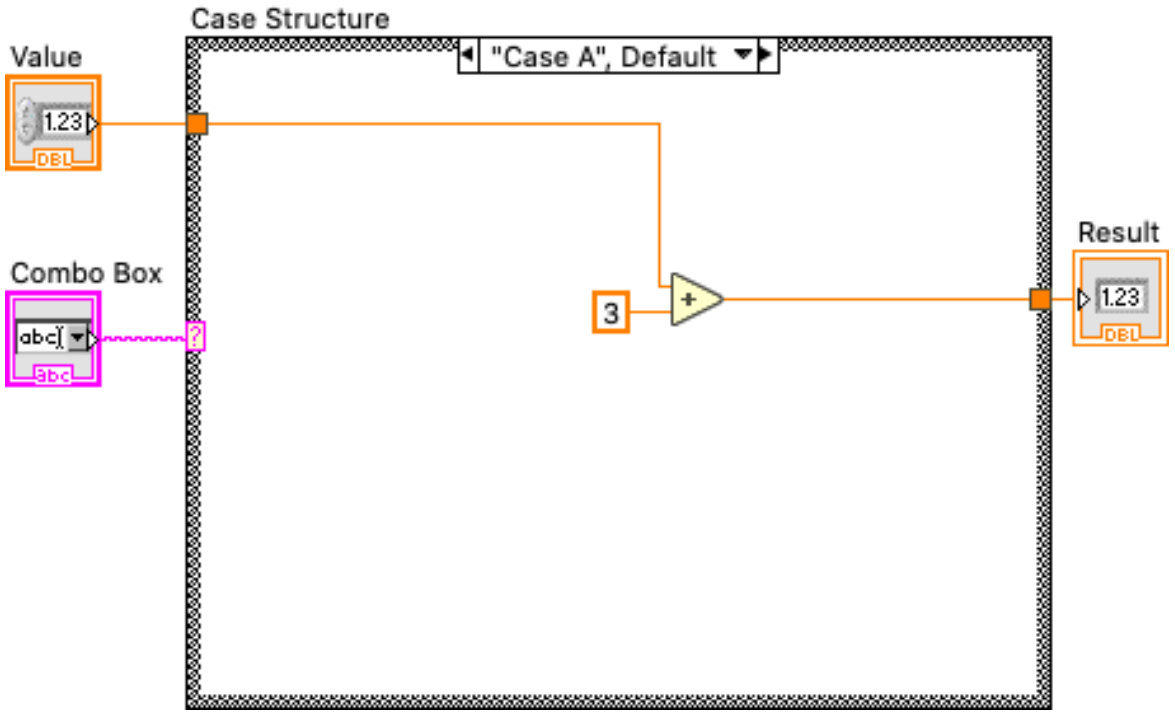
Figure 4.1 (a) For Loop in LabVIEW and (b) Flow chart equivalent to the For Loop.

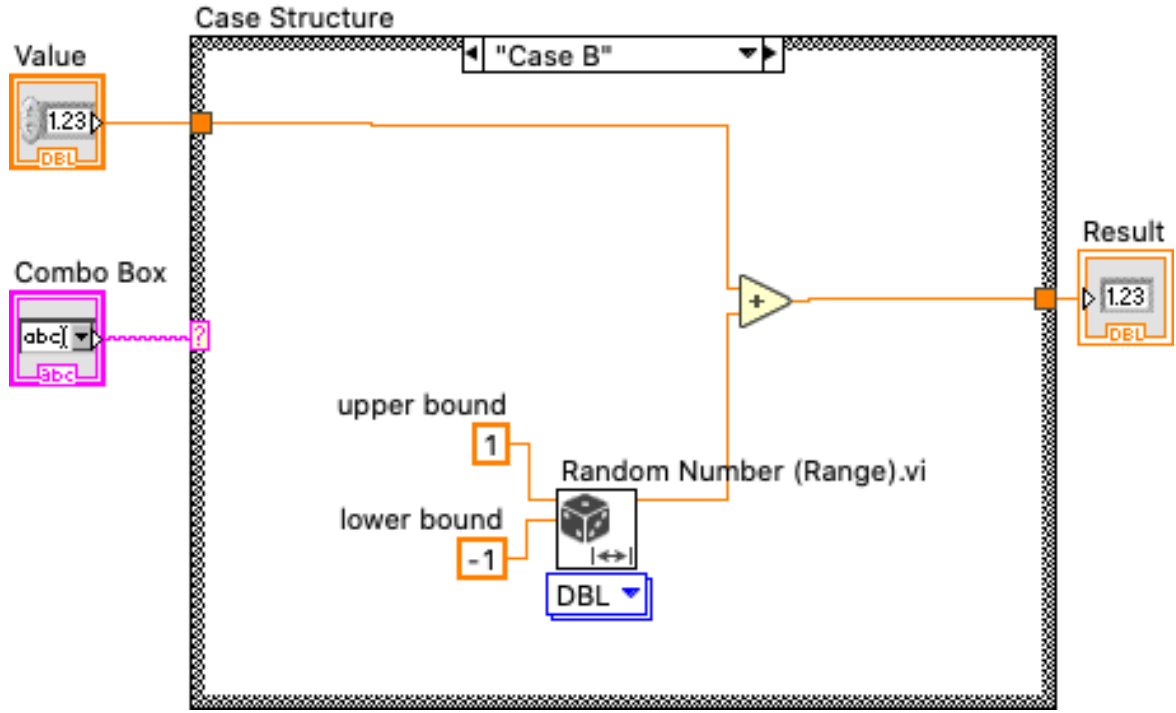


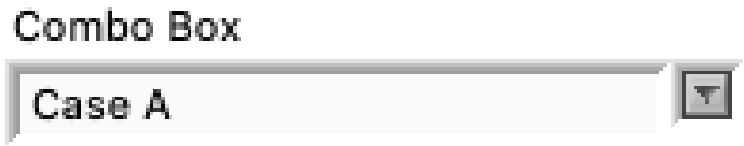
Ciclo While


While Loop
Random Number (0-1)
Array
123
DBL
Wait (ms)
1000
stop
STOP
TF
i

Ciclo Case


Case Structure
"Case A", Default
Value
1.23
DBL
Combo Box
abc
3
+
Result
1.23
DBL


Case Structure
"Case B"
Value
1.23
DBL
Combo Box
abc
upper bound
1
Random Number (Range).vi
lower bound
-1
DBL
+
Result
1.23
DBL


Combo Box
Case A