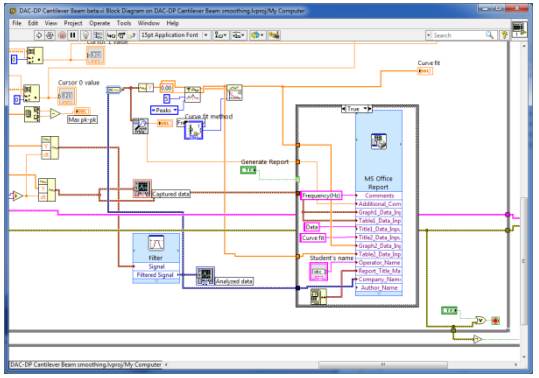
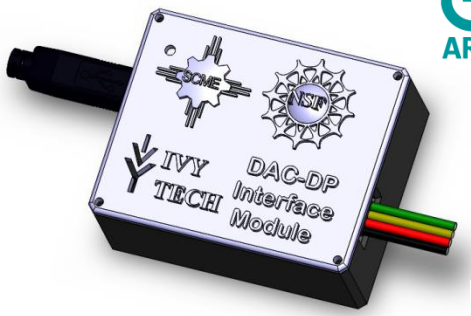
Using Arduino Uno and LabView to Learn MEMS Concepts

Andrew G. Bell
July 22, 2019



As the Internet of Things explodes, it is critical that technicians learn how sensors are integrated with electronics. This workshop will demonstrate the use of MEMS kits in tandem with Arduino Uno microcontrollers and LabView software. Participants will learn how pressure sensor devices and cantilever beams are built and used in educational environments. Participants will be provided mini-MEMS kits that will include pressure sensors and cantilevers with attached strain gauges. Both sensors will interface with an Arduino UNO and custom shield. The Arduino will be controlled by a PC running custom LabView data acquisition code. Participants will receive all the material and software used in the Workshop.



ARDUINO

NATIONAL INSTRUMENTS
LabVIEW

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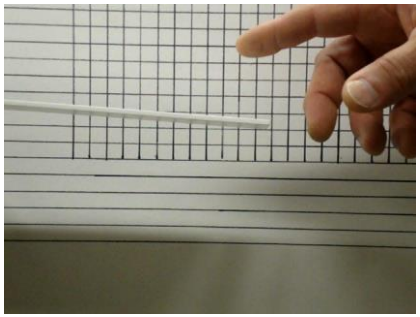
Ivy Tech started its associating with SCME in the Fall of 2012 and has been a Co-PI on Southwest Center for Microsystem Education (SCME) NSF ATE Grant. We also have a NSF ATE small project grant for Microsystems Certification

MEMS Kits Implementation Plan IVY TECH (Fort Wayne & Valparaiso)								
	MEMS Kit	**ENGT 120**	**METC 111**	**METC 143**	**EECT 111**	**EECT 112**	**ENGR 251**	**ENGT 279**
1	MEMS: Making Micro Machines Kit	X						
2	Dynamic Cantilever Kit		X	X			X	
3	Crystallography Kit			X				
4	Pressure Sensor Model Kit	X			X	X	X	
5	GeneChip Model Kit	X						
6	MEMS Innovators Kit							X
7	Lift-off Kit			X	X			
8	Pressure Sensor Process Kit				X			
9	LIGA Micromachining Simulation Kit			X				
10	Anisotropic Etch Kit			X	X			
11	Rainbow Wafer Kit	X						



http://scme-support.org/

The Arduino is a small inexpensive microcontroller board that allows for easy and popular (electronic) project development.

A microcontroller typically includes, I/O, memory and a microprocessor. It is sort of a mini microprocessor board.

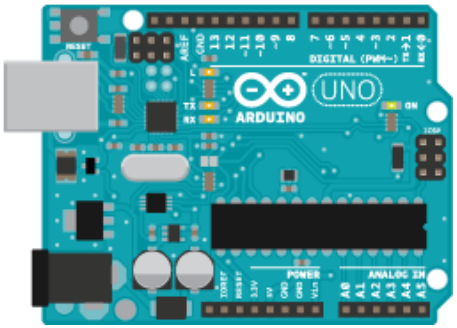
The Arduino is built to accept daughter boards called Shields and there exists many commercially available shield that you can stack onto your Arduino boards.

One of the most common shields is called a prototype shield and it allow the user to develop their own electronics.

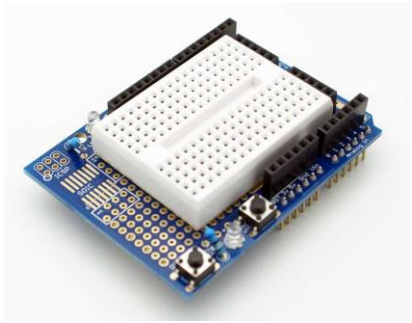
The Arduino can be programmed with simple free open source code or even high level or graphically based languages like LabView.

2 - https://www.arduino.cc/

What is an Arduino?

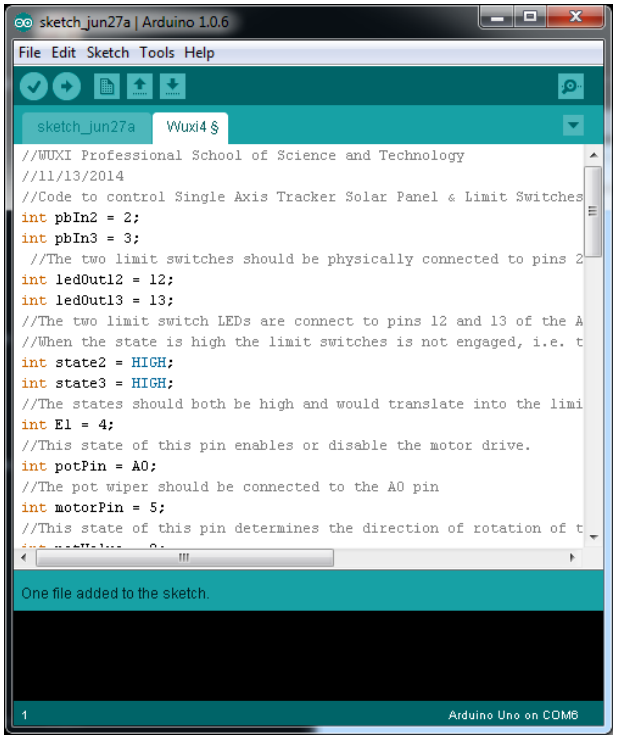


Arduino Uno



Prototype Shield

Example Arduino Shield



Open source Arduino Code

https://www.arduino.cc/

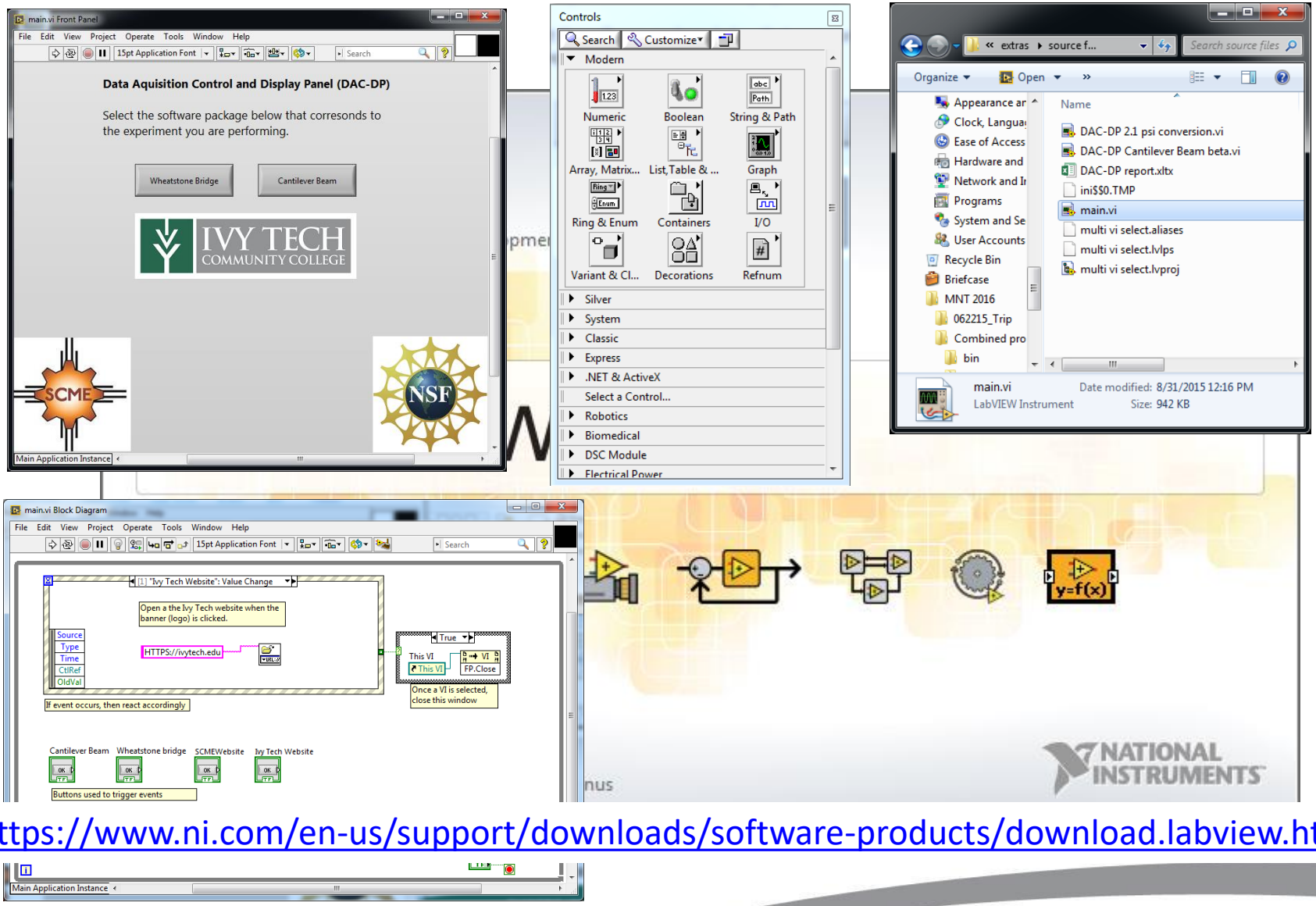
LabView is graphical based programming language developed by National Instruments and used extensively in industry.

LabView program are called "vi" programs and typically include a block diagram type of program that is programmed via block interconnections of various functional blocks.

LabView program also have a gui interface window that can be designed to allow users to view the data and control the programs.

LabView programs can be executed on computers with LabView installed or compiled and run as standalone programs. To create an executable program you must have a compiler.

What is LabView?



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

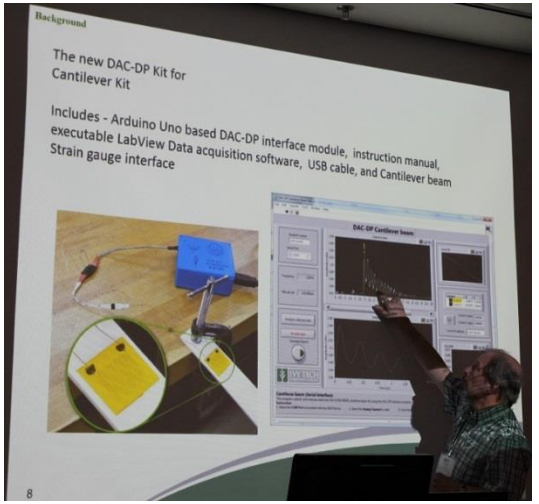
800-433-3488

Design and build electronic kits that could be used in tandem with the SCME[3] kits.

These new kits should focus on cost and maximize student learning

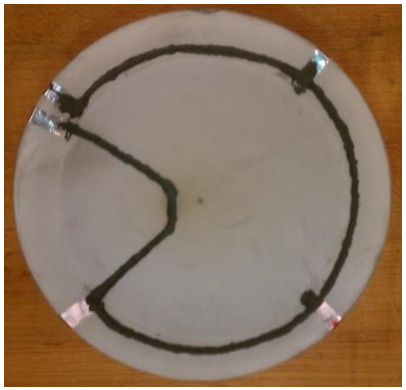
New kits should be developed by student workers

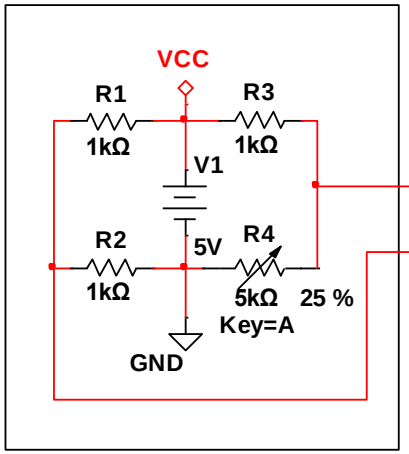
Should be based on Arduino UNO, LabView and SCME kits



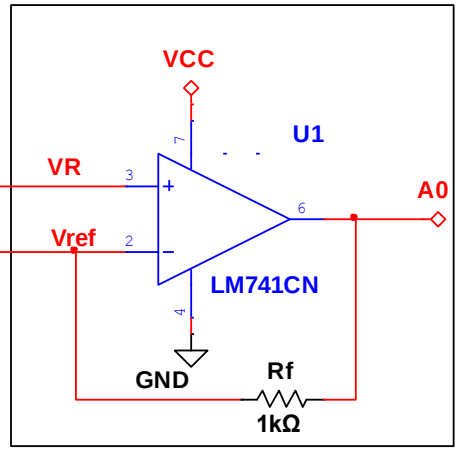
3 - http://scme-nm.org/

First up the Pressure Sensor kit => ***Modeling a Micro Pressure Sensor Kit***

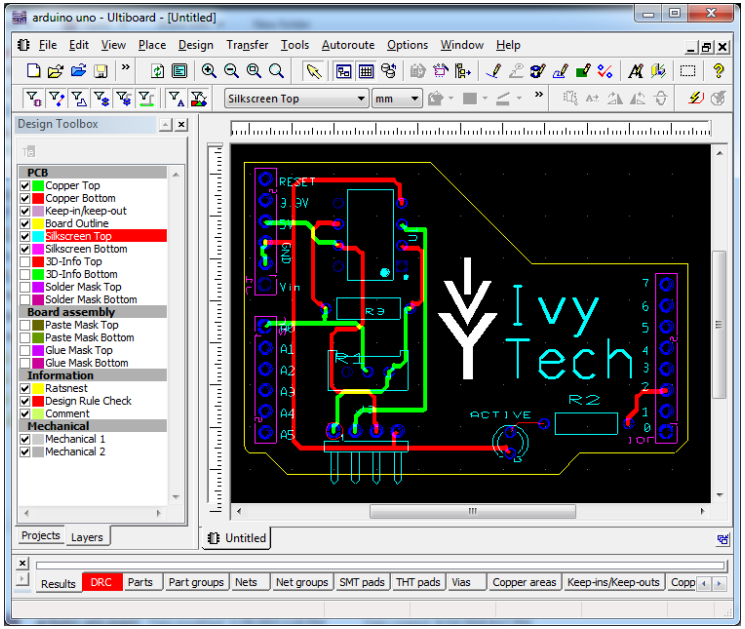


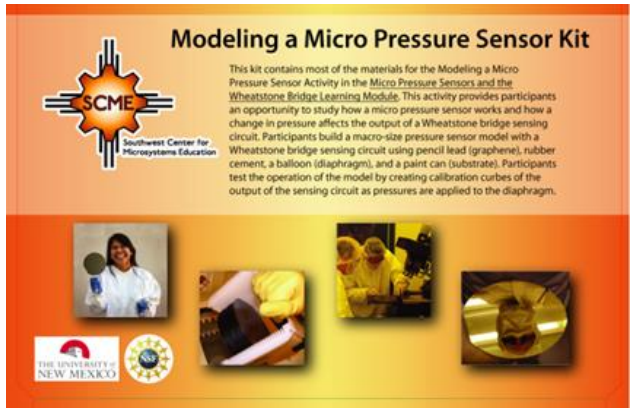


A simulated wheatstone bridge

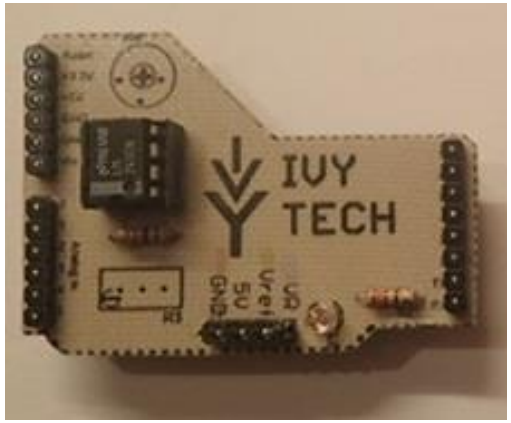


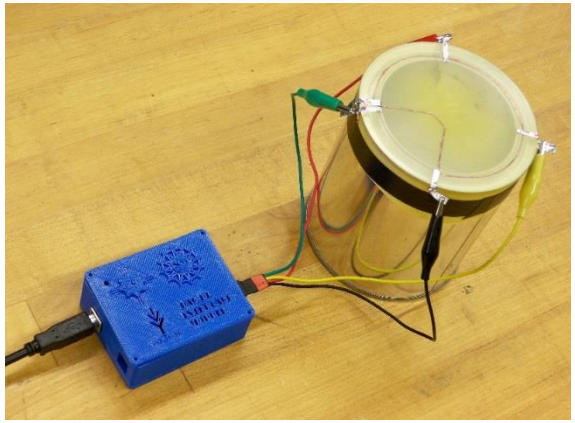
The basic form of the DAC-DP shield

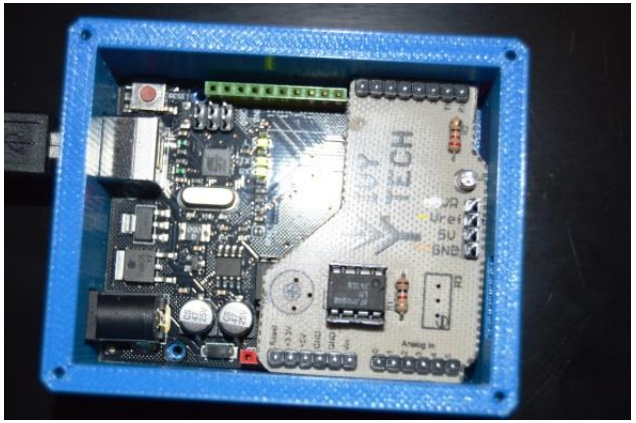


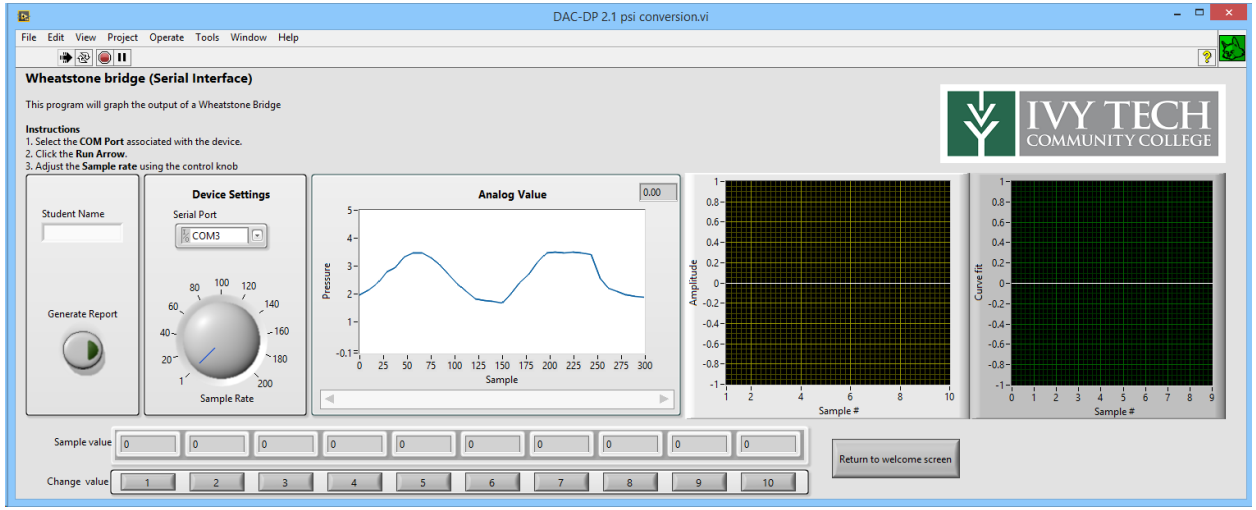


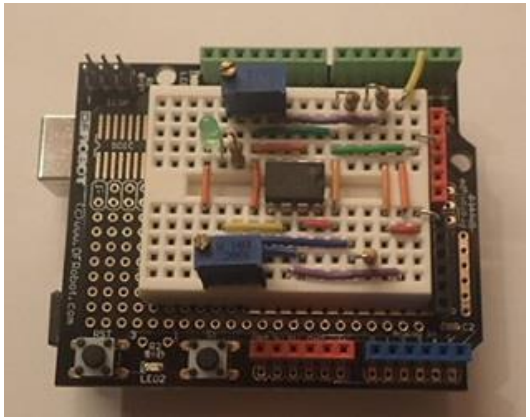
After many months …



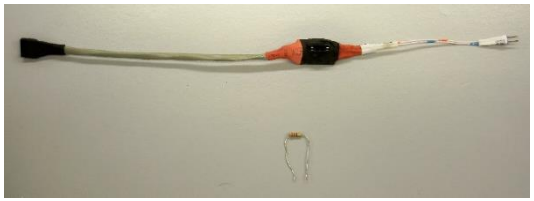


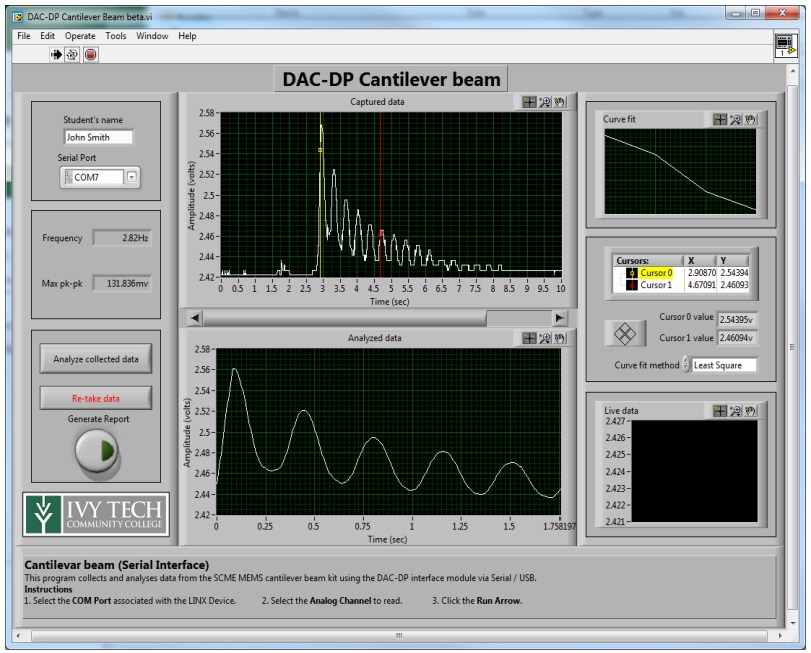


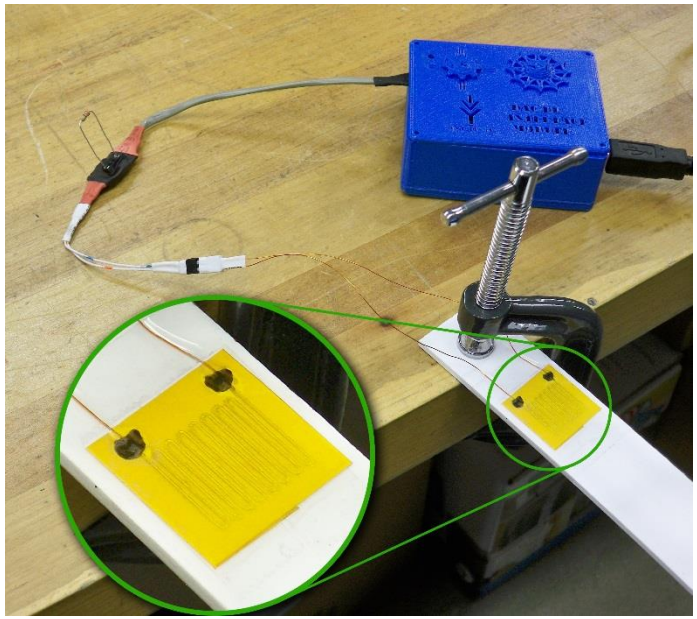




Second up the Cantilever Beam kit => ***Microcantilever Model Kit***







Questions?

http://scme-support.org/
http://www.ivytech-mems.org/
http://faculty.ivytech.edu/~abell118/

Andy Bell
Department Chair – Engineering
Ivy Tech Community College – Northeast
Phone: 260-481-2288 : Fax: 260-480-2052 : abell118@ivytech.edu
SDKB Technology Center, Room TC1240R, 3800 N. Anthony Blvd.,
Fort Wayne, IN 46805

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