Do Engineering:

Experimentation for Every Single Student

Alex Floor, Academic Field Sales Engineer

NATIONAL INSTRUMENTS™


9th ANNUAL SPECIAL
THE HISTORY ISSUE
TIME
Thomas Edison
How One Powerful Idea Changed America
INSIDE HIS IDEA FACTORY
Graphic: How His Inventions Worked
Why He's Relevant Today

TAE Jany 3 1888

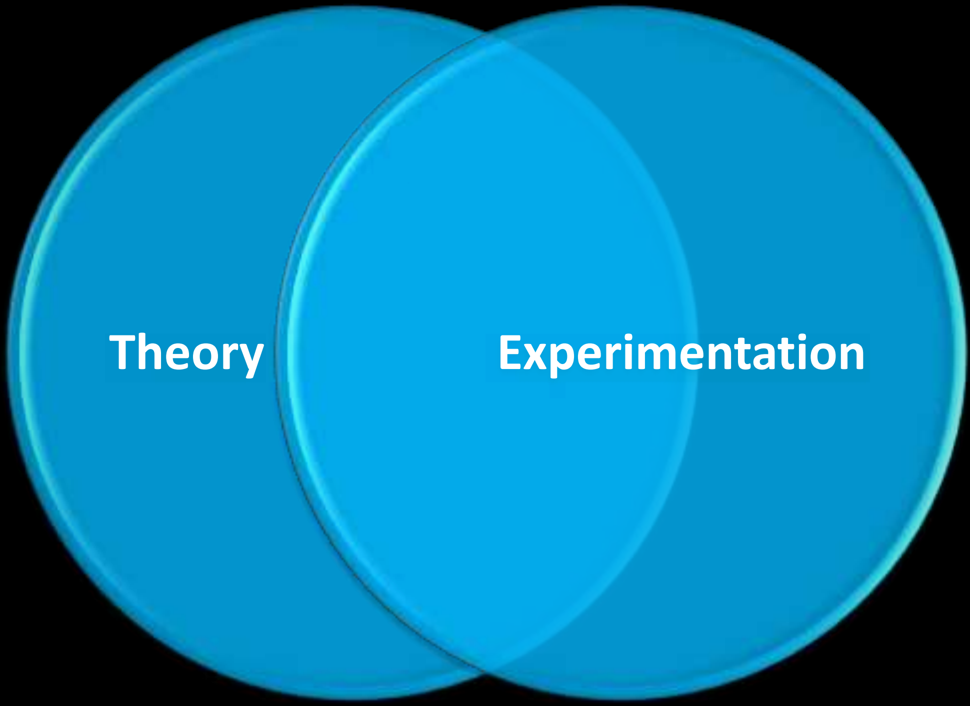
Things doing and to be done.

Cotton Picker
New Standard Phonograph
Hand turning phonograph.
New Slow Speed Cheap Dynamo.
New Expansion Pyromagnetic Dynamo.
Deaf Apparatus
Electrical Piano
Long distance standard Telephone transmitter which employs devices of recording phonogh
Telephone Coil of Fe by H in Parafine or other insulator
Platina Point Trans using new phono Recorder devices;
Grid Battery for Telephones
" " " " Long distance
" " " — Phonoplex
" " " Jump telegraph
" " " Volt meter,

Improved Magnetic Bridge for practical work
Motograph Mirror
" Relay
" Telephone practical.

Artificial Cable
Phono motor to work on 100 volt ckts
Duplicating Phono Cylinders
Deposit in Vacuo on Lace gold & silver also on Cotton Molten Chemical compound of lustrous surfaces to imitate silk — also reg plating system
Vacuous Ore milling Large Machine,
Magnetite Seperator Large "
Locking material for Iron Sand.

The Era of Experimentation



Engineering Grand Challenges


Advance health informatics


Engineer the tools of scientific discovery


Reverse-engineer the brain


Provide energy from fusion


Engineer better medicines


Provide access to clean water


Enhance virtual reality


Restore and improve urban infrastructure


Develop carbon sequestration methods


Advance personalized learning


Make solar energy economical


Prevent nuclear terror


Secure cyberspace


Manage the nitrogen cycle

Do ENGINEERING

To Do:

Haptics for tumor detection
3D Display System
Rotary UAV autopilot
Perfect Tuner

Pitch Pressure analysis and logging system

WIN EcoCAR!

The GRAND Challenges

Advance health informatics
Engineer the tools of scientific discovery
Reverse-engineer the brain

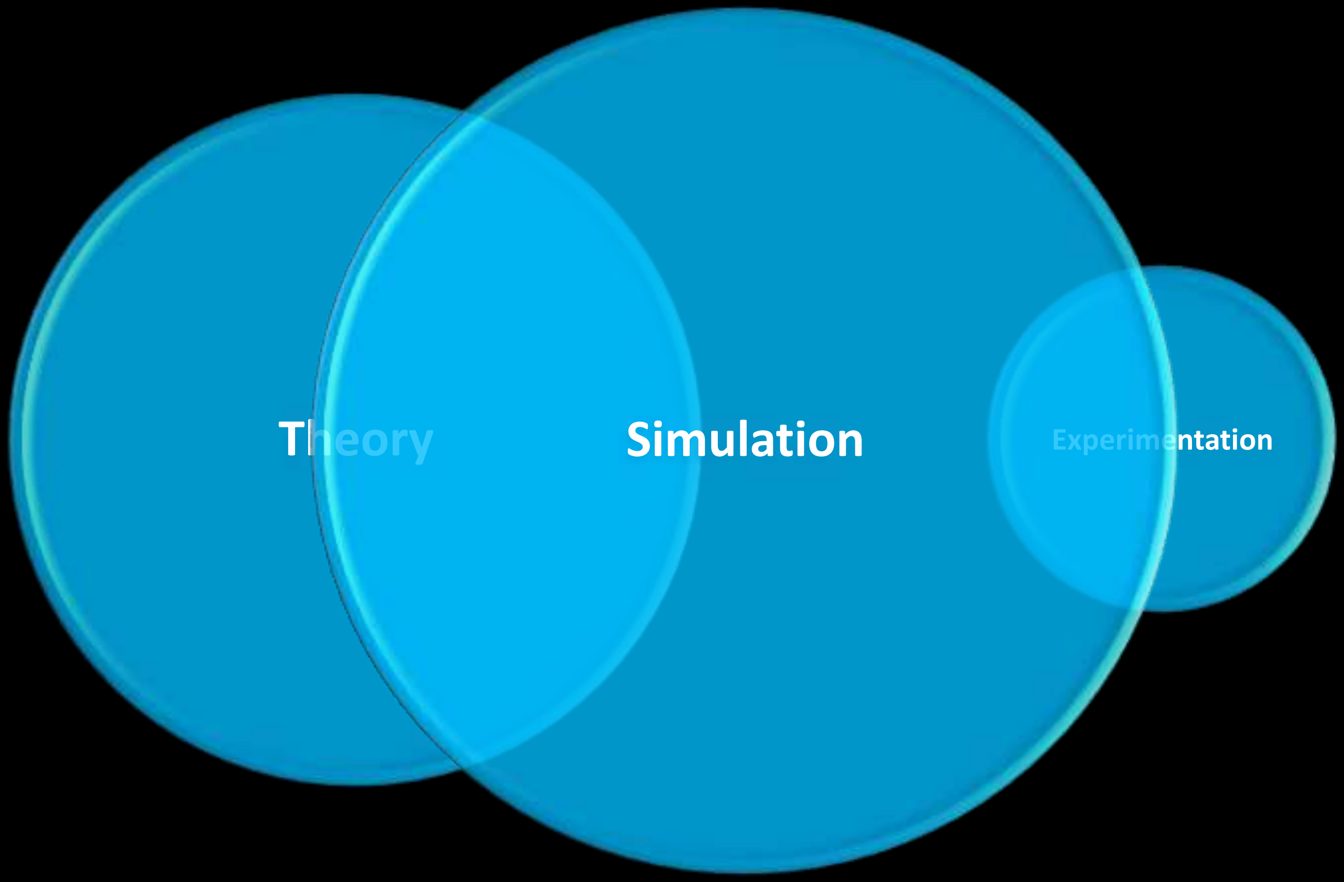
Provide energy from fusion
Engineer better medicines
Provide access to clean water
Enhance virtual reality
Restore and improve urban infrastructure
Develop carbon sequestration methods
Advance personalized learning
Make solar energy economical

Prevent nuclear terror
Secure cyberspace
Manage the nitrogen cycle

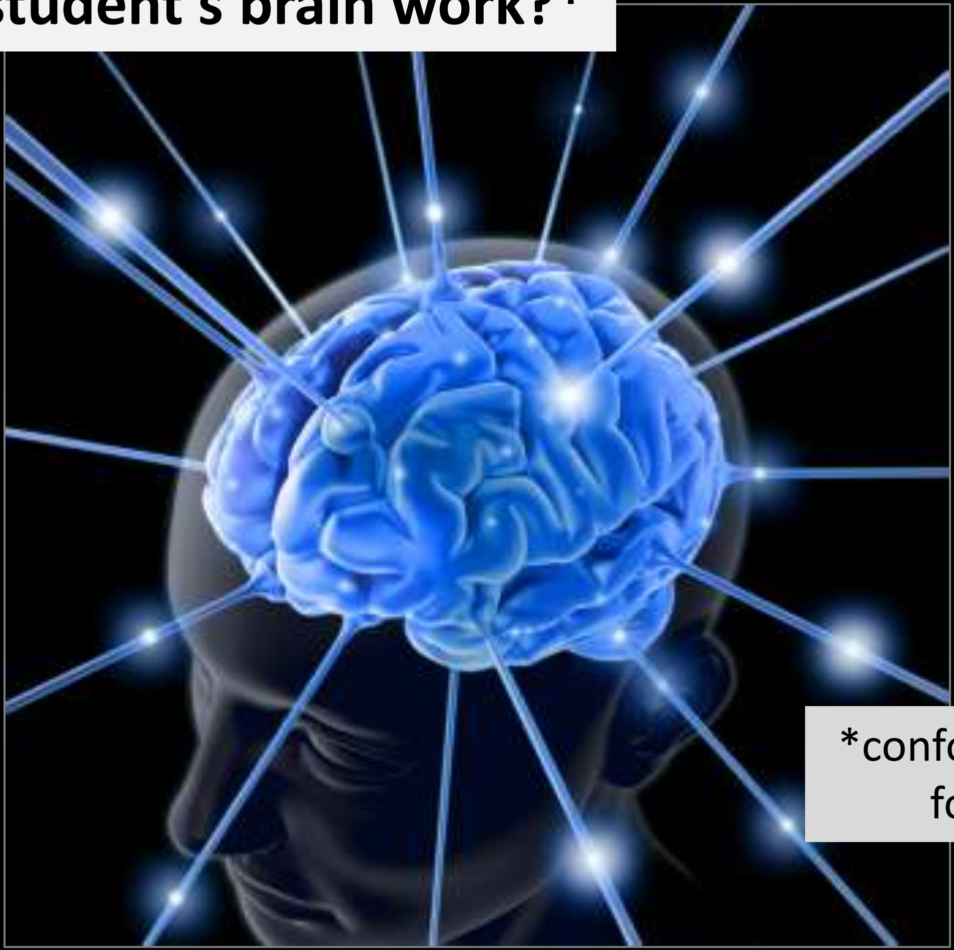
Obstacles to Duplicating Edison's Lab:

- $ Cost
- 🕑 Accessibility & Time
- Ratio

The Rise of Simulation (1980's)

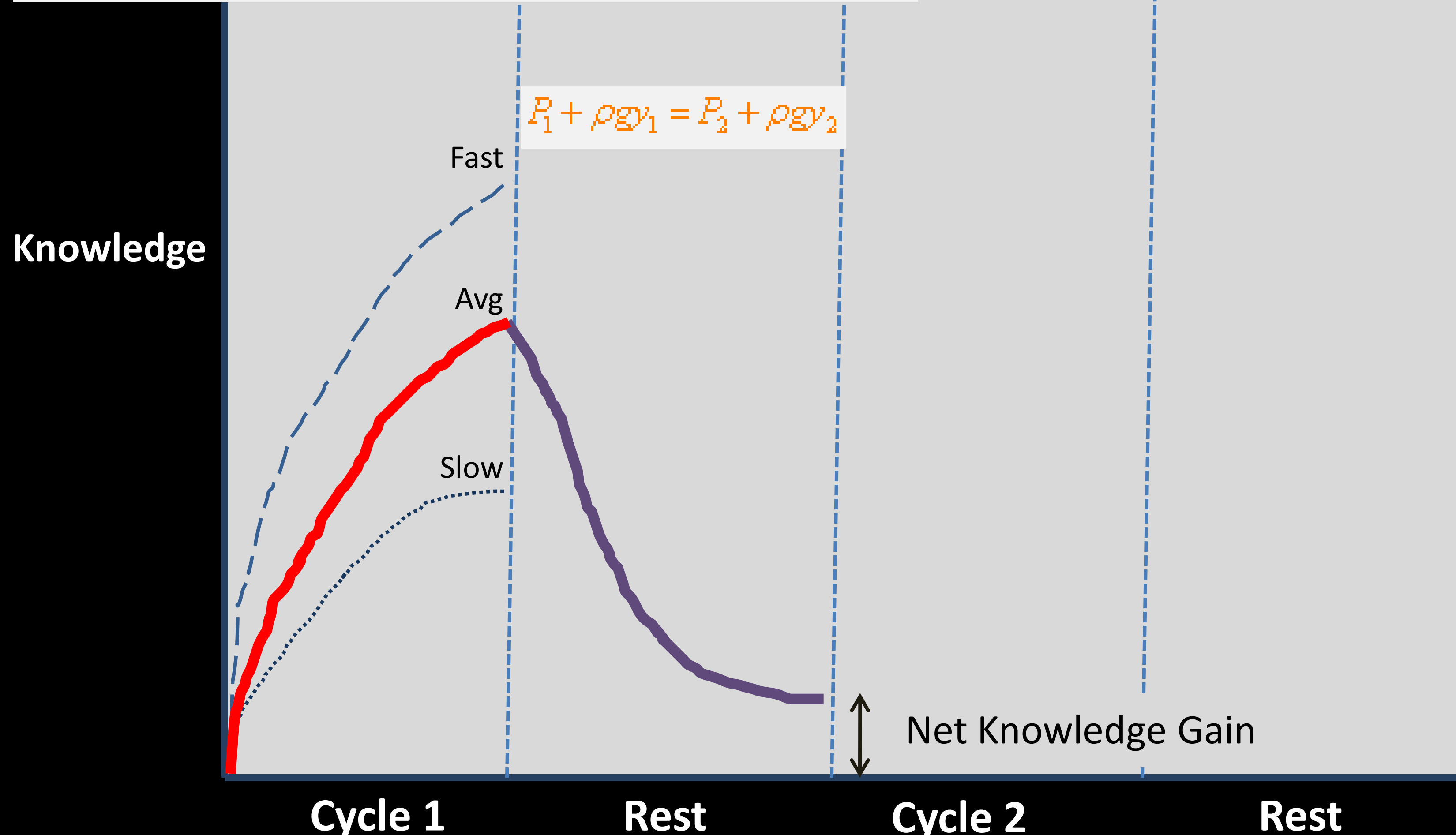


How does a student's brain work?*

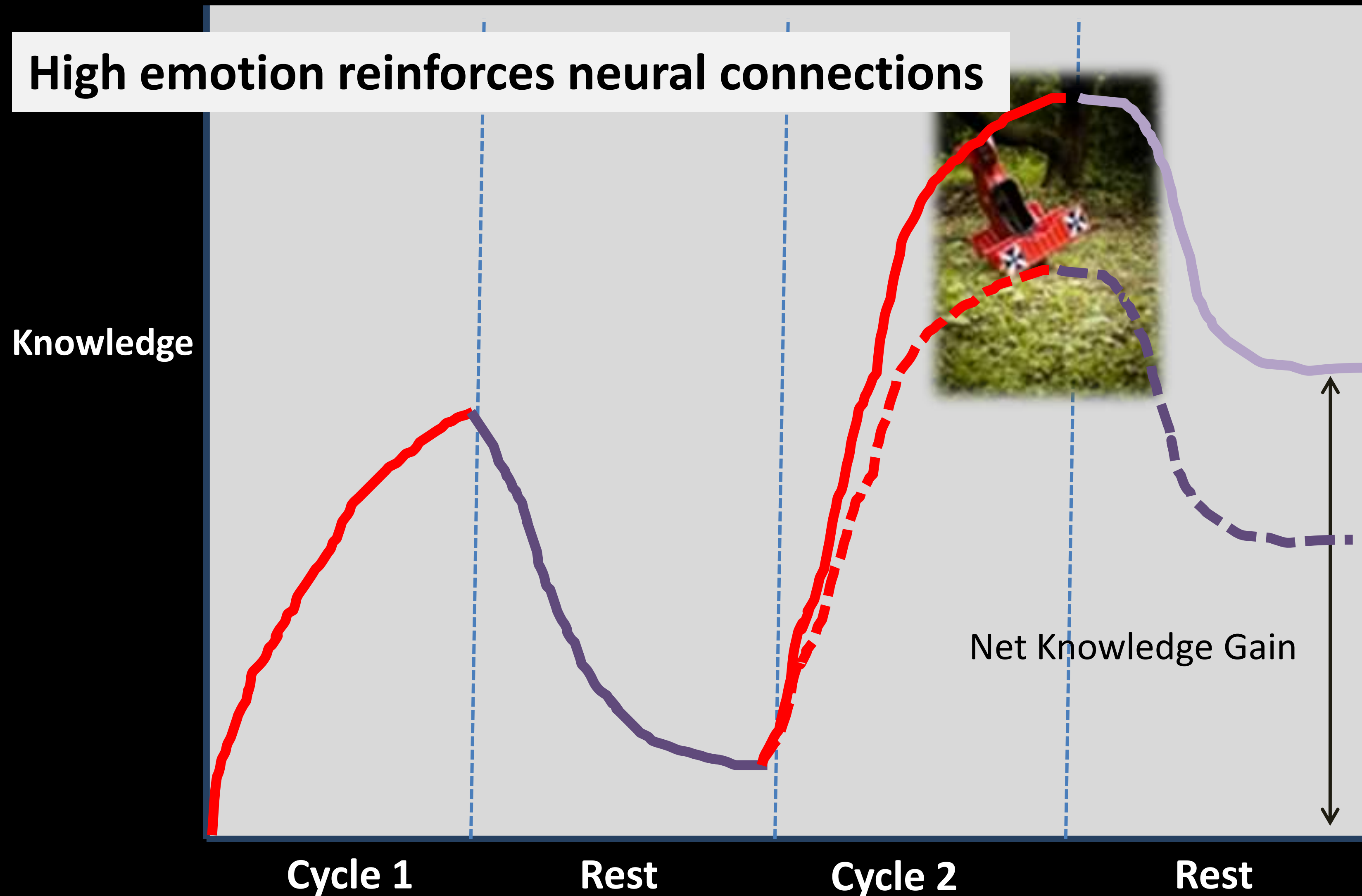


*confounded teachers for centuries!

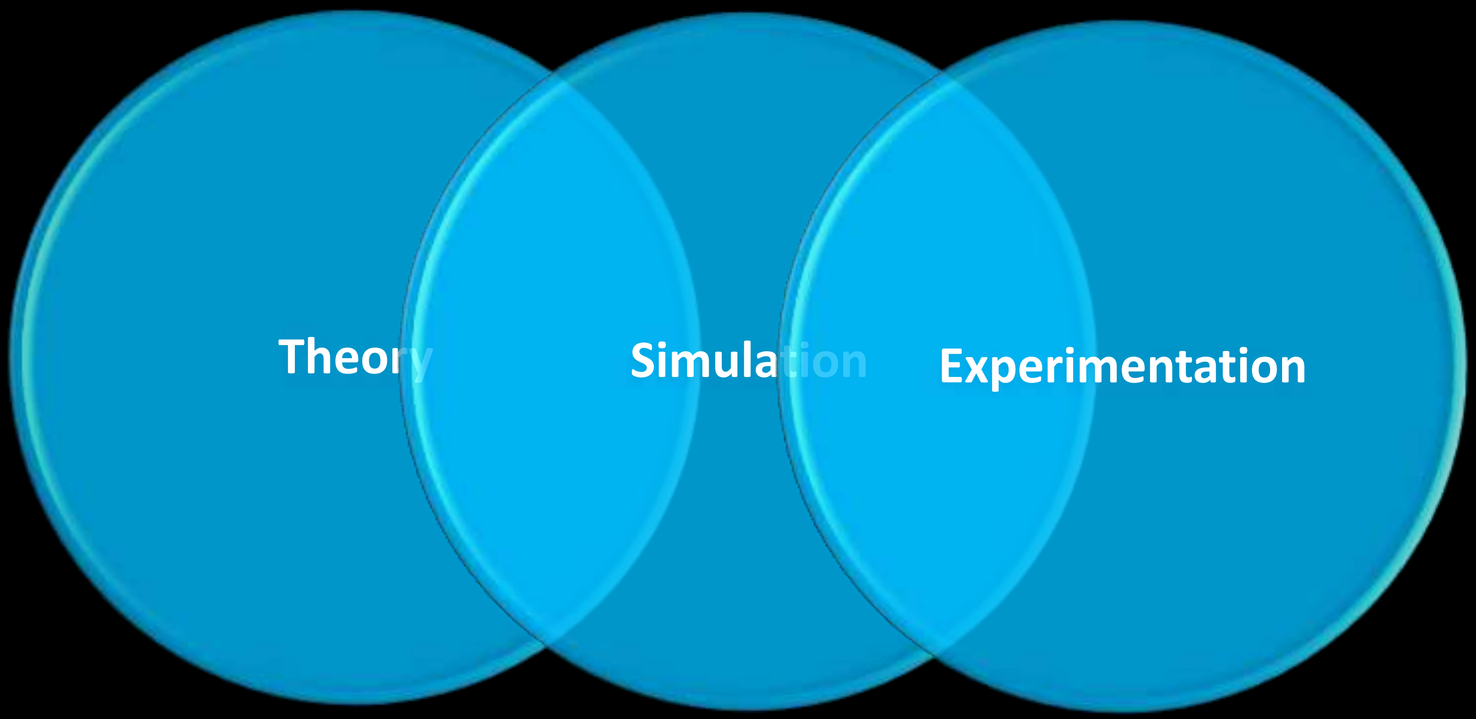
Training a biological neural network



High emotion reinforces neural connections

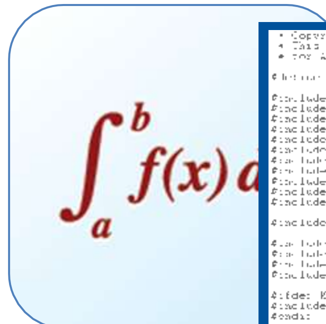


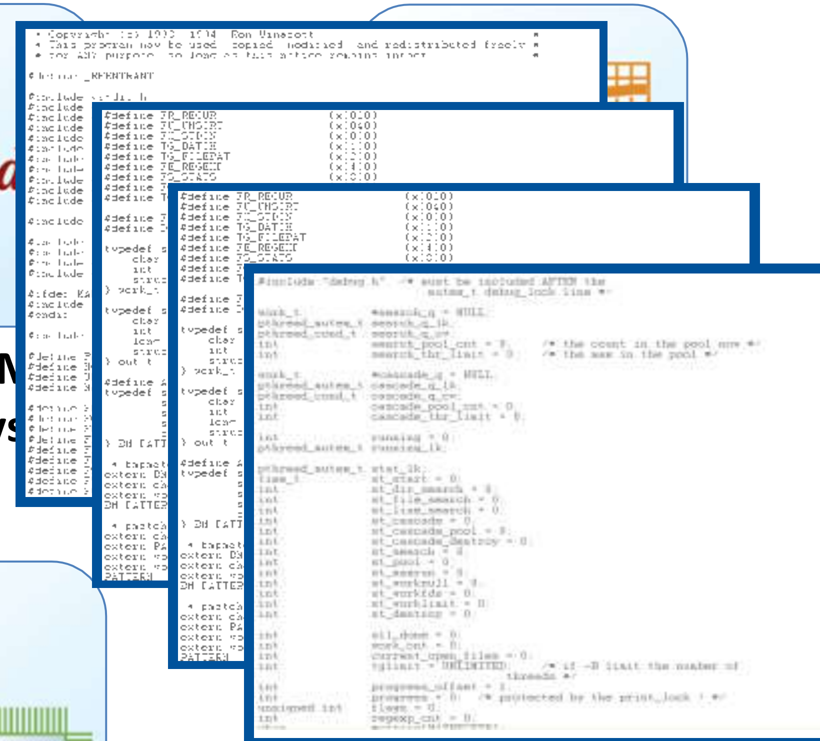
The Return to the Era of Experimentation



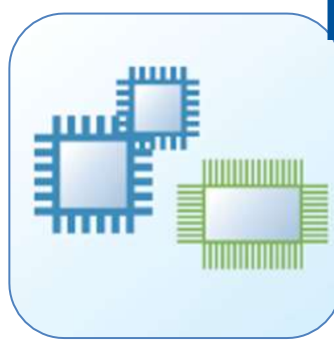
Elements of Engineering

Measurement and Control I/O

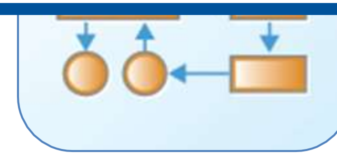




Deployable M and Analys

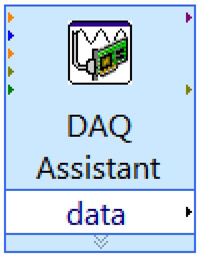


Technology Integration

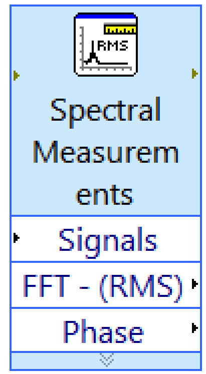


Models of Computation

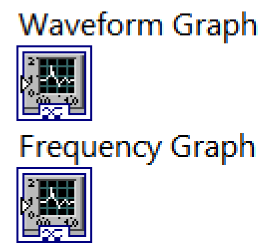
Compatible Elements



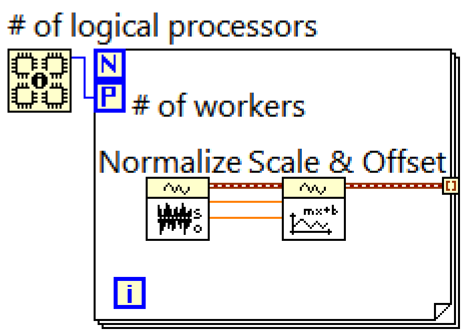
Measurement and Control I/O



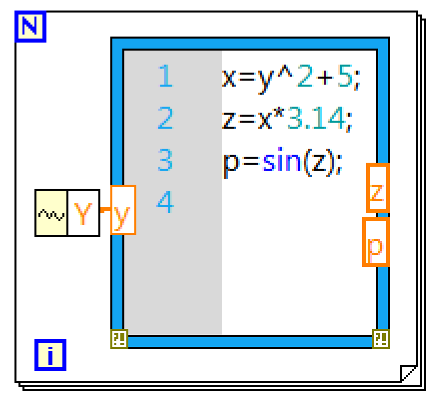
Deployable Math and Analysis



User Interface

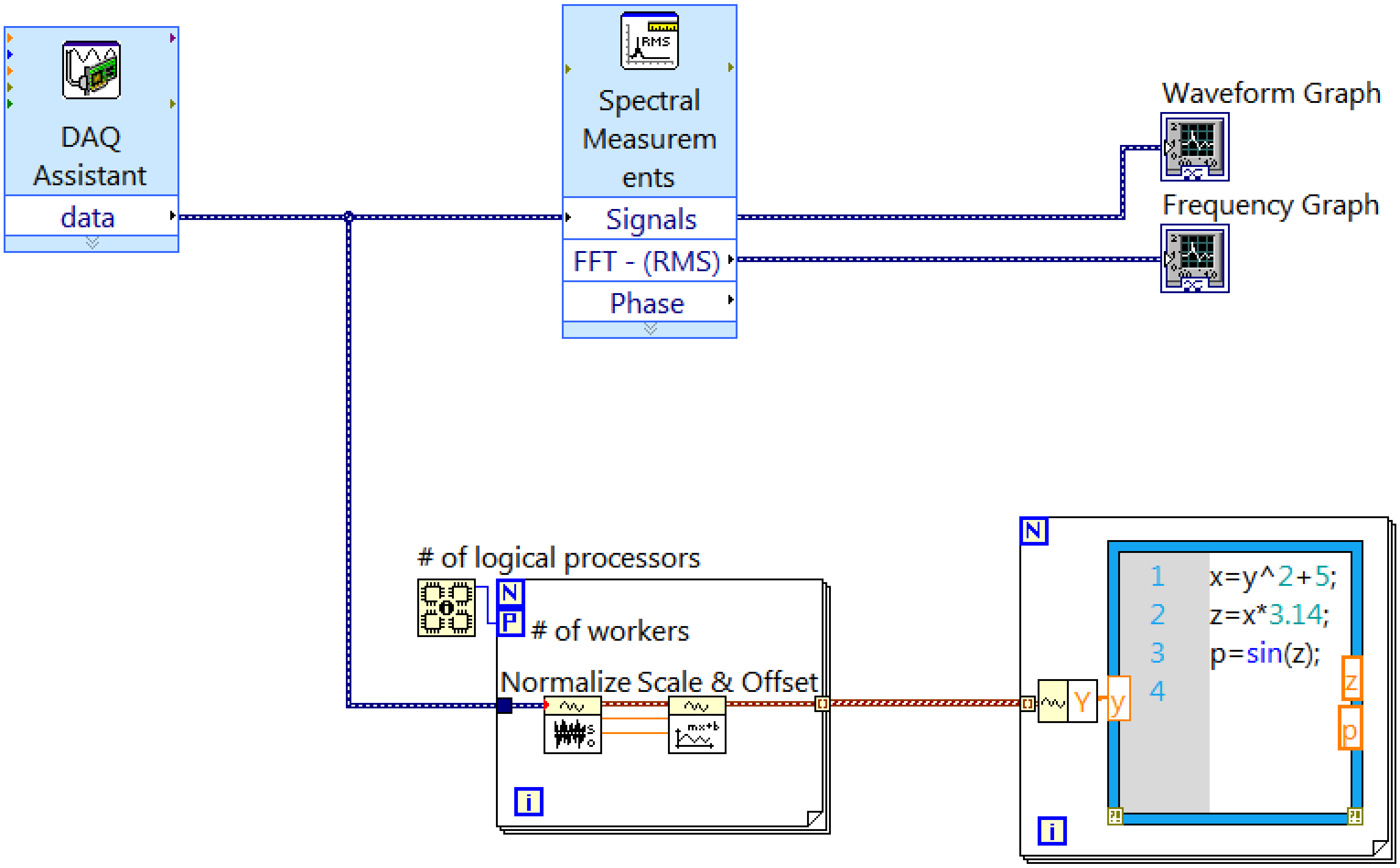


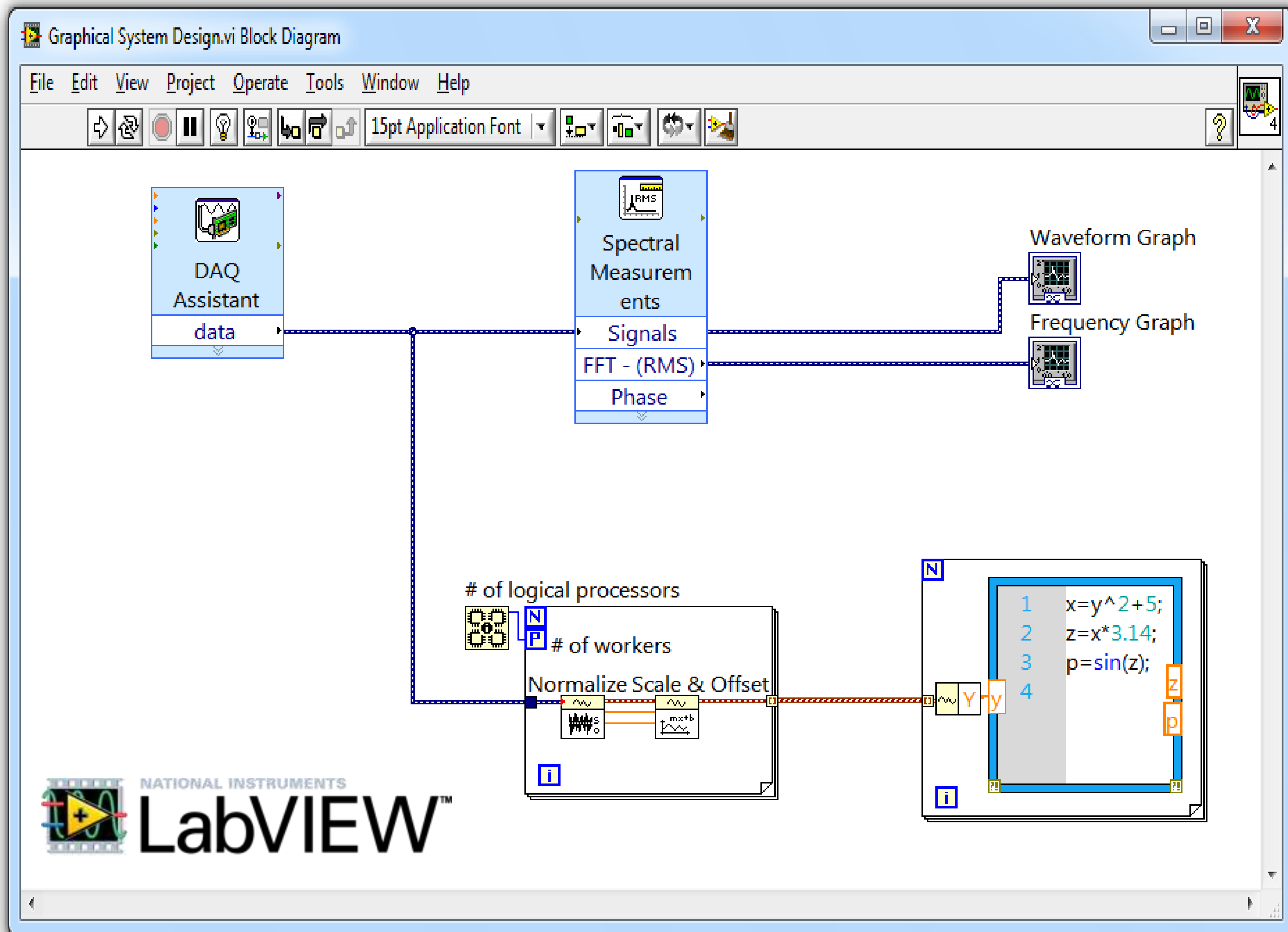
Technology Integration



Models of Computation

Easily Combined





Graphical System Design.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
DAQ Assistant
data
Spectral Measurements
Signals
FFT - (RMS)
Phase
Waveform Graph
Frequency Graph
# of logical processors
N
P
# of workers
Normalize Scale & Offset
i
N
1 x=y^2+5;
2 z=x*3.14;
3 p=sin(z);
4
Y
y
z
p
i
NATIONAL INSTRUMENTS
LabVIEW™


Graphical System Design.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font


Graphical System Design.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
NI LabVIEW system design environment

NI ELVIS | Do Engineering: In the Lab

ni.com/nielvis

Adam Foster
Academic Product Manager

NI ELVIS

Oscilloscope

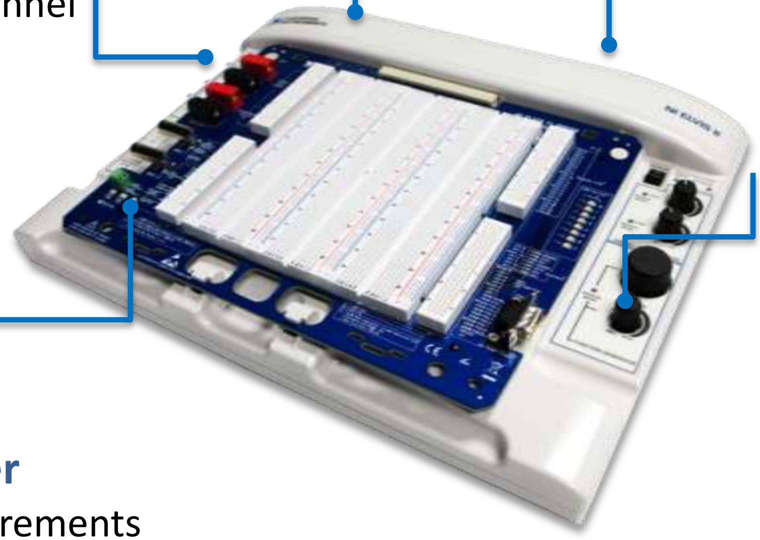
- ELVIS II+: 100MS/s Sampling Rate
- ELVIS II: 1.25 MS/s single channel, 500kS/s two channel aggregate
- 16-bit resolution
- 1 to 1.5 MHz Bandwidth
- 1x and 10x probe
- ±10 V input range
- AC/DC coupling

Internal Circuit Protection

- Resettable fuses

USB Connectivity

- Plug-and-play capability
- USB 2.0 Connection



Function Generator

- 10 bit, ±5V range
- 0.2 Hz to 5 MHz Sine
- 0.2 Hz to 1 MHz Triangle/Square
- Software or manual control
- BNC or prototyping board connection

Digital Multimeter

- Isolated measurements
- 5½ digit resolution
- 60 VDC, 20Vrms, 2 ADC, 2 RMs, 100MΩ



NI ELVIS | Multidisciplinary Teaching Platform

Circuits	Measurements	Control	Embedded	Communications
Electrical, Biomedical, Mechatronics	Physics, Chemistry	Electrical, Mechanical, Systems	Electrical, Computer	Electrical, Computer, Physics
				
NATIONAL INSTRUMENTS	Vernier	QUANSER INNOVATE. EDUCATE.	freescale semiconductor	EMONA tims

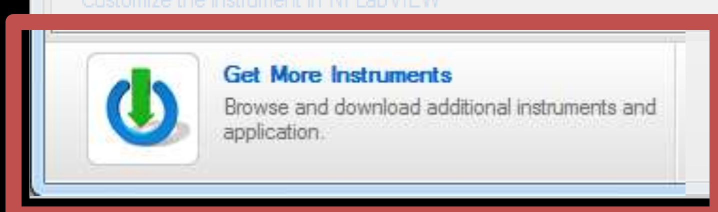
NI ELVIS | Partner Board Additions

Biomedical	Signal Processing
QNET Myoelectric Trainer	SIGEx Signals & Systems Trainer
 QUANSER INNOVATE. EDUCATE.	 EMONA tims

NATIONAL INSTRUMENTS™

NI ELVIS | Virtual Instruments

- Digital Frequency
- Digital Thermometer
- Karaoke Circuits
- DC Motor H-Bridge
- Respiration Monitor
- Resistor Color Code
- Magnetic Field Measurement
- Light Intensity Measurement
- DC Motor Control Using a Tachometer
- H-Bridge DC Motor
- LED Harp
- PID Motor Control
- Servo Motor Controller
- Pitch Measurement
- Pulse Width Modulation Output
- Edge Counting
- Angular Position
- IV Curve Tracer
- Adjustable Pulse Width Modulation
- Digital Waveform Measurement (NI ELVIS only)

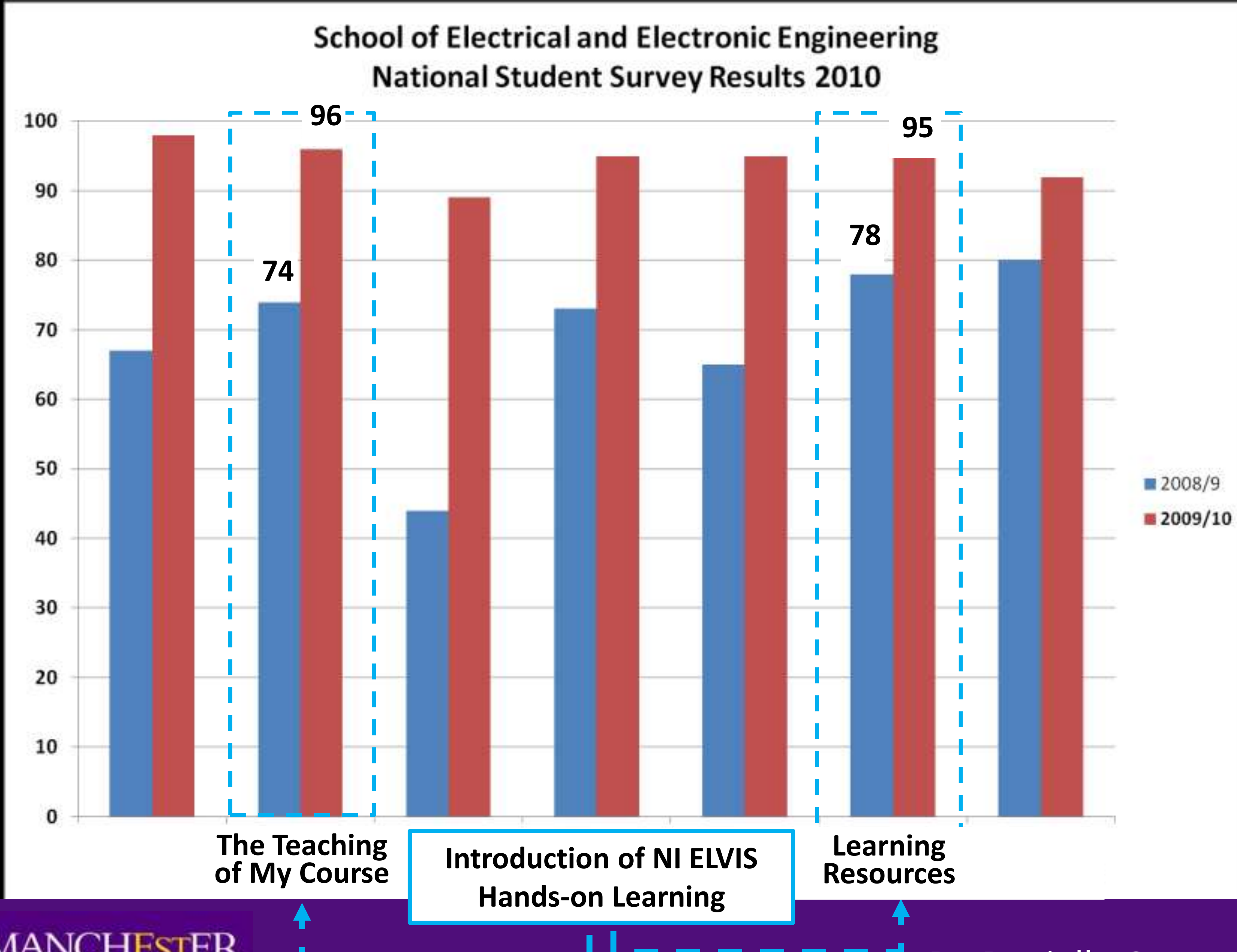


Electronics at The University of Manchester

“…students are now exposed to the hands-on learning experience throughout the first course to complex final year projects.”

Dr. Danielle George

[School of Electrical and Electronic Engineering]



Dr. Danielle George

NI myDAQ | Do Engineering: Anywhere, Anytime

Analog ICs Supplied by TEXAS INSTRUMENTS

ni.com/mydaq

Mark Walters
Academic Product Manager

Universities Using NI myDAQ

PennState

UNIVERSITY OF WISCONSIN

NEVADA

Massachusetts Institute of Technology

CLEMSON UNIVERSITY

CORNELL UNIVERSITY FOUNDED A.D. 1865

MÄLARDALEN UNIVERSITY SWEDEN

Ucla BRUINS

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

UCSD

Cal

OHIO STATE

UNIVERSITÉ PARIS-SUD 11

K-STATE.

UNIVERSITY OF LEEDS

MANCHESTER 1824 The University of Manchester

HOCHSCHULE REGENSBURG UNIVERSITY OF APPLIED SCIENCES

East Carolina UNIVERSITY

technische universität dortmund

NI myDAQ

Analog Input:

2 channels, 200kS/s/ch, 16-bit

Analog Output:

2 channels, 200kS/s/ch, 16-bit

DIO: 8 lines

CTR: 1 counter

Integrated DMM: V, A, Ohm

Power Supply: +5V, +/-15V

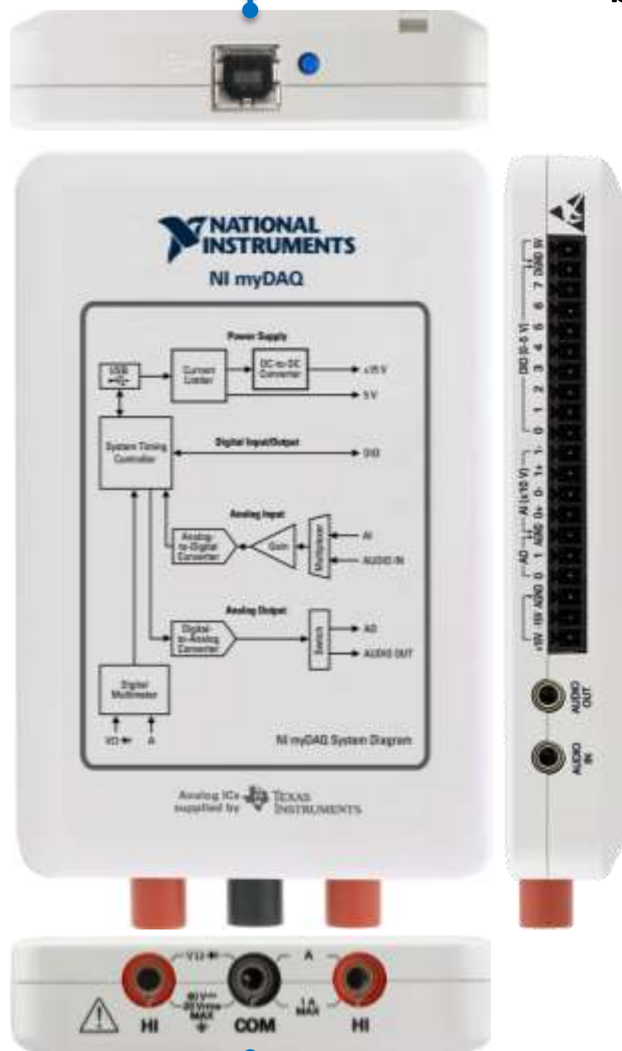
3.5mm stereo audio jacks

ELVISmx SW Instruments:

DMM, O-scope, FGEN, Bode, DSA, ARB, Digital In/Out

Analog ICs Supplied by

Texas Instruments



USB controlled, bus powered

Power Supply: +5V

8 DIO lines, 1 counter

2 AI lines

2 AO lines

Power Supply: +/- 15 V

Audio IN/OUT

Integrated DMM


Make experimentation
relevant and
accessible to
every single student.
NATIONAL INSTRUMENTS

Student Design | Do Engineering: On a System Level

ni.com/studentdesign

NATIONAL INSTRUMENTS™

Engineering Grand Challenges


Advance health informatics


Engineer better medicines


Develop carbon sequestration methods


Engineer the tools of scientific discovery


Provide access to clean water


Advance personalized learning


Secure cyberspace


Reverse-engineer the brain


Enhance virtual reality


Make solar energy economical


Manage the nitrogen cycle


Provide energy from fusion


Restore and improve urban infrastructure


Prevent nuclear terror

Virginia Tech wins EcoCAR Challenge

…it was critical to have an easy-to-use platform that could be used by everyone from start to finish.

Jesse Alley
[Graduate Advisor, Virginia Tech Hybrid Electric Vehicle Team (HEVT)]

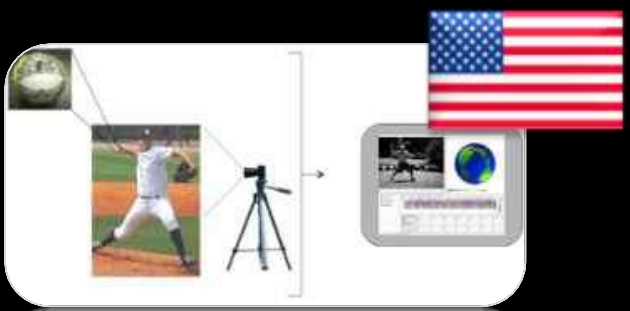
Student Design Competition Finalists

"Haptics for Tumor Detection During Surgery"
University of Leeds

"3D Display System"
Tsinghua University

"Rotary UAV Autopilot"
Konkuk University

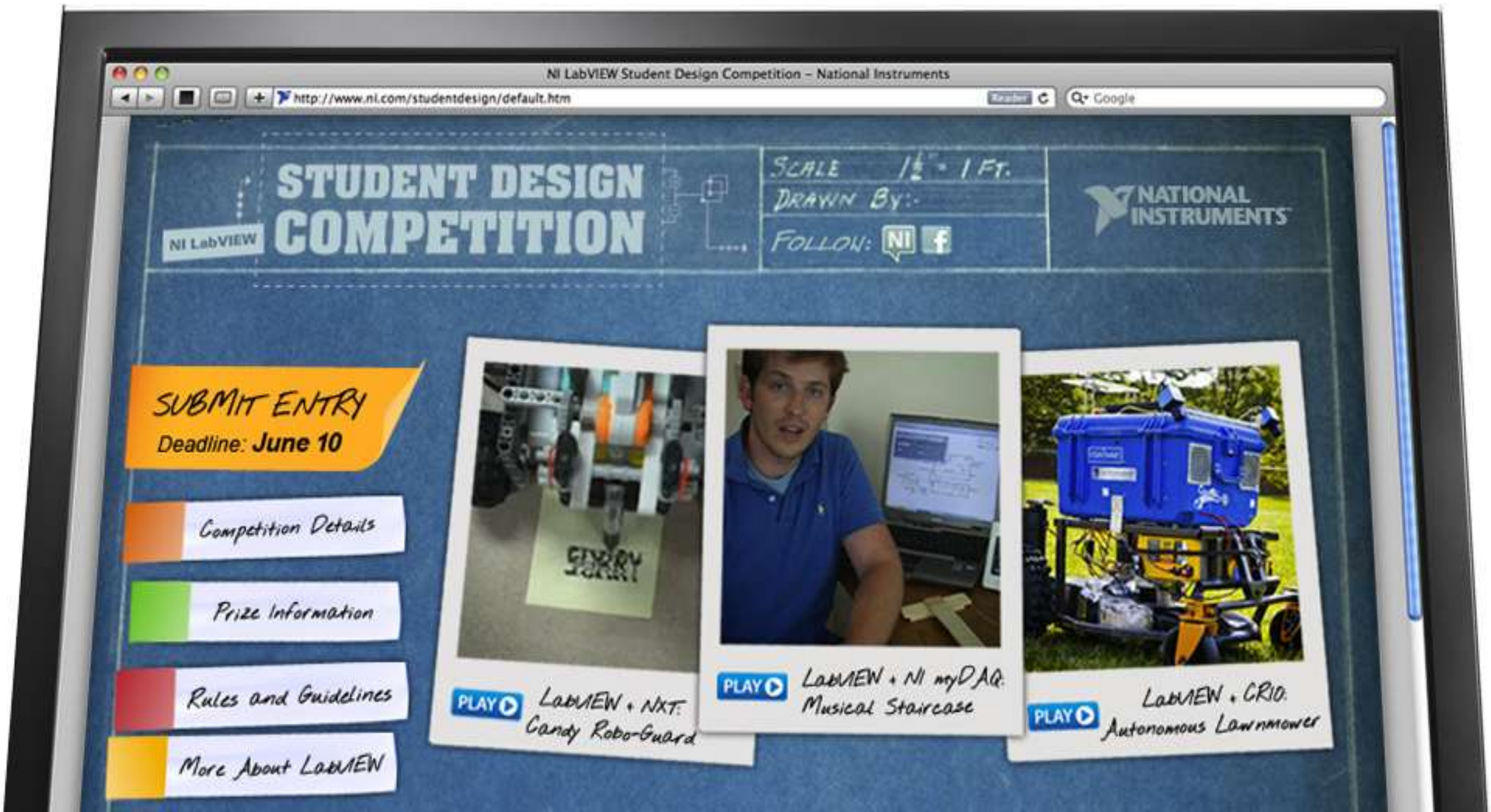
"Tuneacious Perfect Tuner"
The University of California, San Diego



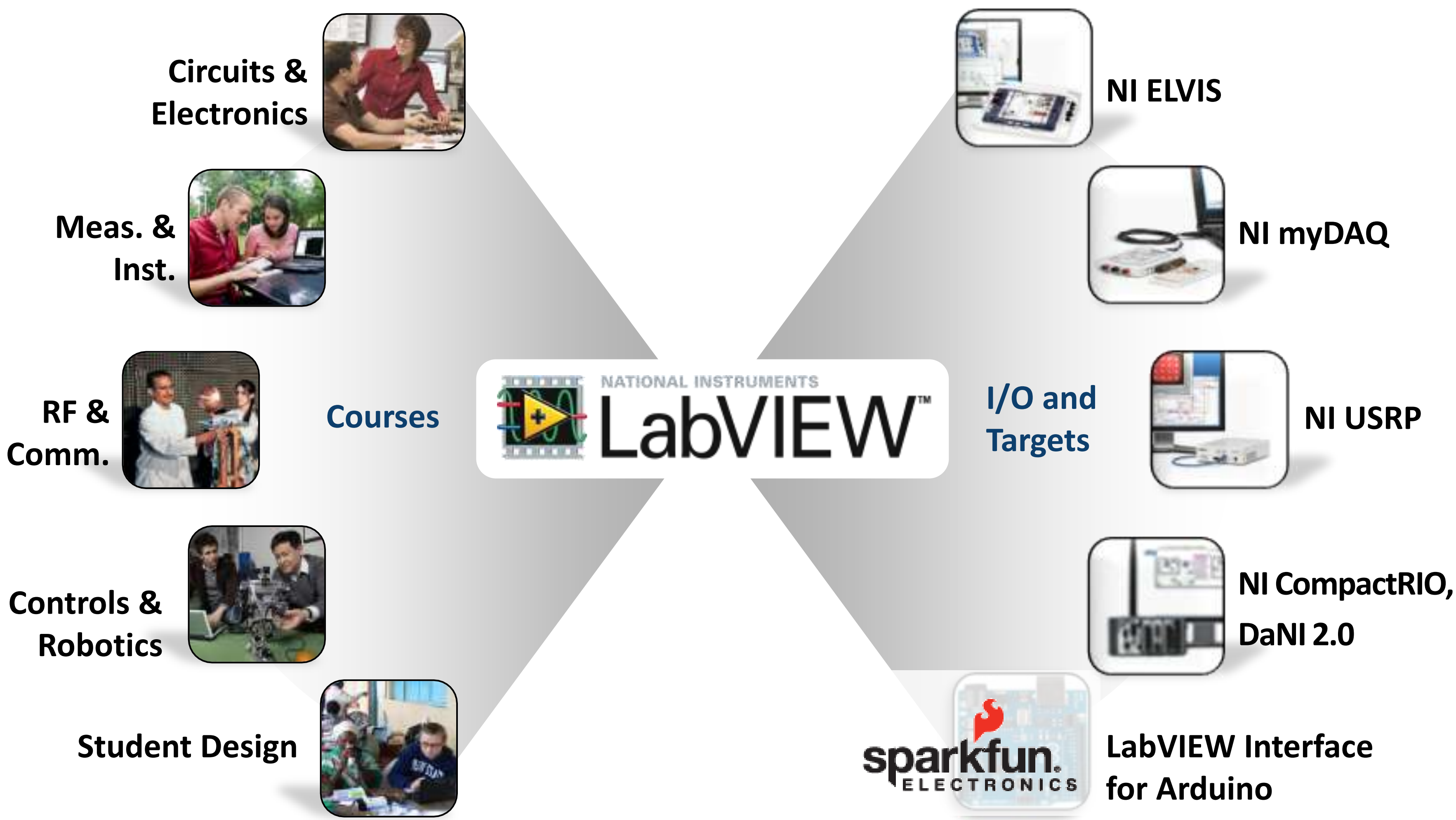
"PitchPALS: Pitch Pressure Analysis and Logging System"
Rice University

Now Accepting Submissions for 2012

SUBMIT YOUR PROJECT AT
NI.COM/STUDENTDESIGN



NI Graphical System Design in Education



✓ Do Engineering

To Do:

- ✓ Haptics for tumor detection
- ✓ 3D Display System
- ✓ Rotary UAV autopilot
- ✓ Perfect Tuner
- ✓ Pitch Pressure analysis and logging system

✓ WIN EcoCAR!

The GRAND Challenges

Advance health informatics
Engineer the tools of scientific discovery
Reverse-engineer the brain

Provide energy from fusion
Engineer better medicines
Provide access to clean water
Enhance virtual reality
Restore and improve urban infrastructure
Develop carbon sequestration methods
Advance personalized learning
Make solar energy economical

Prevent nuclear terror
Secure cyberspace
Manage the nitrogen cycle

Make experimentation **relevant** and **accessible** to **every single student.**

NATIONAL INSTRUMENTS™


Do Engineering

NATIONAL INSTRUMENTS™