Sew An LED Monster

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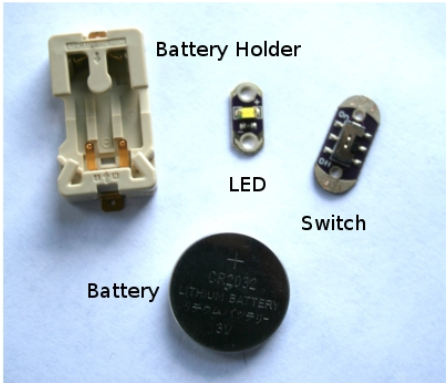
1 Project Overview

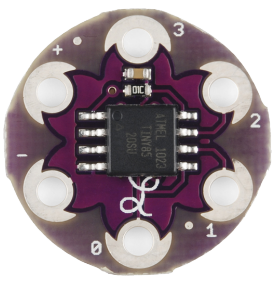


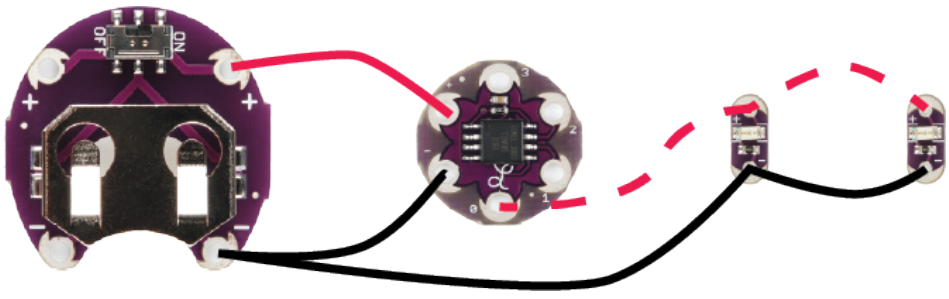
Today we're going to sew our own light-up monsters. Everyone should have: 1 battery, 1 battery holder, 1 switch, some light-emitting diodes (LEDs), and 1 LilyTiny.

First, pick out your felt and decorations. Cut out a template, or sketch your own shape. Start thinking about how you want your finished product to look and where you want to put your LilyTiny, switch, and battery holder. Two layers of felt lets you tuck the components out of sight; strategic patches or layers can protect your conductive stitching. A clear bead or patch of felt can soften the glow of your LED, and a sequin can help reflect it. Use alligator clips to test out your LED design, to make sure your battery can support that many lights.

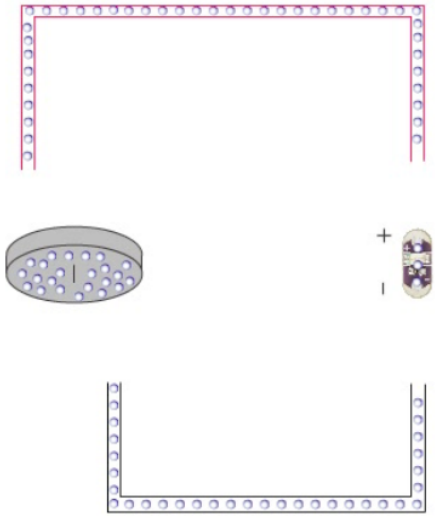
When you're ready to sew your conductive circuit, follow these steps:

1. Thread your needle with conductive thread and tie a knot. Attach the positive (+) side of the battery holder to the felt with at least 3 loops.
2. Use running stitch to connect to the positive (+) patch of the LilyTiny. Stitch at least 3 loops, tie a knot, and cut the thread. If you want to use a switch, consider placing it between the battery and the LilyTiny.
3. Tie a new knot, and sew 3 loops on the negative (-) side of the battery holder. Sew a connection to the negative (-) patch of the LilyTiny, tie a knot, and cut it off.
4. Now connect each LED. Sew from the positive (+) side of the LED to the patch on the LilyTiny with the effect you want: blink (0), heartbeat (1), breathing (2), random (3). Sew from the negative (-) side of the LED to the negative patch of the LilyTiny or battery holder.
5. Now it's time to test your circuit! Put the battery in the holder. If the LED doesn't light up, check for short circuits and correct polarity, and/or ask an instructor for help.





2 How does it work?



Power is stored in the battery, which produces a voltage - the potential for an electron to do something, like light a bulb, heat a stove, or turn on a motor. Electric current flows from the positive (+) side of the battery to the negative (-) when the circuit is closed. Some circuit components, like LEDs, are designed to only work when current flows from (+) to (-); if you connect them backwards, they won't turn on, and might burn out. Others, like switches, work in any orientation.

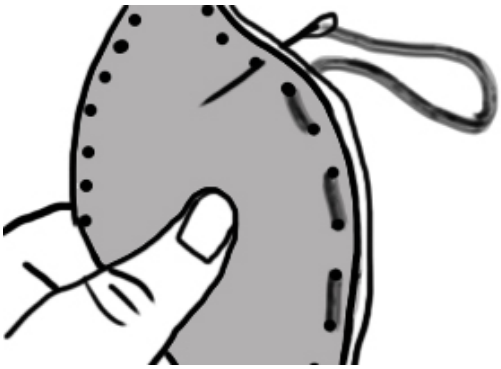
Think of a circuit like a rollercoaster. The battery is the first big hill, towing the electrons up high so they can start with a lot of potential energy. The current flows along the conductive thread connections, which are like flat sections of track. When the current goes through an LED, it hits a dropoff and loses some energy, which turns into light. In a closed circuit loop, the total voltage drop over all the components has to equal the total voltage of the battery, otherwise it doesn't have enough energy to make it all the way around.

3 Sewing

We have regular needles in several sizes. Conductive thread frays easily, so it may be hard to thread your needle, but be persistent!

Starting knot: see diagram on next page.

Ending knot: On the back of the patch, push the needle partway through some nearby thread/fabric. Wrap the end you're tying off at least 3 times around the front of the needle. Holding those loops with your thumb, push the needle through and tighten down the knot. (Extra loops/knots don't hurt.)



Use conductive thread to connect your circuit components. Use colored embroidery thread for other decorative stitching. The embroidery thread is actually 6 threads twisted together; separate out 2 or 3 to stitch your design.

Running stitch is the simplest way to connect up your circuit. Just push the needle straight up and down, following an imaginary dotted line.

(a) Make an X near the end of the thread.

(b) Grip the X with your thumb and index finger.

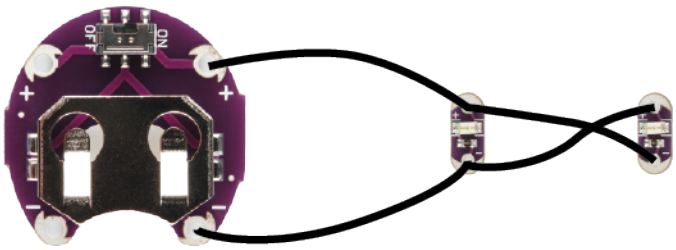
(c) Roll thread off your finger with your thumb.

(d) Tighten the loops into a large knot.

Figure 1: Tying your first knot.

4 How does it not work?

Electrons are inherently lazy, and they flow along the path of least resistance. Any component that does work (light, heat, motion) has high resistance compared to the conductive thread. If you cross two conductive lines or leave a stray end, you could cause a short circuit, which could burn out your battery. This is also why it's important to cut and knot your thread after stitching each connection.



How does the electricity flow in this circuit?

If your LED isn't lighting up, check to be sure that you've connected (+) to (+) and (-) to (-). If you're sure everything looks correct, test your LED with the multimeter (sometimes they break).