Raspberry Pi and Python

Ori Hoxha & Jonathan Wang

My Time at Cal : Ori Hoxha

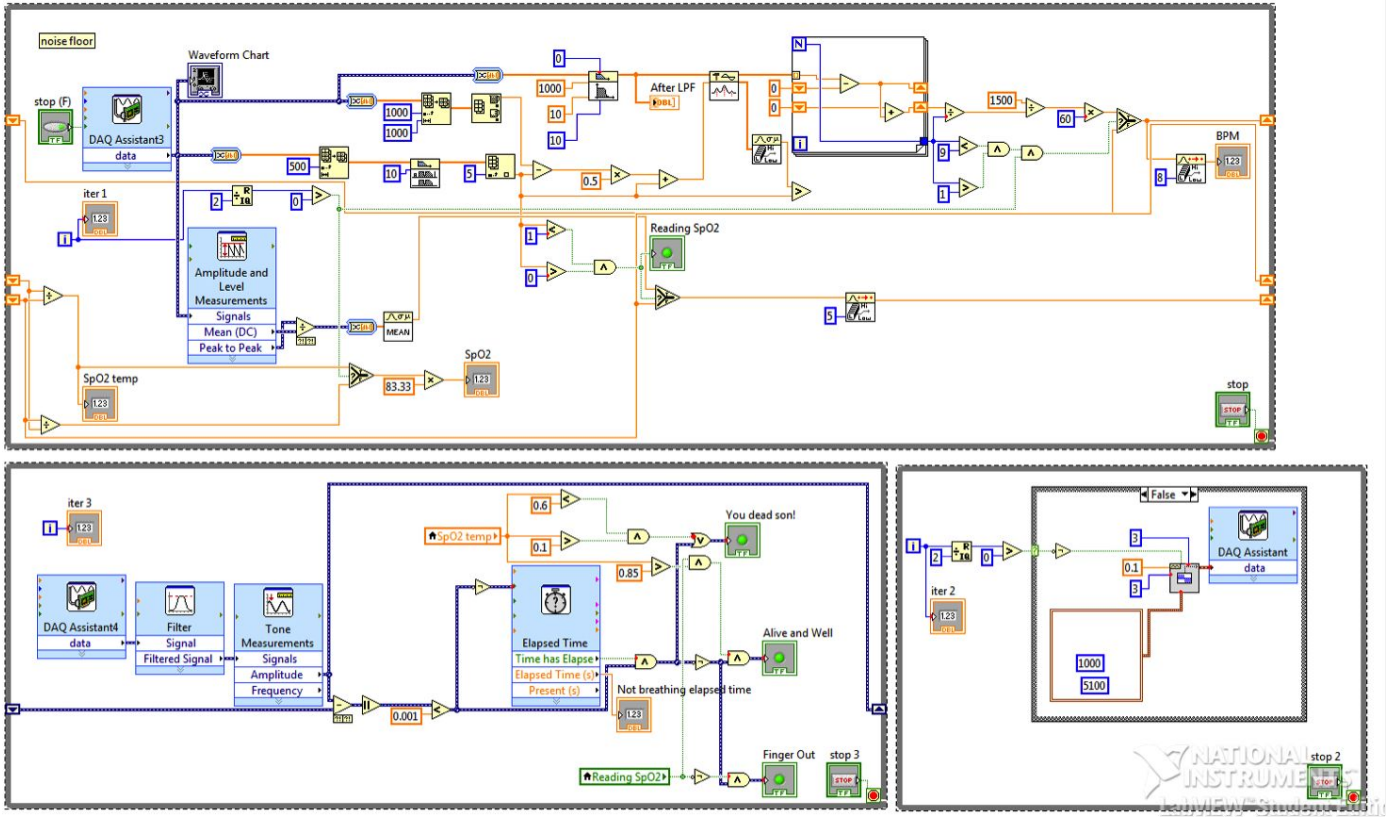
- 4th year Bioengineering
  - Medical Devices
- From Tirana, Albania
- What I learned from Berkeley
  - Way of thinking
  - ...but don’t think too hard
- Future Plans
  - Drug Delivery at Genentech
  - Graduate school eventually

My Time at Cal : Jon Wang

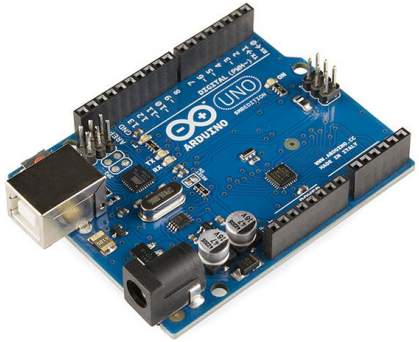
- 4th year Bioengineering & EECS
  - Comp Bio, maybe?
- From SF Bay Area
- What I learned from Berkeley
  - Try lots of things
  - Don’t spread yourself too thin
- Future Plans
  - Software industry for now
  - Graduate school eventually

Goal

Move towards a more intuitive/useful interface



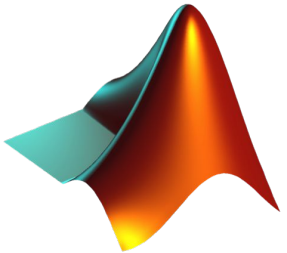
Other alternatives



- Arduino
  - 10 bit resolution
  - Not the most user-friendly software interface
  - Asymmetrical voltage range
  - Sampling rate drops for continuous sampling
- myDAQ & MATLAB
- Raspberry Pi & Python

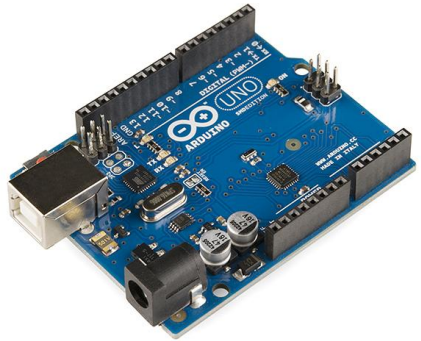
myDAQ & MATLAB

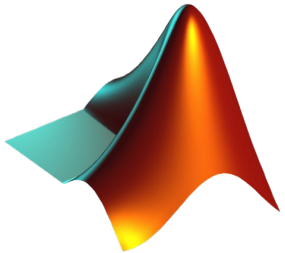
- myDAQ
  - Symmetrical voltage range (+/- 10V !!)
  - 200 kHz sampling rate
  - 16 bit resolution
  - Continuous input/output without significant loss of rate
  - Designed to be used with LabVIEW
  - Abstracted / hard to “play” with it
- MATLAB
  - Every engineering student has exposure to it
  - Limited resources online



Arduino & MATLAB

- Easy coding in MATLAB, minimal Arduino coding
- Plotting in MATLAB is slightly annoying
- Lower resolution, sampling rate
- Terrible support and documentation

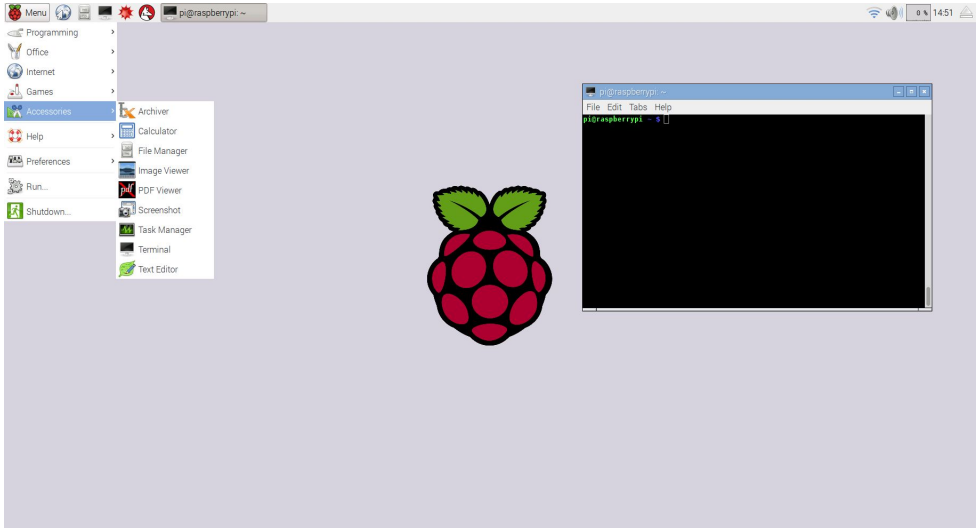




Why we wanted to try something else?

- More freedom in design
- Accessible documentation online
- More constructive educational experience

Raspberry Pi & Python



Raspberry Pi Basics

Raspberry Pi Specs

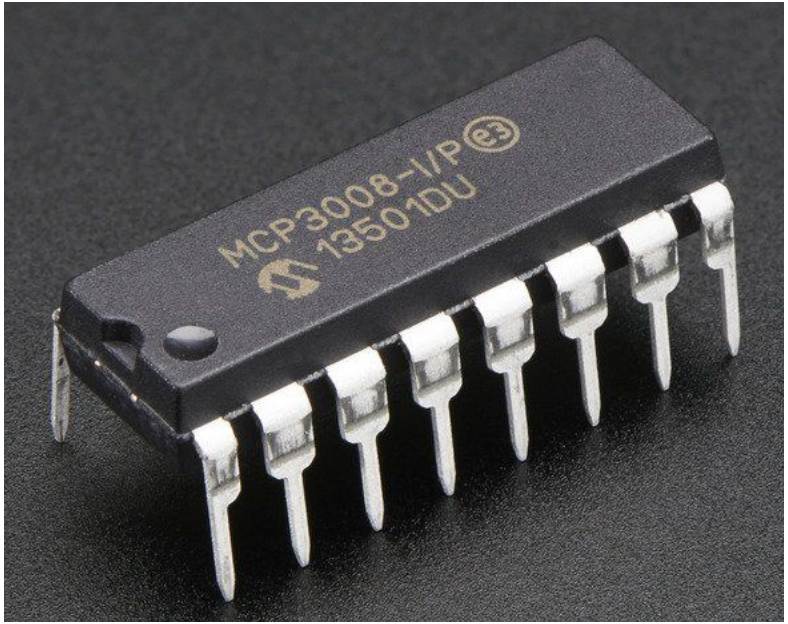
- Pi 2
  - Runs on 5V micro-usb power (same as most Android phone chargers)
  - MicroSD card
  - Ethernet
  - **26 Digital I/O pins**
- Pi 3
  - Beefier CPU
  - Built-in WiFi and Bluetooth

Needs an external ADC / DAC !

Picking an ADC

MCP3008 ($3.75)

- 10 bit resolution (same as Arduino)
- 8 channels multiplexed & continuous
- 75kHz
- More circuits to build = more places something breaks
- Asymmetric voltage range: 0-5V
  - More than 3.3V can fry the Pi!



Labview vs Matlab vs Python

Labview

- Costs a lot
- Proprietary
- Graphical interface
- Works with myDAQ out of the box

Matlab

- Free student license
- Proprietary
- Code-based
- Works with Arduino & myDAQ with minimal setup

Python

- Free for everybody
- Open Source
- Code-based
- Tedious setup process
- Used in EE 16 series

Ideal implementation of Pi as an Embedded system

- ADC/DAC functionality within a “black” box
- Run it through a host computer over Wi-Fi
- Hardware & Software pre-configured

Thank you