

Step 1: Simple Electronic Map



Have you ever looked at a map and wanted a quick way to know where a particular business, subway station, or landmark is located? Electronic maps, like the one shown in Figure at Boston's Museum of Science, use lights to mark the positions of local landmarks. Each button on the panel in front of the map corresponds to a location in Eastern Massachusetts. When you press the button for a particular location, its spot on the map lights up.

In this unit, you will make your own electronic map. In Challenge 1, you will construct the map board. In Challenge 2, you will add the electronic components.

Step 2: Set Up the Map Board



Challenge 1 involves printing out or drawing an image for your electronic map and affixing this image to a piece of foam board.

Collecting Your Components

In order to complete the electronic map project, you will need the following components (shown in Figure):

Part Quantity Description

A 1 Battery pack

B 3-15 LEDs (assorted colors)

C 3-15 Button switches

D 1 Foam board (12-inch by 12-inch piece)

E 8-12 390-Ohm resistor

F 3 Machine screws (1/2-inch, 4-40)

G 3 Machine screw nuts (1/2-inch, 4-40)

H 3 Washers

I 2 Spools of wire (1 black and 1 red)

J 1 Tape

Step 3: Tools



You will also need the following tools, shown in Figure:

Tool Quantity Description

A 1 Utility knife

B 1 Cutting mat

C 1 T square

D 1 Wire stripper

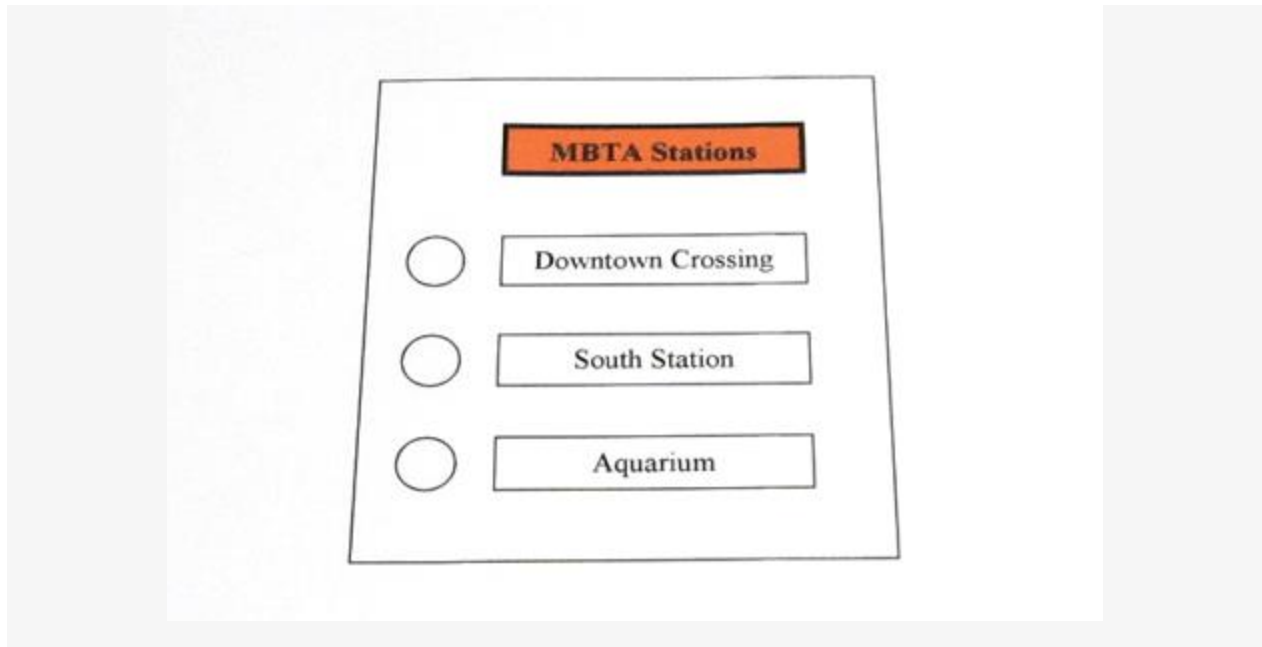
E 1 Scissors

F 1 Screwdriver

G 1 Sharpened Pencil

Step 4: Printing Out the Images





You can use any image you want for your map. Road maps and satellite images work well, but you could also use a building floor plan, a seating chart from a sports arena or theater, or any other appropriately sized image with specific locations you want to highlight. A map of downtown Boston, shown in Figure, is used in the project illustrations. A printable version of this map is available as pdfs below.

Once you have printed out your map, you will also need a set of three or more button labels, identifying specific locations on your map image. The labels used with the Boston map are shown in Figure, and a printable version is available as pdf below.

Step 5: Cutting Out the Base

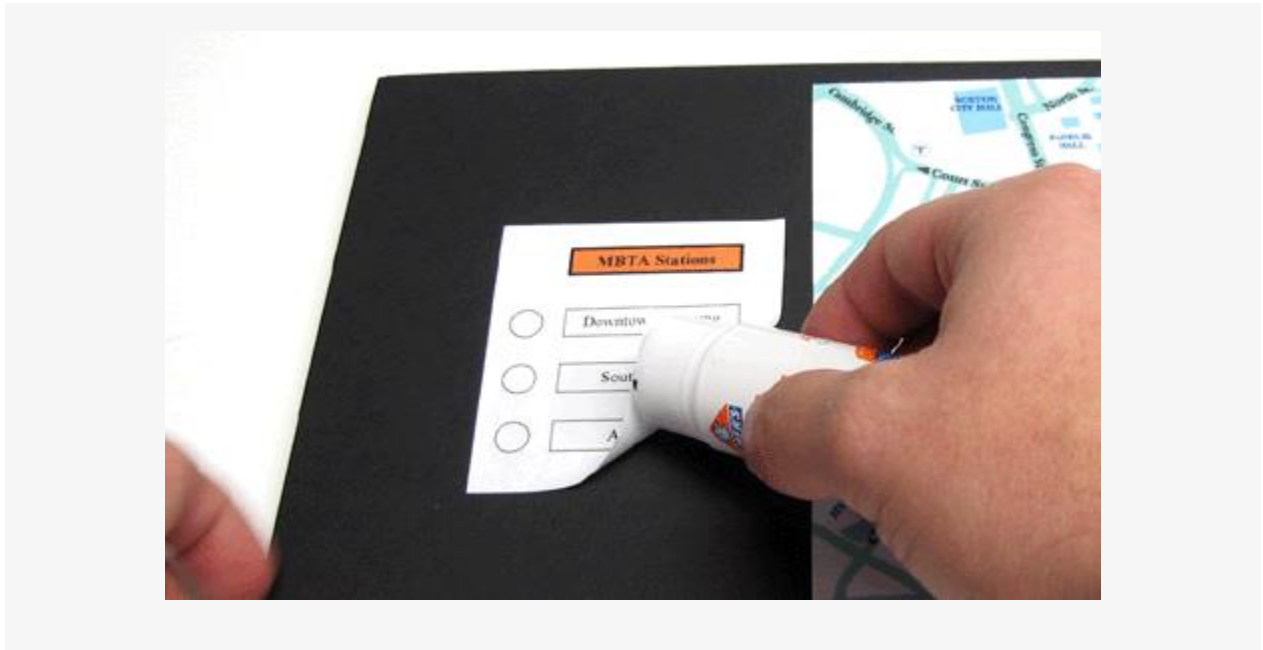


As a base for your map, you need a piece of foam board large enough to provide backing for your map and a set of labeled buttons. In some cases, you may need to cut this base piece from a larger piece of stock.

1. Using the metal T square or a metal ruler, measure your map image and your button labels.
2. Cut out a piece of foam board with room enough for the map image and the button labels. Protect your work surface with the cutting mat, as shown in the figure.

*Note: Please use a new sharp blade when cutting foam board; it will be easier to cut and you will avoid it catching.

Step 6: Applying the Map Image and Button Labels



Glue from a glue stick is used to affix the map image and button labels to the map base.

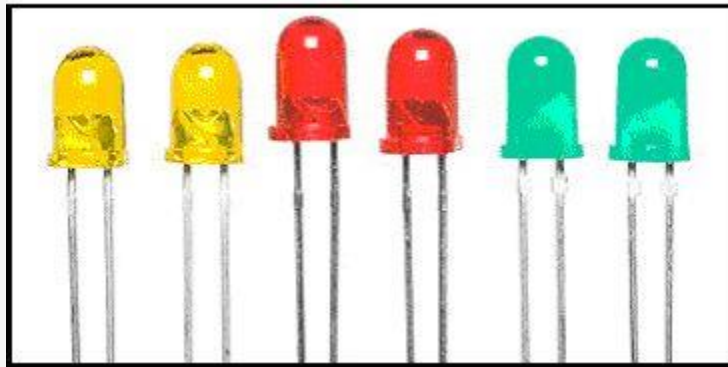
1. Glue the map image to one side of your map base, leaving room for the button labels, as shown in Figure.
2. Glue the button labels next to the map image as shown in Figure.

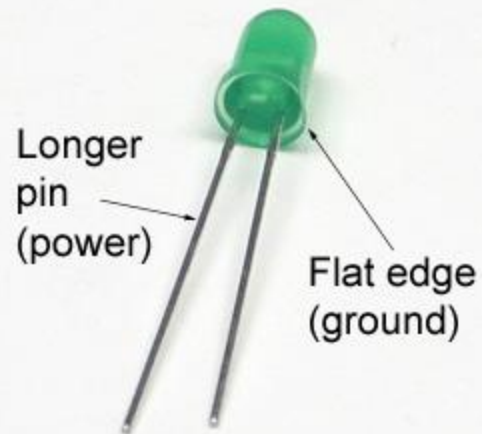
*Note: I used a glue stick, as opposed to spray adhesive, for safety reasons. Not all classrooms are properly ventilated.

Step 7: Add the Electronics

In Challenge 2, you will learn how LEDs work, and add LEDs and other electronic components to your map.

Step 8: About LEDs



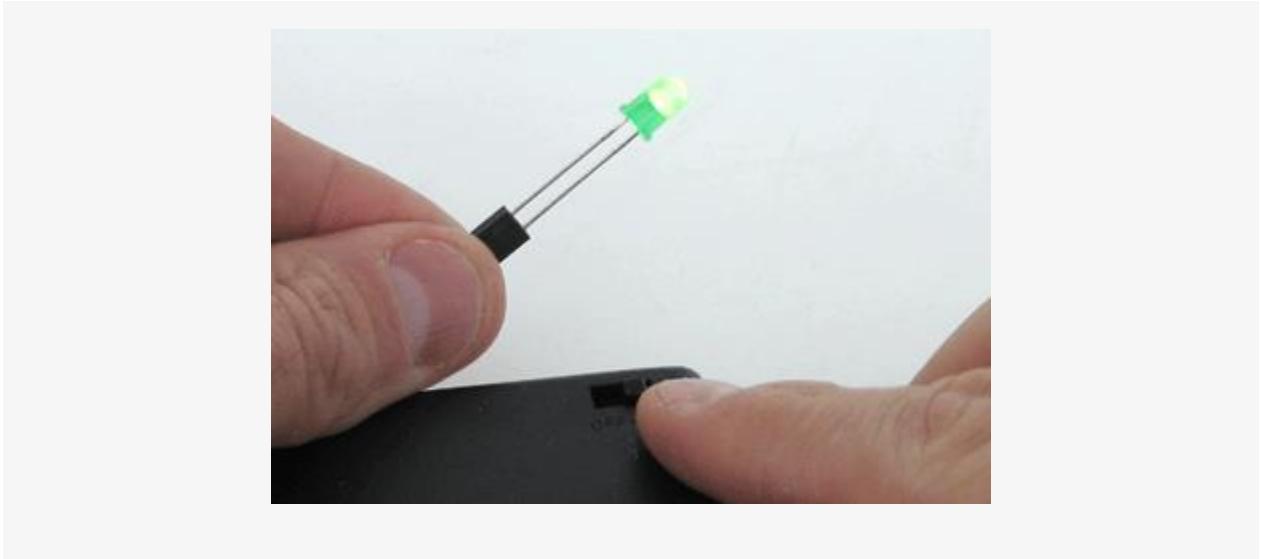


Light emitting diodes (LEDs) are like tiny light bulbs that emit light when electricity passes through them. The figure below shows yellow, red, and green LEDs.

Because LEDs require very little electricity, and last for thousands of hours, they are becoming increasingly common in electronic devices and other applications. Your computer keyboard probably has a few LEDs to indicate when the Caps Lock or Num Lock keys have been pressed. Grouped together, LEDs can produce enough light to be used as a source of household illumination, as in the lamp shown in figure below.

Every LED has a specific polarity, meaning one of its two pins must connect to the power side of the circuit and the other pin must connect to the ground side. A tiny flat segment on the round rim of the LED's circular base marks the ground pin. The power pin is typically longer than the ground pin, but this is an unreliable indicator, since the pins may be trimmed during installation. Figure below shows these distinguishing features.

Step 9: Lighting an LED



Now that you know a little bit about LEDs, you are ready to try lighting an LED.

1. Make sure the power switch on the battery pack is in the OFF position.
2. Insert the LED's power pin into the red wire side of the wire harness.
3. Insert the LED's ground pin into the black wire side of the wire harness.
4. Move the switch on the battery pack to the ON position. The LED should light, as shown in the figure below. If it does not light, check the polarity.

Step 10: Adding Terminal Screws to the Board



Three machine screws provide points of connection, or terminals, for the map's electronic components. Two of these screws should be positioned to the left of the button labels, and one should be placed directly beneath the button labels.

1. Using a screwdriver, puncture the foam board at the location of each of the three terminal screws.
2. Add the three machine screws, securing each with a washer on top and a nut on the bottom, as shown in Figure.

Step 11: Installing the Button Switches



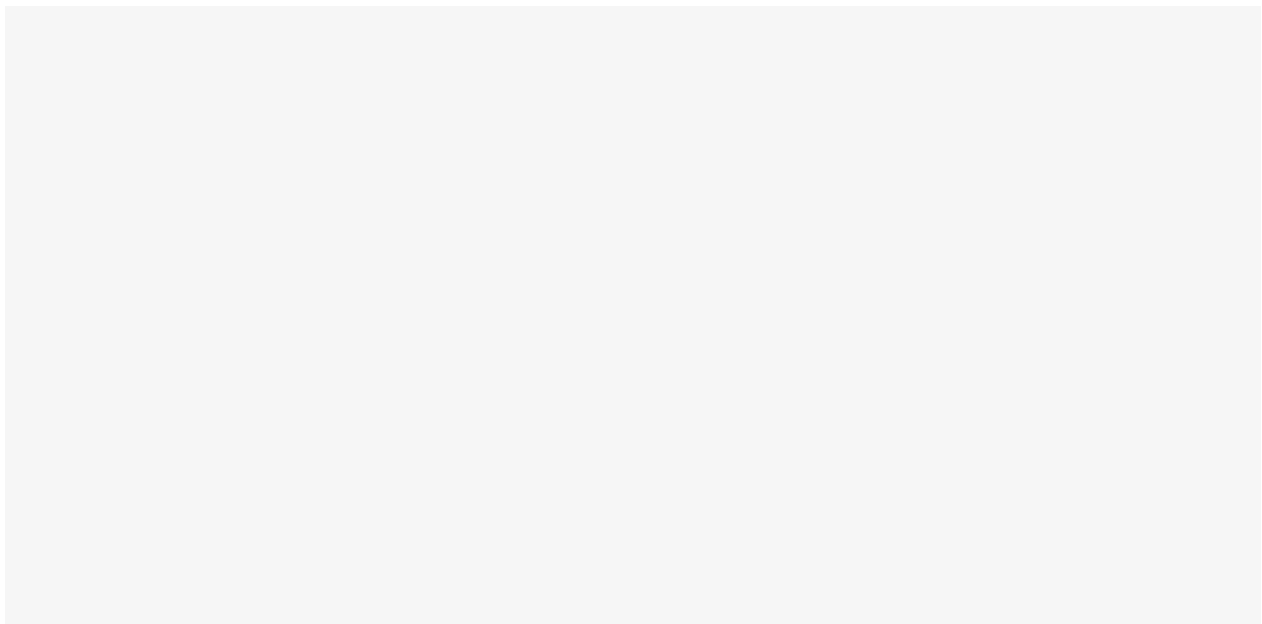
1. Using a screwdriver or a pencil, puncture the foam board at the location of each switch, as shown in Figure.
2. Add the switches, securing each with a nut on the top, as shown in Figure. (NOTE: You may need to compress the foam board slightly to thread the nuts securely onto the button switches.)

Step 12: Installing the LEDs



The LEDs should be positioned on the map board to highlight your selected locations.

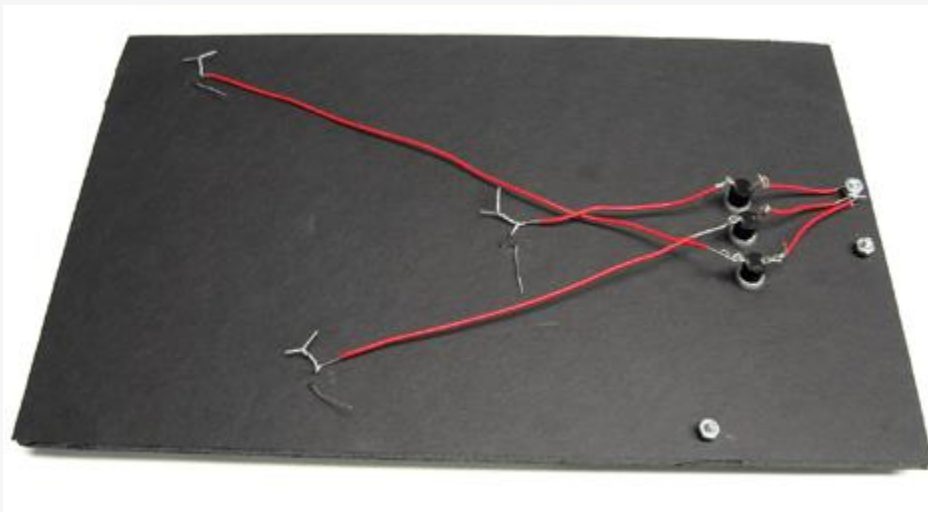
1. Using a screwdriver or other tool, make a small puncture in the map panel where you want to position the LEDs.
2. Push the LED pins through the panel and bend them apart slightly to secure the LEDs in place, as shown in figure below.



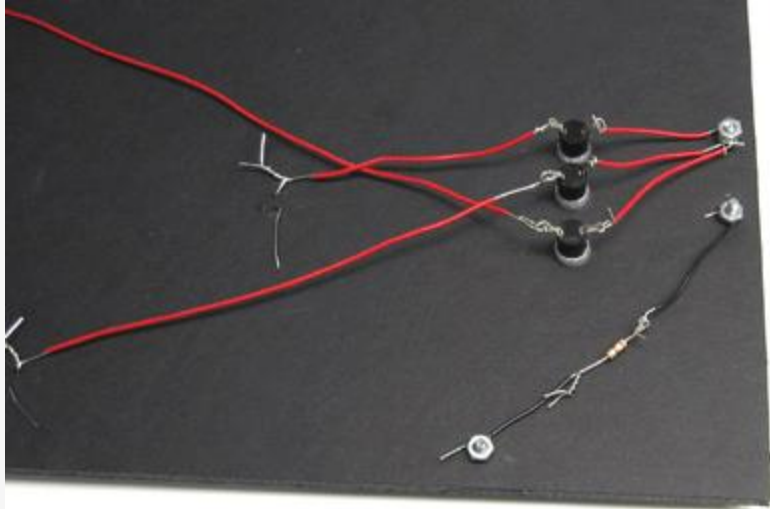
13: Making the Electrical Connections



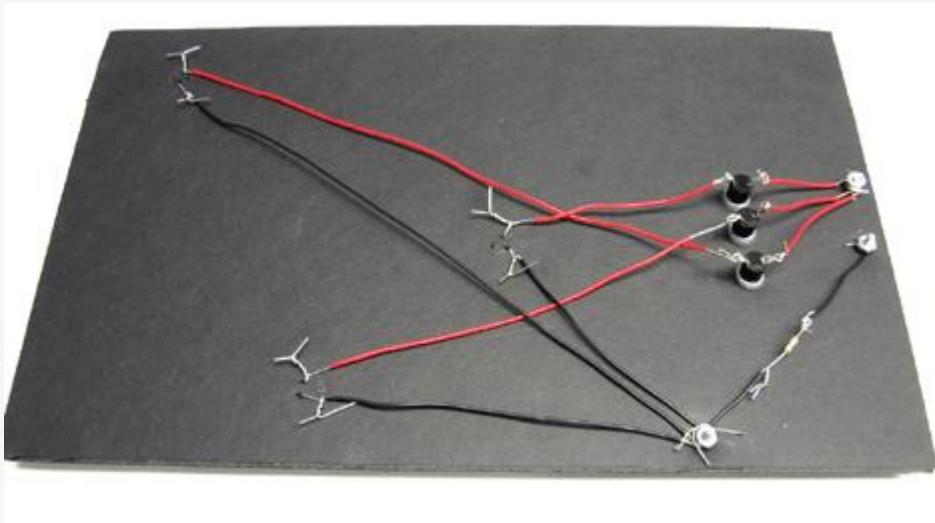
1. Using short lengths of red wire, connect one of the two terminals next to the map labels to each of the buttons, as shown in Figure below. This will be the power terminal.



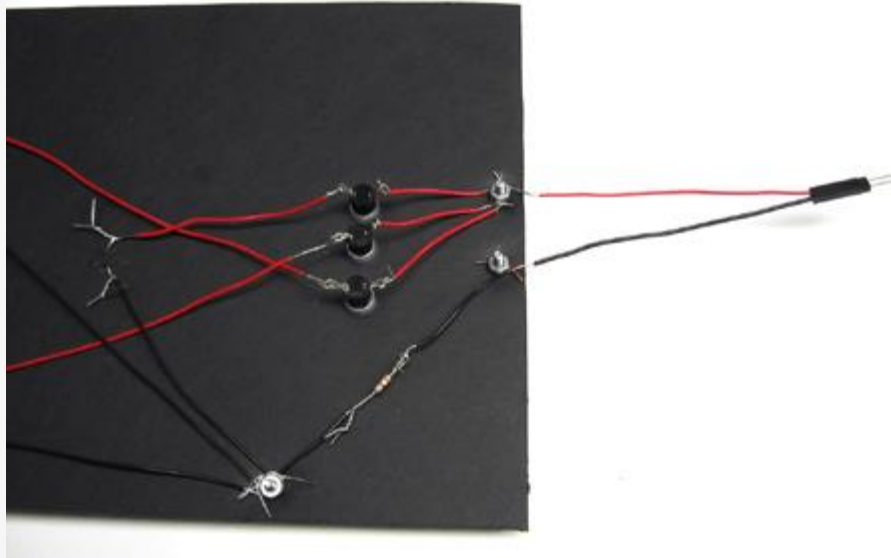
2. With longer lengths of red wire, connect the open side of each button to the power pin of the appropriate LED, as shown in Figure. (NOTE: Be sure to match buttons to LEDs correctly! You may want to label the buttons and LEDs on the back.)



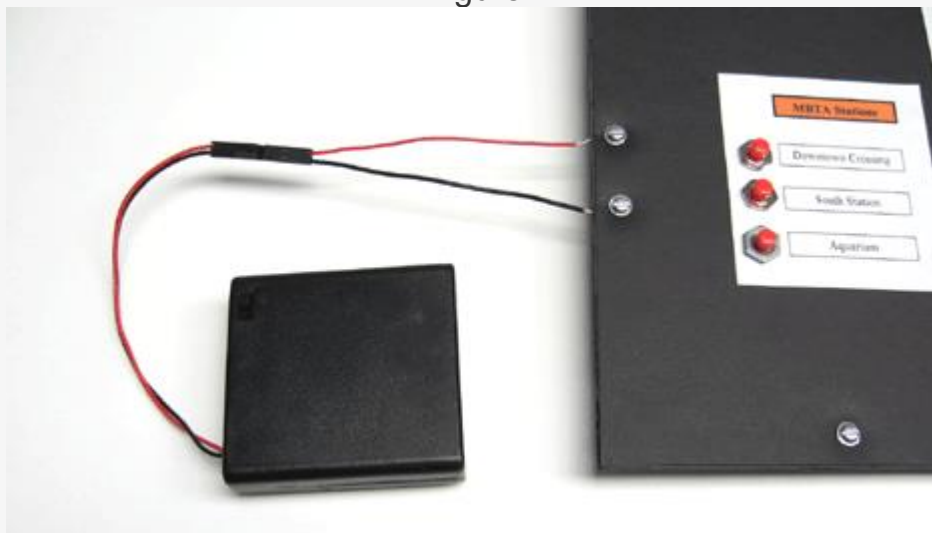
3. Using two short lengths of black wire and a resistor, connect the two open terminals, as shown in Figure. These will be your ground terminals.



4. With longer lengths of black wire, connect the ground pins of the LEDs to the terminal screw beneath the map labels, as shown in Figure.



5. Connect the red and black battery lead extensions to the board, as shown in Figure



6. Finally, connect the battery pack to the battery lead extensions, as shown in Figure.

With your buttons, LEDs, and terminals installed, you are ready to connect these components on the back of the board.

Step 14: Using Your Map



Turn on the battery pack, plug in the jump wire cables, and test your electronic map!