Engineering Innovation Center
Basic CAD Training
The Engineering Innovation Center is a large academic maker space with plenty of tools and equipment. In order to use these items you must have the proper training. This online popup class will teach the basic fundamentals of this tool or piece of equipment.

How to choose a microcontroller – shows how to choose a microcontroller based on the needs of a project. The key is the right tool for the right job. This class will discuss how to identify and use these tools.
What is a Microcontroller (MCU)?

• Small computer on a single chip

• Contains:
  — Processor core
  — Memory
  — Peripherals

• MANY, MANY options to choose from
Features of (nearly) All Microcontrollers

- Timers and Interrupts
- General Purpose Input/Output (GPIO)
- Pulse Width Modulation (PWM)
- Digital Signal Processing (DSP)
- Communications Protocols (I²C/SPI/UART/etc.)
- Power Saving Features

Some are better at specific jobs than others!
Three Classes of Microcontrollers

- Real-time (RTOS)
- Hobbyist
- Single Board Computer

Embedded
Embedded-ish
Operating System
RTOS Microcontrollers

- I/O in real-time (deterministic)
- Fast interrupt handling
- Low level control
- Slower clock speeds
- Very low power use

Good for custom-built hardware

Many, many families/models to choose from
Examples of RTOS Microcontrollers

MSP430: Lowest power

Stellaris: General Purpose
Examples of RTOS Microcontrollers

Concerto: Dual Core Microcontroller + ARM

Piccolo: DSP and computation
Hobbyist Microcontrollers

- Cheap, low barrier to entry
- RTOS-lite
- Larger footprint
- Little programming skill required
- Not well suited for complex projects

Good for getting a job done quickly

“Shield” add-on boards can do just about anything
Examples of Hobbyist Microcontrollers

- Teensy
- Leaflabs Maple
- Sparkfun Redboard
- Arduino
- Redboard
Single Board Computer

- Raw computational power
- Runs computer OS (Linux, etc)
- Lots of memory
- Audio/Video outputs
- Kernel-based: NOT deterministic
- Many programming/scripting languages

*Great at doing computer things without a computer*

*Useful if your project requires a software user interface*
Examples of Single Board Computers

Intel NUC

Raspberry Pi

Beaglebone
How to Choose your Controller

1. Define your requirements:
   - What are my hardware interfaces? I/O and comm ports
   - Do I need low power or really fast processing? Clock speed
   - Am I working with huge sets of data? RAM
   - Do I need to respond instantly to inputs? RTOS/Interrupts
   - Will I need a GUI user interface? SBC
   - Is high performance DSP/PWM really important? Specialty MCUs
   - Do I need timers or ADC inputs? Resolution? Determined by MCU
   - What programming language should I choose? Determined by MCU

2. Always add 20%!
How to Choose your Controller

3. Do some research
   — MCU Manufacturers have pretty good search tools
   — Most families of MCU have several sizes/pinouts of chip
   — Google really is your friend!

4. The EIC MCU spreadsheet lists what we have on-hand

5. If all else fails ask Michael or Jared
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