Create a e-textile bag

Path and modules

Discovery
E-Textiles

Name of the activity:

E-Textiles
Duration of activity : 24 hours

License and credits

This method has been designed by Paddy Condevaux from Onl'fait for shemakes.eu.

Get to know the activity (audio of 45 second of the activity)

https://drive.google.com/drive/folders/1qEiLXBKQM9KLMpeDPJdbUbrt9CJau5wS?usp=sharing

Flyer for participants

https://drive.google.com/drive/folders/1qEiLXBKQM9KLMpeDPJdbUbrt9CJau5wS?usp=sharing

Activity description

Production of a drawstring bag with integrated electronic components: light or distance sensors, microcontroller and LEDs with 3d printed caps. The bag will be decorated with a cut-out sticker.

Objectives

- Concept development
- Understand how we can produce soft circuits
- Learn how to embed electronics on fabrics
- Study and learn soft-hard connections
- Discover necessary materials, components, tools
- Design a circuit with a sensors and LEDS
- Program a microcontroller
- Aesthetics and function
- Documentation

Target audience and context of use

Our target audience were 2nd year Fashion University students but this activity can be adapted to any students. To make the workshop easier, you can give to the students a pre-made bag (tote bag or drawstring bag). We advise to have a maximum of 8 participants.

Preparation

It is highly recommended to make a sample of the swatch in order to show a tangible example to the participants.

Read the information provided by Adafruit on the Gemma V2 board: https://learn.adafruit.com/introducing-gemma/introduction

Prepare sample code that can be easily used to test the circuit.

Buy a pre-made bag (tote bag or drawstring bag) if you want to focus on the electronic part of the workshop.

Equipment, tools and software

Software:

Mu Editor, a simple code editor that works with the Adafruit Gemma v0 and others CircuitPython boards. It's written in Python and works on Windows, MacOS, Linux and Raspberry Pi. https://learn.adafruit.com/adafruit-gemma-m0/installing-mu-editor

Inkscape for vector graphics

Software for the Silhouette Cameo vinyl cutter

Cura: slicer for the 3d printer

Tools

- Sewing needle
- Sewing machine
- Soldering iron
- Vinyl cutter (Silhouette Cameo)
- 3d printer (Creality CR-20)

Consumables

- Adafruit Gemma M0
- Lilypad light sensor or Ultrasonic distance sensor (RCWL-1601 compatible HC-SR04)
- Lithium Ion Battery (400 mAh or more) with JST-PH connector
- PLA transparent (optional - 1g per button)

Materials

- Textile, Leather, felt
- Pattern paper
- Conductive thread - Stainless Steel
- Alligator clips

Safety rules & Tips

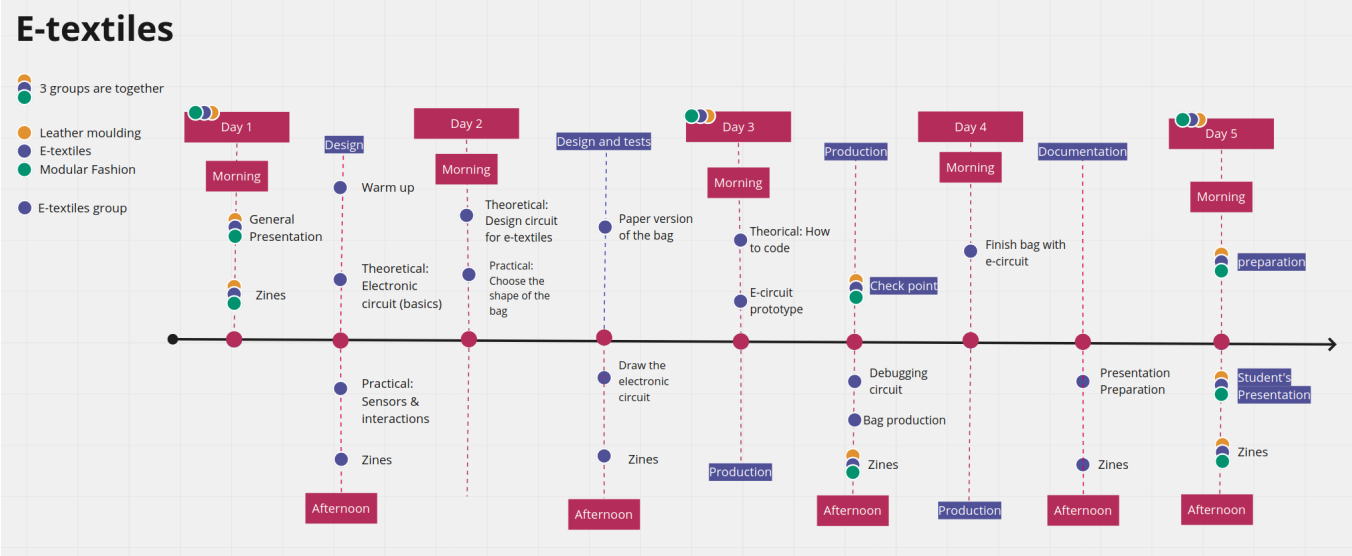
The circuit relying the + of each led and the circuit for the ground must never cross each other to avoid short circuit.
If some leds don't come on or are flickering, your stitches might not be snug enough against the pads of the circuit board. Double check your sewing and reinforce it where necessary (with the circuit off/unplugged).

Proposed Schedule

Agenda:

Day	a.m.	p.m.
Monday	Introduction	design
Tuesday	Design and tests	Production
Wednesday	Production	Production – Check point
Thursday	Production	Documentation

Friday Presentation preparation Presentation



Process Scheme:

Step 1: Understanding Electronic Circuit

In the first part of the workshop, participants need to understand how electronic circuits work.

You first have to demonstrate the differents components of an electronic circuit:

Sensors which collect environmental datas.

Actuators which are responsible for moving and controlling a mechanism (motor, light…)

Microcontrollers: integrated circuit with a microprocessor. It runs a program that controls the actuators depending on the datas collected by the sensors.

Step 2: Onboarding in E-textiles

Presentation of the electronics components used in e-textile project: neopixels LED, Adafruit Gemma microcontroller, Lilypad light sensor, ultrasonic sensors, conductive thread and battery.

Step 3: Start building a circuit:

Show the constraints around e-textiles (battery, avoid short-circuit)

Step 4: Define your algorithm and program it:

Algorithm is a step-by-step procedure that defines clearly for each possible inputs and outputs. This algorithm could be translated into a program that can be

understood by the microcontroller. The programming is done in micro python. Here a template that can be reused.

Step 5: Decorate with vinyl cutting

This technique is used to decorate the bag. First, the design is done with a vectorial drawing made with Inkscape. Then, it is cutted with the vinyl cutter (https://vinylcuttingmachines.net/how-to/silhouette-cameo-3-beginners-guide/)

Step 6: Opt for the 3D printing of buttons

To change the aspect of the neopixel LED, 3d printed buttons are used. You can look at the file (https://www.thingiverse.com/thing:226407) and print it with your machine.

Step 7: Produce and assembly

Cut, assembly and sew the bag, the integrated circuit and vinyl cut decoration. Test the electronics.

Step 8: Prepare and run a presentation for showcasing the creations

Each of the groups have to do a presentation of their day.

Here are the link of their presentations:

https://drive.google.com/drive/folders/1bjBRl6S1rTuv3INpn0MT86mBWejF-1xr?usp=sharing

Estimated cost

BOM of materials (for 6 groups)

Quantity	Description	Link to vendor	Cost
5*6	Neopixel	https://www.adafruit.com/product/1260	$63.60
6	Gemma M0	https://www.adafruit.com/product/3501	$59.70
5	LilyPad Light sensor	https://www.sparkfun.com/products/14629	$18.75
5	Ultrasonic distance sensor	https://www.adafruit.com/product/4007	$19.75

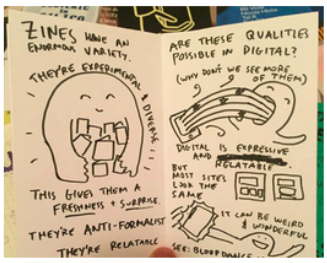
2	Conductive Thread - 60g (Stainless Steel)	https://www.sparkfun.com/products/11791	$47.95
6	Lithium Ion Battery (400mAh) JST-PH connector	https://www.sparkfun.com/products/13851	$4.95 * 6 $29.70
Total for 6 groups			$239.45

Evaluation Criteria

During this week of activity of learning and prototyping e-textile bags, the students were graded by their tutor and by the Lab. This grading system was decided by the tutor of la HEAD.

Additionally, it is possible toused zine as a form of evaluation of each day. Here some examples:

Drawings

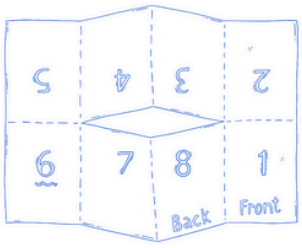


Alt-text

Poetry

Collage

How-to's



Lay-out

Folder of the zines.

Tips to facilitate the activity in context (to-do / not do)

To do:

- Give templates for the code, to allow students to modify values according to their needs, without coding from scratch
- If time doesn't allow it, 3D print the button for the neopixels before the workshop.
- Show them an example of an e-textile product.
- If you want students to focus only on the electronic and programming part, give them an already made bag (tote bag for example)

Don't:

- Don't let the students work too extensively on the design of the bag because the electronics part takes as much time. Students should include the electronic circuit early in the production. Electronic debugging and coding takes about 3-6 hours. Depending on the specific objectives of the workshop, consider ½ or 1/3 of the time for the modeling and sewing part and ½ or ⅔ of the time for the electronics
- Don't let them decide when to do their evaluation (zines) otherwise they won't do it at all.

Links to photos and recorded materials

Here is my example of pattern:
https://drive.google.com/drive/folders/1pQitRvEaaomhC2j-GHenkgSvAADq8ueB?usp=sharing

Photos:
https://drive.google.com/drive/folders/1_fwMnV_XxQYOQ1tTwXkdEDi-G24tUwE1?usp=sharing

References and further reading

https://class.textile-academy.org/classes/2020-21/week05/

https://class.textile-academy.org/classes/2020-21/week10/
http://thesoftcircuiteer.net (Liza Stark)
https://www.kobakant.at/DIY/?p=1272 (hard 1& soft connections)
https://learn.adafruit.com/introducing-gemma/introduction
https://learn.adafruit.com/flora-rgb-smart-pixels

Related and supporting activities/modules

https://class.textile-academy.org/2020/jeanmarie.durney/assignments/week09/