LILY TINYS

Goal: To provide students with the technical understanding of micro-controllers and begin learning the concept of programming by adding dynamic behavior to electronic textiles.

Scientific Significance

Understand electricity principles, learn about parallel and independent circuits, and understand switches and basic programming skills.

Key Terms

LilyTiny microcontroller: a mini computer that acts as the "brain" of the circuit, with a program controlling the LED lights

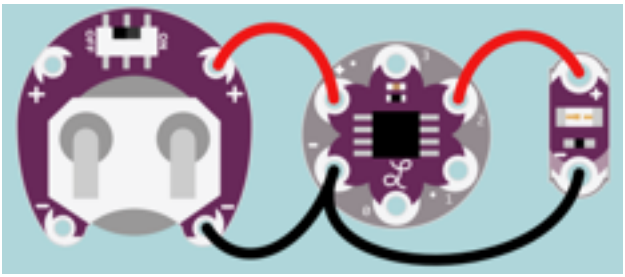
Pin: the part of the microcontroller or LED that connects the conductive thread to the source of electricity

Circuit: uninterrupted path made from conductive elements that lets electricity flow between anode and cathode sides of a power source

Common ground: the common path for the electric current, e.g. the negative side of the LEDs are connected using a single line back to the battery

Parallel Circuit: connecting multiple lights with one pin

Independent Circuit: connecting different lights to individual pins



What are Lily Tinys?

A LilyTiny is a micro-controller computer that has four pins that have been pre-programmed with four different blinking light patterns. This computer can help expand E-textile projects by providing more complicated designs and better understanding of circuits and programming.

Directions:

1) Share any examples with students while explaining the activity. Distributes supplies to students.

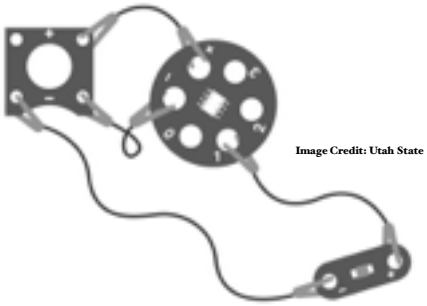
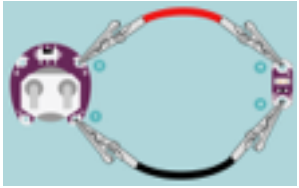


Image Credit: Utah State

2) Instruct the students to first test out the *LilyTiny* by connecting the battery, battery holder, LilyTiny, LED lights, and alligator clips.



3) Begin by connecting the positive pin on the battery with the positive pin on the LilyTiny (and negative with negative) using the alligator clips

Supplies

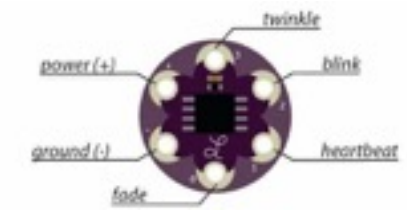
- LilyTiny LEDS lights (~3 per student)
- LilyTinys
- LilyTiny Battery holders
- Felt and/or Fabric
- Conductive thread
- 3V Coin battery
- Metal snaps
- Regular thread
- Sewing needles
- Alligator clips
- Scissors
- Sewing chalk

Facilitator Tips

- Encourage students to help each other
- Start each session by connecting the previous section (summarize what they learned and created last time)
- Encourage the sharing of thoughts or motivations behind the design and how they got their circuit to function
- Encourage connecting what students learned with their daily lives

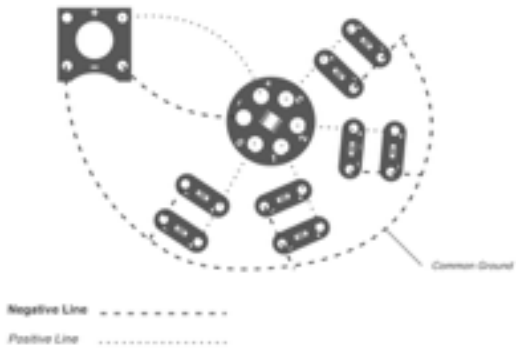
4) Then connect the positive *pin* of the LED to one of the numbered pins on the LilyTiny, and connect the negative pin of the LED to the other negative pin on the battery holder.

5) Ask students to write out what each pin does (twinkle, blink fade etc.)



6) Remind the students of *parallel circuits,* and use this to example how to add more LED lights to their LilyTiny design.

7) Point out how the LilyTiny should be between the battery and the LED to allow the LilyTiny to send information to the LED light. Point out how the positive pins of the battery holder, LilyTiny, and LEDs should all be connected through *common ground* and the negative pins should all be connected to make that parallel circuit.

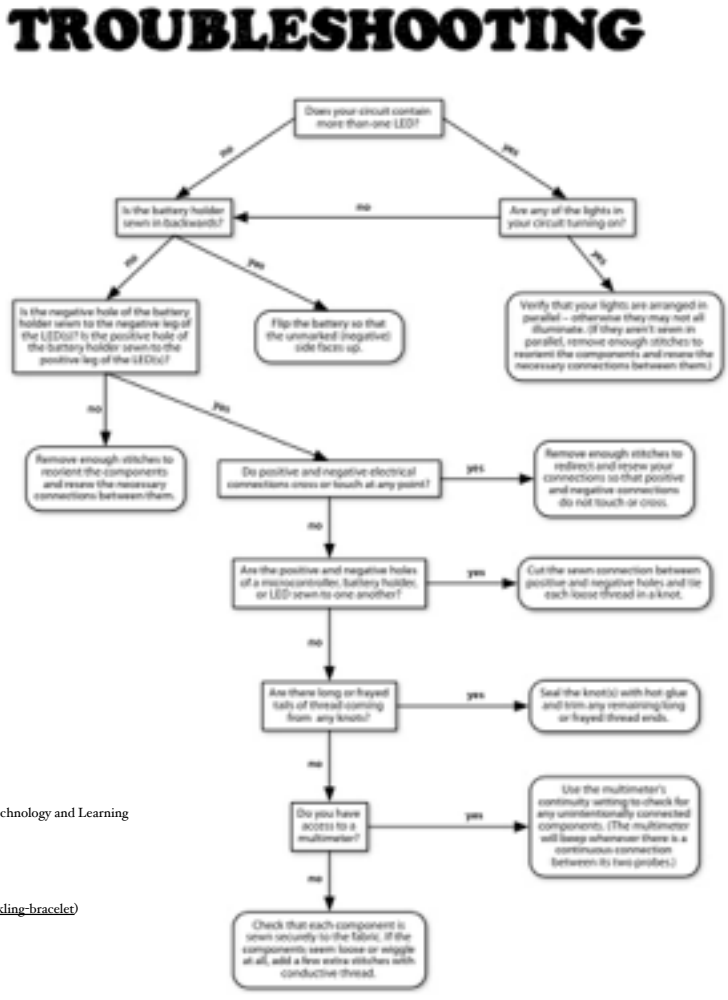


8) Have the students draw their design with the electrical connections and placements of all the components of their project on paper. (where will the LEDs, snap, and LilyTiny go? How will all the LEDs connect to the LilyTiny and battery holder?)

9) Have the students begin attaching the components to the fabric with a tiny bit of hot glue (making sure not to cover the pin holes) and begin sewing their design.

Troubleshooting Tips:

- Keep your stitches as close together as possible to keep them in place when you pull on the fabric
- Conductive thread tends to fray, so if circuit isn't functioning, check for spots where thread has frayed
- Remember to connect positive to positive and negative to negative
- Knots that are tied with conductive thread may not stay in place permanently on their own. Secure knots by dabbing them in hot glue to insulate loose ends.
- Avoid cutting conductive thread over work because the fibers create shorts later
- For good connections, make at least 3 loops of thread through the attachment point, pulling the thread snug.
- Avoid short circuits by preventing positive and negative traces from touching or overlapping.
- Color code your positive line and negative line when designing to avoid confusion. For example, black for the negative line, and red for the positive line.



References:

Utah State University Instructional Technology and Learning Sciences

www.learn.sparkfun.com/tutorials

www.sewelectric.org/diy-projects/sparkling-bracelet)