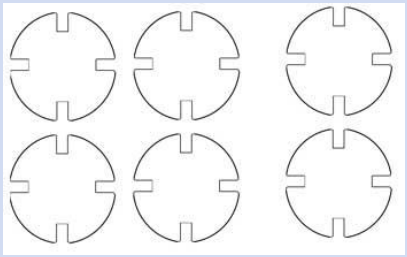
Kathy's Adventures in

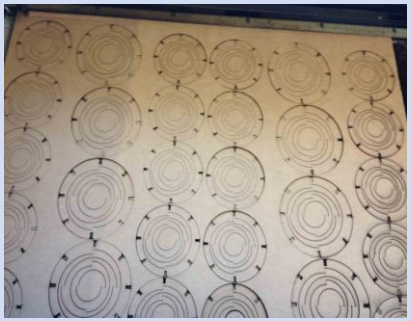
Week 1: Computer Controlled Cutting

2D design



- Parametric design
- Press fit construction
- Chamfer joints

Laser cut parts



- Machine settings
- Kerf of laser

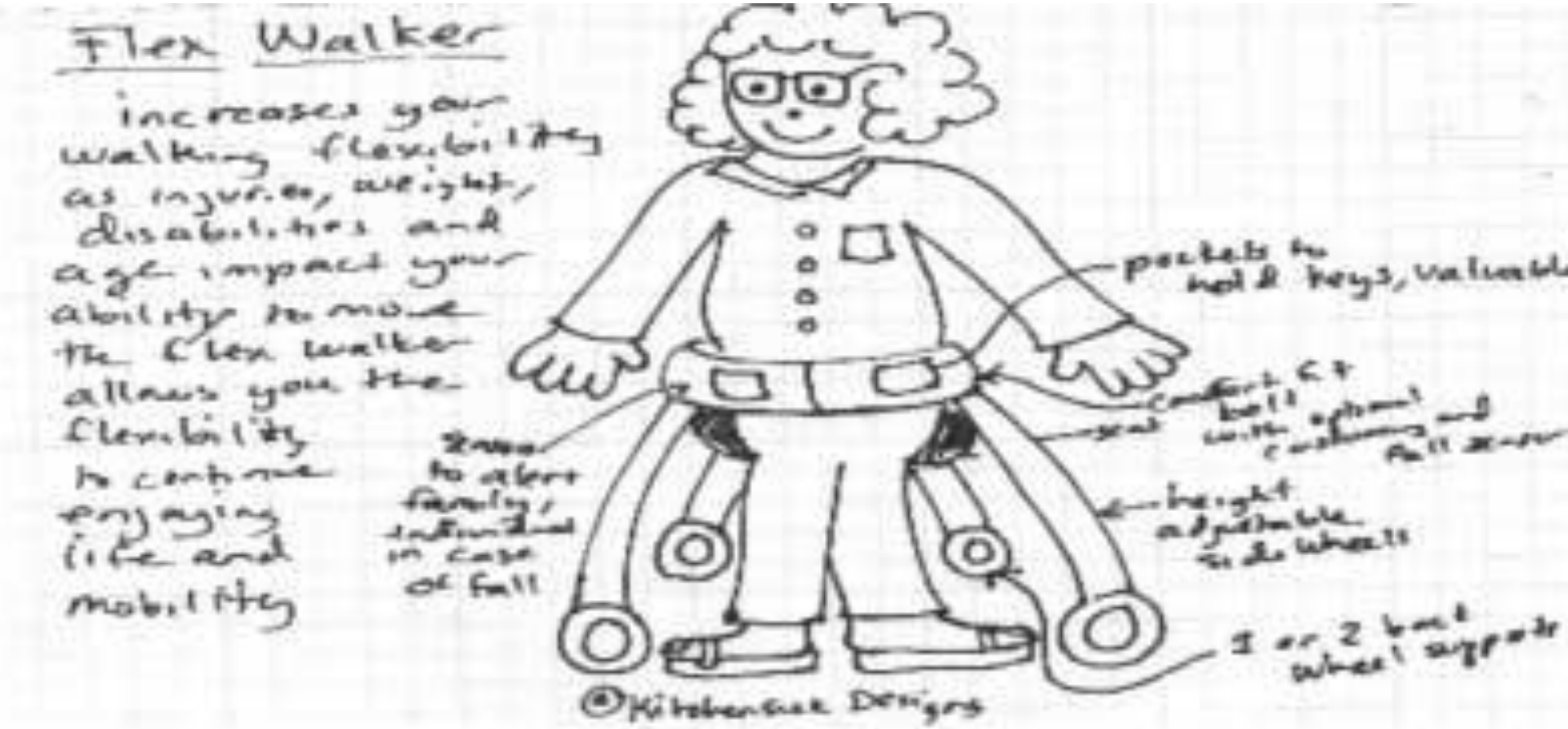
3D Design

- **Successes:**
  - Designed part in 2D software to create 3D press fit construction
  - USED awesome lasers to cut things!!!
- **Failures:**
  - cloning a part to make it parametrically can fail if you're not careful

Lessons Learned:

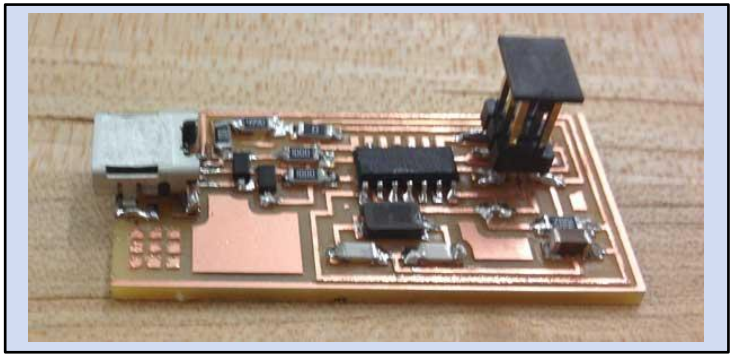
- Resizing a grouped shape will also resize your slot sizes slightly- even if they are cloned and parametric.
- Red trace lines in the fab modules are not a bad thing- they just indicate the path the laser is traversing
- The slot size is perfect for the small circles. But a bit too large for the larger circles. Tolerances are important in press fit construction
- I would indent the interior folds with the laser in a future version so the structure stays folded out more reliably
- I would add more connector pieces to my construction kit to increase versatility
- I also want to add a piece to make a chandelier.
- I would offset my slots so they do not align with the circular cuts.
- Parametric design is important

Week 0: Final Project Proposal



- I got into the class---- amazed. I have no experience with ANY of these processes and am really looking forward to the class

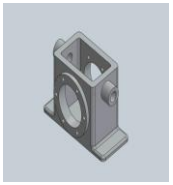
Week 2: Electronics Production

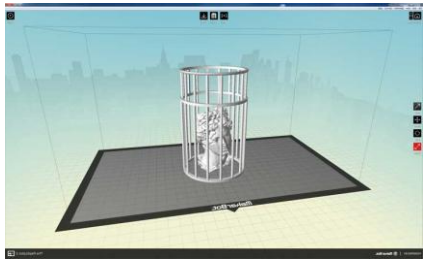


- **Successes:**
  - fabricated, stuffed, soldered a board that works used it to program other classmate's boards
- **Failures:**
  - took a LONG time to learn the modela, stuff and solder the board
- **Lessons Learned:**
  - Check to make sure your end mill is not broken before using it
  - Check to make sure your surface is clean and level
  - Check to make sure you have the correct number of offsets when cutting out your board
  - Check your job part way through to see if it is removing the copper properly. If not something is wrong. Start over.
  - Check to make sure you change your bit as well as your settings in the fab module when cut out your board
  - Check to make sure you are using the correct schematic when stuffing your board with components.
  - Kill the processes for the modela on the computer before restarting your job
  - Give yourself more time than you think you need
  - If solder is not flowing readily make sure your temperature on your soldering iron is high enough
  - People are incredibly helpful and a wealth of information
  - The soldering tweezers are essential to hold components.
  - du -k tells you the size of your directory
  - To reduce picture sizes: open photos in photoshop, save them for web, reduce the pixel size of the image. This reduces your file sizes dramatically so you can get more pictures on your page!

Week 3: 3D Printing and Scanning



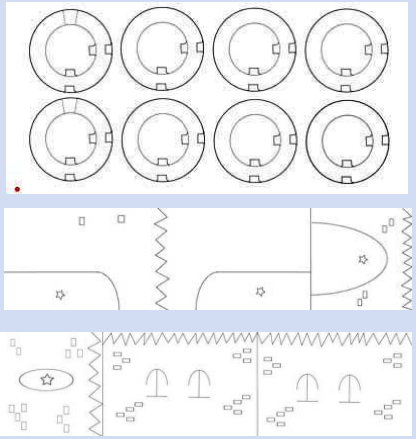





- **Successes:**
  - scanned and printed part, designed parts in 3d software
- **Failures:**
  - Milk scanner mechanical design, parts to small and did not stick (machine quality)
- **Lessons Learned:**
  - 3D scanning is wonderful when it works, and requires a LOT of post processing clean up when it does not work
  - Give yourself more time than you think you need
  - 'Everything is difficult before it is easy' my Chinese fortune for the week:
  - I think we will be eating a lot of takeout this semester
  - Patience is a virtue 3D printing is slow.... I am still a fan of 3D printing!! Assemble the parts you need for a project before starting the project it will save a lot of time and frustration
  - There's a huge variation in quality among 3D printers
  - Learning SolidWorks takes a lot of time!

Week 4: Computer Controlled Machining

2D design



•Parametric design
• Press fit construction
• Chamfer joints

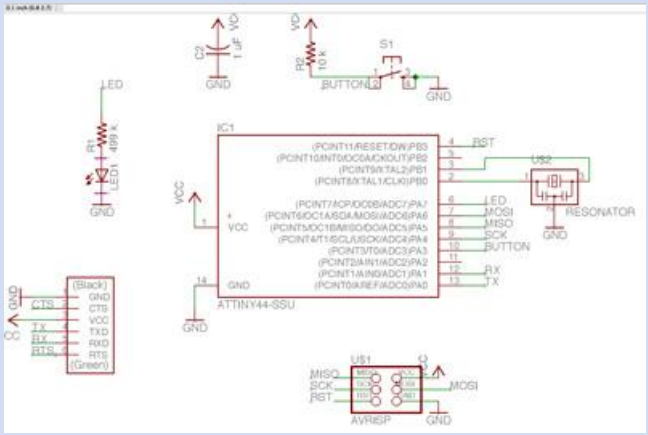
Machine cut parts

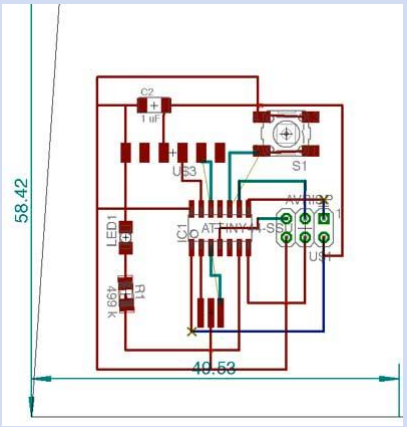
• Machine settings
• Kerf of cutting tool

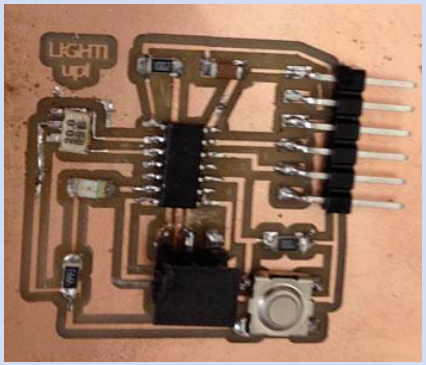
3D Design

- **Successes:**
  - **Designed part in 2D software to create 3D press fit construction castle**
- **Failures:**
  - **cut many pieces by hand because the machine was booked**
- **Lessons Learned:**
  - **document earlier.. documentation takes way longer than you think it will**
  - **start earlier**
  - **Measure twice, cut once**
  - **Hand cutting pieces takes Forever.**
  - **Even if you're in a rush go slowly. Rushing is how you get hurt**
  - **be prepared to wait. If your big thing involves cutting more than one piece start even earlier**
  - **Making something big requires patience, waiting and being open to alternate ways of doing things**
  - **If you put a link to a vimeo video on your webpage the night before it will not convert in time for the next day, See lesson 1.**

Week 5: Electronics Design

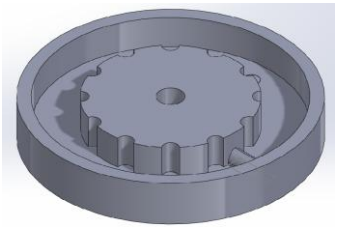


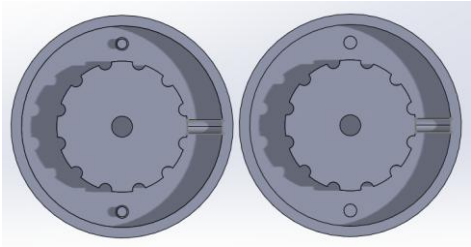


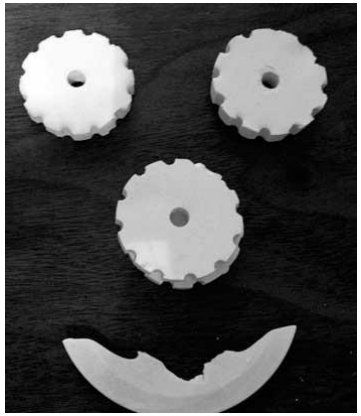


- **Successes:**
  - **Designed board in eagle, fabricated, stuffed and soldered board**
- **Failures:**
  - **did not yet program board, had to redesign board twice**
- **Lessons Learned:**
  - **Make sure your traces are large enough before exporting your image**
  - **The 6 pin header is 1 long header and you break off 6 pins you need**
  - **Check to make sure your end mill is not broken before using it.**
  - **Check to make sure your surface is clean and level.**
  - **Check to make sure you have the correct number of offsets when cutting out your board.**
  - **Check your job part way through to see if it is removing the copper properly. If not something is wrong. Start over.**
  - **Check to make sure you change your bit as well as your settings in the fab module when cutting out your board.**
  - **Check to make sure you are using the correct schematic when stuffing your board with components.**
  - **Kill the processes for the modela on the computer before restarting your job.**
  - **Give yourself more time than you think you need.**
  - **If solder is not flowing readily make sure your temperature on your soldering iron is high enough.**
  - **Designing and rerouting traces takes a really long time. Check your board and design before milling**

Week 6: Molding and Casting







- **Successes:**
  - **Designed 2 pat mold and cast parts from it**
- **Failures:**
  - **design with machine in mind first, take care when mating and registering parts**
- **Lessons Learned:**
  - **air bubbles are no good -- try to reduce them as much as possible**
  - **design with your machine in mind.**
  - **If you have a drill bit of a certain precision and depth think about that before designing deep features.**
  - **Think about the machine and it's capabilities and limitations before designing your parts**
  - **parametric design is a good thing**
  - **Each step requires care and attention.**
  - **I first designed the wheel piece by piece non parametrically and it took Forever!!!**
  - **2 part mold making is not as easy at it seems, learned to use a cnc machine and drill press**

Molding and Casting

Introduction

This is what you will be doing:

CASTING AND MOLDING
FROM PART DESIGN TO FINISHED PART
10.10.2012

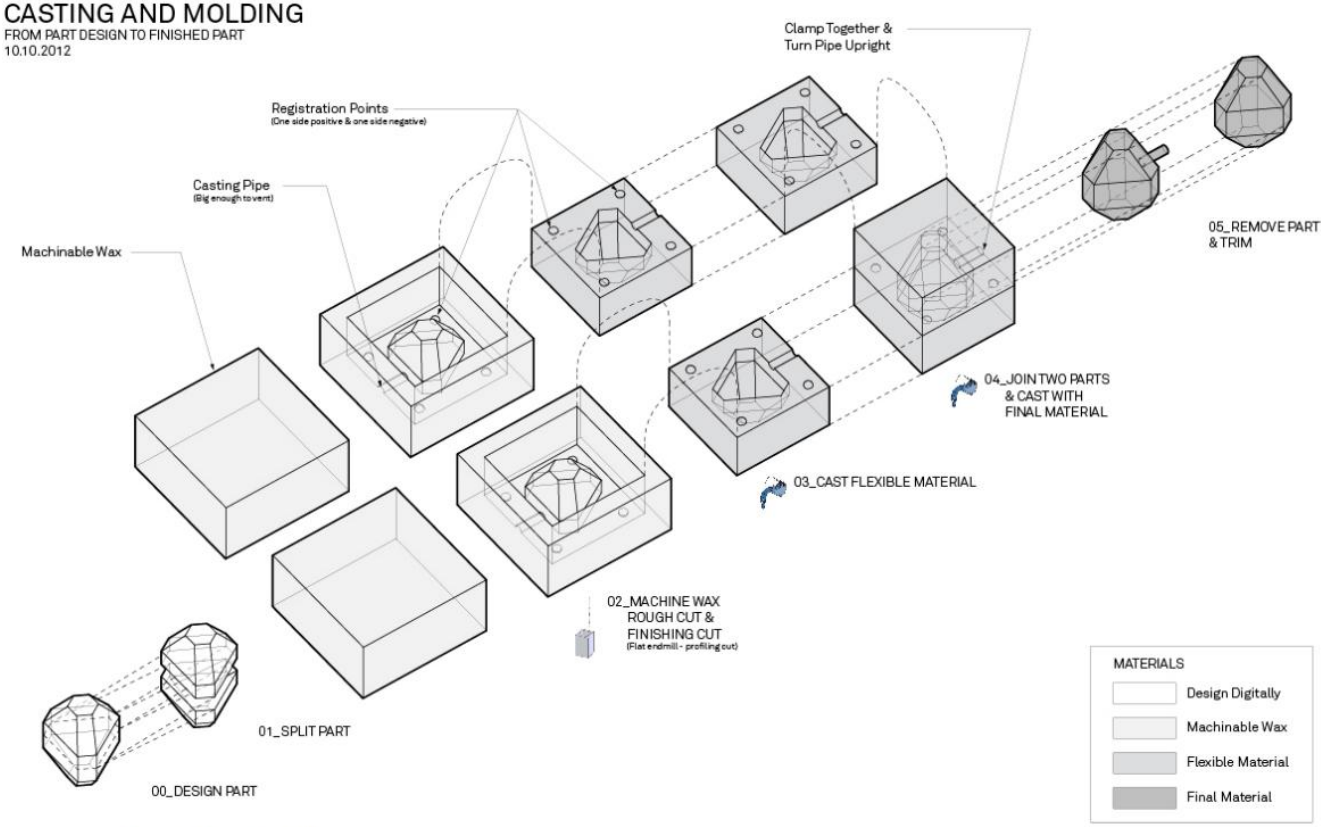
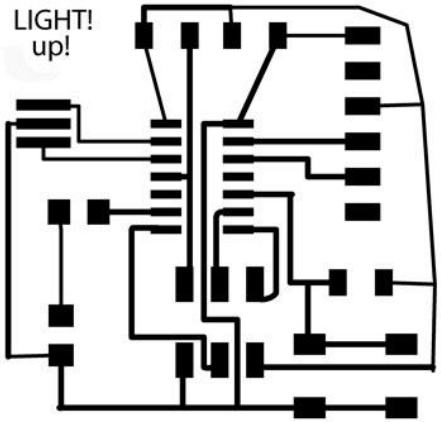
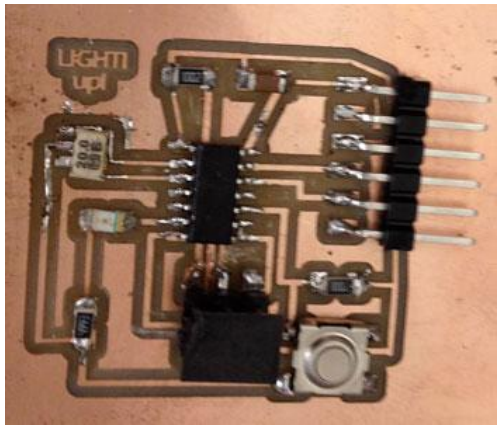


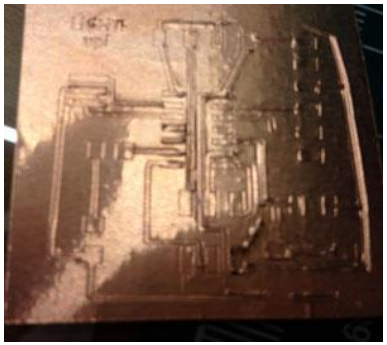
Image created by Karina Lia Penedo Silvester

- **Molding and casting can provide greater versatility than 3-D printing for rapidly and reliably reproducing large quantities of highly detailed parts**

Week 7: Embedded Programming

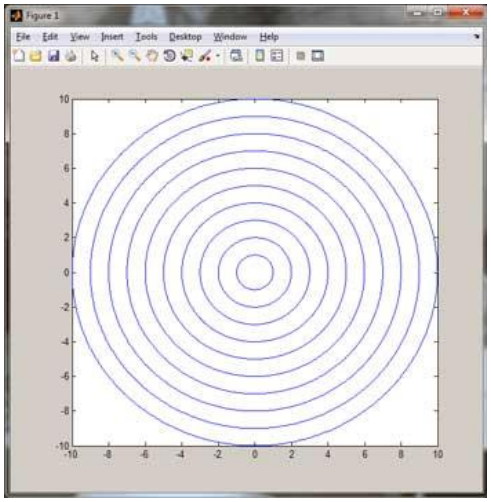


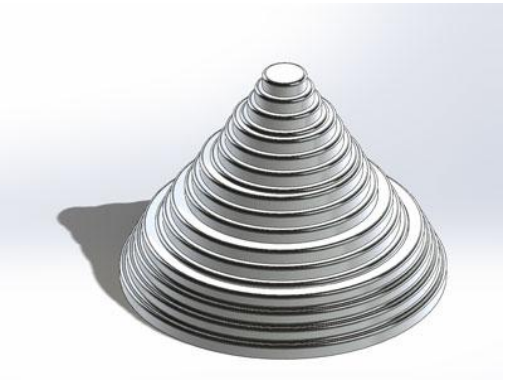


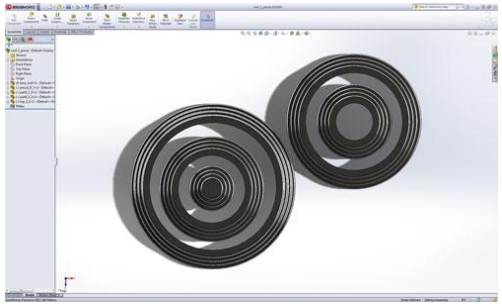


- **Successes:**
  - **Redesigned, soldered and stuffed board**
- **Failures:**
  - **failed to vinyl cut board**
  - **first designed board failed**
  - **failed to connect with or program board at all, failed to actually program the board. Failure in every way!**
- **Lessons Learned:**
  - **no new machine is as simple as you think – vinyl cutting takes awhile to master**
  - **soldering and milling does get easier with practice**
  - **start waaaaaaaaaayyyy earlier. In utero is preferable.**
  - **still need to do the actual assignment!!**
  - **everything is harder when your kid is sick**
  - **kids always get sick**

Week 8: Composites

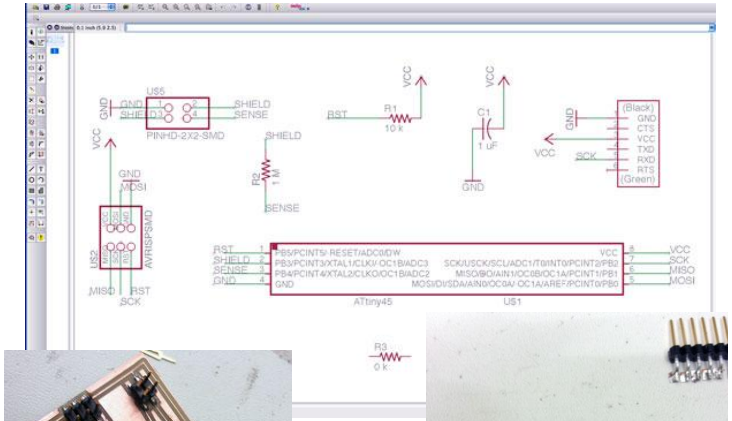


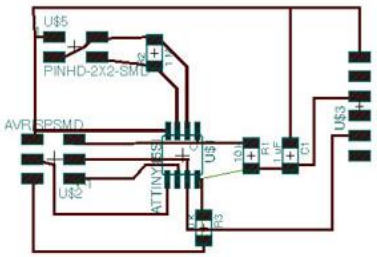


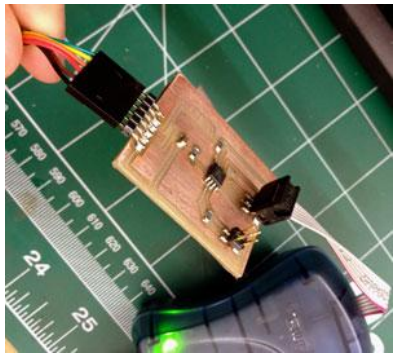


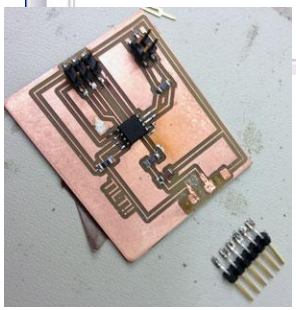
- **Successes: Designed part in 2D software, created mockup prototype,**
- **Failures: leaf composite, actually milling and creating composite part- made hydrostone burlap composites later in class**
- **Lessons Learned:**
  - **I am pretty useless when I am sick and also taking care of a sick baby**
  - **leaf composites with banana leaves don't work- fibers too close together?**
  - **leaf composites with chopped fiber leaves may not work either- fibers not long enough? or too far apart??**
  - **Preplanning your design with foam and burlap helps inform later design decisions**

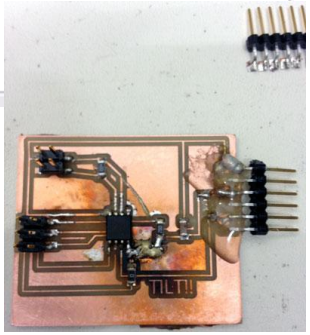
Week 9: Input Devices

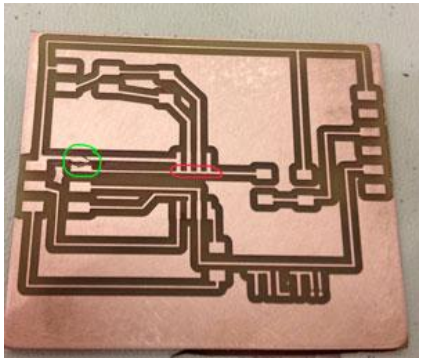


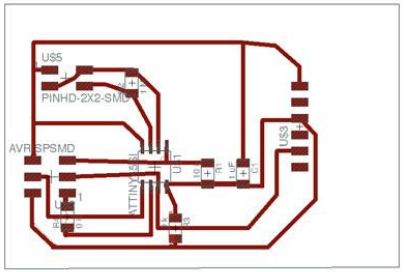






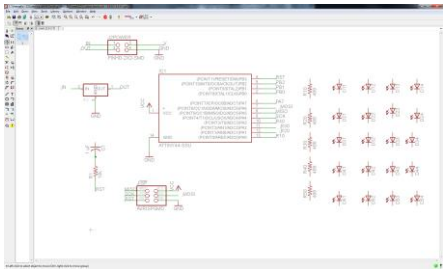


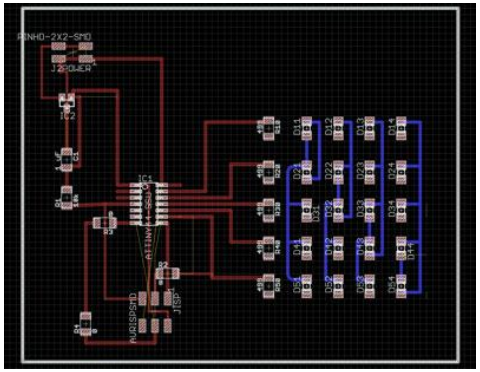


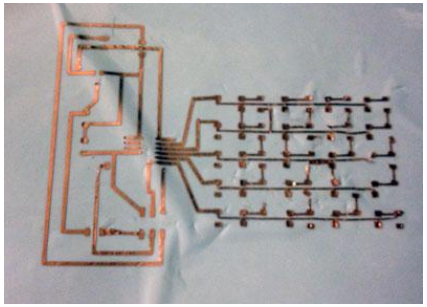


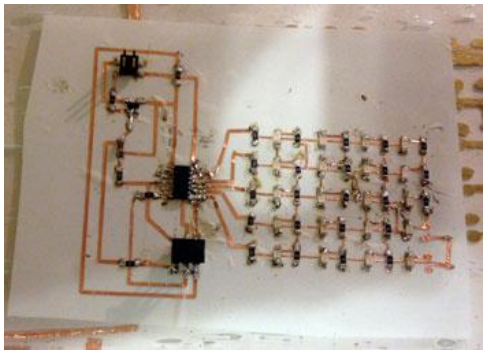
- **Successes: Designed input device board in eagle and milled, stuffed and soldered board, broke board trying to program, redesigned board for future use**
- **Failures: failed to actually program board to do anything- board shorted connections bad, put microcontroller in wrong place, broke header, cut connections**
- **Lessons Learned:**
  - **Read the datasheet**
  - **It is hard to work on software if your hardware is failing**
  - **Be meticulous about your design. Ensure all connections are properly made.**
  - **The voltmeter is an excellent tool to trace paths and connections**
  - **Things are easier to figure out when you're with someone experienced.**
  - **Hot glue can fix a lot of things but sometimes you're better just starting over.**
  - **keep enough space on your circuit to support the ftdi header. This is a precarious piece and can break easily.**
  - **Documentation is good. It can help you figure out what went wrong earlier and correct it for the future..**

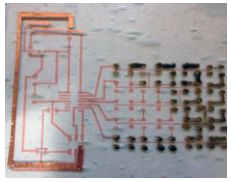
Week 10: Output Devices





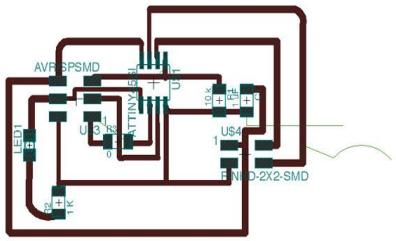


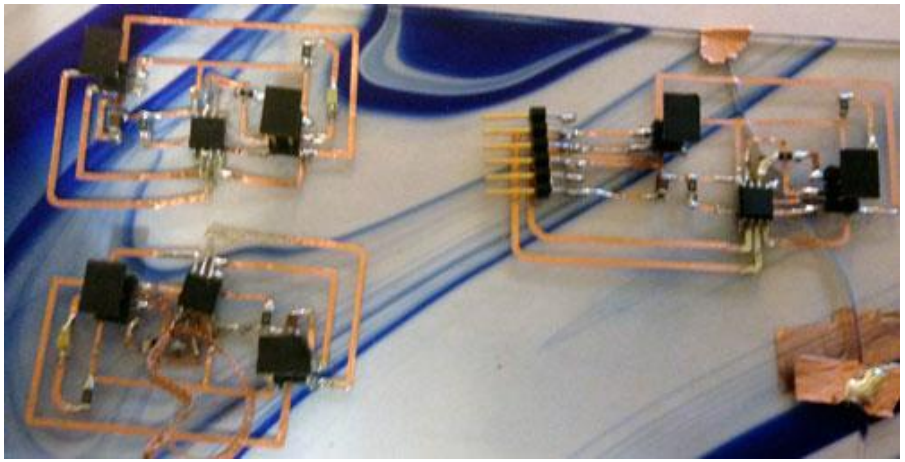


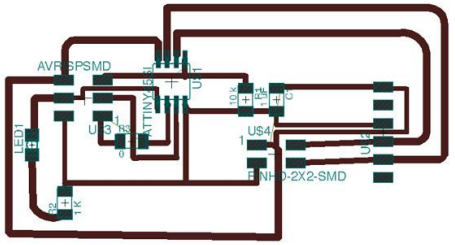


- **Successes: Designed output device in eagle and vinyl cut, stuffed and soldered board, my success on the vinyl cutter is questionable**
- **Failures: I failed to actually program this board to do anything, traces moved around, I burned the vinyl, installed on the wrong substrate, messy soldering**
- **Lessons Learned:**
- **Designing a board twice takes a lot of time**
  - **Make sure your vinyl cutter cut all of the way through your component before weeding**
  - **Be meticulous about your design. Ensure all connections are properly made.**
  - **If you want to vinyl cut keep your traces large... keep a printout of your intended design so you know which components you need to repair**
  - **Flooding a component with solder does not work when soldering a vinyl cut circuit**
  - **Solder faster**
  - **Spend extra time pressing down your traces- the adhesion will matter later**
  - **The sticker substrate doesn't work well. Use something else**
  - **Your traces may move around a bit when you solder- if you can design your circuit with a bit of wiggle room so you don't inadvertently create a short**
  - **I make things harder than they have to be**
  - **The voltmeter is an excellent tool to trace paths and connections**
  - **Things are easier to figure out when you're with someone experienced.**
  - **Hot glue can fix a lot of things but sometimes you're better just starting over.**

Week 11:
Networking and Communications

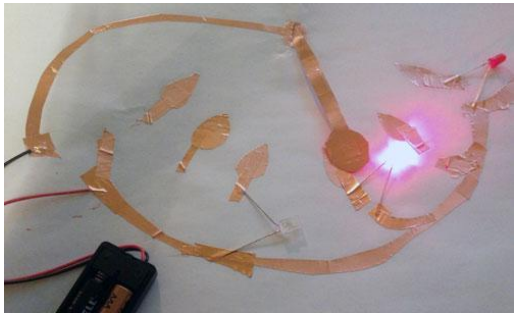


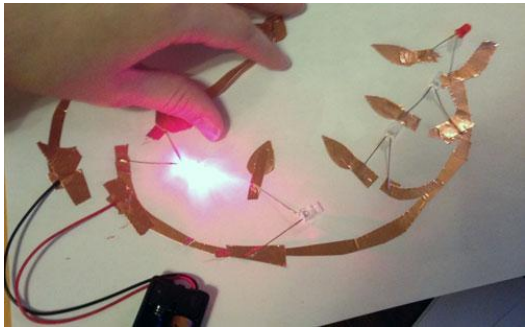




- **Successes: Designed 2 boards in eagle, vinyl cut them, applied to glass, stuffed and soldered them**
- **Failures: failed to actually program the boards to do anything broke board while trying to rework board and connections**
- **Lessons Learned:**
  - **Make sure your vinyl cutter cut all of the way through your component before weeding**
  - **The heat gun will crack glass**
  - **The solder braid will not work do not try it- or try it in peril**
  - **Be meticulous about your design. Ensure all connections are properly made.**
  - **If you want to vinyl cut keep your traces large... keep a printout of your intended design so you know which components you need to repair**
  - **Flooding a component with solder does not work when soldering a vinyl cut circuit**
  - **Solder faster**
  - **Spend extra time pressing down your traces- the adhesion will matter later**
  - **The sticker substrate doesn't work well. Use something else**
  - **Your traces may move around a bit when you solder- if you can design your circuit with a bit of wiggle room so you don't inadvertently create a short**
  - **I make things harder than they have to be**
  - **The voltmeter is an excellent tool to trace paths and connections**
  - **Things are easier to figure out when you're with someone experienced.**

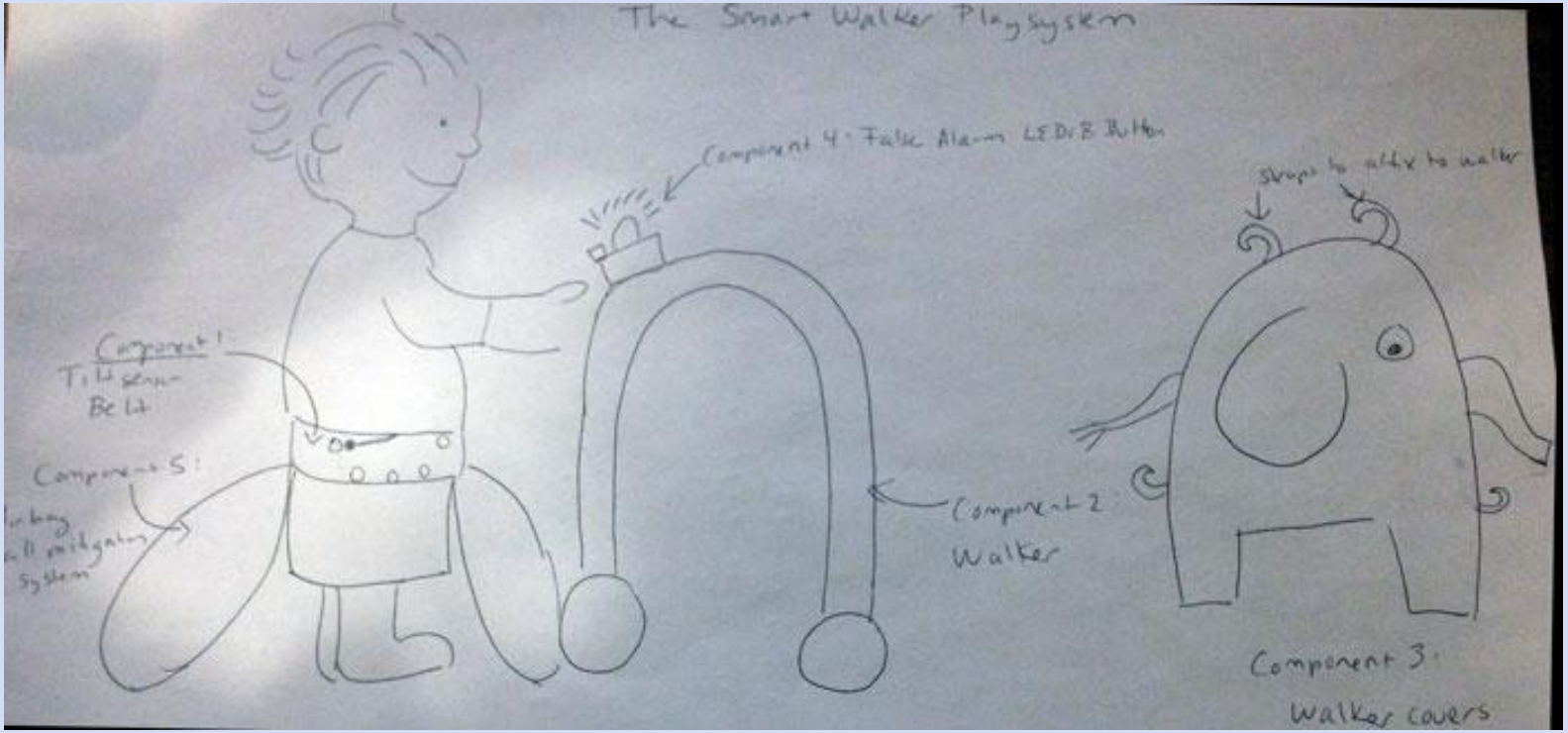
Week 12:
Interface and Application Programming





- **Successes: updated project page, scope and created paper tilt sensor**
- **Failures: failed to actually do any proper software downloaded a lot of software in trying**
- **Lessons Learned:**
  - **None of my previous boards worked or broke so trying to write an interface for a broken board isn't that fruitful**
  - **copper foil is sharp, beware or you'll bleed all over your circuit**
  - **downloading software and proceeding as planned never quite works the first time**
  - **The voltmeter is an excellent tool to trace paths and connections**
  - **Things are easier to figure out when you're with someone experienced.**

Final: Play Walker System



Lessons Learned:

- **Things take a long long long time to make.**
- **Think big but start small, (spiral development)**