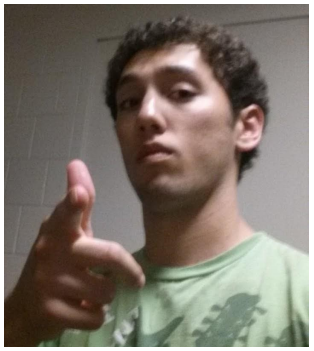
Arduino Workshop

“The best thing about a boolean is even if you are wrong, you are only off by a bit.”

Meet the team!



Dominic
Stanford
Electrical Engineering

Ashley
DePauw
Biochemister
Comp Sci

Grace
UNCC
Comp Sci

Michael
UCLA
Applied Mathematics

Morgan
Augustana College
Mathematics
Biochemistry

Jon
Clemson University
Electrical Engineering

Dobromir
Ramapo College
Mathematics and Comp Sci

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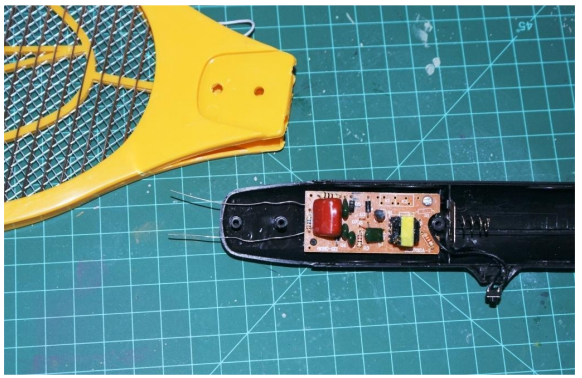
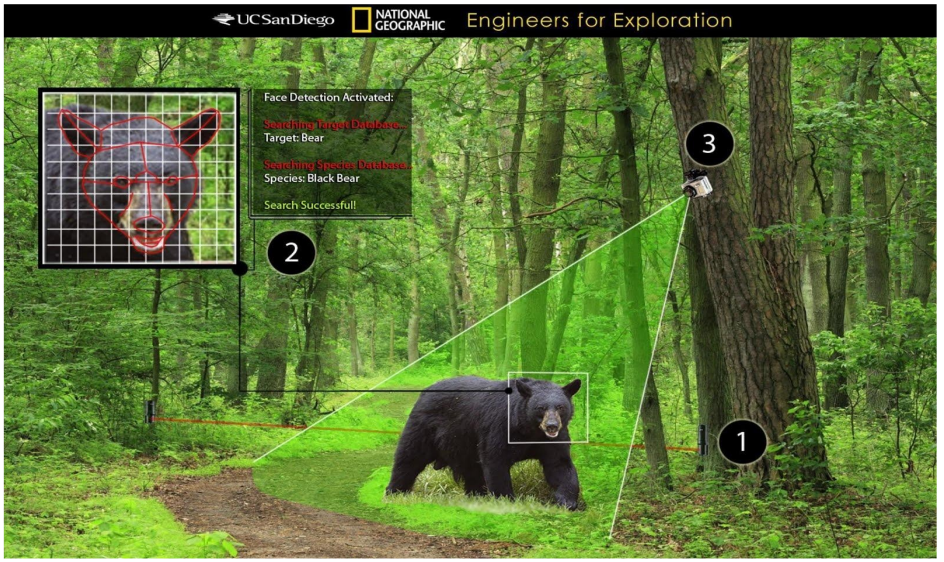
Cool Projects

- Projects we have done:
  - Barometer
  - Gyroscope based mirror correction
  - E-textiles
  - Pitot tube
  - Fountain audio-visualizer
  - Arduino Cell Phone
  - Industrial Applications
  - Camera Trap





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Industrial Application

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ECE 201

- Breadboard: basis for electronic prototypes
  - Easy to alter
  - No need for soldering
- Circuits: foundation for electronics
  - Kirchhoff's Laws
  - Can incorporate a variety of tools

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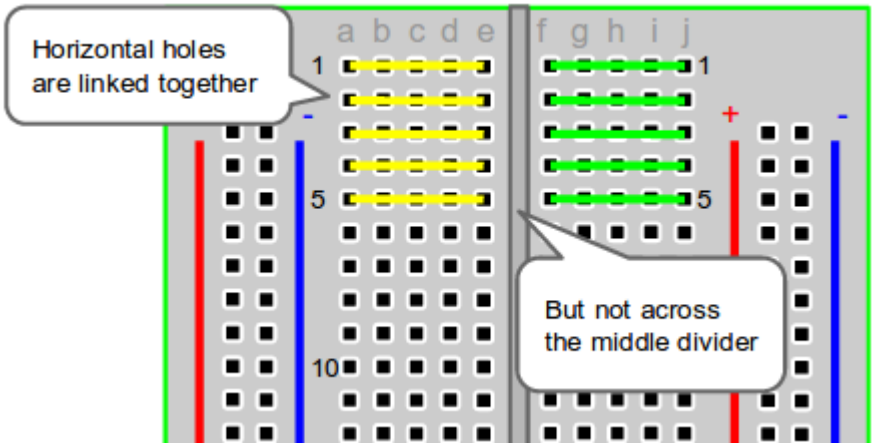
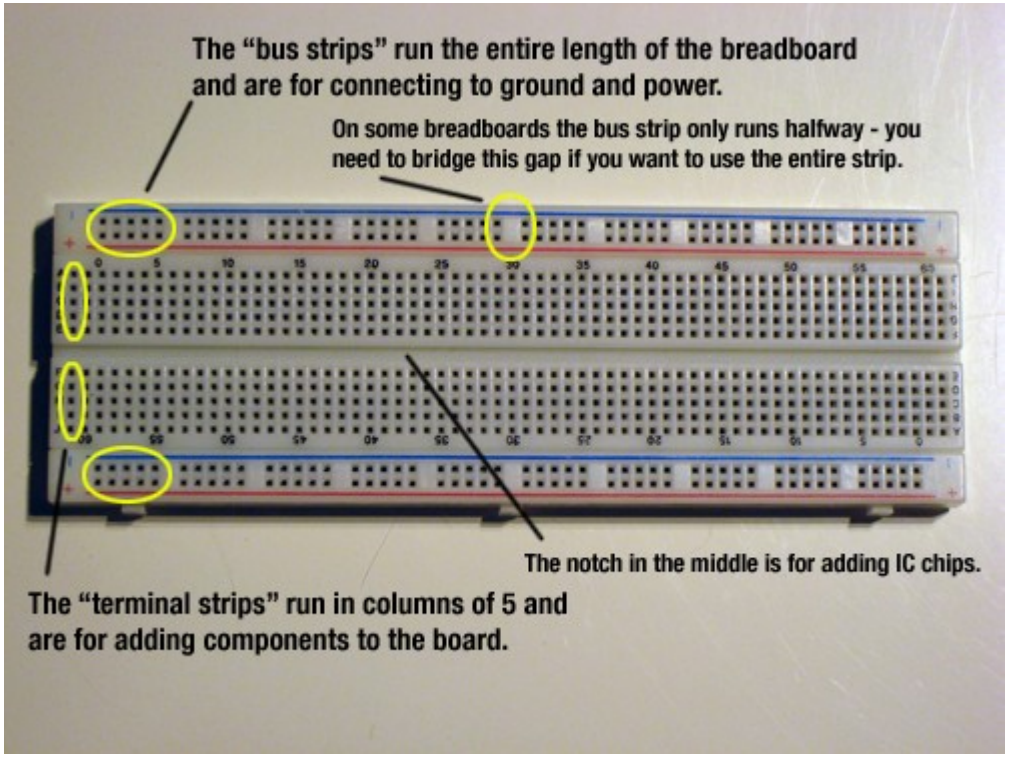
Breadboard





http://computers.tutsplus.com/tutorials/how-to-use-a-breadboard-and-build-a-led-circuit--mac-54746

http://tymkrs.tumblr.com/post/6386624174/how-to-use-a-breadboard

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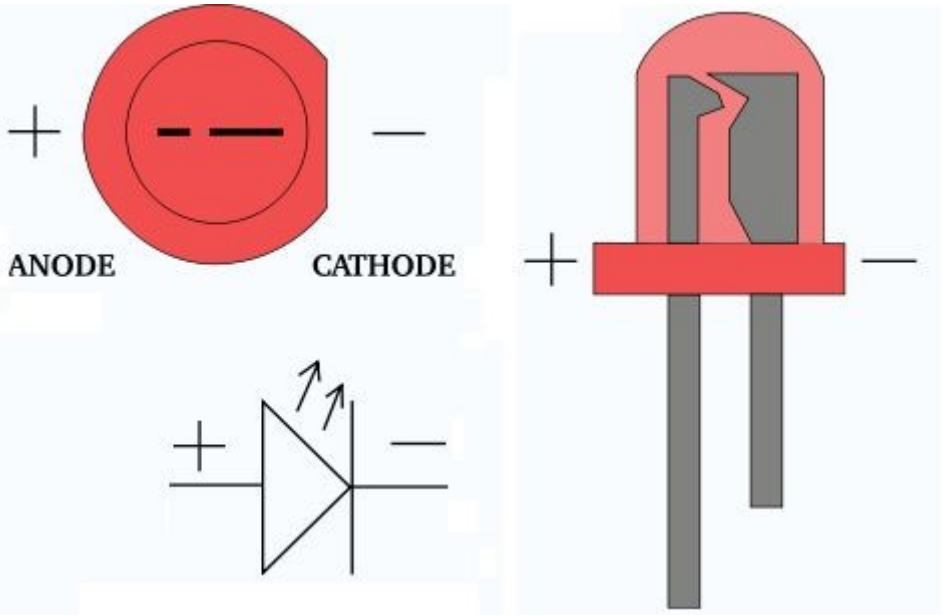
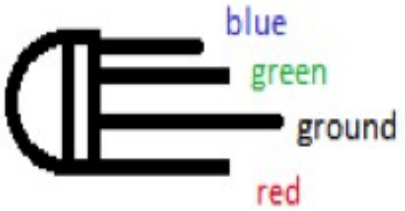
More LEDs



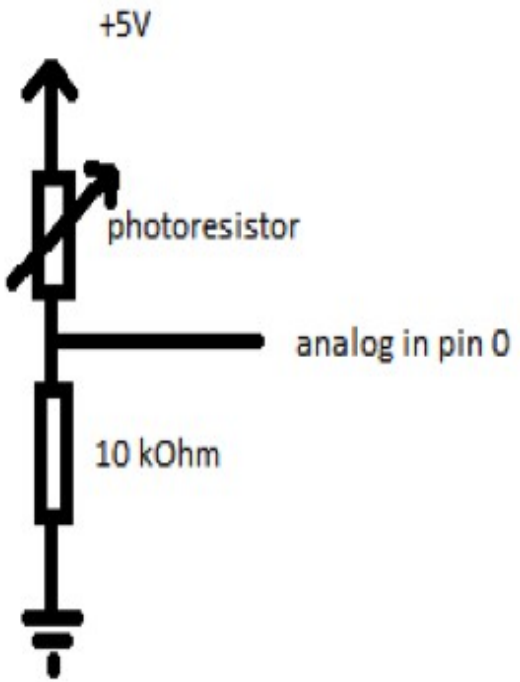
http://www.instructables.com/id/LED-Polarity-Tester/

LEDs and Voltage Dividers

LED setup



Photoresistor setup



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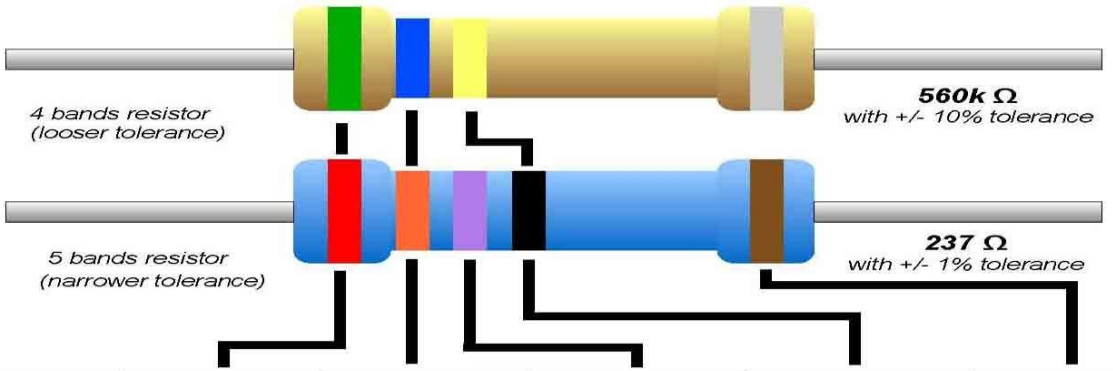
Resistors!

Resistor Color Code

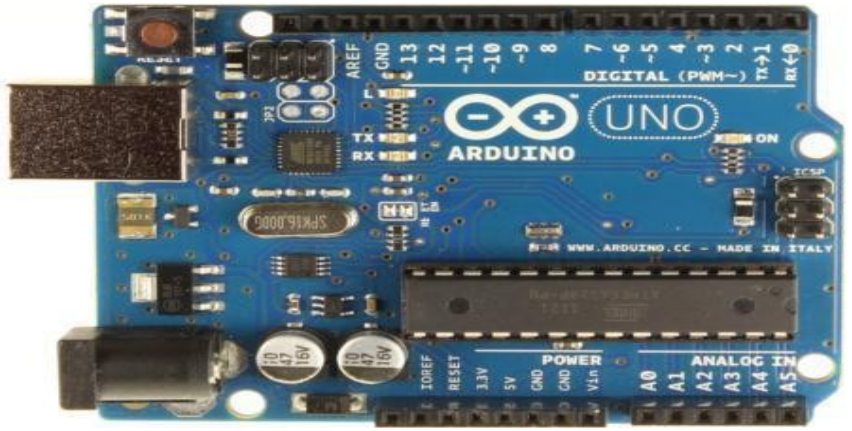


Color	1st Band	2nd Band	3rd Band	Multiplier	Tolerance
Black	0	0	0	x 1 Ω	
Brown	1	1	1	x 10 Ω	+/- 1%
Red	2	2	2	x 100 Ω	+/- 2%
Orange	3	3	3	x 1K Ω	
Yellow	4	4	4	x 10K Ω	
Green	5	5	5	x 100K Ω	+/- .5%
Blue	6	6	6	x 1M Ω	+/- .25%
Violet	7	7	7	x 10M Ω	+/- .1%
Grey	8	8	8		+/- .05%
White	9	9	9		
Gold				x .1 Ω	+/- 5%
Silver				x .01 Ω	+/- 10%

http://www.google.com/imgres?imgurl=&imgrefurl=http%3A%2F%2Fdiy-stem.org%2Fknatom%2Fresistors%2F&h=0&w=0&tbnid=VbUoXDea7PenhM&zoom=1&tbnh=187&tbnw=270&docid=zo0TrBBZQS2NVM&tbm=isch&client=ubuntu&ei=KpXEU76BLu3hsASLzYHoBw&ved=0CAUQsCUoAQ

Arduino

- Microcontroller
- Open source physical computing platform
- Inexpensive, cross-platform
- Rapid prototyping



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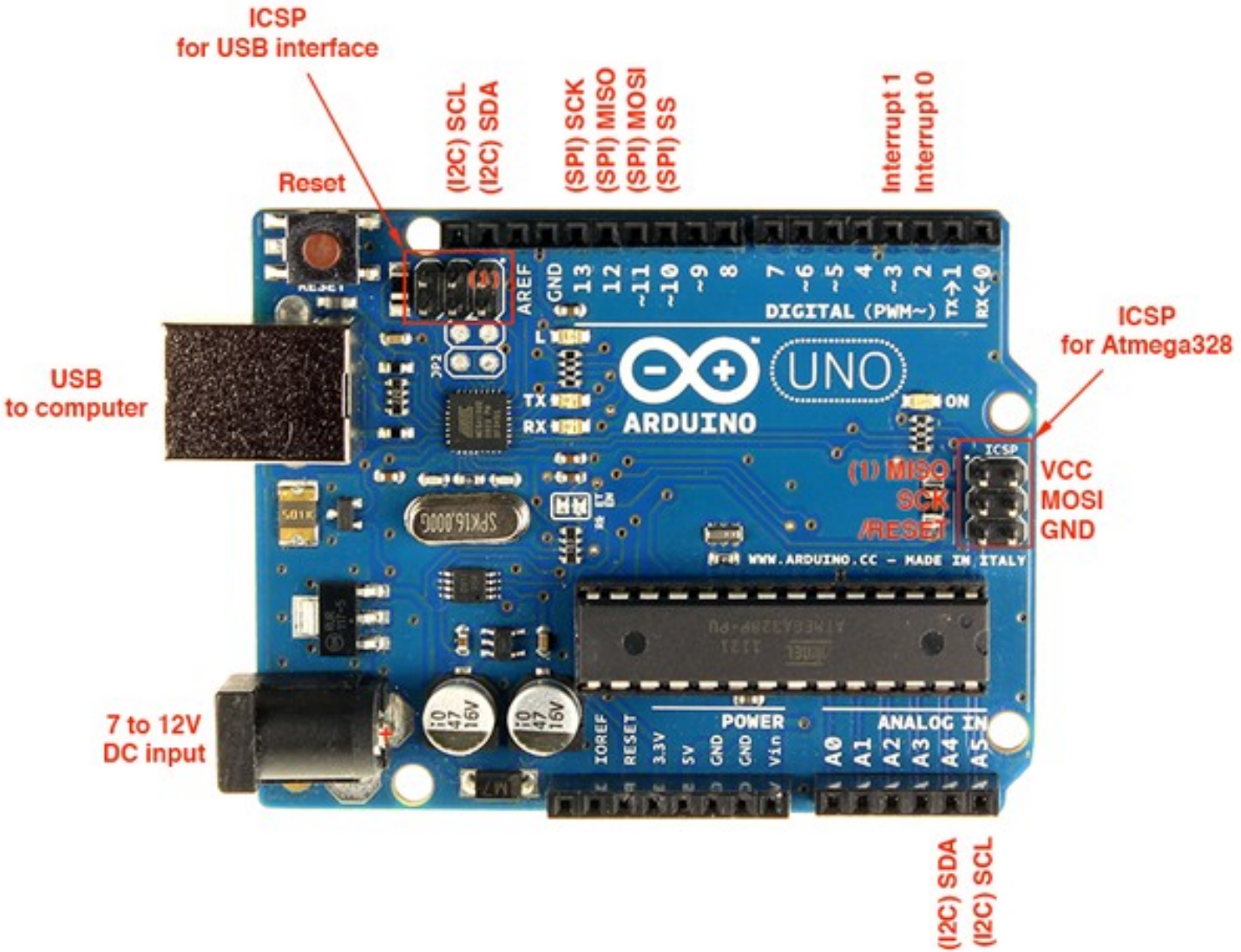
Arduino Components



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Digital----------Analog

- 1 → HIGH (> 3.3V)
- 0 → Low (< 3.3V)
- Read and write voltages to pins

- Read a voltage and get a value between decimal value
- Output a PWM signal

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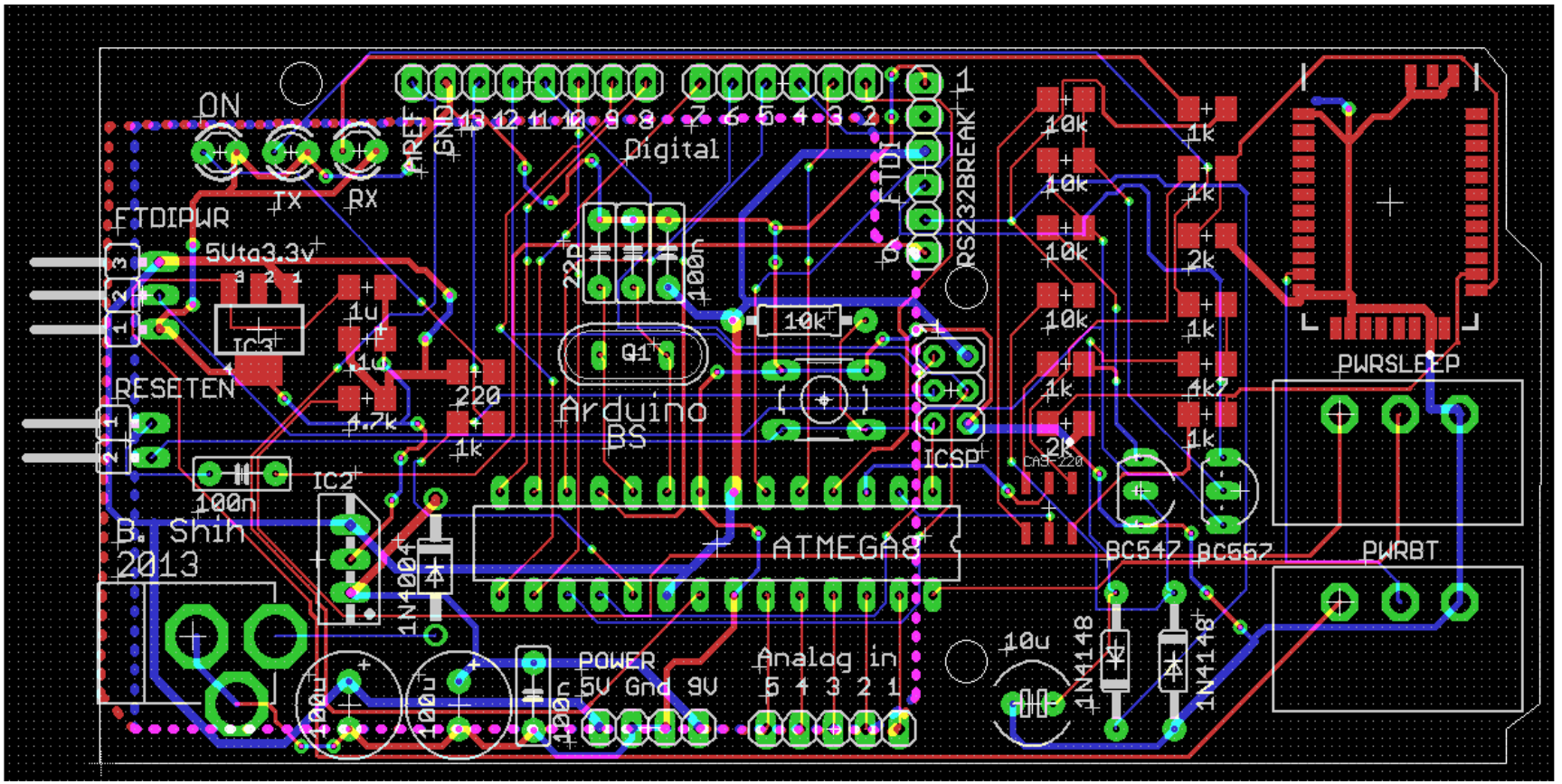
Arduino PCB



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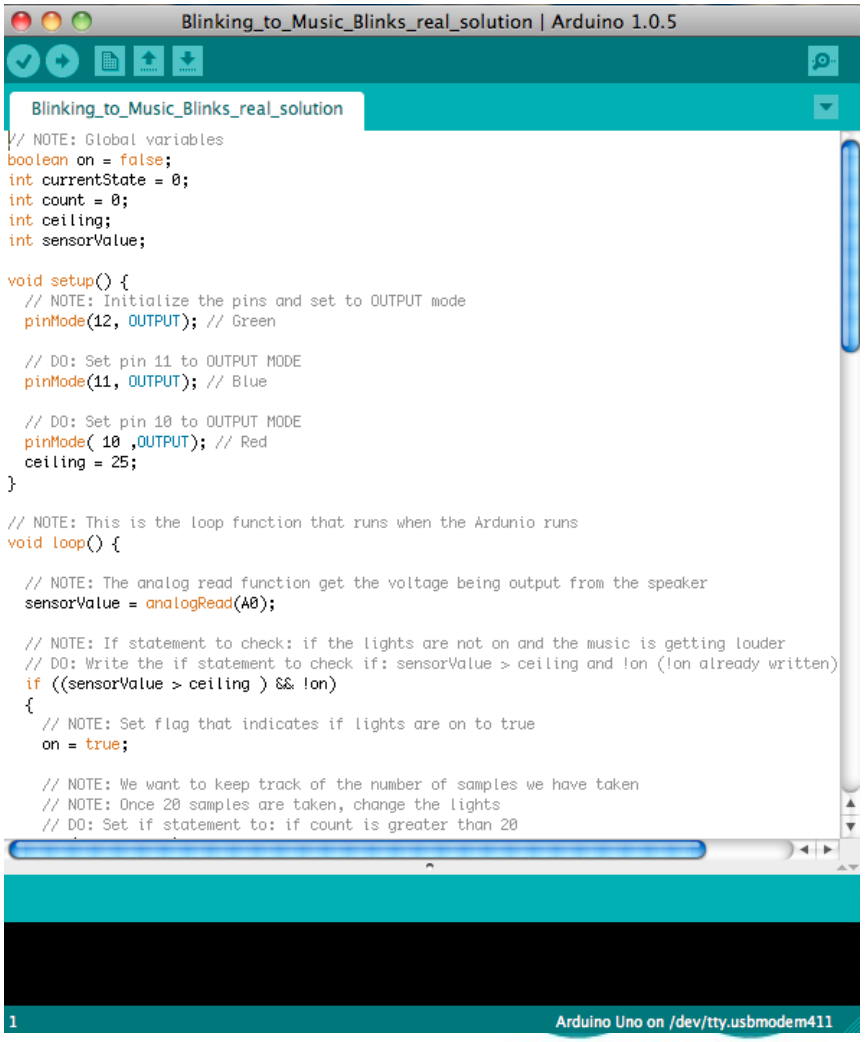
Code

- Arduino IDE
- Processor:
  - Programmed with a C derivative.
- What actually happens:
  - Code gets compiled to machine code
  - Syntax Errors get caught here
  - Machine Code gets loaded onto the microcontroller
  - Microcontroller executes code
- Why is this so amazing?



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Language Basics

- Header:
  - #include [statements]

- // Comments these words are not compiled!

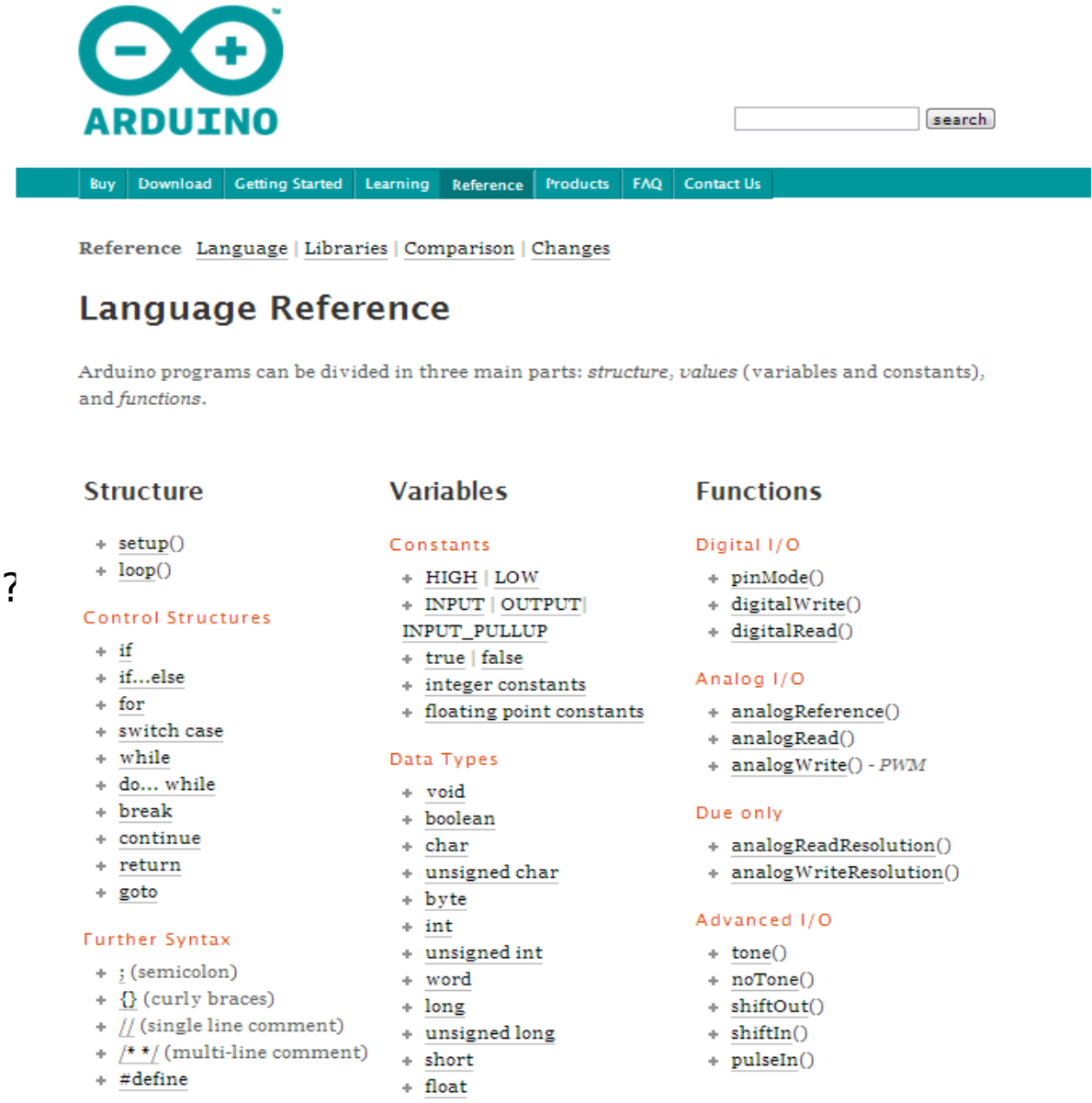
- void **setup**(void) {} <-- must
- void **loop**() {} <-- must

- [type] functionName([type] var, [type] var2)

- '{' and '}' indicate a "body" of code
  - if, else, else if
  - for
  - switch

Online API

- What is a library?
- Why use a library?
- What code is in the library?
- Can I make my own library functions?
- Where can I go for help coding?
- http://arduino.cc/en/Reference/If



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Reference Language | Libraries | Comparison | Changes

Language Reference

Arduino programs can be divided in three main parts: *structure*, *values* (variables and constants), and *functions*.

Structure

- setup()
- loop()

Control Structures

- if
- if...else
- for
- switch case
- while
- do... while
- break
- continue
- return
- goto

Further Syntax

- ; (semicolon)
- {} (curly braces)
- // (single line comment)
- /* */ (multi-line comment)
- #define

Variables

Constants

- HIGH | LOW
- INPUT | OUTPUT| INPUT_PULLUP
- true | false
- integer constants
- floating point constants

Data Types

- void
- boolean
- char
- unsigned char
- byte
- int
- unsigned int
- word
- long
- unsigned long
- short
- float

Functions

Digital I/O

- pinMode()
- digitalWrite()
- digitalRead()

Analog I/O

- analogReference()
- analogRead()
- analogWrite() - *PWM*

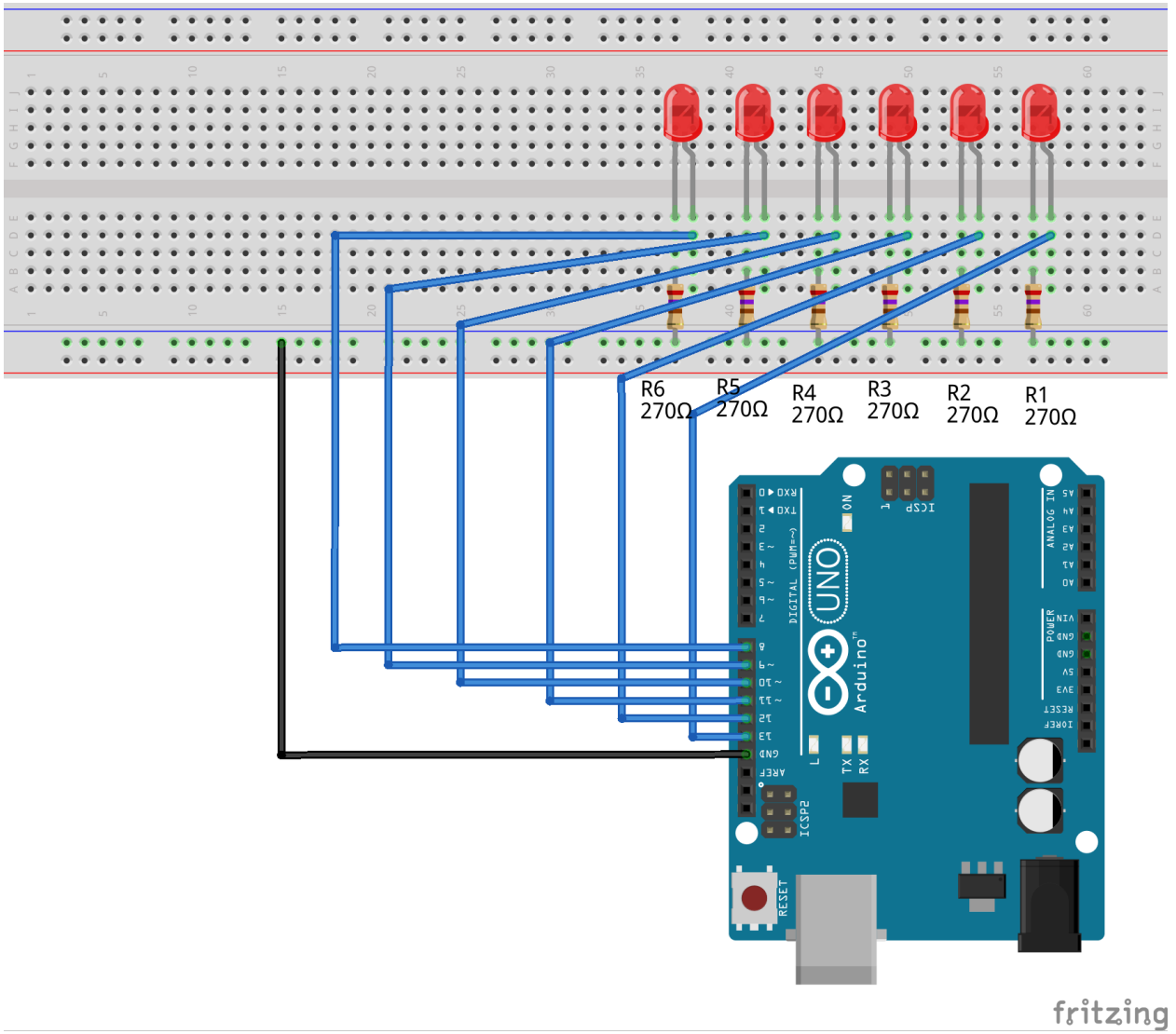
Due only

- analogReadResolution()
- analogWriteResolution()

Advanced I/O

- tone()
- noTone()
- shiftOut()
- shiftIn()
- pulseIn()

Die Circuit



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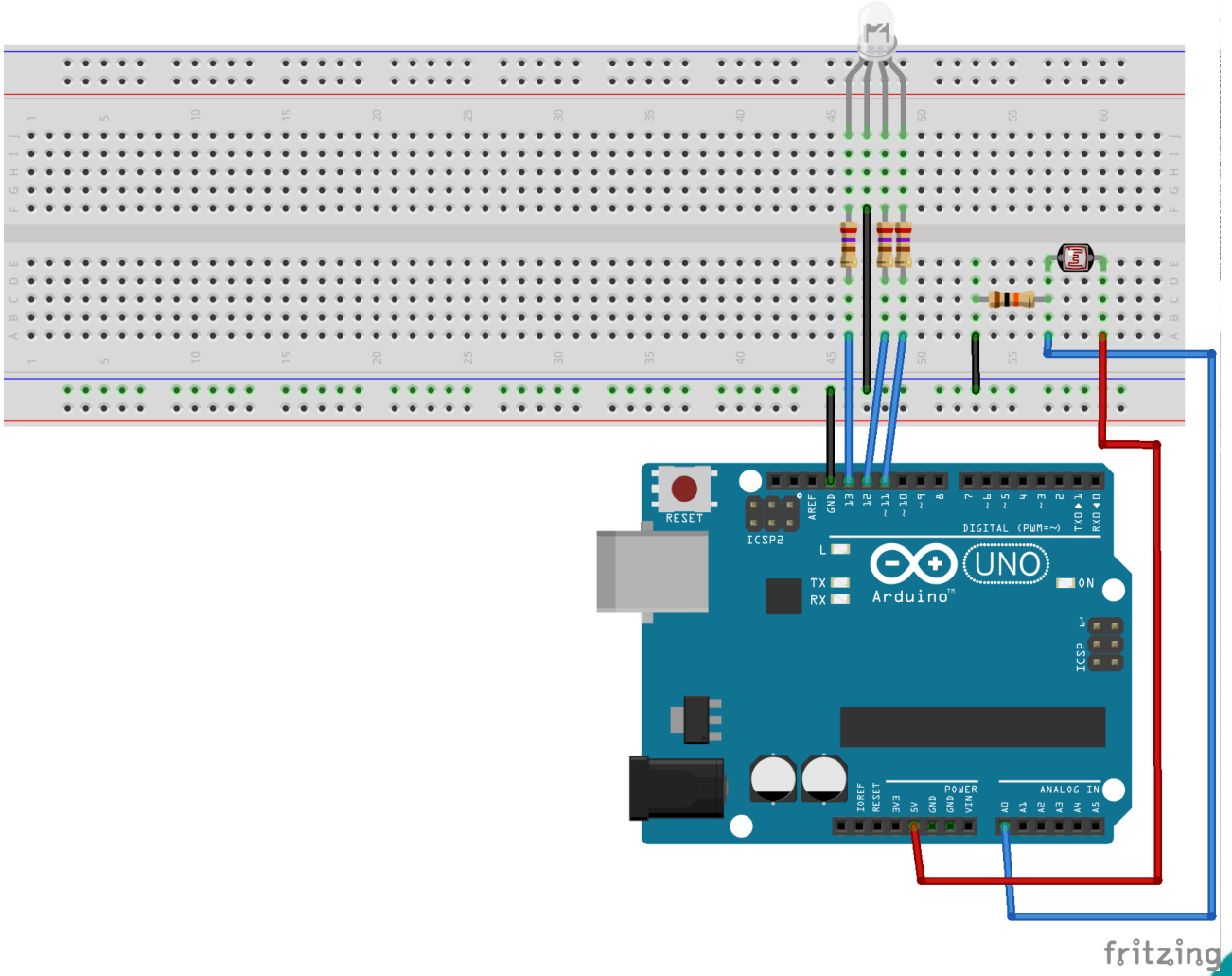
Die Parts

- 6 - LEDs
- 6 - 270 Ohm Resistor

Distance Detection Circuit



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Distance Detection Parts

- 3 - 270 Ohm resistor
- 1 – 10K Ohm resistor
- 1 – Photo-resistor

Party Lights Parts

- 1 – Speaker
- 1 – Audio Jack
- 3 – LEDs
- 3 – 270 Ohm resistors

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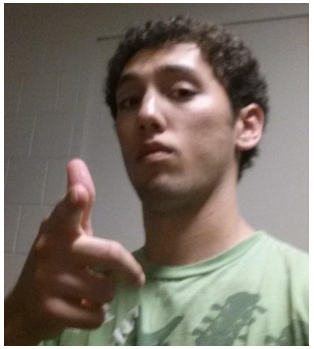
Chat Parts

- 2 – Arduinos
- 3 – Wires

Meet the team!



Dominic

delgado4@stanford.edu

Ashley
ashleymaeconard@gmail.com

Grace
gchriste@uncc.edu

Michael
michaelputhawala@gmail.com

Morgan
mtsorensen13@ole.augie.edu

Jon
Oakl.jon@gmail.com

Dobromir
dyordan@google.com

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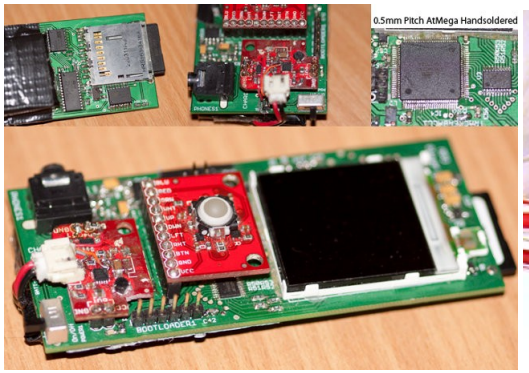
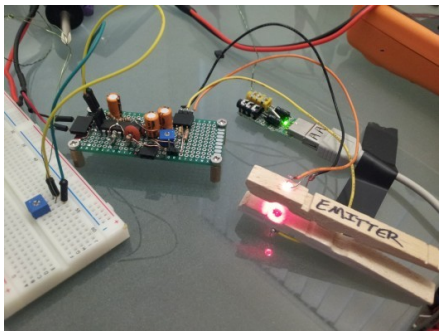
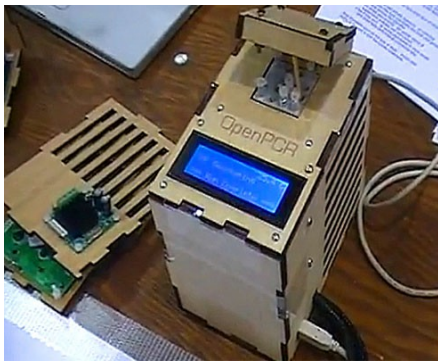
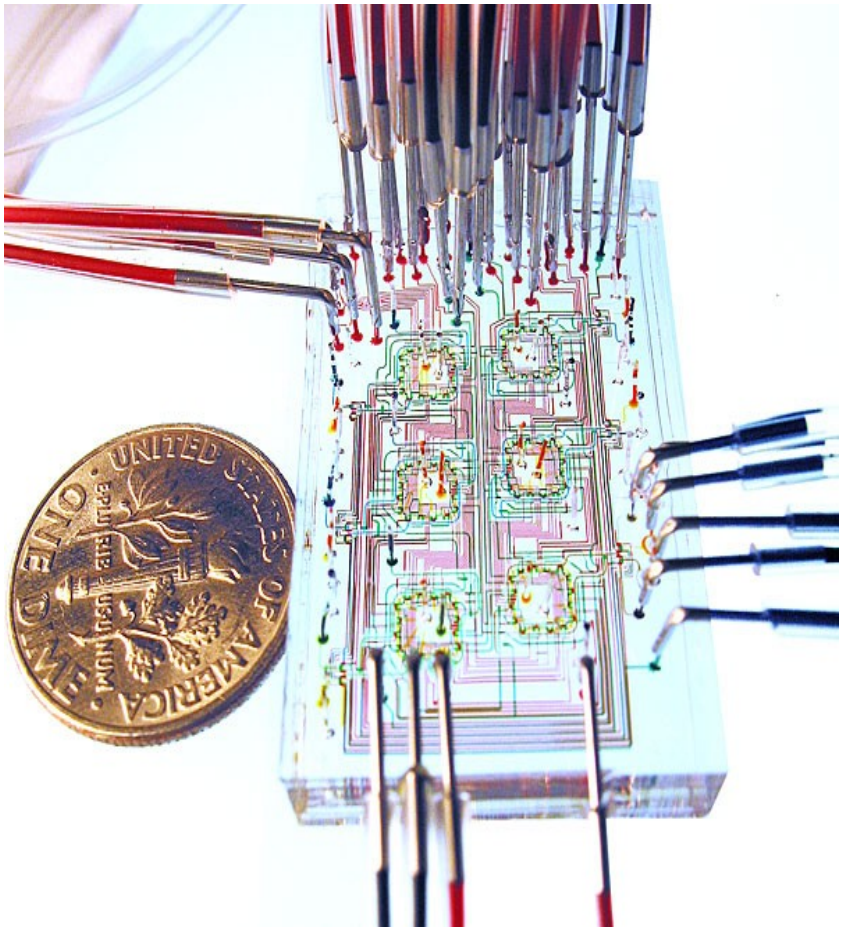
Real life application for Arduinos

- MP3 player
- Phone
- Robots
- Microfluidic devices
- Open PCR
- ECG and pulse oximeter









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- http://www.nudatech.com/blog/20-arduino-projects-of-2012/
- http://medicarduino.net/?cat=4