Guide
E-Textiles Project
TECHNICAL
Day 2 - Designing the project & start sewing (if time)

With slight variations in component placement, project is more individual ones - they can decorate in different ways.

* Note - it's much easier to get the students to all do one type of
  project. It's more engaging to let the students do something different.

- Ask students to think about the design they want to make the following day.
  - Add metal pieces with alligator clips and temporary program.
  - Add LED(s) with alligator clips and add more hours of code.
  - Play with example blink program.
  - Spell Ll/Llpad and Llpad

Programming Activity (See handout)

through mini-USB to Llpad to make things light up
for the Llpad - write instructions in computer, compile and upload

- Human Do
  - to first open the JS, etc. compute don't fill in the blanks like
  - need to explain where to get bread to get time, to get it,
  - must break down bigger concepts into smaller concepts (e.g. making a PCB)

- A set of three or a computer to do something
- Introduce programming/coding
  - online - search YouTube, or Llpad of things you find
  - show different projects (electronic samples or things you find
  - combine with coding

- From MIT Media Lab, Arduino-based, scalable components, combine
  - the girls are doing with real world projects/designers/builders/enginers?
  - more - consider showing a video of powerpoint here to connect what
  - customers etc.

- Introduce Llpad and other components

Place to buy e-textiles components

http://www.sparkfun.com

Diy projects you can do

http://heal.sparkfun.com/quarters/leds/Llpad

(Which is also very helpful)


in an excellent place to get started - easy to follow if you get lost (also based on

http://www.learncircuitboards.com

Online Resources:

- }
seconds max)
Take off paper backing and lay it onto your felt piece. Iron on (2)
Trace out the desired shape of the patches
Add double sided fusible interfacing to the conductive fabric

Create the basic design in felt

Clean double because of this.
Use a light needle, it’s thicker. Also single thread is better
Be careful with it, it can break and shred if you pull too hard
Make sure thread isn’t too long, it tends to twist and knot
For conductive thread

See this tutorial: https://lilypadaradio.org/7/2016/12/15

Reach basic sewing if needed

Start sewing (fl line)

Marbling
Make sure to get your design checked by the facilitator before
Think about where to put the battery - hide in pocket
description Very important. Otherwise your project won’t work
Make sure that the lines do not cross unless they are negative
Draw the connection lines (two)
LEDs (how many, in parallel) (a)
LilyPad

Include:
from above a map to make sure the components connect correctly.
Add the electronic components to your paper design – use the worksheet
draw your design on a piece of paper

Creating project blueprints
covered by felt
Check to see how the LEDs go with each other on top of or
monsters’ paws, then the eyes break in a short-long pattern
What hànhions do you want (G? When you squeeze her
For all designs:
Shape and placement of the metallic patches
Think about the LilyPad & LED(s) placement. Think about the

For own designs:
Examples with the circuit map from above
Examples with the circuit map from above
Note: It would be useful here to lay to trace the circuit on the

Initial brainstorming/Planning
Optional

Day 5 - Finish up

Day 4 - Finish sewing

Day 3 - Continue sewing

Day 2 - Continue sewing

Optional

Troubleshooting:

- Write program based on first day's worksheet
- Note - nothing considered writing up a blank code sheet fill in basic
- Note - remember that actions can include steady blinking, but also
- If not touching palate, then
- If touching palate, then
- What behavior do you want to occur? (fill in the blank)
- Start programming the project (if time).
- Notice - remember that actions can include steady blinking
- Calibrate the part levels so they correspond to touch (see the sew
- Uploaded to individual projects
- See Attached.
- Note - something written up a blank code sheet fill in basic

Day 1 - Finish sewing

Day 0 - Finish sewing

This is way to check your progress (sewing things fits up), alone

1. Sew connections are working.
2. Insert alligator clips to check initial sew connections
   (optional)
   - Doesn't touch skin.
   - Conductive, in this case, use conductive parts with clips to make sure already
   - Make up rest program and upload to Lipo pads.

Optional - Use alligator clips to check initial sew connections

Remainder - If the stitches will eventually touch human skin (le at a time)
- Follow personal design blueprint (circle)
- Hand out and go over the sewing basics page (attached)

Sew on the electrical components

End of project
career. Or video game design, etc.

(6) a girl interested in dance might not think about lighting design as a

their current career plans and how these might be related to STEM careers

handicapped door). What else can they think of?

objects like laptops and cell phones, and anything automated like a

computer programming use in everyday life (in controlling everyday

real world e-textiles projects and who likely designs them

careers, it might be useful to have a group discussion. Topics might include:

In order to get the participants to connect their workshop activity with STEM
What does the program do?

```c
{ 
    delay(1000); // wait for a second
    digitalWrite(13, LOW); // turn the LED off by making the voltage LOW
    delay(1000); // wait for a second
    digitalWrite(13, HIGH); // turn the LED on (HIGH is the voltage level)
}
void loop() { // the loop function runs over and over again forever
    the setup function runs once when you press reset or power the board
    pinMode(13, OUTPUT); // initialize digital pin 13 as an output
    void setup() {
    }
    the setup function runs once when you press reset or power the board

    /* by Scott Fitzgerald
    modified 8 May 2014

    This example code is in the public domain.

    The documentation at http://www.arduino.cc
    pin the on-board LED is connected to on your Arduino model, check
    pin the on-board LED is connected to digital pin 13. If you're unsure what
    Leonardo, it is attached to digital pin 13. You can control on the Uno and
    Most Arduinos have one on-board LED. You can control on the Uno and
    turns on an LED on for one second, then off for one second, repeatedly.
    Blink
    */
```
- Try to change the program
  o Switch the words HIGH and LOW, Does anything change?
  o Change the number after delay (Does anything change? (hint make the first number higher and the second number lower)
  o Erase a semicolon (;) or a bracket (}) – does anything change?
  o Try something else? How would you change it back to the original program?

- Challenges:
  o Try to change the program so that it just stays on forever.
  o Try to change the program so that you create a heartbeat pattern to your LED (hint – it’s long short, long short).
```c
{ 
  delay(1000); // delay for a second
digitalWrite(9, LOW); // turn the LED off by making the voltage LOW
} 
{ 
  digitalWrite(13, LOW); // delay for a second
digitalWrite(9, LOW); // turn the LED on (HIGH is the voltage level)
digitalWrite(13, HIGH); //
} 
void loop() 
{ 
  // the loop function runs over and over again forever

  pinMode(6, OUTPUT);
  pinMode(13, OUTPUT);
  // initialize digital pin 13 as an output
  } 
void setup() 
{ 
  // the setup function runs once when you press reset or power the board
  //
  // by Scott Fitzgerald
  modified 8 May 2014

  This example code is in the public domain.

  The documentation at http://www.arduino.cc
  pin the on-board LED is connected to on your Arduino model, check
  located. If is attached to digital pin 13. If you're unsure what
  MOSFET. Have an on-board LED? Can control. On the Uno and
  Blinks for one second, then off for one second, repeatedly.
  • Get both lights to blink with this program.
  • Compile the program and see what happens.
  • pinMode(9, OUTPUT);
  • pinMode(13, OUTPUT);
  • In your program, change the number in the following line
  one of the numbered pins (I suggest 9).
  • Clip the plus or positive (+) end of this LED with another alligator clip. Clip that to
  • – pin (or pedestal).
  • Clip the minus or negative (−) end of an LED with an alligator clip. Clip that to the
  Adding an LED

  E: Teelsh Activity -- Coding
```
Optional - Add yet another LED by clipping the negative end to the negative

Compile the program and see what happens.

Parallel Circuit

Add another LED by clipping + to + and - to - of the first LED. This is called

Add more LEDs.
What happens? • Touch one patch with one hand, and the other patch with the other hand.

{ { digitalWrite(9, LOW); digitalWrite(13, LOW); }
  else {
    delay(1000);
    digitalWrite(9, LOW);
    digitalWrite(13, LOW);
    delay(1000);
    digitalWrite(9, HIGH);
    digitalWrite(13, HIGH);
  }
}

if (analogRead(A2) > 300) {
  delay(500);
  Serial.println(analogRead(A2));
  void loop() {} }

{ {
  Serial.begin(9600);
  digitalWrite(A2, HIGH);
  pinMode(A2, INPUT);
  pinMode(9, OUTPUT);
  pinMode(13, OUTPUT);
  void setup() {} }

Change your existing program so that looks like the one below. •

electrically.

charge will flow between the two patches because the human body conducts.

charge will flow into the other patch. When you touch both of them then the

A positive charge will be sent to the patch you attached to A2, while a negative

A piece will feel as sensors. They will sense when you touch with your hands.

attached to the negative pin (there’s not enough room on the pin). Now these

attached to the negative pin (there’s not enough room on the pin). Now these

throughout the body. If you can clip it to another clip that is already

Cu the conductive fabric in half. Use the alligator clip to attach it to A2. Clip the

Keep the LEDs attached.

Adding the Sensors
Before taking another one,
  delay is so that it can stop and print the reading
  behavior over and over. The reason why there is a
  loop, which means it will keep repeating this.

In the program, that is done through the following lines:

else
  then do this other action.

Then we set up a conditional statement, which is basically a set of instructions like,

Serial.begin(9600); // This tells the computer to set up the AZ mock
digitalWrite(AZ, HIGH); // This sends a positive charge to the AZ mock
pinMode(AZ, INPUT); // This makes the patch connected to AZ into an input.

Explanatory comments on the side:

Basically, you're setting up the patch connected to AZ as a sensor, which means that it

How it works:

E-Textiles Activity - Coding
Think about where you want to place your battery. The battery can cross over lines or go over

LED1

LED2

LED3

LED4

Checklist for design:

- [ ] Optional LED3
- [ ] Optional LED4

If you want to add the other two LEDs (LED3 and LED4), then sew them positive (+) to positive

Sew negative (-) of both LED1 and LED2 to patch 2 OR the negative (-) pin.

Sew positive (+) and of LED2 to 10.

Sew positive (+) and of LED1 to 3.

Sew patch(-) to the negative (-) pin.

Sew patch(-) to patch 1.
Scotch tape to flatten out the knots.

NEAT KNOTS - When you sew, make sure the knots at the back of the project are not touching or freshly cut. If they touch the back that will also cause a short circuit. Use the stitch I zip or

TWO PIECES OF THREAD TO CONNECT - When you are sewing the LEDs into the fabric (or

WORK

NO CROSSING LINES - When using the conductive thread, make sure your connections or

SEW THREE TIMES - Sew each electrical part in three times to ensure a strong electrical

RULERS

E - Textile Sewing and Design Rules
void loop() {
  // Serial.begin(9600);
  // digitalWrite(A2, HIGH);
  pinMode(A2, OUTPUT);
  pinMode(10, OUTPUT);
  pinMode(3, OUTPUT);
  void setup()

  if (analogRead(A2) > 969) {
    delay(500);
    Serial.println(analogRead(A2));
  } else {
    digitalWrite(A2, HIGH);
    digitalWrite(10, HIGH);
    digitalWrite(3, HIGH);
    delay(1000);
    digitalWrite(10, LOW);
    digitalWrite(3, LOW);
    delay(1000);
    digitalWrite(10, HIGH);
    digitalWrite(3, HIGH);
    delay(1000);
    digitalWrite(10, LOW);
    digitalWrite(3, LOW);
    delay(1000);
  }

  // When the patches are touched, then the LEDs are off.
  // This pattern repeats as long as the patches are
  // attached to 3 pin on board 1 and 3, then both off.
  // When the patches are NOT touched, then the lights
  // blink on and off in intervals of one second. When
  // they ARE touched, then the lights are off.

  // Sample Programs - With Example Circuit
Basic T-Shirt Design

You can put the lights above or below the writing.

You can also put the tulle in the lights.

Put the tulle on the back.
Basic Monster Design

[Diagram of a monster design with various parts and labels]