STEAM CLOWN[™] PRODUCTION

ARDUINO STEM ACADEMY

March, 2017

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ARDUINO STEMM ACADEMY

Art without Engineering is dreaming. Engineering without Art is calculating.

- Steven K. Roberts



Aug, 2016

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PC NEEDS & MICROPROCESSOR TO RUN, RIGHT?





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WHAT ABOUT THESE...



Did you know they are built with a Microprocessor or Microcontroller too?



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WHAT IS A MICROPROCESSOR? WHAT'S THE DIFFERENCE BETWEEN A MICROPROCESSOR AND A MICROCONTROLLER?

• A microprocessor, like the Intel Or AMD processors, contains

 a CPU, but needs help from other components to make it function, components like DRAM and hard drives

 A microcontroller, like the Arduino, is a standalone single-chip that contains

 a CPU, read-only memory to store the program, RAM to store variables used in the execution of the program.







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DID YOU SAY "ARDUINO"?

- Arduino Is An Open-source Electronics Platform
 - \odot With easy to use hardware & software.
 - \odot Intended for anyone making interactive projects
- Arduino Can Sense & Control It's Environment

 Receiving information from sensors on input pins
 Affecting it's surroundings by controlling lights, motors, actuators, etc on output pins
- You Tell Your Arduino What To Do
 - O Writing code in the Arduino programming language
 O Using the Arduino development environment





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THERE ARE MANY TYPES OF ARDUINOS





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WHAT'S A PROGRAMING LANGUAGE?

• A programming language is

 A formal constructed language designed to communicate instructions to a machine, particularly a computer

 Programming languages can be used to create programs to control the behavior of a machine or to express algorithms.

• The Arduino uses C++







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BLINK - FIRST SKETCH - C++



GO FROM A SKETCH TO BLINKING AN LED



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STEAM CLOWN'S ARDUINO RESOURCE PAGE



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IS IT POSSIBLE TO GET HELP?

- Git Hub See Steam Clown's Files
- <u>http://www.arduino.cc/</u> ← Official Arduino Site
- http://www.arduinobook.com/
- Google Is Your Friend...
 - o Google <u>Arduino Getting Started</u>
 - Google <u>Arduino Tutorials</u>
 - o Google <u>Arduino Sketches</u>
- PDF books
 - o Arduino Programmers Notebook
 - o Arduino in a Nutshell
 - o Introduction to Arduino A piece of cake!
- YouTube
 - o Arduino: Your First Arduino Sketch
 - o Tutorial 01 for Arduino: Getting Acquainted with Arduino



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KIT AND INSTALL OF TOOLS



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WHAT IN YOUR KIT

- Arduino Uno (clone)
- USB Cable
- Breadboard
- Battery Connector
- Jumper Wires
- 2 Buttons
- LEDs
- Resistors





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LET ME INTRODUCE YOU TO ARDUINO...



PLEASE REGISTER FOR THE SITE HTTPS://WWW.ARDUINO.CC/ WE WILL BE USING THIS SITE TO CODE OUR ARDUINO KITS



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POWERING YOUR ARDUINO UP FOR THE FIRST TIME

• Connect the USB cable from your PC to the Arduino



 Power "good" LED will turn on, you will see a bunch of Blinking on the RX/TX LED, and LED 13 should start Blinking



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BLINK - FIRST SKETCH



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MAKE SURE YOU RENAME YOUR SKETCH

• Remove STEAM_Clown from your Sketch names... Please



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HOW DO YOU CHANGE THE BLINK RATE?

- Change the number in the delay(1000)
- Delay is measured in ms

Shall Obey - Shirt.Woot 🛛 🗴 🖉 steamClass_Blink_Squeaky... 🗙 🖓 P Pandora Radio - Listen to F... 🗙 🖾 🗸 C 🔍 pandora 🧃 Most Visited 🗌 Getting Started 📴 Xilinx 🥃 EveryDay 📑 Jimbo 📑 LDS 📑 Pintrist & Other pages ... 🧧 sailing 📮 Stuff2Sort 🧧 Projects 📑 Halloween 📮 NewU 📮 zOMBIES tHEY aRE co... 📮 Xilinx Links 📑 eDGERaLLENpOE \circ (1000 ms = 1 second) 🐼 codebendei Squeaky Hinge Log Out S steamClass Blink SqueakyHinge 15 // // the loop function runs over and over again forever void loop() Change from 1000 digitalWrite(arduinoBoardLED, HIGH); // turn the LED on to something like 500 or level delay(500); < // wait for a second 250 or 100 digitalWrite(arduinoBoardLED, LOW); // turn the LED of on your 10, by setting the voltage LOW delay(500); // wait for a second digitalWrite(arduinoBoardLED, HIGH) delay(1000); //Wait for a second

File Edit View History Bookmarks Tools Heli

What can happen in 500 ms?

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🎔 Follow @codebender_cc 📑 Like 😂.9k

//Set the LED min to LOW. This turns it digitalWhite(anduinoBoardLED, LOW): delay(1000); //Wait for a second

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Number of lines: 61

Contact us! ελη σι σι

Sketch size: 1082 bytes

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BLINK - EDIT SKETCH



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PPODI

BLINK FASTER: VERIFY, SAVE, RUN



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DEBUGGING?

Why Is It Called "Debugging"?

What Useful Tools Could You Use To Debug Your Code?



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MOTH IN THE MACHINE: DEBUGGING THE ORIGINS OF 'RUG'



"Debugging" Attributed to Admiral Grace Hopper in the 1940s, but the term "bug" in the meaning of technical error dates back at least to 1878 and Thomas Edison

9/9 andan started 0800 1.2700 9.037 847 025 1000 antan . 9.037 846 95 const +76415 to3) 4.615925059(-2) 13 00 (032) PRO 2 2.130476415 2.130676415 -2 in 033 failed spiral speed test Relas Started 1100 Sine check) 1525 Relay #70 Panel F (moth) in relay. 1545 145/600 andament started. closed dom

© Copyright 2016 STEAM Clown"

DEBUGGING IS A METHODICAL PROCESS OF:



- Finding and reducing the number of <u>bugs</u>, or <u>defects</u>, in a computer program or a piece of electronic hardware, making it behave as expected.
- Debugging tends to be harder when various subsystems are <u>tightly</u> <u>coupled</u>, as changes in one may cause bugs to emerge in another.
- "games are the worst to debug"... Why?
- Spaghetti code?







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DEBUG SKETCH

https://github.com/jimTheSTEAMClown

	10 // 11 // define variables that will be used in the sketch			
Defines Variables.	12 // 13 const int arduinoBoardLED = 13; // LED on pin 13	P I his repository Search	ull requests issues Gist	
What is the difference between "const int" and int"?	<pre>14 15 int firstTimeThroughLoopVar = 0; // Use to control 16</pre>	jimTheSTEAMClown / Arduino-Code (> Code ① Issues 0 ⑦ Pull requests 0 ①	Branch: master - New pi	
Setup Function This is stuff that runs	<pre>20 // This is where you define pin directions 21 void setup() 22 { 24 Serial.begin(9600); // Use Serial Monito 25 Serial.println("Beginning of Setup"); 26 // initialize the digital pin as an output.</pre>	Arduino Code - source code and other student res Add topics	jimTheSTEAMClown cc □ LCD_Shield_Sample_Dc	
Main Loop	<pre>27 Serial.println("Setting I/O pin Status and Direction") 28 pinMode(arduinoBoardLED, OUTPUT); 29 30 // This only runs one time 31 Serial.println("Printing something in the Setup Functi 32 Serial.print("The pin the LED is connected to: "); // 33 Serial.println(arduinoBoardLED); // this prints a Var 34 Serial.println("Setup Complete"); 35 } 36 </pre>	ion"); / this prints text, but no line f and a line feed and return ("steamClass_[EREADME.md teamClass_" _DEBUG	
	<pre>37 37 37 37 37 37 39 39 39 40 4 41 42 41 42 44 42 44 44 44 44 44 44 44 44 44 44</pre>	er: he time through the loop this is skipped	steamClass_BLINK	
	<pre>48 //Set the LED pin to HIGH. This provides 5 volts to th 49 digitalWrite(arduinoBoardLED, HIGH); 50 delay(250); //Wait for a second 51 //Set the LED pin to LOW. This turns it off 52 digitalWrite(arduinoBoardLED, LOW); 53 delay(250); //Wait for a second 54 Serial.print("."); 55 }</pre>	The LED and turns it on	STEAM CLOWN ^M & Squeaky Hinge PRODUCTIONS	
		Page 27 - Cyber Security Class	© Copyright 2016 STEAM Clown	

 🔅 codeb	bender	Searc	h			Logged in a	s Sque	aky Hinge Log Out		
🖹 Save	Verify	→ Ru	n	COM11	•	Arduino Uno	-	Serial Monitor	•	
S steam	Labs_Debu		< V	erification succ	essful!		7			
steamLat kyHinge.i	os_Debug_Squ ino	Jea	9 10 11	// // define vari	iables th	will be used in t	the ske	tch	····· ^	

Serial Monitor -

- Setup → Serial.begin(9600)
- Loop → Serial.println(variable or text string);

9600 💌	彩 Disconnect	✓ Autoscroll Echo	Both ML & CR		
connected at	9600				
Beginning of	Setup				
Setting I/O pin Status and Direction					
Printing something in the Setup Function					
The pin the LED is connected to: 13					
Setup Complete nrint vs nrin				ntln	
Beginning of	Main Loop	L			
Blinking:					

18	//						
19	// The setup routine runs once when you load the sketch or press reset:						
20	// This is where you define pin directions						
21	<pre>void setup()</pre>						
22 -	{ · · · ·						
23	-						
24	Serial.begin(9600); // Use Serial Monitor to debug						
25	Serial println("Beginning of Setup");						
26	// initialize the digital pin as an output.						
27	Serial println("Setting I/O pin Status and Direction");						
28	pinMode(arduinoBoardLED, OUTPUT);						
29							
30	// This only runs one time						
31	Serial.println("Printing something in the Setup Function");						
32	Serial.print("The pin the LED is connected to: "); // this prints text, but no line feed						
33	Serial.println(arduinoBoardLED); // this prints a Var and a line feed and return						
34	Serial.println("Setup Complete");						
35	}						
76							
37	//						
38	// the "main" loop routine runs over and over again forever:						
39	void loop()						
40 -	(
41							
42	<pre>if (firstTimeThroughLoopVar == 0) // only does this one time</pre>						
43 -	{						
44	Serial.println("Beginning of Main Loop");						
45	Serial.print("Blinking: ");						
46	<code>firstTimeThroughLoopVar = 1;</code> // set so next time through the loop this is skipped						
47	}						
48	//Set the LED pin to HIGH. This provides 5 volts to the LED and turns it on						
49	digitalWrite(arduinoBoardLED, HIGH);						
50	delay(250); //Wait for a second						

- You can Do a Lot with a Blinking LED!!!
- Comments Are Bug Prevention... Why?



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CONTROL STRUCTURES



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PROGRAM STRUCTURE AND CONTROL

- Program Structure
 - \circ Define Variables
 - Setup
 - $\circ \text{Loop}$
- Controlling Program Flow
 - \circ if
 - \circ if...else
 - $\circ~\mbox{for}$
 - o switch case
 - \circ while
 - \circ do... while
 - o break
 - \circ continue
 - o return
 - o goto



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IF STATEMENT

If (someVariable >50)

//do something here

- Search and clone sketch "<u>steamClass if</u>"
 What does this sketch do?
- Comparison Operators
- Lets Change it...

How could we change it?Look back at the "Debug" Sketch

```
digitalWrite(arduinoBoardLED, HIGH);
delay(myDelayTime);
digitalWrite(arduinoBoardLED, LOW);
delay(myDelayTime);
Serial.print(".");
myDelayTime = myDelayTime + 20;
if (myDelayTime > 500)
    {
        myDelayTime = 10;
        Serial.println("R");
```

```
x == y (x is equal to y)
x != y (x is not equal to y)
x < y (x is less than y)
x > y (x is greater than y)
x <= y (x is less than or equal to y)
x >= y (x is greater than or equal to y)
```



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WWW.ARDUINO.CC



Reference Language | Libraries | Comparison | Changes

Language Reference

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



Variables

Constants

- HIGH I LOW
- INPUT I OUTPUT I INPUT_PULLUP
- LED_BUILTIN
- true l false
- integer constants
- floating point constants

Data Types

- void

booloar

Functions

Digital I/O

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

Analog I/O

- analogReference()
- analogRead()

Due & Zero only

- analogWrite() - PWM



MORE IF STATEMENTS

• if / else

```
if (someVariable < 500)
{
   // action A
}
else</pre>
```

```
// action B
```

```
if (someVariable < 500)
 // do Thing A
else if (someVariable >= 1000)
 // do Thing B
else
 // do Thing C
```

• if / else if / else



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LETS DO SOME CODING - WRITE YOUR OWN SKETCH

- Review The Code In The Sketches In Your Account

 Look at Sketches in "Squeaky Hinge" or other Bender Accounts
 Look at coding examples on <u>www.arduino.cc</u>
- Create A New Sketch In Your Account
- Use "If", "If/Then", "If/Then/Else" Statements
- Make The LED Blink Differently Based on Your Program Control
- Before You Start Coding... Plan It Out In Your Lab Book



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LET'S DO SOME DEBUGGING...

- Remember when I asked "What can you do in 500ms?"
- Search and Clone
 - o steamClass_DebugBlinkLoop1
 - \odot What is it doing?
 - \circ Run it....

```
void loop() {
    if (loopCouonter == 250)
```

```
digitalWrite(arduinoBoardLED, HIGH); // turn the LED on
loopCouonter = loopCouonter++;
```

```
else if (loopCouonter == 500)
```

```
digitalWrite(arduinoBoardLED, LOW); // turn the LED off
loopCouonter = 0;
```

```
else
```

```
loopCouonter = loopCouonter++;
```



LET'S DO SOME DEBUGGING...

- Add a Serial.println

 Serial.println(loopCouonter);
- Now is it working?

• Why?

```
void loop() {
 if (loopCouonter == 250)
   digitalWrite(arduinoBoardLED, HIGH); // turn the LED on
   loopCouonter = loopCouonter++;
 else if (loopCouonter == 500)
   digitalWrite(arduinoBoardLED, LOW); // turn the LED off
   loopCouonter = 0;
 else
   Serial.println(loopCouonter);
   loopCouonter = loopCouonter++;
```


LET'S DO SOME DEBUGGING. void la time

- Now, Search and Clone

 <u>steamClass_DebugBlinkLoop3</u>
- What Is This Code Doing?
- Now, Search and Clone

 <u>steamClass_DebugBlinkLoop4</u>

What can happen in 500 ms?

void loop() { timeStart = millis(); // gets the top of loop time if (loopCouonter == 250) // If /Then /Else Loop delay(10);timeStop = millis(); Serial.print("Loop Start: "); Serial.print("\t"); //prints time since program started Serial.print(timeStart); Serial.print("\t"); Serial.print("Loop Stop: "); Serial.print("\t"); Serial.print(timeStop); Serial.print("\t"); Serial.print("Total Loop Time = "); Serial.println(timeStop - timeStart);



LET'S DO SOME DEBUGGINGOP() { if (loopCouonter == 250)

Now, Search and Clone

 <u>steamClass_DebugBlinkLoop4</u>

```
digitalWrite(arduinoBoardLED, HIGH); // turn LED on
Serial.println(loopCouonter);
loopCouonter = loopCouonter++;
delay(300);
```

```
else if (loopCouonter == 500)
```

```
digitalWrite(arduinoBoardLED, LOW); // turn LED off
Serial.println(loopCouonter);
loopCouonter = 0;
delay(300);
```

```
else
```

```
// Serial.println(loopCouonter);
loopCouonter = loopCouonter++;
```





FOR LOOP STATEMENT

Loop "for" some time...
What does this code do?
Why would you use code like this?



• Search and Clone

o steamClass_ForLoop_STEAM_Clown

```
for (int i = 0; i < 20; i ++)
```

digitalWrite(ledPin, HIGH); delay(delayPeriod); digitalWrite(ledPin, LOW); delay(delayPeriod); for(int x = 2; x < 100; x = x * 1.5)
{
 println(x);
}</pre>



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WHILE AND DO WHILE LOOP STATEMENT

• Do Something "While" statement is "TRUE"



• What if we set var = 1;



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WHILE AND DO WHILE LOOP ter = 1; while(loopCourter)

Search and Clone

o steamClass whileLoop STEAM Clown

- What are these loops doing?
- Are they different?

// while(loopCounter != 10) while(loopCounter < 10)

delayTime = 200; digitalWrite(arduinoBoardLED, HIGH); delay(delayTime); digitalWrite(arduinoBoardLED, LOW); delay(delayTime); loopCounter++;

do

delayTime = 500; digitalWrite(arduinoBoardLED, HIGH); delay(delayTime); digitalWrite(arduinoBoardLED, LOW); delay(delayTime); loopCounter++; }while(loopCounter < 10);</pre>



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LETS DO SOME CODING - ADD FOR AND WHILE LOOP

- Review The Code In The Sketches In Your Account

 Look at Sketches in "Squeaky Hinge" or other Bender Accounts
 Look at coding examples on <u>www.arduino.cc</u>
- Create A New Sketch In Your Account
- Add a "for" Loop and "While" Loop Statements
- Make The LED Blink Differently Based on Your Program Control
- Before You Start Coding... Plan It Out In Your Lab Book



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SOME VARIABLE TYPES

- <u>char</u> text like A,B,C...
- <u>byte</u> 8-bit unsigned number, from 0 to 255
- <u>int</u> : 16-bit (2-byte) value. This yields a range of -32,768 to 32,767 (minimum value of -2^15 and a maximum value of (2^15) 1)
- <u>unsigned int</u> 2 byte value. Instead of storing negative numbers, they only store positive values, yielding a useful range of 0 to 65,535 (2^16) - 1).
- long 32 bits (4 bytes), from -2,147,483,648 to 2,147,483,647
- <u>unsigned long</u> Unsigned longs won't store negative numbers, making their range from 0 to 4,294,967,295 (2^32 - 1)
- <u>float</u> Floating-point numbers can be as large as 3.4028235E+38 and as low as -3.4028235E+38. They are stored as 32 bits (4 bytes) of information



BITS AND BYTES?

- How does a computer count?
- What is Base 2 number system?

You See the Number 3, The Computer Sees 0011

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• Bits, Bytes, Words



Decimal (Base 10)	Binary (Base 2)	Hex (Base 8)
0	0000 0000	0
1	0000 000 1	1
2	0000 00 10	2
3	0000 00 11	3
4	0000 0 100	4
5	0000 0 101	5
6	0000 0 110	6
7	0000 0 111	7
8	0000 1000	8
9	0000 1001	9
10	0000 1010	А
11	0000 1011	В
12	0000 1100	С
13	0000 1101	D
14	0000 1110	E
15	0000 1111	F
16	0001 0000	10
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ROLLOVER...

- Now, Search and Clone

 <u>steamClass_IntRollover_STEAM_Clown</u>
- What Is This Code Doing?

```
void setup()
{
    int intRollOver = 32764;
}
void loop()
{
    while(intRollOver != -32764){
        Serial.print("Intiger = "); // this prints text
        Serial.println(intRollOver); // this prints integer
        intRollOver++;
    }
```

- Now Change it to be an Unsigned Integer
 - int : 16-bit (2-byte) value. This yields a range of -32,768 to 32,767 (minimum value of -2^15 and a maximum value of (2^15) 1)
 - unsigned int 2 byte value. Instead of storing negative numbers, they only store positive values, yielding a useful range of 0 to 65,535 (2^16) - 1).



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LETS DO SOME MATH

- Open and Download Sketch "Math" o steamClass Math STEAM CLOWN
- Now do some math in the Main Loop

```
{
   Serial.begin(9600);
   int a = 1;
   int b = 2;
   int c = a + b;
   Serial.print("a + b = ");
   Serial.println(c);
}
```

c = a + b; c = a - b;

- Know that <u>integer constants</u> default to <u>int</u>, so some constant calculations may overflow (e.g. 60 * 1000 will yield a negative result)
- Know at what point your variable will "<u>roll over</u>" and also what happens when it does



LETS LOOK AT WHAT ELSE IS IN YOUR KIT

- Arduino Uno (clone)
- USB Cable
- Breadboard
- Battery Connector
- Jumper Wires
- 2 Buttons
- LEDs
- Resistors





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HOW DOES THE BREADBOARD WORK?



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ROWS & ROWS OF ELECTRICAL CONNECTIONS





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SEEING AND HEARING THE

Const int pushButton = 6; // LED on pin 13
const int pushButton = 6; // input pin for Push Button sensor
int buttonVal = 0; // variable to store the read value

void setup()

```
pinMode(arduinoBoardLED, OUTPUT); // set pin 13 as output
pinMode(pushButton, INPUT); // set pin 6 as input
```

void loop()

buttonVal = digitalRead(pushButton); // read the input pin digitalWrite(arduinoBoardLED, buttonVal); // sets the LED to button's value

- PullDown?
 - When the button is "open" the Yellow wire is "pulled" to a "LOW" potential
 - Imagine the button is a valve, and the wire is a water hoses



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PULLUP

pinMode(buttonPin, INPUT);

digitalWrite(buttonPin, HIGH); // set pullup on analog pin 0





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CONNECTING THE PUSH BUTTON

- Connect the Red wire to the 5V pin on the Arduino
- Connect the Black wire to the GND pin on the Arduino
- Connect the Yellow wire to the Digital pin 6 on the Arduino



WHAT IS AN LED?

- Light-emitting diodes (LED) are semiconductors. As electrons pass through this type of semiconductor, it turns into light.
 - $\odot\,\text{LEDs}$ are efficient in turning energy into light.
 - \odot Don't have a filament that will burn out, and they don't get especially hot
 - \odot They are illuminated solely by the movement of electrons in a semiconductor material





BREAD BOARDING AN LED CIRCUIT





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OUTPUT HOW?

• We already see how to connect to the Arduino Board LED

const int brdLED = 13; // LED on pin 13

Setup()

pinMode(brdLED, OUTPUT); // LED output

• Edit the Sketch blink to have an output on pin 2



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OK, YOU HAVE A BUNCH OF LEDS AND BUTTONS...

- Connect a few more buttons
- Connect a few more LEDs
- Make the LEDs Blink at different rates
- Make the LEDs Blink one after the other
- Make them Blink at the same time, but different rates...
- Come up with something different...



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REFERENCE SLIDES

Reference



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LCD

Reference



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LCD SHIELD



- Now, Search and Clone
 <u>steamClass_LCD_STEAM_Clown</u>
- What Is This Code Doing?



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PS2 KEYBOARD

Reference



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PS2 KEYBOARD



- Now, Search and Clone

 <u>steamClass_PS2Keyboard_STEAM_Clown</u>
- What Is This Code Doing?



#include <PS2Keyboard.h>
const int DataPin = 11;
const int IRQpin = 2;
PS2Keyboard keyboard;



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SERVO MOTORS

Reference



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MOVE A SERVO MOTOR

• PWM?

 \circ Pulse Width Modulation

• Lets Watch a Servo Motor Video







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WRITING TO A SERVO MOTOR



#include <Servo.h> Servo myservo; // create servo object to control a servo // twelve servo objects can be created on most boards int pos = 0; // variable to store the servo position void setup() myservo.attach(9); // attaches the servo on pin 9 to the servo object // myservo.write(pos); void loop() for(pos = 0; pos <= 92; pos += 1) // can goes from 0 degrees to 180 degrees // in steps of 1 degree myservo.write(pos); // tell servo to go to position in variable 'pos' delay(5); // waits 15ms for the servo to reach the position for(pos = 92; pos>=0; pos-=1) // can goes from 180 degrees to 0 degrees myservo.write(pos); // tell servo to go to position in variable 'pos' delay(5); // waits 15ms for the servo to reach the position STEAM CLOWN™



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CODE PROJECTS

- Servo Control • Haunted Box
 - Read a Switch
 - Write to I servo
 - 2 LEDs
 - \circ Wave Hello
 - Read a Switch
 - Write to 2 Servo
- Think about how
 - O What to do when a switch is pushed. Delay?
 - \odot What is the pattern you want?
 - What to do after the "Event" has happened? Reset?

Triggering a Pneumatic

 Read Switch
 Write to LED
 Write to Sound board
 Write to Pneumatic



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INSTALLING CODEBENDER



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COVER ISSUES INSTALLING



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INSTALLING THE ARDUINO TOOL

- Step-by-step directions and the soft-ware available at: <u>http://arduino.cc/en/Main/Software</u>
- If you have Questions
 - o arduino@squeakyhinge.com
 - o Jim.burnham@gmail.com





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INSTALLING DRIVER

- Unzip the <u>CH341SER.ZIP</u>
- Plug in the Arduino
- In your start menu, right mouse click on Computer and open the properties
- Then open the Device manager
- See USB 2.0 Serial as "Other Device)
- Select Update Driver Software
- Browse my computer for driver software and go to the directory "CH341SER\CH341SER\



Panel

System and Security

System

Windows edition

Service Pack 1

Processor

System type

Pen and Touc

💇 Intel(R) 82579LM Gigabit Network Connection

Update Driver Software...

💇 Intel(R) Centrino(R) Ultimate-N 6300 AGN

Disable

Uninstall

Installed memory (RAM): 16.0 GB

Windows 7 Enterpris

Copyright © 2009 Mid

View basic information about your comput

6,6 Windows Experience Inde

64-hit Onerating System

VSUIMRO31

CSJJIMBO31.xin

Dept 2030 Dell E6530

Intel(R) Core(TM) i7-3740QM CPU @ 2.70GHz 2.70 GHz

SChange setting

No Pen or Touch Input is available for this Displa

le Edit View Tools Hel

Device Manana

🚔 Device Manager

Eile Action ⊻iew Help ← → | 〒 | ☑ 〒 | № → ■ Monitors

🔺 🔮 Network adapters

Other devices
 Other devices
 Other Joint Commentation
 Other devices
 Other devices

🔲 Pro

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Sour
 Stor

🕞 - 🔍 Syste

🖒 - 🕛 Uni

🔮 Bluetooth Device (Personal

🔮 Bluetooth Device (RFCOMM

🚉 Cisco AnyConnect Secure M

👰 Intel(R) 82579LM Gigabit N

🔮 Intel(R) Centrino(R) Ultimati

Intel(R) Active Management Technologies - SOL (COM3)
Standard Serial over Bluetooth link (COM4)

A - Ib Other devices

T ECP Pr

💯 Intel/B

🔺 🖤 Ports (COI

USB2.0 Comine

Remote settings

System protection



- Run downloader
- \circ Run debugger



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APPENDIX

Extra Credit



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HOW LONG DOES YOUR LOOP TAKE

- Investigate where you are spending your "loop" time
- Why is this important?

Dago 77

- What can you do about it
- Loop at blinkLoop1, blinkLoop2 & blinkLoop3


RESOURCES

Dago 72

http://arduino.cc/

 \odot Has Software to download \odot Video, tutorials, labs, etc



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VIDEOS & RESOURCES

 $D_{2}\sigma_{0}$ 7/

• <u>https://www.youtube.com/watch?v=5F054MNB1QI</u>



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CLASS LOGISTICS AND SETUP



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STUFF WE STILL NEED FOR PRESENTATION

Dago 76

- Do we have a Slide Template?
- We should have 2 projectors, 1 to project the slides, and 1 to project the code. 2 laptops too.





WHAT WOULD A "CLASS" LOOK LIKE

- Intro to the Arduino
 - Play a few YouTube videos
 - o Intro to what a Microprocessor is, and stuff it in.. Like every thing...
- Get kits out to students
 - Depending on what it will take, we could have all the tools installed or have the student do it (my vote is to not have them do it in class, but give them instructions on how, so they can do it at home)
- Intro to Coding
 - o Load "blink" (arduino's version of HelloWorld)
 - o Edit Blink
 - Talk about the code in Blink
 - o Intro to Variables
 - Intro to math functions
 - o Intro to conditional commands
 - if, then else, for looks, while loops,
 - o Edit Blink to include conditional commands
 - Give Students a problem... can do it many different ways
 - Debug in print & println
 - Strings, Char, Boolean
 - o Debug a real problem... I have a good example that pulls stuff together
- Project to control something

Dago 77

• This would be a project where the student needs to write a program to control our "cheese sorter" (or what ever we here as Xilinx build for them to control with their arduinos



SOURCE FOR CODING CURRICULUM

- There are lots of on-line sources for Coding
- Lots of Videos, Tutorials, examples etc...

Dago 70

• We can mix class lecture with Slides, with Video breaks, etc.



HOW MUCH TIME DO YOU WANT TO FILL?

Dago 70

- Between Xilinx and the Teachers, we could fill the whole 12 hours... but the Arduino is easy enough to do stuff on that in a few hours the first day and a few hours the second day, we could lay down strong fundamentals with hand outs they can study later.
- If we let the students take their Arduino home after the class, even better.





MONSTER IN A BOX SLIDES 2 ND DAY...

- Setup problem \leftarrow describe what we want to do
- Discuss options \leftarrow when motion is detected:

 trigger immediately? Delay? What to do first? Sound? Lights? What motion pattern? Fixed? Random? When we reset, how long to delay next trigger?

 Break up the problem (different teams to build parts (read input, trigger lights, trigger motion, trigger sound)

 \odot Plan how to put it together.

- How to hand off / provide inputs and output for each part of the code
- I'll have hardware so each team can test their paris and verify that they are communicating with the next part
- Putting it all together

Dana QA

CLASS TOPICS

• Safety First



Xilinx Confidential

Sailing 81

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WORKING REFERENCE SLIDES



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HOW AN LED WORKS



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• Show and Describe the theory of an LED



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WHAT IS AN LED?

• Light-emitting diodes (LED) are semiconductors. As electrons pass through this type of semiconductor, it turns into light.

Epoxy lens/case

- \odot LEDs are efficient in turning energy into light.
- \odot Don't have a filament that will burn out, and they don't get especially hot
- They are illuminated solely by the movement of electrons in a smaterial



BREAD BOARDING AN LED CIRCUIT





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ADAFRUIT RGB LCD



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ADAFRUIT RGB LCD



https://www.adafruit.com/products/398





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IR SENSOR (TSOP38238)

https://learn.adafruit.com/ir-sensor

IR detectors are little microchips with a photocell that are tuned to listen to infrared light. They are almost always used for remote control detection - every TV and DVD player has one of these in the front to listen for the IR signal from the clicker. Inside the remote control is a matching IR LED, which emits IR pulses to tell the TV to turn on, off or change channels. IR light is not visible to the human eye, which means it takes a little more work to test a setup.

When the detector sees IR signal, it will pull the output low, turning on the LED since the LED is red its much easier for us to see than IR!

Now grab any remote control like for a TV, DVD, computer, etc. and point it at the detector while pressing some buttons, you should see the LED blink a couple times whenever the remote is pressed







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TYPICAL SENSOR SIGNAL / DEVICE CONTROL





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SERVO WIRING DIAGRAMS



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STEPPER MOTOR PATTERNS





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ARDUINO RUBE GOLDBERG



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YOU TUBE LINKS

- Arduino Reuben Goldberg (2:34)
- <u>Rube GoldBerg Project</u> (3:02)
- Bill Nye The Science Guy & Simple Machines & Full Episode (22:32)



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