Hack your Shirt!
This ain’t your Grandma’s sewing circle.

Take an old shirt and make it shine! Literally. Sew some LED lights onto your shirt. Light up that ol’ fashion quilting bee.

Gather your Supplies!
- T-Shirt (or shoes, hat, gloves, backpack...)
- Sewing Needles
- Conductive Thread
- Sew-able Micro LED lights or regular LED lights
- Sew-able Battery Holder
- Coin Batteries to fit the holder
- Sew-able LED switches/buttons (optional)
- Tailors chalk or pencil
- Beeswax (optional)
- Sewing Machine (optional)
- Embroidery Hoop (optional)

*Find these items individually or in kits from online stores such as sparkfun.com or adafruit.com. Also available locally in Denver from The Concoctory, concoctory.com.

Step 1: Let’s start at the very beginning. A very good place to start.

In order to light up an LED, we’ll create circuits to channel the electric current from positive to negative. When the current passes through an LED it will light up, and the current goes round and round and round again! Like NASCAR, just brighter and (hopefully) with less fiery crashes.

Know what? You’re already a circuit maker, because you’ve changed a battery and struggled to see whether the + or - sign should go first, right? These are positive and negative terminals, everything that has power has them, and when connected with something conductive you create a circuit! Aww, circuits are so easy!

Enough chat, let’s get visual:
in schematic-ese in vibrant real-life color

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+ Battery + LED +
| | |
|---|---|---|
| + | LED | - |

Positive piece of thread = Negative piece of thread
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Step 2: Plan it and sketch it.

Place the LEDs, battery holder, and switches/buttons where you want them on your shirt. Using a pencil or tailors chalk, plan and sketch a circuit on the shirt for reference while sewing.

Basic circuits can come in one of two flavors: **parallel or series**. A parallel circuit requires less voltage, and will work better for this project.

Parallel circuit: One piece of conductive thread connects the positive terminal of the battery holder to the positive terminals of each component. (look for the + and - signs) A different piece of thread will connect the negative terminals. **THE TWO THREADS SHOULD NEVER TOUCH!!**

If you aren’t totally sure, use the last page to sketch out a circuit before taking it to the fabric!

Step 3: Sewing!

You’ve planned it, now sew it.

1. Thread your needle. It’s hard, get over it. Cut a new piece of thread to reduce fraying, lick or rub beeswax on the end to help!

2. Measure out an arm’s length of thread and cut. If you have a long distance to cover, consider doubling your thread. If your thread has a high resistance/ small metal content the current won’t reach with a single strand.

3. Tie a knot at the end of your thread.

4. Starting from the wrong (back) side of the fabric, push the needle and thread through to the right side (front) till you reach the knot. Do not pull too hard at the knot, it might pull through.

5. Push the needle back through from the right side to the wrong side about 1/4” away. You made a stitch! Now, repeat.
Step 2 3/4: So you don’t have fancy sew-able LEDs.
No problem! Grab some needle-nose pliers and bend some regular LEDs!

LEDs with long leads (legs) have positive and negative sides too.
Positive = long lead
Negative = short lead

Also, the casing above the negative lead (leg) will be flat. You can mark it with a marker if that will help.

Try bending the + lead in a round curlicue and - lead in a square curlicue to know which is which.

Awesome! Now you have all your supplies ready to go. Read on....
Step 3, cont.: Keep Sewing!

Keep your stitches nice and neat.

No! That’s crossing streams.

No excess thread touching the battery pack. Sew a few stitches around the top of pack, and don’t leave any loose ends.

Cut this out! You can’t cross the positives with the negatives!

A loop-de-loop? No way! That’s just asking for trouble.

This is some loosey-goosey needle work. It’s got to go. Your two threads shouldn’t touch, remember?

Step 4: Sewing components!

Place your components. Double check you are sewing to the right terminal (+ or -). Tightly sew loops around the terminals a number of times to make sure there is a strong connection.

STOP!

Do NOT sew components with the battery in the battery pack. It won’t hurt you, but it will fry your lights.

Such a same polarity!

Such a strong connection!

Step 5: Finishing flourishes!

Knot it off. Check your circuit for any loose threads or crossed wires. Put the battery in, and light it up!

How to tie a knot:

1. Bring your needle and thread to the wrong side of the fabric and draw it through the last stitch.

2. Pull your thread until there is a loop. Draw your needle through the loop.

3. Pull tight! There’s your knot!
Plan your circuit design here:
Look to the right for some inspiration.

YOU’RE DONE! HERE’S SOME NEXT STEPS YOU COULD TAKE:

Highlowtech.org: Lots of tutorials and projects from the MIT Media Lab.
learn.SparkFun.com: SparkFun is a great place to buy the supplies you need, and they have a bevy of cool tutorials, projects and inspiration to take you to the next level.
LilyPadarduino.org: LilyPad is the ultimate in programmable wearable electronics. Check out their website for some excellent tutorials.
lilypond.media.mit.edu: An online community for etextilers to share their latest and greatest creations, get inspiration, and find projects like the ones above.