How to Choose a Microcontroller
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) ➔ Embedded
- Hobbyist ➔ Embedded-ish
- Single Board Computer ➔ 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

- Leaflabs Maple
- Sparkfun Redboard
- Teensy
- Arduino
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 George, Cody, or Michael
## The EIC MCU Spreadsheet

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