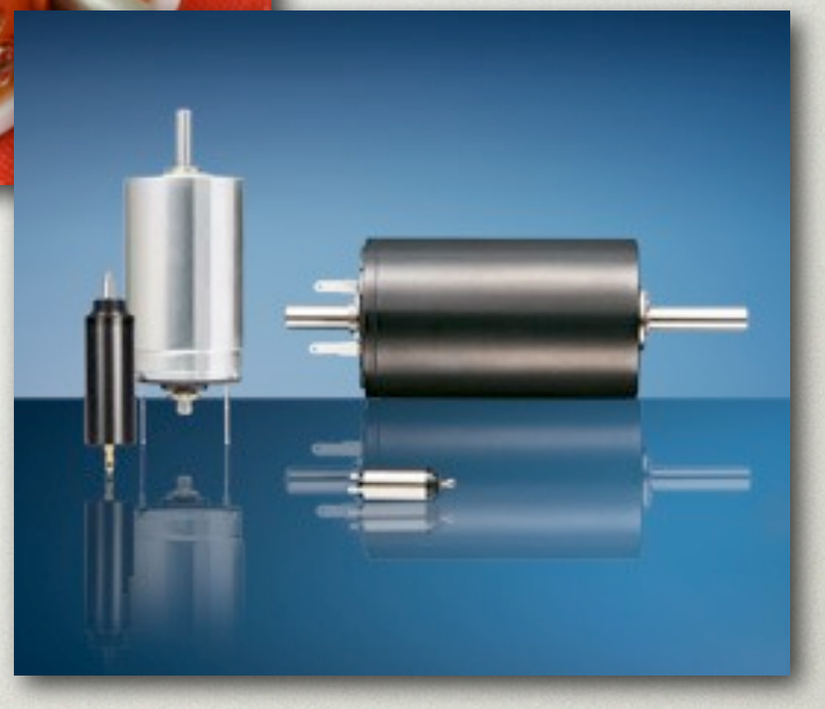
MicroMouse: Motors, Encoders, and Power, Oh my

November 1st, 2012

Motors and Encoders

Types of Motors

- DC
- BLDC
- Materials
  - Graphite
  - Metallic

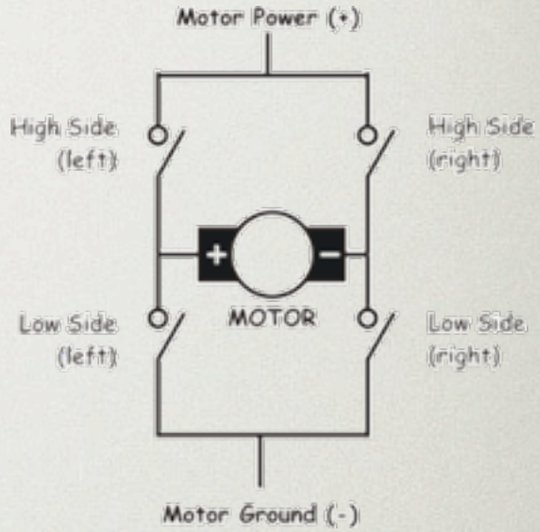


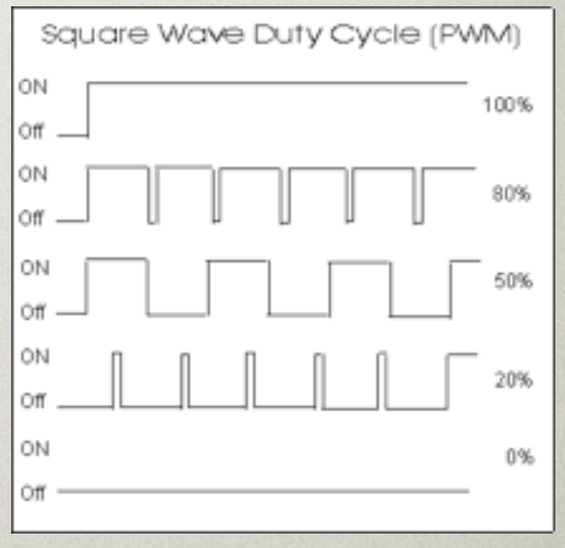
Motor properties

- Power requirements
  - Nominal voltage
    - Stall current
  - Gear ratio
    - Maximum RPM
  - Dimensions

Controlling your motor

- Speed proportional to voltage
- H-Bridge
  - Allows forward and reverse drive
- PWM
  - Approximation of analog output
  - Maximize applied voltage with MOSFET



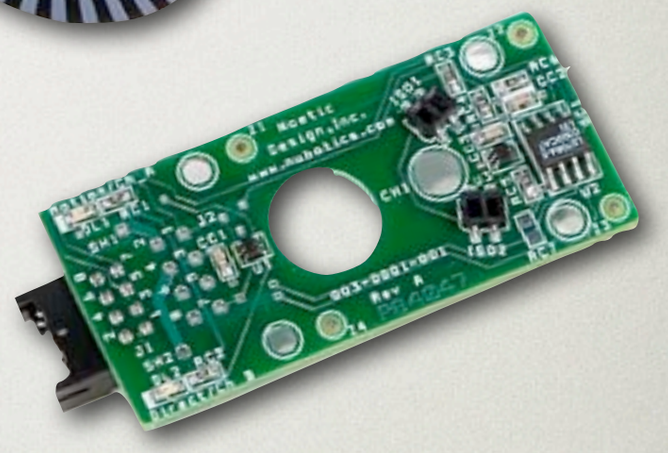


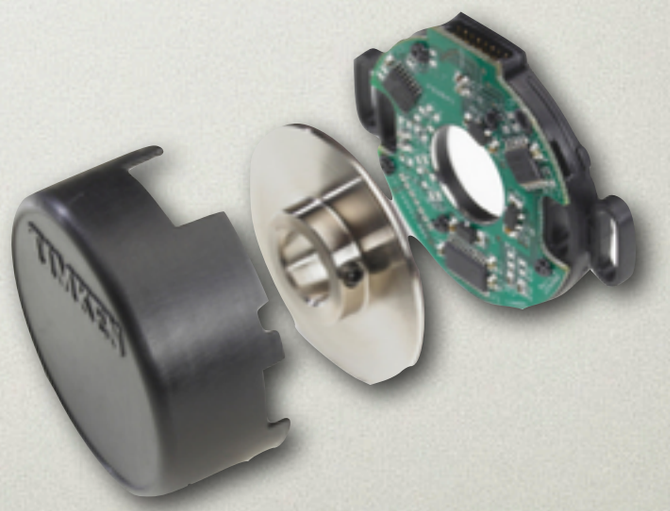
What is an encoder?

- Let's you figure how far you've gone
  - Measures angular displacement
    - Translates to distance traveled
    - Can also be used for feedback control

Encoder properties

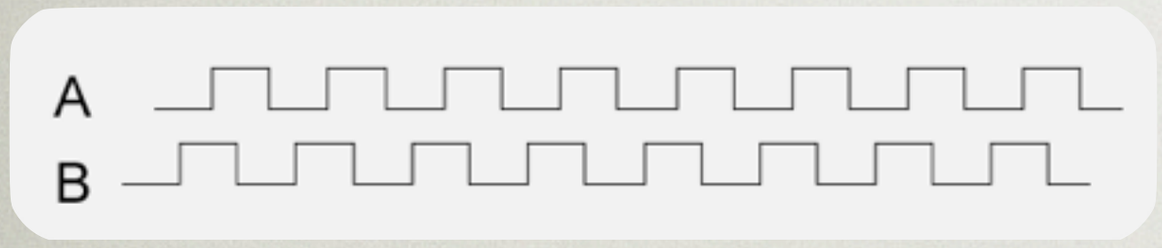
- Resolution
  - Ticks per revolution
- Methods of measurement
  - Optical
  - Magnetic
- Power requirements



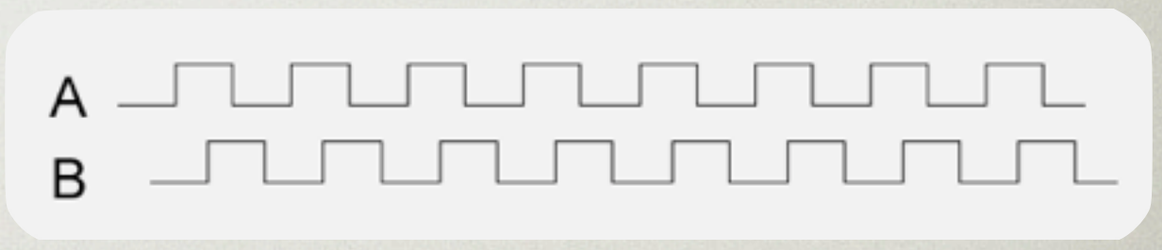


Encoder Logic

- Most use quadrature encoding
  - Grey code for those of you in EE M16
- Magnetic use Hall Effect sensor
- Optical use IR sensors



B leads A (forward)

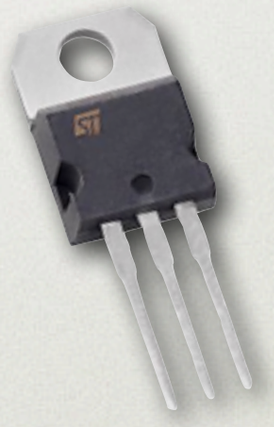


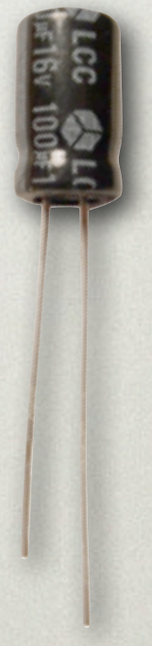
A leads B (backward)

Power System

Basic Components

- Battery
- Voltage regulators
- Filtering capacitors

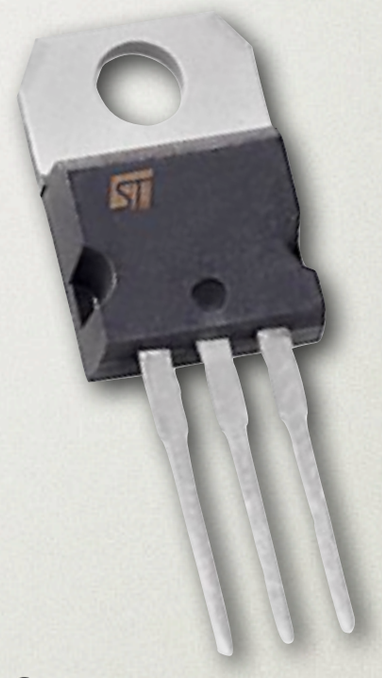




Power Distribution

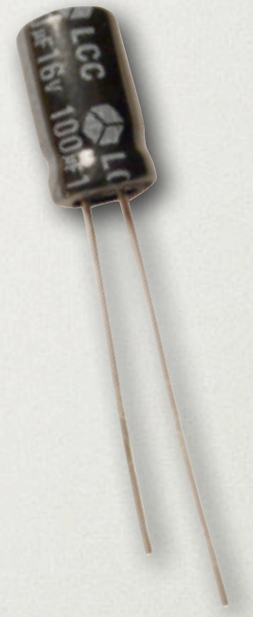
- Power-hungry parts
  - Motor system: ~500mA per motor
  - IR Sensors: ~40mA per sensor
- Low-power parts
  - MCU: ~30mA
  - Other sensors
    - Gyro and encoders: <10mA total

Voltage Regulators



- Different voltages for different components
  - 3.3v and 5v
- Very inefficient, but easy to configure
  - Suitable for our purposes

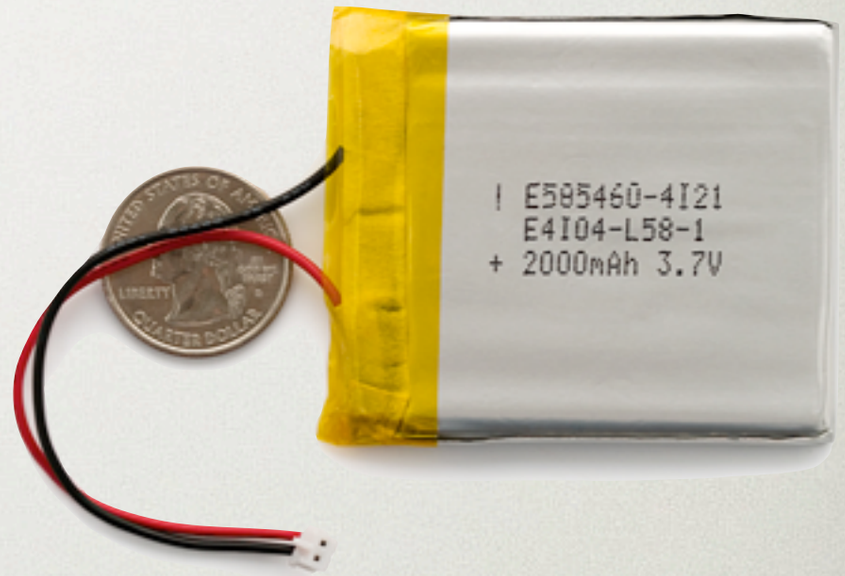
Filtering Capacitors



- Especially useful for sensors
- Connect between power and ground
- Smooth voltage ripple
  - Give ground path for high frequency noise
- Lower capacitance = Higher cutoff frequency
  - Values around 10uF and 0.1uF work well

Recommended Batteries

- Li-Po's are the best!
  - Small
  - High power density
- Or maybe not
  - Require specific charging profile
  - Don't stab them!!!



Some Recommended Choices

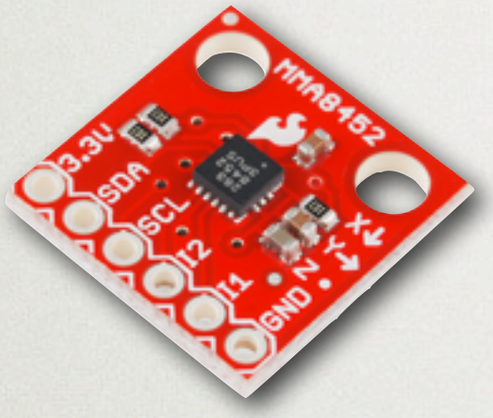
Motors and Encoders

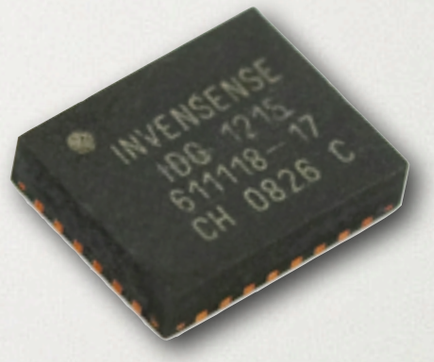
- GM9 Motors from Pololu
  - Matched with Wheel Watcher Kit
- Pololu motor and encoder kit
  - Metal gearbox
- Faulhaber Motors
  - Super high performance
  - Only for high budget

Choosing Parts

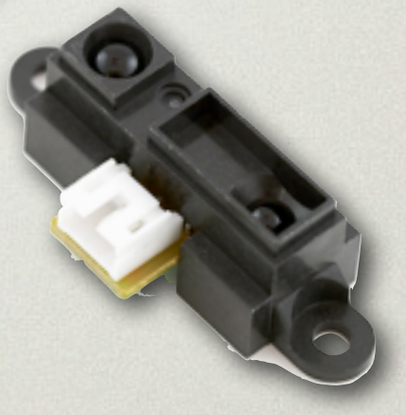
- Create spreadsheet from our template
  - Share with us
    - Add microcontroller and motor choices
      - Including vendor, part no., and other information
- This will be how you order parts

Next Meeting's Agenda





Sensors!!!



Deposits

- We'll call you up by team
- Make checks out to UCLA IEEE
- If you don't have it now, drop it off in the IEEE Lab before next Thursday!