Light-Up Bracelet Student Guide

Instructional Technology and Learning Sciences

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Acknowledgments: This guide was created based on our own experiences, and with help from Emily Lovell's Soft Circuit Guide hosted at https://cdn.sparkfun.com/assets/resources/2/8/guide.pdf Please visit this and other great websites for more craft technology projects and tutorials.

LIGHT-UP BRACELET INTRODUCTION

Description

This light-up bracelet project will introduce you to simple circuits, parallel circuits, and switches. In addition you will learn about conductivity, polarity, and beginning crafting techniques. Be as creative as you want with your bracelet so that you will learn even more about electricity and circuitry. All of the examples shown in this guide are exactly that - examples. Use your imagination to create something personally meaningful.

Objectives

- Learn beginning electricity principles
- Learn how to create a simple circuit
- Learn the difference between parallel and simple circuits
- Learn how to make a switch
- Learn beginning crafting techniques

Supplies

- Various colors of felt (or other sturdy fabric of your choice)
- Conductive thread
- LED lights:
    - ° Diffused LEDs (these are basic, and cheap, but more difficult to sew)
    - ° LilyPad LEDs (great for sewing)
- 3 Volt coin cell battery
- Battery holder
    - ° LilyPad Coin Cell Battery Holder (easier for sewing, but more costly)
    - ° Sewable SMD Coin Cell Holder (harder to sew, but cheaper)
- Metal Snaps (sold at any crafting store)
- Thread (just normal thread)

LIGHT-UP LED BRACELET

Step One:

The first step is to draw out your circuit on paper. This will be an important part of every project you make. Make sure to clearly label the ***positive*** and negative lines. This will help you to make sure that your lines don't cross and create a short. This will be especially important as projects become more complex. Below you will see two images. The first is an example of how you would sketch the diagram on paper, the second is a picture of the finished project. It is important that you sketch out all of the components that you will need for your circuit including batteries, snaps (switch), and lights.

TIPS AND TRICKS

Color Coding

One way to keep yourself from getting confused with which is your ***positive*** line, and which is the **negative** is to color code them. We recommend that you use black for the **negative** lines, and red for the ***positive*** lines; this is the standard practice.

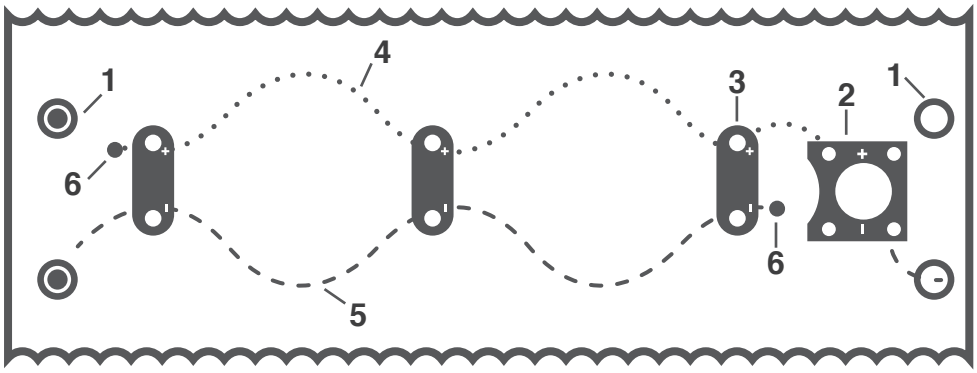

Figure 1: Bracelet Sketch Diagram

Diagram Key

1. Snaps
2. Battery Holder
3. LED Lights
4. **Negative** Line
5. ***Positive*** Line
6. Thread Knots

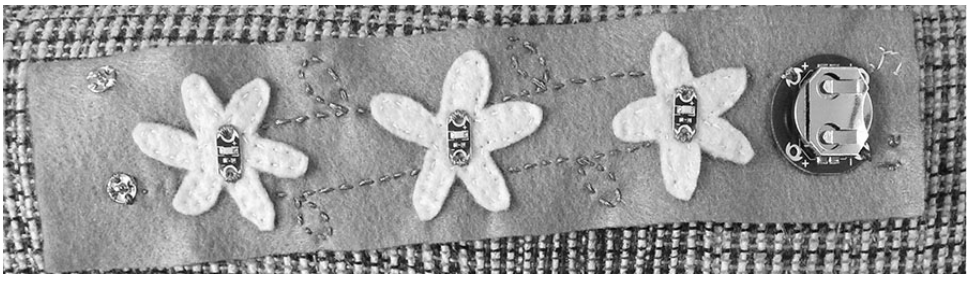

Figure 2: Final Bracelet

Step Two:

The next step is to cut out your felt or other material and to draw your circuit/sewing lines on to the material with a fabric pencil. Fabric pencils are non-permanent and will wash out of the material. Using a fabric pencil will allow you to be more precise in your crafting and can help with the aesthetics. Be sure to make marks to differentiate your *positive* and **negative** lines, and to indicate where all of your components will go.

For the example bracelet we made, we included some decorative felt flowers to add to the aesthetics. If you would like to do something similar then you will need to cut our your felt flowers (or whatever you are doing) at this point. Then before drawing your sewing/circuit lines, sew your flowers on to the bracelet. See the second picture below.

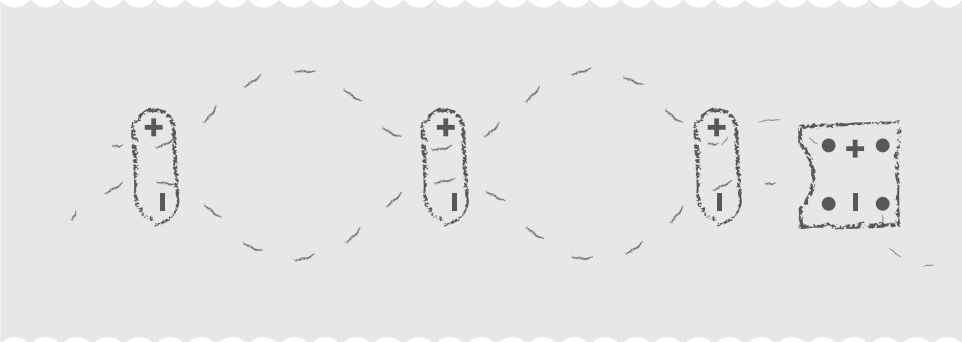

Figure 1: Outline of Circuit on Felt

Figure 2: Add Decorative Additions

TIPS AND TRICKS

Edges

One way to add interest to the bracelet is to use edging scissors to make fun shapes or patterns. You can buy edging scissors at a craft store like Joann.

Knots

For this project you have to knot off the thread in several places to make the circuit work. We would recommend that you *mark where you are going to knot* your thread so that you don't forget.

Positive vs. Negative

Just like in the previous step it is important that we clearly identify the *positive* and **negative** lines of the circuit. One idea would be to draw the **negative** line as a **solid line**, and the *positive* line as a *dashed line*. How you distinguish your lines is up to you though.

Step Three:

Now we are ready to sew our **negative** line with conductive thread. **DO NOT** connect the lights directly to the battery. The reason for this is because we are going to be creating a switch. A switch allows you to turn the electricity on and off. If both the **negative** and *positive* lines of the LEDs are connected directly to the battery the lights will be on all of the time. So we need to choose one line and keep it disconnected from the battery. In the example below we chose the **negative** line. Using the conductive thread, start with your first LED and sew around the **negative** pin and then continue sewing around the **negative** pins of each of the following LED lights (See Figures 2 & 3 below). After you have sewn the **negative** line of the LEDs continue to sew for several more stitches. Next, before knotting and cutting your thread, sew on one half of a metal snap. The snap will serve as our switch.

Figure 1: How to Sew an LED

Figure 2: Negative Line - Sample Project

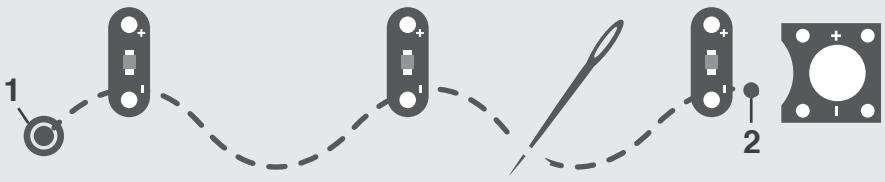

Figure 3: Sewing the Negative Line Diagram

TIPS AND TRICKS

Three is the Key

Whether you are sewing on an LED light, a battery, or a snap, make sure that you loop around the component three times with the conductive thread. By making three loops you will be ensuring good conductivity. See Figure 1.

Creative Stitching

One way to add to the aesthetics of the bracelet is to do some creative stitching. In the picture below of the example bracelet you can see that we made leaves for the flowers with the conductive thread. Other thing that you could do would be to do back stitching, or other type of stitching, or create other patterns with the thread.

Sewing on the Snap

The snaps will serve as the switch, and tit will allow you to fasten the bracelet so it can be worn. This first half of the snap should be sewn onto the same side of the felt as the LEDs, battery holder.

Diagram Key

1. Snaps
2. Thread Knots

Step Four:

The next step is to sew the *positive* line of your circuit with conductive thread. We suggest starting by stitching around the ***positive*** pin on the battery holder and then continuing to sew on each of the LEDs with one consecutive strand of conductive thread. Be sure that you knot of your thread once you have sewn on the last LED (See Figure 3). If you do not knot off your thread before continuing to sew you will create a short in the circuit and the lights will not work. This is a common mistake among many beginners. See the figures below.

Figure 1: How to Sew an LED

Figure 2: Positive Line - Sample Project

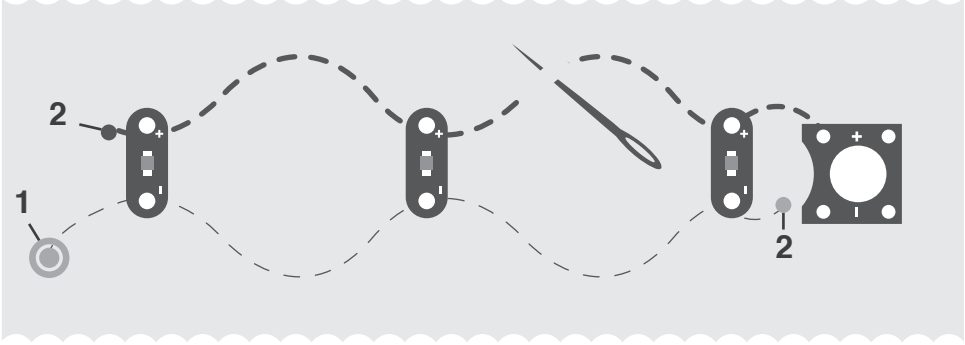

Figure 3: Sewing the Positive Line Diagram

TIPS AND TRICKS

Sewing Under the Flowers

One way to add to the aesthetics is to sew between the flower layer of felt and the bracelet layer of felt. This will allow you to continue using one strand of thread without having to knot of your thread after sewing on each light, while hiding the thread. If you want to skip this step you could sew right on top of the flowers and incorporate the stitching into your design.

Common Error

One common error that people make is that they connect the ***positive*** line and the **negative** line of their last LED with the same piece of thread. This will create a short. The light is already made so that the electricity with flow through the LED. This can be a hard concept, because it seems logical that you need to connect the ***positive*** and **negative** lines, but they are already connected.

Diagram Key

1. Snaps
2. Thread Knots

Step Five:

Now to finish the switch and the circuit. Take the other half of the snap that you are using for your switch and connect it to the **negative** pin of the battery holder with conductive thread. Now when you connect the snaps you will complete the circuit and the lights will turn on.

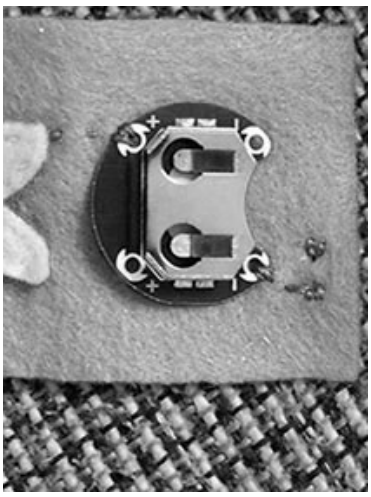

Figure 1: Battery to Snap - Sample Project

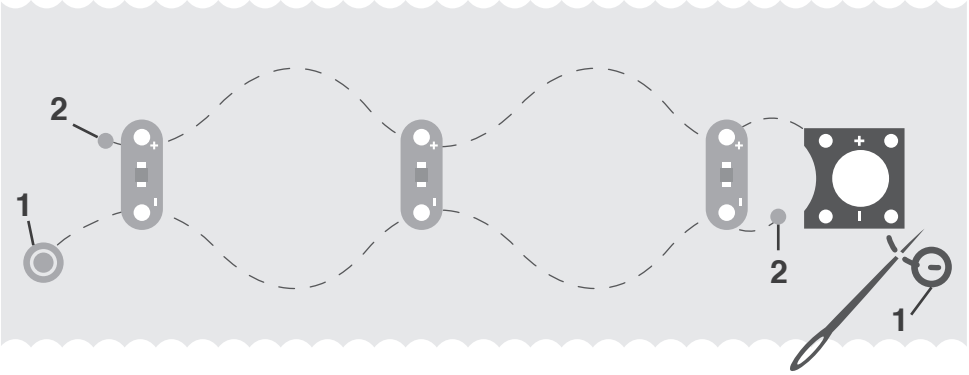

Figure 2: Connecting the Battery to a Snap Diagram

Diagram Key

1. Snaps
2. Thread Knots

TIPS AND TRICKS

My Lights Don't Turn On

This is a learning moment. There are several reasons that your light might not be turning on.

1. You have a short. Check to make sure your ***positive*** and **negative** lines aren't touching.

2. No conductivity. Use a multi-meter to check different points of the circuit to check for resistance problems. Re-enforce with more conductive thread or jewelry wire.

3. Bad LED. If an LED isn't working try connecting it directly to a battery. If it still doesn't work then cut it out and replace it.

4. Purple LED. Purple LEDs are more dim than the other LED colors. Green lights can be touchy too. The brightest lights are the red, yellow, pink, or white lights.

Sewing the Snaps

Unlike the first half of the snap that you sewed on in step four, the second half of the snap should be sewed onto the opposite side of the felt. See Figure 1.

Step Six:

This step is optional. If you would like to add another snap to the bracelet to make it more secure when being worn, you can simply sew on another snap with normal thread. After you have completed this step you are finished!

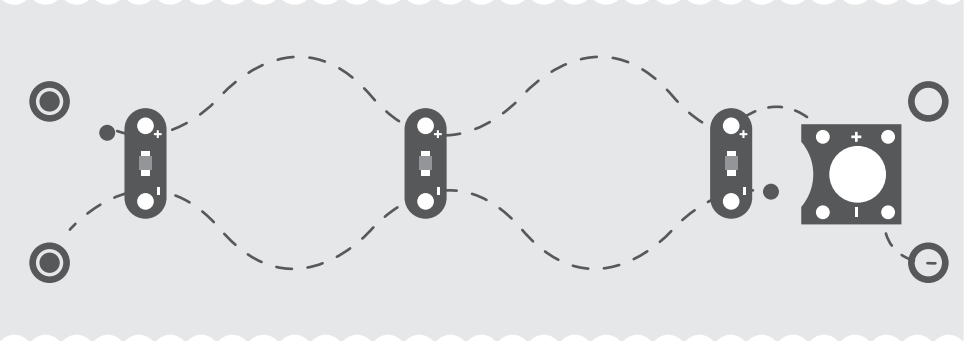

Figure 1: Final Bracelet Diagram

Figure 2: Final Bracelet Sample Project

TIPS AND TRICKS

Glowing Flowers

One technique that is fun is to put felt over the LEDs so that they glow. One thing that you can do is to sew the flowers on last so that the lights shine through them instead of sewing the flowers on at the very beginning.