Beyond the Slab

(or, a beginner shares a little of what he knows regarding hardware hacking)

who am i?

last update: Sunday, 05-Jan-97 12:53:51

i am jm, owner & maintainer of beats.com, & webmaster of Golden Dome Productions (which is going under a re-reconstruction!)

my man flynn's got his new EP out, and i'm diggin' it so far. (disclaimer: i don't have much to do with eartube 'cept the fact i get advanced copies 'cos i'm friends with this cat...oh, & the website's here. make sure you contact eartube, and not me, for info!)

bio go

```
pager: 1-888-653-0480 (toll free)
(note that i'll only answer ld calls if i recognize the phone #)
e-page me (up to 120 chars)
email: jm@goldendome.com
          (jm@beats.com for personal stuff)
PGP Public Key Block
Geek Code
my domain, ill.beats.com.
```

Here's some unschooling info (note: the Jon is not me in those pages).

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Member,

THE HTML WRITERS GUILD

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1997 😂

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Member,

jon

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Member,

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I've been writing software professionally for over 15 years.

I was introduced to embedded computing working for a Major Appliance Manufacturer in their research lab.

I've been in the Nordstrom Innovation Lab for about 3 years.

We focus on testing things that the business may find too risky to spend a lot on up front, and often try to do it fast.

This means we ~~get to play with~~ test ~~cool~~ nascent technologies and processes every now and then in order to get there.

I picked up an Arduino for my kid at Christmas a few years back, thinking, "we'll learn it together", and that i could also try some things out at work.

We started!

Actually, we blinked an LED or two, then stopped. I was done.

Then, at work, someone asked me to dim some lights.

Why hack hardware?

Because, it's not that hard anymore, and actually fun

Why is this space blowing up?

1. *Arduino and friends. These platforms have made it so easy to write software to our electronics. Hardware's more malleable than ever*
2. *Support for higher level languages. We're no longer speaking the language of the "Metal", but in languages in which we're already productive*
3. *It's less expensive to prototype electronics than in the past*

The Landscape

What's available?

Here's a short list

Arduino: Uno,Nano,LillyPad,Duemilanove,..., Beaglebone, Beaglebone Black, ChipKit, Edison, LightBlue Bean, LPCXpresso, Netduino (.Net Micro Framework!), Parallax Propeller Activity Board, Raspberry Pi, Raspberry Pi B, Seeed Linkit (GPRS even!), Spark Core (OTA programming), Tessel, Teensy, TI LaunchPad, Trinket, Twine, Beacons (Bluetooth)

Kinds of devices

- *Microcontrollers (Arduino & variants)*
- *"Tiny computers" (BeagleBone, Raspberry Pi series)*
- *Wireless microcontrollers (Spark Core, Lightblue Bean)*
- *Language-specific boards (Tessel,Netduino)*
- *Specialty Boards (LillyPad Arduino)*

Necessary Skill Sets

- *Computer hacking skills*
- *Desire skills*
- *Google skills*
- *Asking for help skills*

So, wanna see something IRL?

https://github.com/jonmadison/arduino-servo-control

```
var five = require("johnny-five"),
    board = new five.Board();
var program = require('commander');
var keypress = require('keypress');

program
  .version('1.0.0')

board.on("ready", function() {
  console.log("board ready. left right arrow keys, 'q' to quit.");
  var servo = new five.Servo({
    "pin": 9,
    "startAt":program.startAt
    });
  process.stdin.on('keypress', function (ch, key) {
    // console.log('got "keypress"', key);
    if (key && key.name == 'right') {
      servo.to(0);
    }
    if (key && key.name == 'left') {
      servo.to(180);
    }
    if(key && key.name == 'q') {
      process.exit(0);
    }
  });

  process.stdin.setRawMode(true);
  process.stdin.resume();
});
```

Other ways I could have done it

- *Work directly with AC to dim the light switch*
- *Used LED Lighting, MOSFET or somesuch to boost electricity needed*

Door Unlock Mechanism--from legit schematic to project

- *12VDC Solenoid*
- *12V Power supply*
- *Relay to condition our power from the Arduino's 3.3V to 12V*

```javascript
var router = require('tiny-router'),
    tessel = require('tessel'),
    relaylib = require('relay-mono');

var relayOpenDefault = 3000;

var relay = relaylib.use(tessel.port['A']);

[...]

relay.turnOn(1,function turnOnResult(err){
  [...]
}

[...]

relay.on('ready', function relayReady () {
    router
        .get('/unlock',function(req,res) {
                unlock(req,res,relay);
        });

    router.use('static', {path: __dirname + '/public'});

    setTimeout(function(){
        router.listen(80);
    },5000)
});
```

```html
<html>
  <head>
  <meta name="viewport" content="width=device-width, initial-scale=1.0, maximum-scale=1.0, user-scalable=no" />
  <meta name="apple-mobile-web-app-capable" content="yes">
  <link rel="stylesheet" href="/css/main.css">
  <link rel="stylesheet" href="/css/rad.css">

  <title>Unlock this door</title>
  </head>
  <body>
    <div class="container">
      <div id='radial-progress' class="progress-radial progress-step-0">
        <div class="overlay" id="radial-progress-overlay" onclick='runProgress()'>locked</div>
      </div>
    </div>
  </body>
</html>
<script type='text/javascript'>
  var relayOpenDefault = 4000;
  var setProgress = function(element,i) {
    // console.log("set progress: " + i);
    var progress = document.getElementById('radial-progress');
    var progressMessage = progress.children[0];
    if(!(i%5)) {
      progress.className = 'progress-radial progress-step-' + i;
      // progressMessage.innerHTML = i + '%';
    }
    if(i>=100) progressMessage.classList.add('complete');
  }

  var runProgress = function() {
    resetProgress();
    var i = 0;
    var progress = setInterval(function(){
      setProgress('progressbar',i++);
      if(i == 101) {
        clearInterval(progress);
      }
    },1);
  }

  var resetProgress = function() {
    var progress = document.getElementById('radial-progress');
    progress.className = 'progress-radial progress-step-0';
    var progressMessage = progress.children[0];
    progressMessage.classList.remove('complete');
    progressMessage.innerHTML='locked';
  }

  xmlhttp=new XMLHttpRequest();
  xmlhttp.onreadystatechange=function()
  {
  if (xmlhttp.readyState==4 && xmlhttp.status==200)
    {
      var progressMessage = document.getElementById('radial-progress').children[0];
      progressMessage.classList.add('complete');
      progressMessage.innerHTML=xmlhttp.responseText;
      setTimeout(function(){
        resetProgress();
      },relayOpenDefault)
    }
  }
  var unlockDoor = function() {
    runProgress();

    document.getElementById("radial-progress-overlay").innerHTML='...';
    xmlhttp.open("GET","/unlock",true);
    xmlhttp.send();
  }

  var el = document.getElementById('radial-progress-overlay');
  el.addEventListener('click', unlockDoor, false);
  el.addEventListener('touchstart', unlockDoor, false);
</script>
```

Other ways I could have done it

- *Use Raspberry Pi or BeagleBone, add a DB to store/sync unlock codes with a central service*

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- *Use Bluetooth module instead of Built-in WiFi*

Other ways I could have done it

- *Use Raspberry Pi or BeagleBone, add a DB to store/sync unlock codes with a central service*
- *Use Bluetooth module instead of Built-in WiFi* (but i was cheap, and in learning mode)
- *These other ways depend on what i was trying to accomplish...*

Refining your Prototype

- *Who is your audience?*
- *Where will it live?*
- *How much more time do you have?*
- *Is Duck tape GEFN?*
- *Often, you'll want to move to PCB while you're still prototyping*

Things that will learn along the way, and will become more important

- *How to draw and read schematics*
- *Shields, Capes, Plates, oh my (also, Modules)*
- *Component foo*

  capacitors, diodes, resistors, MOSFETs, all that jazz, and why they're important. You'll run into some earlier than others.
- *How to make your creation self-contained*
  - *Look into ATTiny*
  - *External Power Supplies*

My recommendations 👍

- Grab an Arduino (Uno or Mini) *Kit* to start
- Grab a Raspberry Pi or a Tessel -- you'll start to take your creations "off the screen"
- Find a local group!
- Ask for help

Resources

- *Learning Stuff: www.allaboutcircuits.com, Youtube, duh*
- *Buying stuff: _Adafruit, SparkFun, Seeed Studio*
- *Metrix Create Space*
- *Ada Technical Books*
- *http://iot.ieee.org/*

Libraries/Toolkits

- *Johnny-Five* (Javascript)
- *CylonJS*
- *RPi.GPIO* (Python)
- *Netduino speaks .Net micro framework*
- *Fritzing for creating and sharing sketches and schematics*

Questions?

figgi

Thanks!

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jonmadison on most social networks

Shouts to my nord folk

Marius Grigoriu, Paul Payne, Mark Selander, Erin Shellman, Cheri Thompson, Brett Wagner, Nbitu Yilma

(The Lab's hiring, like everyone else ;-)