

## Let's Code Blacksburg, 2013-09-05

### Physical Computing: Controlling The World Around You with Arduino

By Thomas Weeks from Rackspace, for Let's Code Blacksburg, 2013-09-05

Hardware & Hosting Gracefully provided by Summation 360, Inferno Red, & TechPad

This PDF: [http://theweeks.org/tmp/FILES/ARDUINO-STUFF/LCBB-Physical-Computing-Sheets\\_2013-09-05.pdf](http://theweeks.org/tmp/FILES/ARDUINO-STUFF/LCBB-Physical-Computing-Sheets_2013-09-05.pdf)

#### Software Setup

##### •Linux

- RHAT: # yum -y install arduino' #(reqs: uisp avr-libc avr-gcc-c++ rxtx avrdude)
- Ubuntu: \$ sudo apt-get install arduino #(reqs uisp avr-libc gcc-avr avrdude librx-tx-java)
- or download & Install Software from: <http://www.arduino.cc/en/Main/Software>

##### •Linux T-Shooting:

- check permissions of /dev/ttyUSB0
- May have to open port permissions to:  
usermod -a -G uucp,dialout,lock \$USER  
-or may have to tempfix:  
chmod 777 /dev/ttyUSB0

##### •Windows T-Shooting:

- Check/fix COM port settings

##### •Mac T-Shooting:

- check device permissions

#### Part-I: Physical Computing Intro & Overview

##### •Physical Computing (or controlling your world)

- Make, Hackaday, LadyAda
- Arduino, Uno, Teensy, Mega
- Uno R3 Plus uses the Atmega328p microcontroller @ 16MHz
- 32KiB Flash, 1KiB EEPROM, 2KiB SRAM
- Digital I/O (14)/PWM(6), Analog In(6)
- Standard Arduino form factor shields

##### •Hardware Hacking Tips

- Fail Quickly, Fail Cheap, & Learn!
- Success lies on the far side of failure
- Design loosely coupled subsystems

#### Part-II: Load and Test "Blink" Program

##### •Select Tools / Board and

"Arduino Uno"

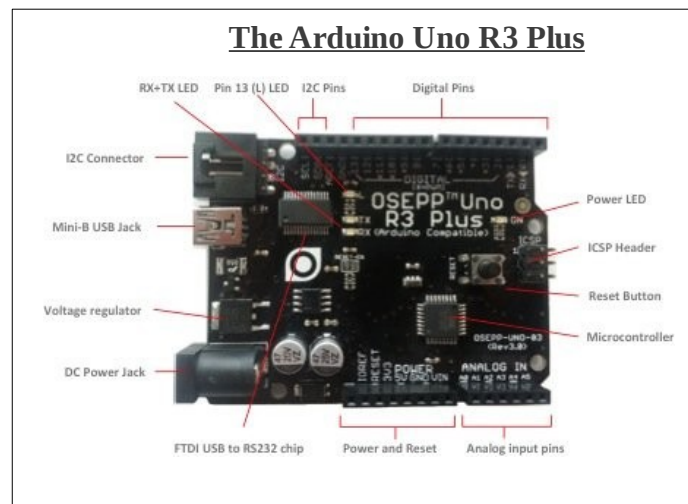
NOTE: If has upload problem, try setting to the  
"Arduino Duemilanove" or "Nano w/ ATmega328"

##### •Select correct Tools / Serial Port (/dev/ttyUSB0)

##### •Load or type "Blink" program

- Click "upload & run" icon to  
compile, upload and run your program

##### •Discuss and play with Analog In



```
// Blink
int ledPin = 13; // LED connected to pin 13

void setup()
{
  // set the digital pin as output
  pinMode(ledPin, OUTPUT);
}

void loop()
{
  digitalWrite(ledPin, HIGH); // turn LED on
  delay(1000);                // wait a second
  digitalWrite(ledPin, LOW);  // turn LED off
  delay(1000);                // wait a second
}
```

## •Part-II “Blink” Hardware build

NEED: breadboard + 1 LED + resistor

- LED positive (long) to digital pin2
- LED negative (short) to resistor
- Resistor to GND (in “POWER” section (bottom/center))
- in program, change digitalWrite(13) to pin "2"
- upload & run

## •Part-III: "Chaser & Pot Delay"

### A) Hardware build: Chase Lights,

NEED: breadboard + 7 LEDs + resistor

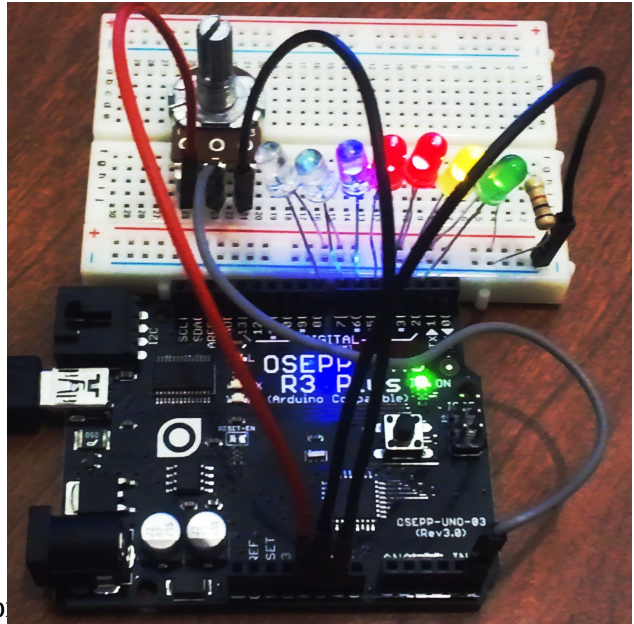
- LED positive (long) legs to digital pins 2,3,4,5,6,7,8 (top “DIGITAL” inputs)
- LED negative (short) legs to breadboard, tied together (can use red/positive rail)
- All LED negative legs to resistor
- LED-Resistor to GND (blue rail, wired back to “POWER” GND pin (bottom))
- Modify Program to output to LED pins
- Testing, mentoring, t-shooting

### B) Hardware build: Analog Read & Delay

NEED: breadboard + 7 LEDs + resistor + potentiometer

- add potentiometer (silver knob) to breadboard for variable chase light speed
- Wire pot leg pin 1 (left pin) to "5V" (on “POWER” header side (bottom))
- Wire pot leg pin 2 (middle) to A5 or "Analog5" (on “ANALOG IN” header (bottom right))
- Wire pot leg pin 3 (right pin) to GND (on “POWER” header (bottom middle), or breadboard GND rail))
- Use "analogRead(5);" in program to sample the pot value (from 0 to 1023 max)
- Replace "delay(1000);" with delay(analogRead(5));" to use the pot read as the delay
- Compile, upload and run code
- Twist knob to adjust chase light speed (delay)

**Try this:** See data with Serial.print(analogRead(5));" to see your pot value in the serial console



-Useful Arduino Links:

Arduino Playground: <http://www.arduino.cc/playground/>

Arduino Cheat Sheet: <http://sites.google.com/site/mechatronicsguy/arduinocheatsheet>

## Hardware/Parts Sites:

Microcontroller Hardware

<http://osepp.com/products/arduino-compatible-boards/>

<http://www.sparkfun.com/>

<http://www.seeedstudio.com/>

Misc. Parts and Surplus

<http://www.allelectronics.com/>

<http://www.jameco.com/>

<http://www.mouser.com/>

<http://www.alltronics.com/>

<http://www.mpja.com/>

*If interested in free classes like this, help us start a "MakerSpace" here in Blacksburg!*

*Indicate interest on our sign-in sheet, or contact us directly:*

[letscode@startupblacksburg.com](mailto:letscode@startupblacksburg.com)

[tweeks-bcb@theweeks.org](mailto:tweeks-bcb@theweeks.org)