Week 3. Electronics and programming

* We run our catch up plans and be back on track by Friday.
* Next week. Design and group project with Luciano integrating all skills learned
* Electronics and programming is NOT a one step learning process. It is a permanent learning process. Depth is infinite. The more you give, the more you obtain.
* Remember: There is a difference between **knowing** the path and **walking** the path. Walk-the-path.
* Remember to document the process every day. Exercise the habit of documenting.

# Day 1. Electronics Production

* Proper use of the heat gun. Remember to put it in cold air after use until no heat comes out.
* Soldering SMD components
  + It’s not like painting. Doesn’t work like this. Soldering Iron in, Solder in, Solder out, Soldering Iron out.
  + Use the double side tape to fix the board to the table
  + Start with the microcontroller, continue towards the perimeter
  + Easy with the tweezers
  + Soldering day - No coffee
  + Use good lighting and loupes
* In groups of 2 people, Fabricate the Fab ISP
  + Prepare the Roland Modela bed and sacrificial layer
  + Download from Fab Academy Electronics production week or follow <http://fabacademy.org/archives/2015/doc/electronics_production_FabISP.html>
  + Mill traces, cut board
  + Stuff
  + Program and Debug <http://fabacademy.org/archives/2015/doc/programming_FabISP.html>
  + Deadline 13:00h
* Afternoon: Catch up time

# Day 2. Basics about electronics

* Basics about electronic components
* Basics about microcontrollers
  + Registers
  + Fuses (HIGH, LOW, EXTENDED) Tutorial: <http://fabacademy.org/archives/2015/doc/fuses.html>
  + Interrupts
  + ADC

# Day 3. Modifying CAD Files with kokopelli

* Crash course: <http://fabacademy.org/archives/2013/students/sanchez.francisco/weekly-assignments/week-06/index.html>
* Changing the output
* Adding components
* Adding traces
* Advanced: Creating your own components
* Advanced: Non rectangular cutouts
* Assignment: Add an LED and a button to Hello World board
* Deadline 13:00h

# Day 4. Programming

## Embedded Programming

* Basics about programming
  + Add Author, date, description and license
  + Always comment your code
  + Init and loop parts
  + Digital output
  + Analog output (PWM)
  + Digital input
  + Analog input (ADC) 8 bit/10bit
  + Pull up down resistors (10k)
  + Multitasking? Polling
  + Debounce buttons
* Programming. 3 paths depending on proficiency:
  + Beginners: Arduino IDE
  + Intermediates: C
  + Advanced: Assembly
* Why C? <https://www.youtube.com/watch?v=ERY7d7W-6nA&feature=youtu.be>
* Why Assembly? <https://en.wikipedia.org/wiki/Apollo_Guidance_Computer>
* Assignment
  + Make LED blink
  + Turn ON/OFF LED
  + Serial communication (send something to computer, read something from computer)

## Interface programming

The goal is to create an interface program for the computer or smartphone that displays information and/or controls one of the boards you made.

* You need a communication channel between your board and the interface program
  + Serial connection
  + Bluetooth
  + Internet connection
* Computer interface
  + Processing
  + Python <https://www.codecademy.com/>
  + Webapp <https://www.codecademy.com/>
* Smartphone interface (Bluetooth connection)
  + Webapp MIT App Inventor 2 <http://appinventor.mit.edu/explore/>
  + Android App: **MIT AI2 Companion** Google Play Store
* Assignment
  + Requirements
    - Micro USB to USB cable (phone cable)
    - USB hub
    - USB to TTL converter (Inventory)
  + Install MIT App Inventor in computer and phone
  + Create an interface with a button and Indicator
  + Control the indicator with the board button
  + Control the board LED with the interface button

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# Day 5. Video Conferencing

* <http://video.cba.mit.edu/>
* Line with 1Mbps Uplink at least. If only 1Mbps Uplink is avaliable then dedicated line recommended.
* Software
  + Mac and Windows: Chrome Addon **Jabber Call**
  + Ubuntu: **Ekiga** or **Linphone**
* Connections
  + Lab Connection: mcu.cba.mit.edu
  + Individual connection: mcuc.cba.mit.edu
  + Normally only lab connects to MCU. Individual only for special reasons: Travel, illness...
  + Important Rooms
    - 1 Fab Labs
    - 4 Class (protected by pin number) Pin shared at Fab Academy start
  + Booking a room (Specify timezone): <https://docs.google.com/spreadsheets/d/1eZUNi7_2wsY3-YTyPQIBnljpAxztgQfcJgpNATWwn-w/edit#gid=0>
* Muting
  + Local mic mute. Check that always is muted except for talking
  + MCU mute. By default your are muted. Check that your microphone is locally muted and then to toggle MCU unmuted/muted dial **\*6**
  + After talking remember to **locally mute your mic** again
* Wednesday Class
  + Class starts at 9 AM Boston Time (EDT) Check your local time every week: <http://www.thetimezoneconverter.com/>
  + Lab Manager joins at 8:30 AM EDT for class preparation
  + Beware winter/summer time changes. Not the same all around the world
  + If connection does not work for some reason do not hammer the entire class mailing list. Check first with other people to see if it is a local or global problem.
* Setting up the scene
  + World is watching and listening to you. Prepare a nice looking environment
  + Check Focus is correct, lighting is enough
  + Avoid bright backgrounds
  + Frame the entire class
  + Have a seat near the mic and camera for the person showcasing
* Assignment: Check the time in Boston, Taipei and Barcelona and talk to them in the Fab Lab Room. Mute/Unmute in MCU. Prepare the lab for videoconferencing.

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# One last thing

* Design for long lasting <http://www.core77.com/posts/24649/When-We-Built-Things-Solidly>
* Use digital fabrication to fix things and give trash a new life
* Find the treasures in electronic waste: Bearings, motors, shafts, encoders. Use the heat gun to recover those.
* Please, stop 3D printing more figurines. -Ben Parker- (Uncle Ben). Don’t be evil.
* Live long and prosper