



LilyPad Technology SparkFun Electronics Summer Semester

LilyPad Technology

What are Lilypads? LilyPad is a wearable e-textile technology developed by Leah Buechley and cooperatively designed by Leah and SparkFun. Each LilyPad was creatively designed to have large connecting pads to allow them to be sewn into clothing. Various input, output, power, and sensor boards are available. They're even washable!

Great, how do we use them? Utilizing conductive thread we can connect power to different component boards, but to start we need to cover a few basics of circuit design. In building basic circuits, there are two types of configurations: a parallel and series circuit.



Both have advantages and disadvantages. The largest disadvantage to a series circuit is that you need a very large volt battery to run even a small circuit. Due to this fact, it is recommended that you always use Lilypads in a parallel circuit.

Linking batteries in Series combines the voltages of the batteries to create a power supply with a higher voltage.

Linking batteries in Parallel combines the current of the batteries to create a power supply with a higher Ampage.

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LilyPad Battery Life

Before you start it is a good idea to pick all your components and figure out how long a typical battery will run them. For this we will need to do a little, easy math. The first thing to do is to figure out how much current (I) each component will use. In the parallel circuit above, each LED draws about 20 mA (milli-Amps). Since there are three LEDs we need to account for all of them: 20 mA + 20 mA + 20 mA = 60 mA. Then we need to find how how many amps the battery holds. For the coin cell battery, this is 250 mAh (milli-Amp hours). This means the battery will run at 250 milli-Amps for one hour. In order to discover how long your battery will run use this equation:

Battery run time = <u>milli–Amp hour of the battery</u> total milli-Amps of the circuit

So for the circuit above:

Total milli-Amps of the circuit = 20 mA + 20 mA + 20 mATotal milli-Amps of the circuit = 60 mAMilli-Amp hour of the battery = 250 mAhUsing these two values in the equation above: Battery Run time = 250 mAh / 60 mA

Battery Run time = 4.167 hours

Now we know about how long one coin cell battery can power 3 LEDs. If the battery run time you come up with is not long enough, there are some other options available to you. The Lilypad line has various components designed to allow you to plug in different types of batteries.

Enough science, let's get to the fun part: LilyPad basics

Do not sew any components in with the battery installed. There is no risk of getting hurt, but you might kill the battery.

There are generally two types of thread, thick and thin. The thick type is better if you are going to have LEDs far away from the battery. The thin type will work in a sewing machine but the components cannot be too far away from the battery.

Any time you make a connection between a component and the thread, make a few loops through the connection hole. Also make sure you loop through the portion of the LilyPad components that has metal on it, if the thread is only touching purple PCB it will not conduct. The thread will melt similar to nylon. It is good to knot the end of your thread at a component and melt the extra, however be careful you do not burn your project.

If you have two threads that need to cross, there must be some fabric between the two, otherwise the circuit will short and not work.

Finally, make sure to clip any long threads at the end of your stitches as these can short out your circuit.