

# Example Project: Night Light

## Collect Materials

Collect any construction materials that you think would be useful for building a night light. Check your recycling bins for paper or cardboard, and ask your teacher if he or she has extra manilla folders. While you're home tonight, look for cardboard, egg crates, and different types of paper or plastic that you could use to make your night light.

### Some materials that work well:

Manilla Folders

Plastic Cups

Construction Paper

Egg Crates

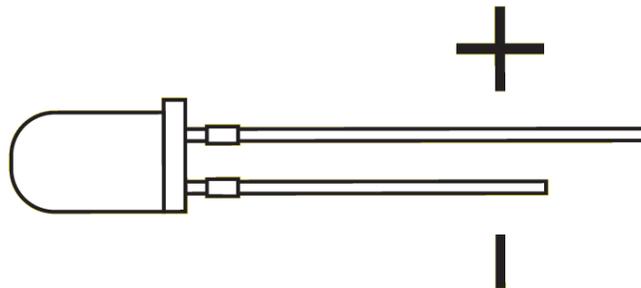
Sheets of Stickers

Milk Jugs

## Hooking up an LED

**Note:** Your Galileo should be unplugged at this time.

Before you make your night light, it's a great idea to build and test the electronics first. Then you can use your working electronics to try out various materials and designs. The first thing that you'll do is hook up and control a Light Emitting Diode (LED). LEDs look like plastic gum drops (but don't eat them!)



You will notice that one leg of the LED is longer than the other. LEDs are "polarized" which means that they will only work when hooked up in the proper direction. The longer leg is called the "anode" and is always connected to the positive side of a circuit. The shorter leg is called the "cathode" and is always connected to the negative or "ground" side of a circuit. If you put an LED into a circuit backwards it won't work, but this usually won't hurt it, and you can reverse it to fix the problem.

To help us hook things up to the Galileo we'll use the red ProtoCAT Shield. Plug the ProtoCAT Shield into the Galileo so it looks like this picture. (Ask for help if you're not sure how to do it). The ProtoCAT Shield gives us plenty of places to connect and control electronic parts like LEDs.



Grab two jumper wires, one black and one red. Find the longer leg of the LED (the anode), and plug it into the red wire. Now plug the shorter leg (the cathode) into the black wire. Make sure that the wires are tightly pressed on to the LED so that they're not loose and won't fall off. Your LED should now have two wires coming off it, one from each leg. In the next step, we'll connect the other ends of the wires to the protocat shield.

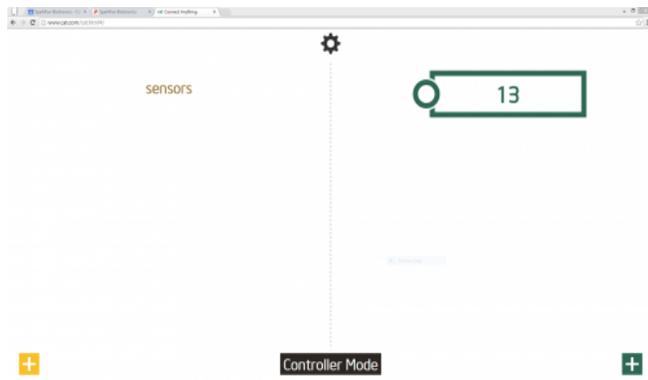


Take a close look at the shield. You will find that there are many rows of small metal pins sticking out of it. These rows are numbered; one side is numbered from 2 to 13 with an RX and TX at the bottom. The other side is labeled A0 to A5. The A0-A5 side of the shield is used for "inputs" (switches, sensors, etc.), and the 2-13 side of the shield is used for "outputs" (LEDs, motors, etc.). For your night light, you will be using output number 13.

You'll see that each row consists of 3 pins. From inside out the pins are "ground" (GND), "power" (PWR) and "signal" (SIG). Take your LED with the red and black wires dangling off it, and plug the BLACK wire into the GND pin on row 13. The red wire is the signal wire, so plug it into the SIG pin on the same row. Now we're all hooked up! One word of warning: if you hook your LED up to PWR and GND, your LED will light up, but it will get too much current, burn out, and you won't be able to use it anymore. **Double-check that you are hooked up to GND and SIG, and not PWR!** Refer to your placemat for the wiring diagram.

## Connecting to Connect Anything

Go ahead and power up the Galileo by plugging it into the included power supply. You'll see the LEDs on the Galileo flickering; this is normal. The Galileo is a small computer, and it is just booting up. It takes about 2 minutes for the Galileo to boot. After 3 minutes, use your laptop to check for a new wireless network coming from the Galileo. The network name that you're looking for will be written on your placemat under the "Wifi" heading. Go ahead and connect to that network.



Once connected, open a web browser (Chrome or Firefox), and navigate to "cat.com". If you get the heavy machinery company, double check that you're connected to the Galileo's wireless network and try again. You should land on a web page that looks like this:

Go ahead and click on the "Controller Mode" button. This will take you to a different page with a single green button that has a 13 on it. This is "Controller Mode", which is essentially like a remote control for your Galileo. Click on the green "13" button. Your LED should turn on. Click on it again to turn the LED off. Awesome!

### If your LED doesn't turn on, here are a few things to check:

- Double-check your wiring. The longer leg of the LED (the anode) should be connected to the red wire, and then to the SIG pin in row 13.
- The shorter leg of the LED (the cathode) should be connected to the black wire, and then to the GND pin in row 13.
- You can also try a different LED; you might have gotten one that's burned out.
- Check the D13 LED on the ProtoCAT Shield, it is pre-wired to pin 13.

Is it all working? Congratulations! You have successfully used Connect Anything!

## Hooking up a Light Sensor

A remote controlled LED is great, but it would be a pain to use it as a night light, which is supposed to turn itself on and off automatically. What you need is a light sensor! A light sensor can tell whether the room is bright or dark. Find the light sensor in your kit. It is the smallest red circuit board and has three pins. The pins are signal (SIG), Ground (GND) and Power (VCC). Power and ground provide power to the sensor, and SIG is the sensor output (light level).



Get three more jumper wires, in red, black and yellow. Now find the row of pins marked A0 on your shield. Use the black wire to connect GND on the light sensor to GND on row A0. Now use the red wire to connect "VCC" on the light sensor to PWR on row A0. Finally use the yellow wire to connect "SIG" on the light sensor to "SIG" on row A0. Your Galileo should be hooked up like the picture on your placemat, with the light sensor connected to row A0 on the input side, and your LED connected to row 13 on the output side.

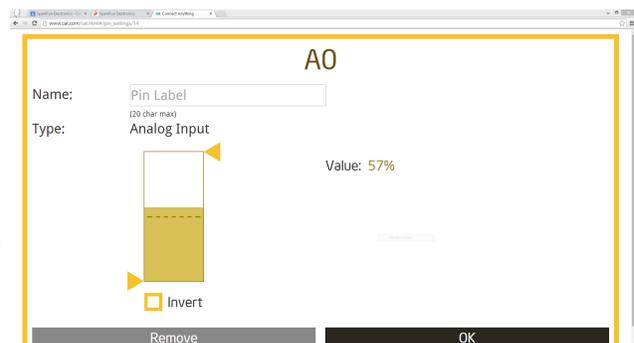
## Connect AnyThing Programming

You have one last step, which is telling the Galileo that the light sensor should control the LED. Return to Connect AnyThing in your browser. If you are still in Controller Mode switch back to Configure Mode and you should see what you did when you first got to cat.com.

You need to tell the Galileo that you've added a sensor to your system. You can do that by clicking on the small yellow plus sign in the lower left hand corner. You are then shown an array of buttons to choose from. Select A0 and then return to Configure Mode. You should now see A0 on the left hand side of your browser window. Move your hand over your light sensor. As the light level changes you should see the background of the A0 box act like a bar graph and move up and down.



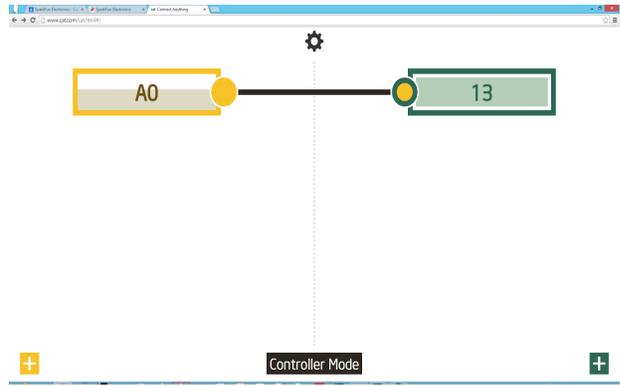
Double click on the A0 box. This opens the configuration window for your sensor. Here you can name the sensor, change the threshold, and invert the output if necessary.



The dotted line is the "threshold" for the sensor. If the bar graph breaks the line, then it will make an output go on or off. Move the arrows up and down to change the threshold. Right now the output is turning on when the light sensor sees light, but for your nightlight you want

the output to turn on when it gets dark. To do this, select the “invert” option. Invert reverses the output so that it will turn on when it gets dark. Shade the light sensor with your hand, and play with the threshold setting to find a good value for your nightlight. When you’re done, select “OK”, and return to Configure Mode.

Now we need to tell the Galileo that the light sensor input (pin A0) will control the LED’s output (pin 13). To connect an Input to an output, click on the input and then click on the output. Once you do that, a line will connect the two. Now when you place your hand over the light sensor, you should see the A0 gauge go up, and when it gets dark enough the LED will turn on. When the light level goes up, the gauge will go down, and when it drops below the threshold the LED will turn off. Yeah! You have built the guts of your nightlight!



### If your nightlight does not work, try these things:

- Check your wiring. Does your LED work in Controller Mode? Do you see A0 change?
- Open A0 in configure mode and change the threshold settings.
- Is it inverted? It should be!

Is it all working? Congratulations! You’ve connected an input (the light sensor) to the Galileo, adjusted a threshold, and use it to control an output (the LED). With these same steps, you can use computers like the Galileo to control all kinds of things!

### Creating your Nightlight

Now that you have the electronics working, it’s time to get creative! Use the craft materials that you gathered up to create a cool nightlight with the system you just built. Build a nightlight that is artistic and creative! You could design a scary one that gives you nightmares or one that looks like a campfire.

