

# Firmware Programming

Press Play: Interactive Device Design | April 11, 2011

# Check-in

How was lab?

Johnny Lee, guest lecture Wednesday

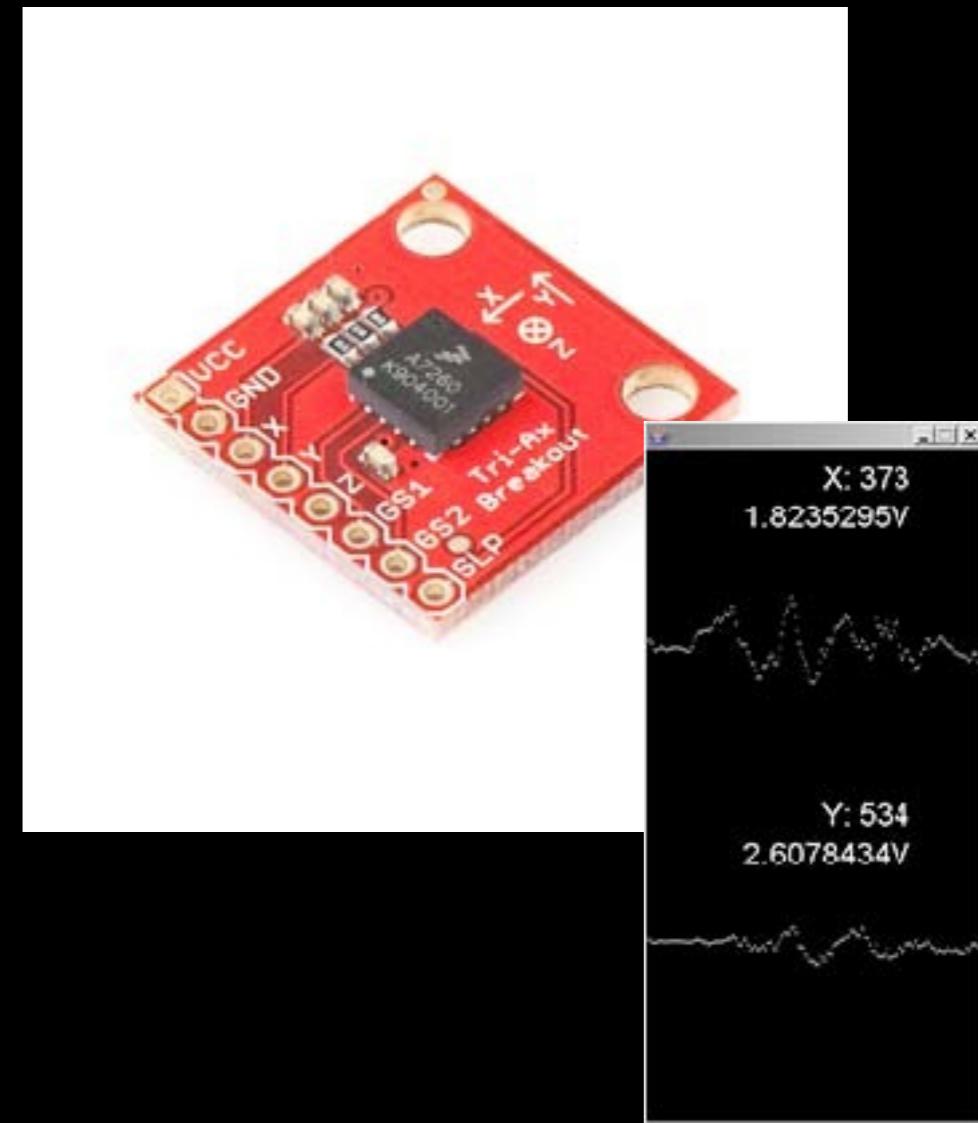
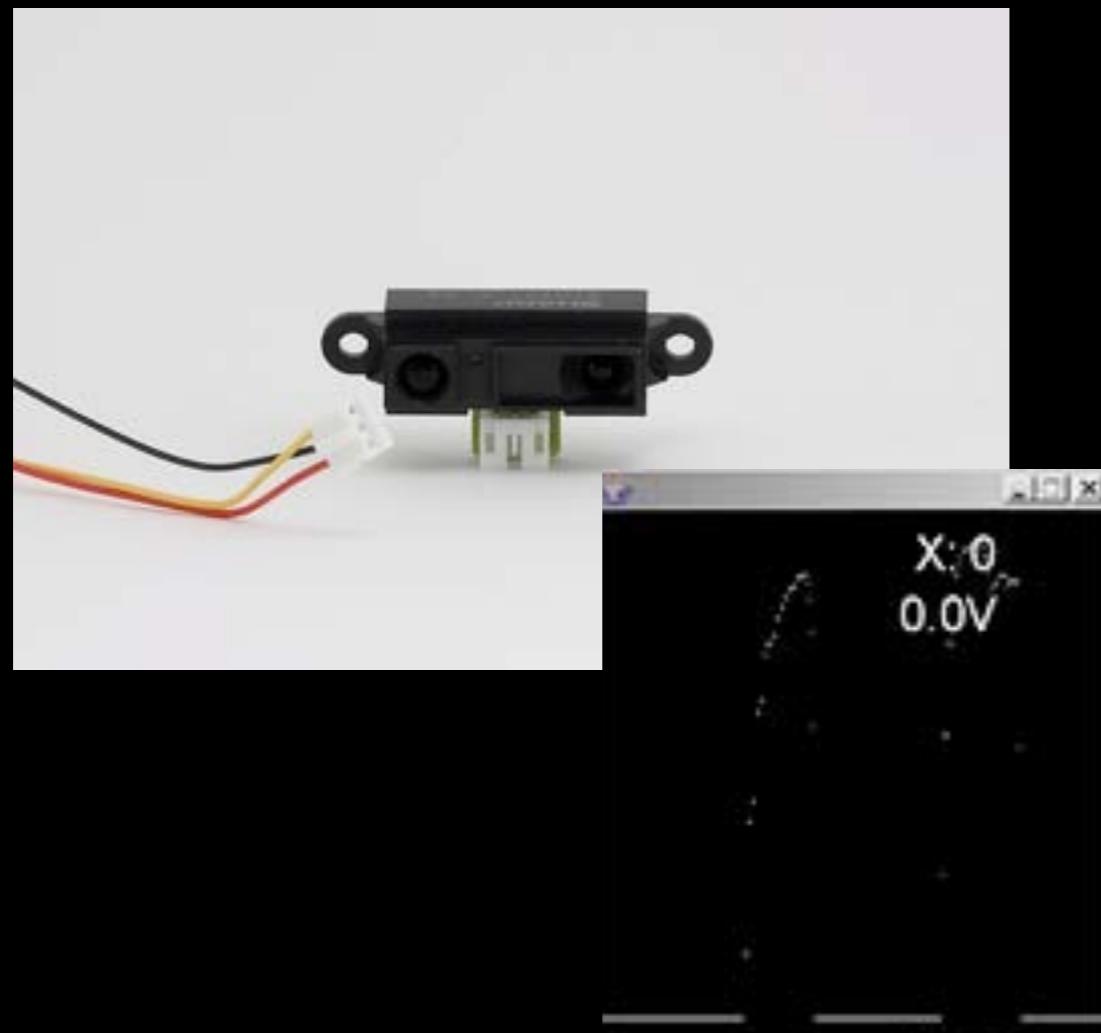
# Sensors

## Resistance varying sensors



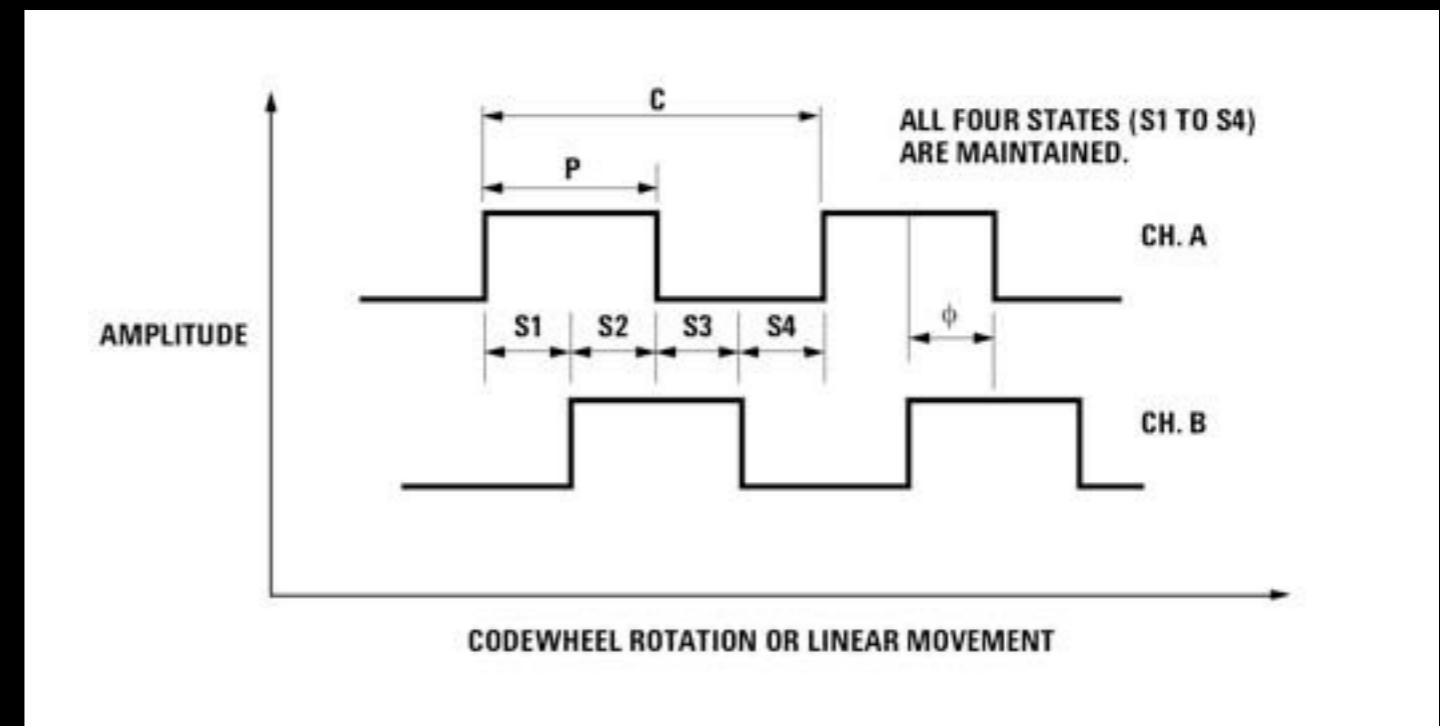
# Sensors

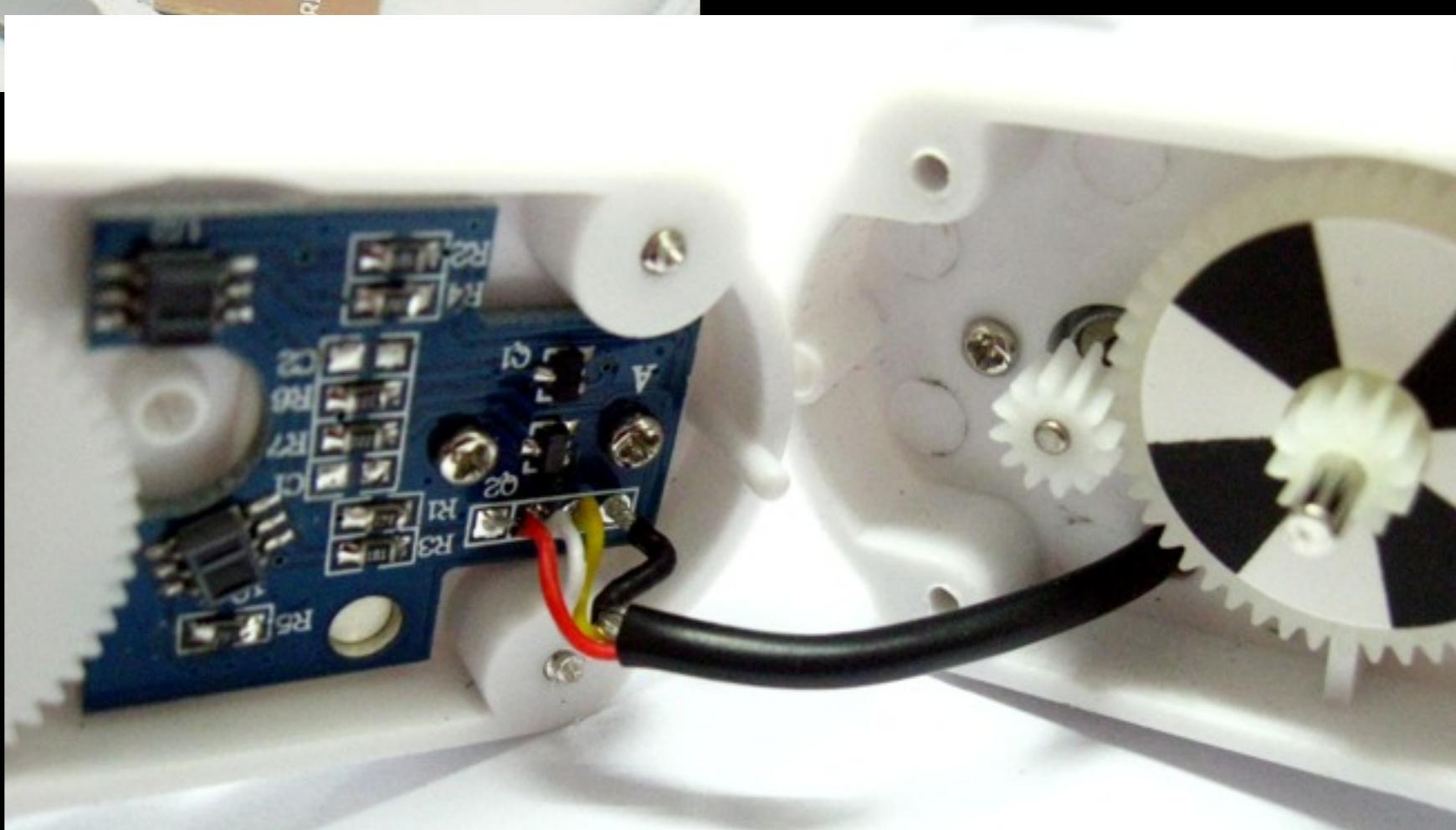
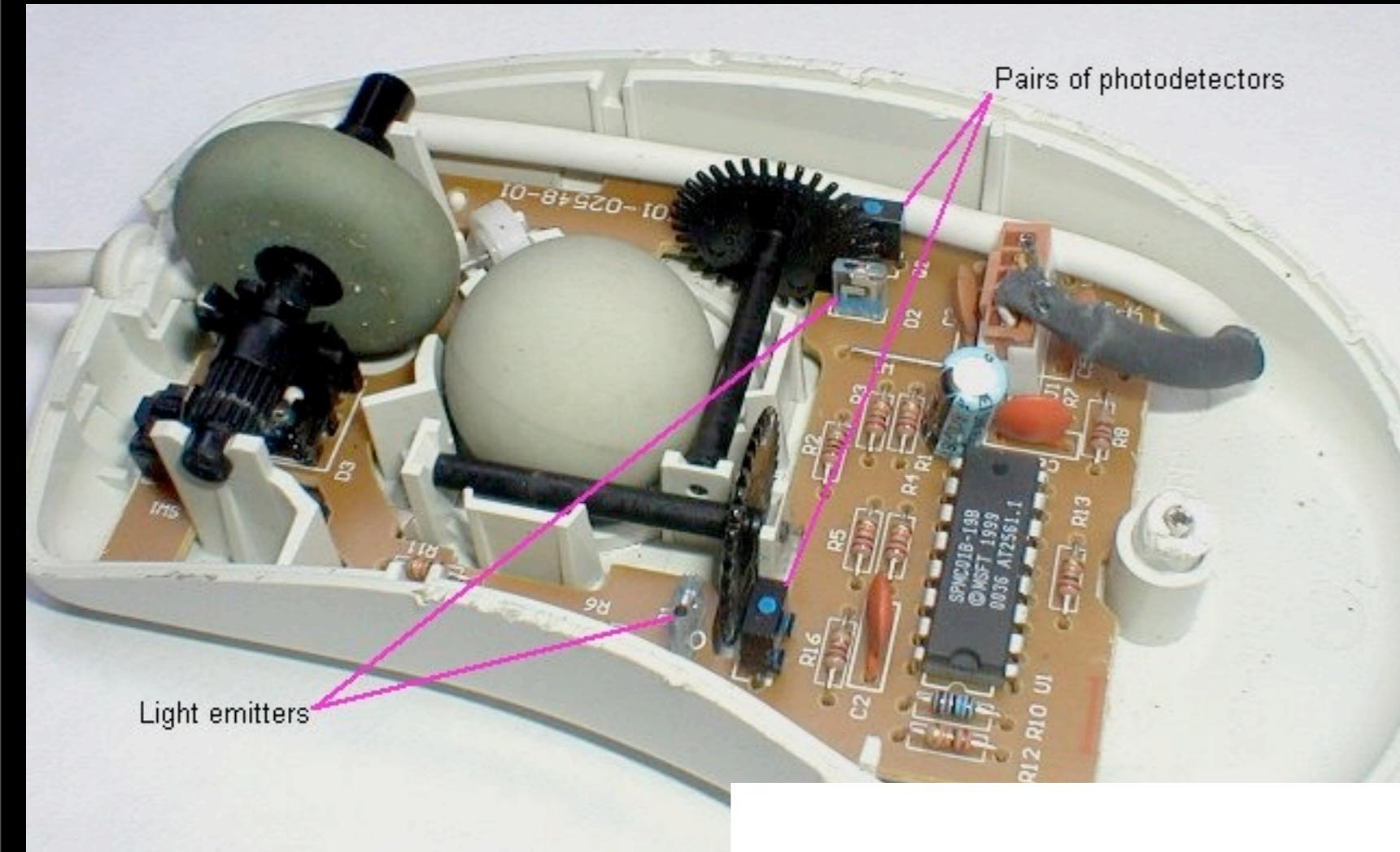
## Voltage varying sensors



# Sensors

## Count varying sensors





# Firmware Programming

Arduino IDE review, questions

Behind the Scenes

Finite State Machines

Modules

# Behind the Scenes

Use <shift> when compiling to get verbose mode.

Let's look at the files.

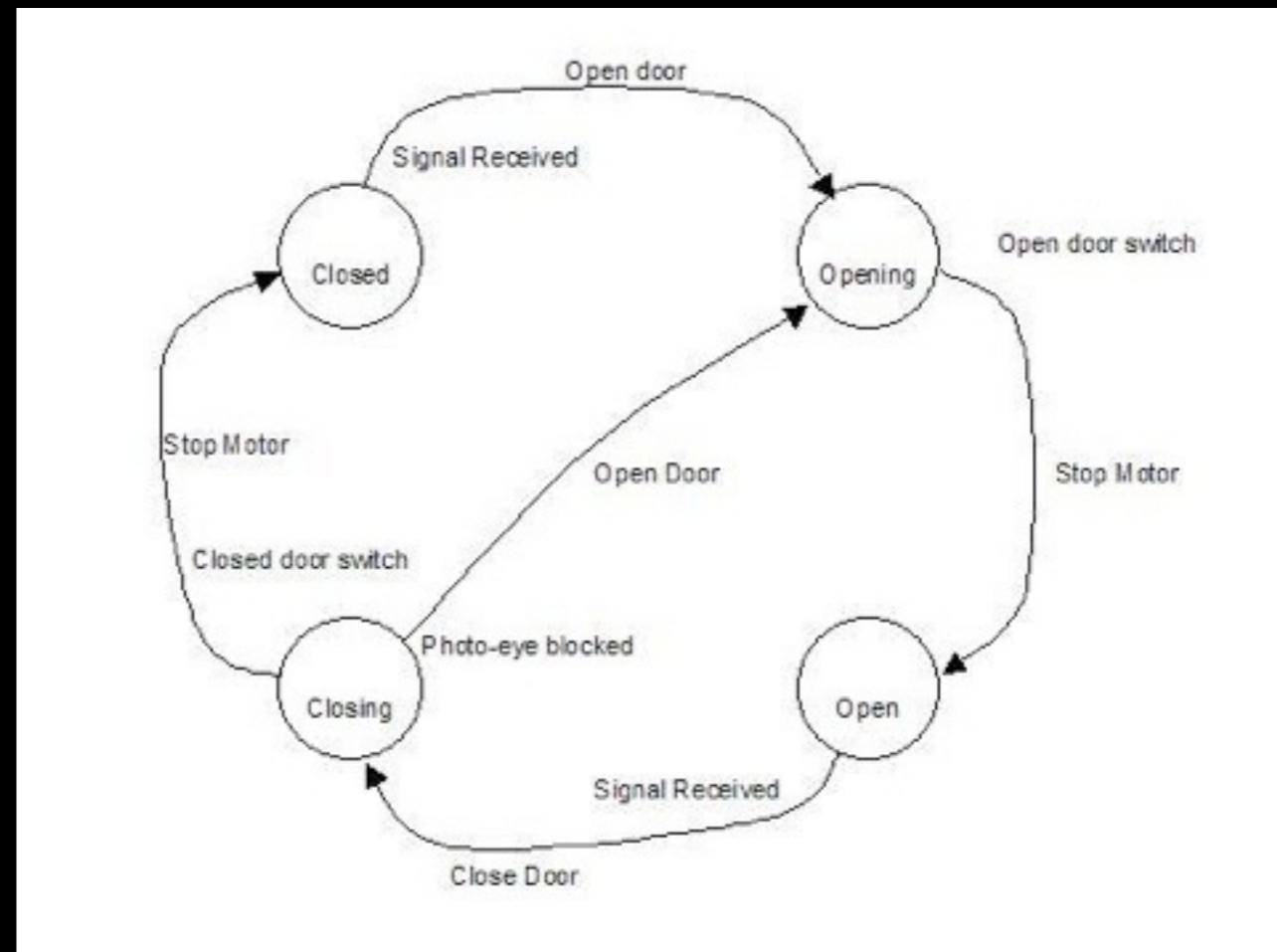
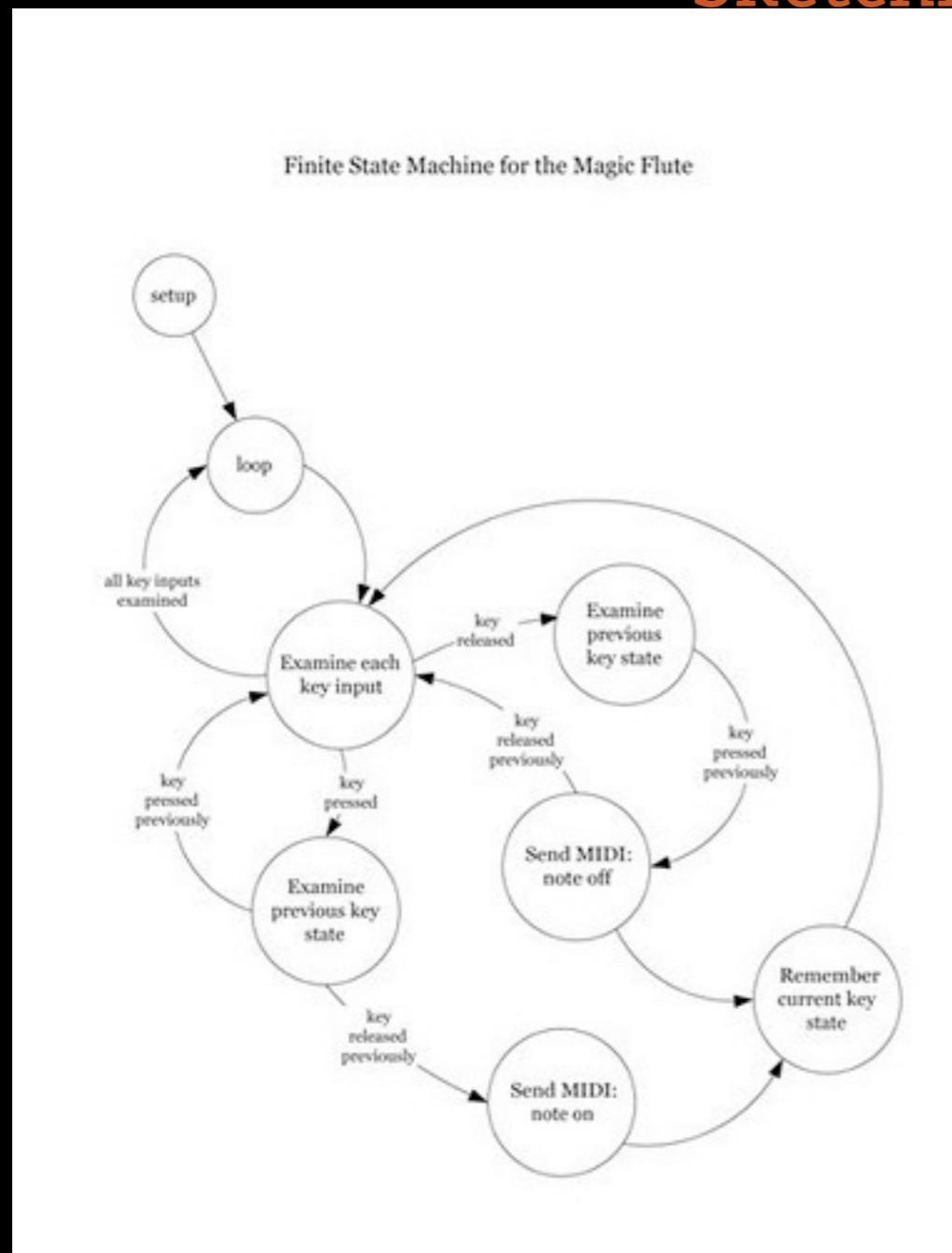
The screenshot shows the Arduino IDE interface with the following details:

- Title Bar:** Blink | Arduino 0022
- Toolbar:** Includes icons for play, stop, upload, and refresh.
- Sketch Name:** Blink
- Code Area:** Displays the `Blink` example sketch. The code initializes pin 13 as an output and sets it to HIGH for one second, then LOW for one second, in an infinite loop.
- Serial Monitor:** Shows the upload process and the avrdude log. The log includes:
  - Done uploading.
  - [Hex dump of uploaded code]
  - avrduude: Recv: . [10]
  - ##### | 100% 0.25s
  - avrduude: verifying ...
  - avrduude: 1018 bytes of flash verified
  - avrduude: Send: Q [51] [20]
  - avrduude: Recv: . [14]
  - avrduude: Recv: . [10]
- Status Bar:** Shows the number '1'.

```
drwxr-xr-x 21 wendyju wendyju 714 Apr 11 15:43 .
drwx----- 16 wendyju wendyju 544 Apr 11 15:47 ..
-rw-r--r-- 1 wendyju wendyju 559 Apr 11 15:42 Blink.cpp
-rw-r--r-- 1 wendyju wendyju 13 Apr 11 15:43 Blink.cpp.eep
-rwxr-xr-x 1 wendyju wendyju 13913 Apr 11 15:43 Blink.cpp.elf
-rw-r--r-- 1 wendyju wendyju 2881 Apr 11 15:43 Blink.cpp.hex
-rw-r--r-- 1 wendyju wendyju 3716 Apr 11 15:42 Blink.cpp.o
-rw-r--r-- 1 wendyju wendyju 17868 Apr 11 15:43 HardwareSerial.cpp.o
-rw-r--r-- 1 wendyju wendyju 31996 Apr 11 15:43 Print.cpp.o
-rw-r--r-- 1 wendyju wendyju 16264 Apr 11 15:43 Tone.cpp.o
-rw-r--r-- 1 wendyju wendyju 5676 Apr 11 15:43 WInterrupts.c.o
-rw-r--r-- 1 wendyju wendyju 7068 Apr 11 15:43 WMath.cpp.o
-rw-r--r-- 1 wendyju wendyju 57548 Apr 11 15:43 WString.cpp.o
-rw-r--r-- 1 wendyju wendyju 184770 Apr 11 15:43 core.a
-rw-r--r-- 1 wendyju wendyju 3168 Apr 11 15:43 main.cpp.o
-rw-r--r-- 1 wendyju wendyju 3288 Apr 11 15:42 pins_arduino.c.o
-rw-r--r-- 1 wendyju wendyju 9392 Apr 11 15:43 wiring.c.o
-rw-r--r-- 1 wendyju wendyju 6776 Apr 11 15:43 wiring_analog.c.o
-rw-r--r-- 1 wendyju wendyju 9256 Apr 11 15:43 wiring_digital.c.o
-rw-r--r-- 1 wendyju wendyju 6812 Apr 11 15:43 wiring_pulse.c.o
-rw-r--r-- 1 wendyju wendyju 5344 Apr 11 15:43 wiring_shift.c.o
```

# Finite State Machine Model

## Sketching Interactive Device Behavior



# Activity

Greeting Card dissection, analysis, & reinvention

# Activity Follow-up

Did you think about how this gets recorded?

How about how someone picks out the card?

How could you make it louder/softer?

# Where do we get cool sensors, displays and actuators?

Fry's (Palo Alto)

Radio Shack (everywhere)

HSC / Halted (electronic surplus)

Jameco Electronics (San Carlos)

?Arrow Electronics (Santa Clara)

Digikey (online)

McMaster Carr (online, for mechanical)

Sparkfun (online, hobbyist)

Acroname (online, robotics)