(OO) LET'S CODE BLACKSBURG!



STEM Educator's "Teach the Teacher" Arduino Workshop

For: STEM Educators of SW VA

By: Thomas "Tweeks" Weeks

2016-08-1 & 3 (CC)(BY)(AS)



{\circ} Day-1 Overview

- About Let's Code Blacksburg!
- About Teaching STEM Using The Arduino
- Jumping In Arduino Overview & Running "Blink"
- Teaching Programming Theory (C++)
- Inputs vs Outputs
- Recipe "BUILD: LED Chase Light"
- Recipe "INPUT: Light Sensor"
- Freeform Combine Sound Generation + Range Sensor

{\circ} Day-2 Overview

- More C++ Programming Theory: Functions & Parameters
- Build "Sibling Detector Alarm" using three recipes:
 - OUTPUT Sound Buzzer
 - INPUT People Motion Sensor
 - INPUT/OUTPUT LCD Keypad Shield
- Teaching Robotics Based Workshops
- Arduino Teaching & Research Resources
- Arduino Hardware Resources (domestic & international)



{\omegastrianglerightarrow} ScRaTcH

- INPUT: Button, PIR (motion), Ultrasonic (range), Pot (knob),
- OUTPUT: Buzzer, Servos,

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About Me

Name: Thomas "Tweeks" Weeks

Position: Rackspace Technical Community Evangelist

Started: Sept 1999 (as employee#12, current #2)

Contact Info:

tweeks@rackspace.com https://fb.com/ThomasW.Weeks @tweeks_tx GPG - 1024D/750152F OTR - tomweeks@gmail.com





About Me

Name: Thomas "Tweeks" Weeks

Position: Rackspace Technical Community Evangelist

Started: Sept 1999 (as employee#12, current #2)

Various Jobs Over 16yrs:

- -Sys-Admin / Engineer, Corp. Technical Trainer
- -Product Engineer, Systems Architect
- -Customer Advocate Engineer, Author / Tech Writer
- -Data Center RCA Team Lead, Cloud RCA Lead
- -Tech Community Relations, Training & STEM Outreach





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About Me

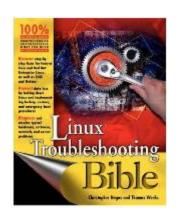
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About Me

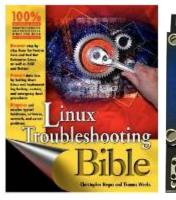
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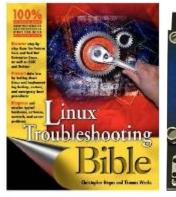
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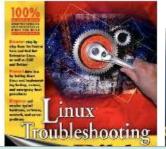
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My Passions











HP Rocketry – www.nrvr.org

Kids & STEM – www.letscodeblacksburg.org



WHO are Let's Code Blacksburg's Trainers

LCBB Trainer

Teaches Workshops On



Kevin Richey



iddie Sheffied homas Weeks Monta Elkins



Nathan Liles









WHY Let's Code Teaches STEM

Our Vision

"Fostering the growth of our technology community by providing not-for-profit, volunteer based, STEM workshops."

{ WHAT and HOW We Do It

WHAT:

HOW:

{ WHAT and HOW We Do It

WHAT: Share and Teach,

HOW:

{ WHAT and HOW We Do It

WHAT: Share and Teach,

HOW: Connect and Grow (the community)



WHAT: Share and Teach,

by <u>creating opportunities for locals</u> (from kids, to tech-learners and IT professionals) <u>to learn new technologies and programming languages</u>.

HOW: Connect and Grow



WHAT: Share and Teach,

by <u>creating opportunities for locals</u> (from kids, to tech-learners and IT professionals) <u>to learn new technologies and programming languages</u>.

HOW: Connect and Grow

<u>Connect local IT experts</u> from our technical community to community-learners to facilitate the sharing of their knowledge into community — <u>and by doing so grow the technical creative capacity of our community</u>.



WHO Supports Us In The Community











{ WHAT Let's Code Teaches

Classes on

Teach Languages





Python







Javascript







Who We Target

What We Call Workshops

Who We Target

What We Call Workshops

Kids

Kids Series

Who We Target What We Call Workshops

Kids Kids Series

Technical Learners General / Learner Series

Who We Target What We Call Workshops

Kids Kids Series

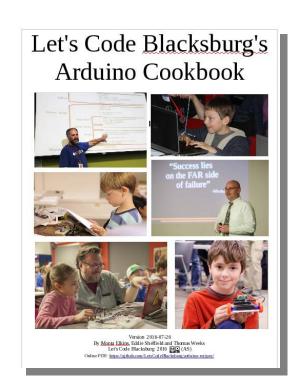
Technical Learners General / Learner Series

IT/Dev Professionals Pro Series

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 - Teaching Programming Theory (C++)
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 - Recipe "BUILD: LED Chase Light"
 - Recipe "INPUT: Light Sensor"
 - Meal Combine Sound Generation + Range Sensor recipes

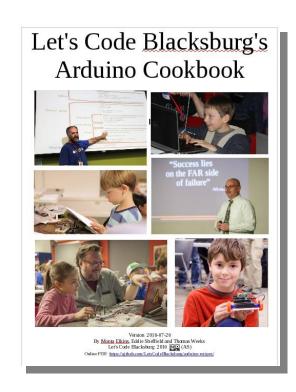
Teaching with the LCBB "Arduino Cookbook" System

The "cook book" structure is comprised of mini "recipes" (see pg 2)



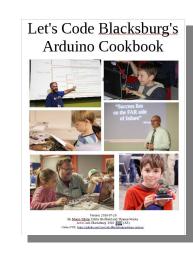
Teaching with the LCBB "Arduino Cookbook" System

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 - 1 recipe = How 1 device is to be connected and programmed



Teaching with the LCBB "Arduino Cookbook" System

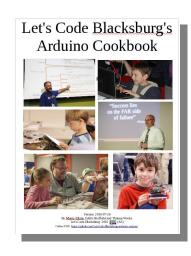
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 - 1 recipe = How 1 device is to be <u>connected</u> and <u>programmed</u>
 - Inventing something = "Cooking a Meal" = recipe1 + recipe2 + recipe3



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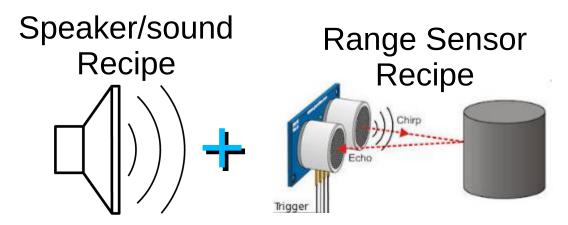
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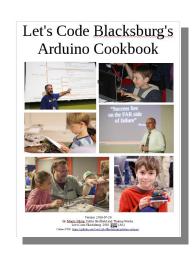
Speaker/sound Recipe



Teaching with the LCBB "Arduino Cookbook" System

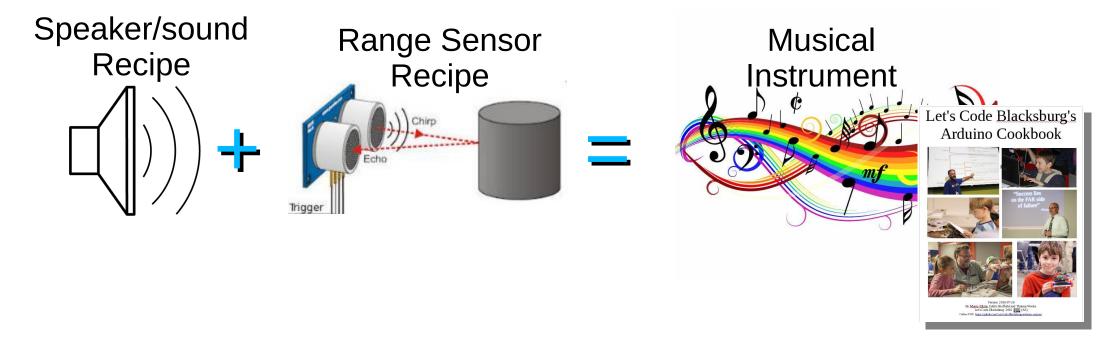
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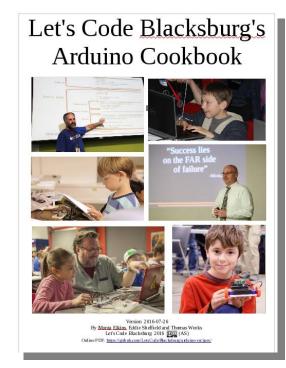
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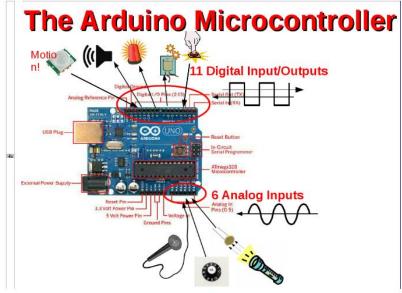


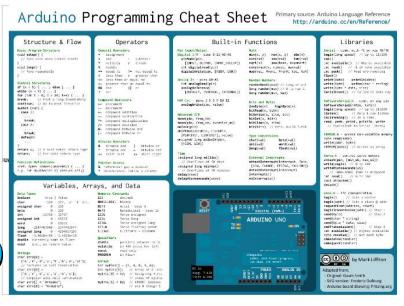
Teaching w/the "Cookbook" System

If a child wants to dig deeper, we also include reference material (scan over pages 4-5)...









(pull this sheet out for use later)

Teaching with the LCBB "Arduino Cookbook" System

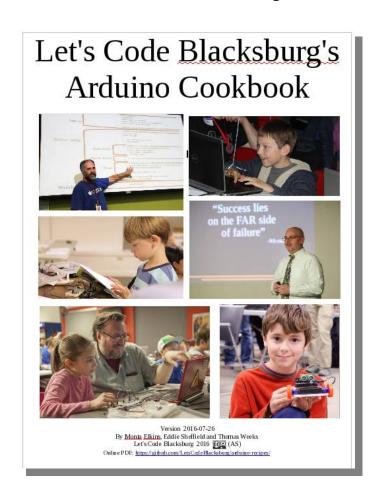
Go ahead and look a the recipes on pages 6-8 of the cookbook..

Note that each "recipe" has a:

What - Theory/concept intro

<u>How</u> – to connect and program it

<u>Fail</u> – to explore possible causes of it not working correctly.



Teaching with the LCBB "Arduino Cookbook" System

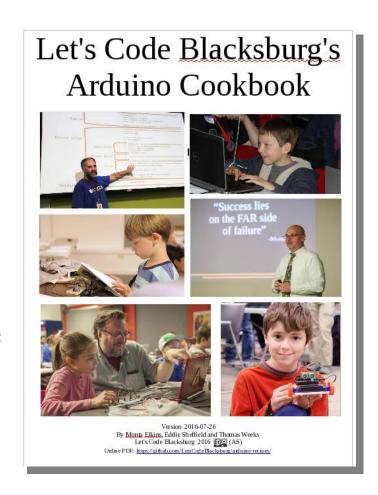
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We REALLY Like To Stress The Importance of...



Teaching kids how to accept & learn from failure...
is <u>CRITICAL</u> for Critical Thinking!!

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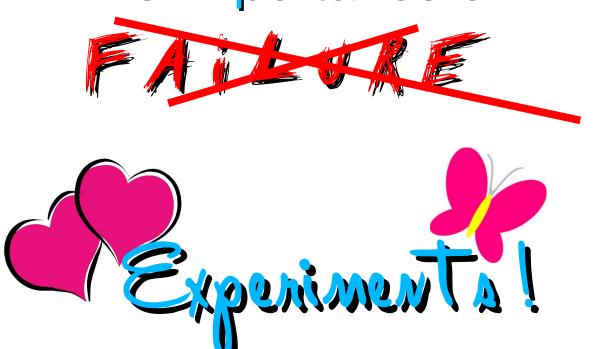
(you can't do science if you can't get past your own ego)





















We REALLY Like To Stress The Importance of...







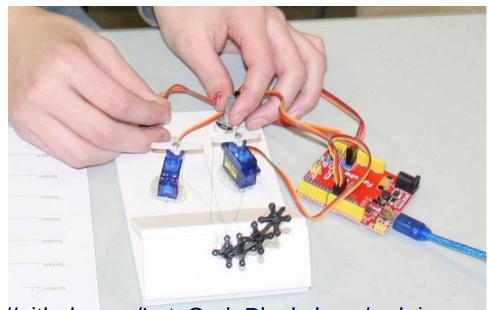
The secret to inventing (or prototyping) is to...

"Fail fast, fail cheap!" —Monta Elkins



"Fail fast, fail cheap!" —Monta Elkins The R.A.T. Workshop (Robotic Alien Tentacle)





https://github.com/LetsCodeBlacksburg/arduino-recipes

The Translation of

"Fail fast, fail cheap!" —Monta Elkins



Teach Kids To Only Build Or Change..



One...
Small...
Thing...
At...
A...
Time...

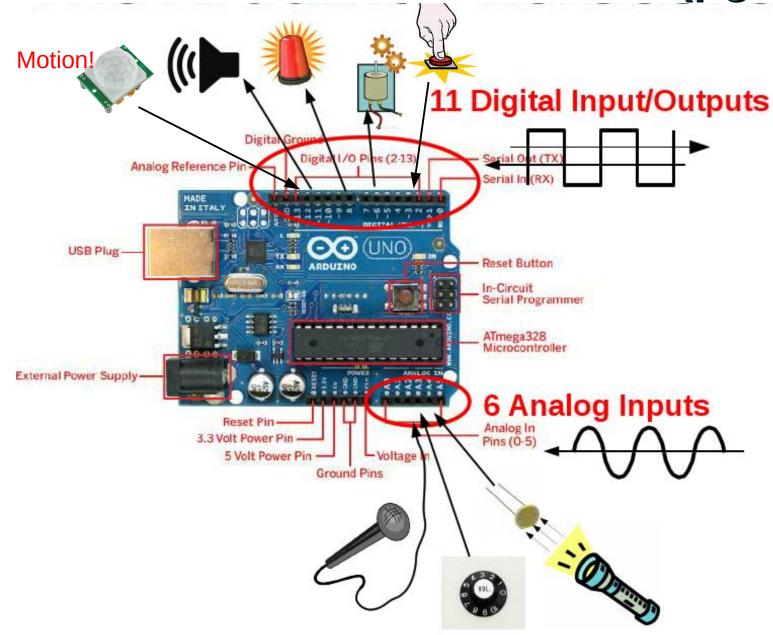
Takeaways of Teaching Failure (today)

- 1) To do science, let go of your ego and assumptions.
- 2) People Learn, Experiments Fail.
- 3) "Fail Fast, Fail Cheap!" = Only change one small thing at a time.

{\circ} Jumping In

- About Let's Code Blacksburg!
- About Teaching STEM Using The Arduino
- → Jumping In Arduino Overview & Running "Blink" (pg 4-7)
 - Teaching Programming Theory (C++)
 - Inputs vs Outputs
 - Recipe "BUILD: LED Chase Light"
 - Recipe "INPUT: Light Sensor"
 - Freeform Combine Sound Generation + Range Sensor

{\circ} Arduino Overview (pg4)



{ Every Class' First Program, "Blink" pg7

Blink is more than just a "Hello World" program..



```
Blink | Arduino 1.6.7
                                                                         File Edit Sketch Tools Help
  Blink §
// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin 13 as an output.
 pinMode(13, OUTPUT);
// the loop function runs over and over again forever
void loop() {
 digitalWrite(13, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000);
                           // wait for a second
  digitalWrite(13, LOW); // turn the LED off by making the voltage LOW
  delay(1000);
                           // wait for a second
                                                      Arduino/Genuino Uno on /dev/ttyACM0
```

{ Every Class' First Program, "Blink" pg7

Blink is more than just a "Hello World" program.. It accomplishes:

- ✓ Tests hardware & drivers
- ✓ Tests USB/serial link settings
- Verifies everything works



```
Blink | Arduino 1.6.7
                                                                          File Edit Sketch Tools Help
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  digitalWrite(13, LOW):
                            // turn the LED off by making the voltage LOW
  delay(1000);
                            // wait for a second
                                                       Arduino/Genuino Uno on /dev/ttyACM0
```

{ Every Class' First Program, "Blink" pg7

Let's Dive In!

- Turn to pg 7
- Start Arduino Program
- Follow "How" Section
- If (success), then
 - Add variable for ledPin and replace 13 with ledPin and run

```
Blink | Arduino 1.6.7
File Edit Sketch Tools Help
  Blink 등
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                            // wait for a second
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  code that gets compiles or executed.
 Comments are just for humans. :)
 #/
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void loop() {
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  delay(1000);
}
loop() function
```

```
int ledPin = 13; Declarations
```

```
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   pinMode(ledPin, OUTPUT);
}
```

```
void loop() {
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   delay(1000);
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   delay(1000);
}
```

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int ledPin = 13;

void setup() {
  pinMode(ledPin, OUTPUT);
}

setup() function
}
```

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  delay(1000);
  digitalWrite(ledPin, LOW); // turn the LED off by making the voltage LOW
                             // wait for a second
  delay(1000);
```

```
if() // to test for conditions and run code once if true
```

```
if()  // to test for conditions and run code once if true
while() // to run code as long as a condition is true
```

```
if()  // to test for conditions and run code once if true
while() // to run code as long as a condition is true
for()  // to run code for a determined number of times
```

```
if(condition==true) {
  doThisOnce();  // just tuns once
while(condition==true) {
  doThis(); // until condition is not true
for( x=0; x<10; x++) {
  doThis(); // ten times
```

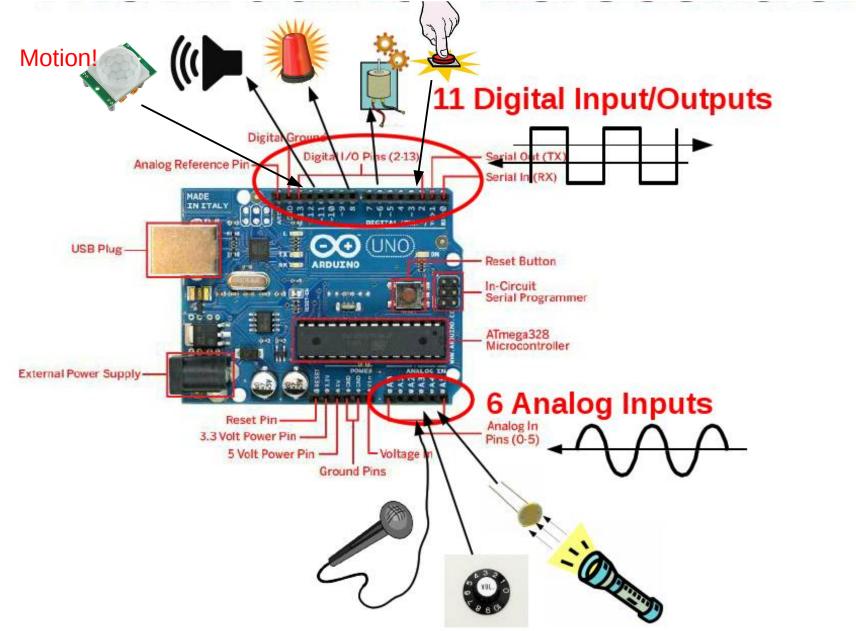
Demonstrating simple programming logic using...

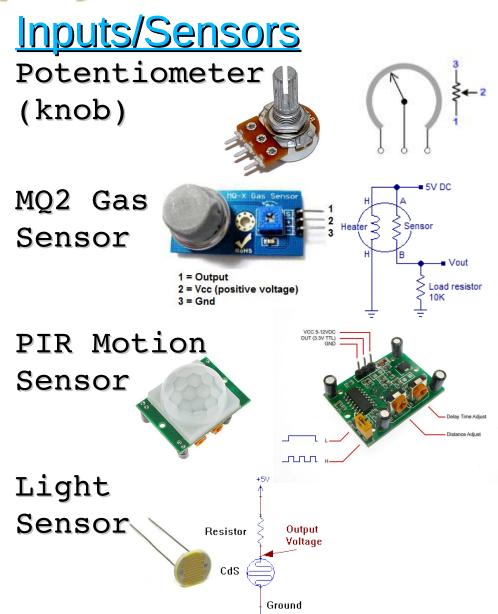
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   doThisOnce();
}

while(condition==true) {
   doThis();
}
```

Let's implement these in your Blink

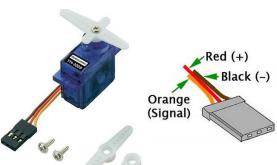
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<u>Outputs</u>

Servo Motor



LCD Screen



Laser Module



IR

Transmitter

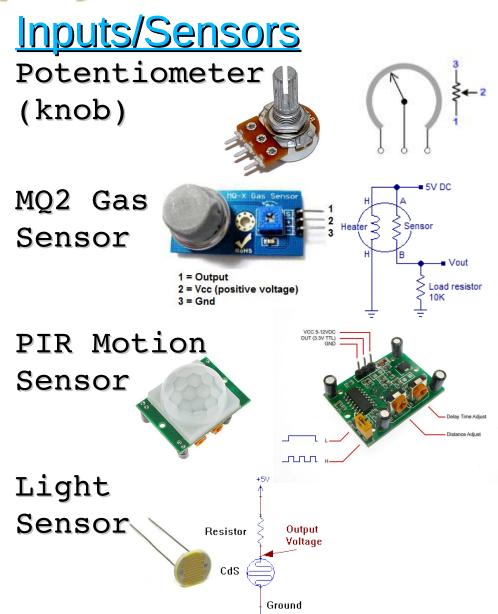


{\omegasty} Programming Theory

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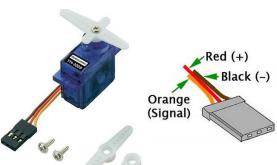
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<u>Outputs</u>

Servo Motor



LCD Screen



Laser Module



IR

Transmitter



{ Arduino Resources

- Code/Activities, LCBB Github: https://github.com/LetsCodeBlacksburg/
- Questions, drivers, learning: http://playground.arduino.cc/
- Arduino projects/lessons: learn.adafruit.com, toptechboy.com/arduino-lessons
- Arduino Parts: amazon.com, mpja.com, sparkfun.com, aliexpress.com
- Robotics: robotshop.com, aliexpress.com