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

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.

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