

# Solar Powered Owl Blinky LED Pendant Jewelry

by [lumenjewelry](#) on May 12, 2013



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We're life-long tinkerers, siblings, and fourth generation engineers. We're not quite sure which of us had the idea of putting LED's on jewelry and powering them with solar cells, but once Marty proved it could be done there was no stopping us. That idea became Lumen Electronic Jewelry. Marty is now the Chief Geek, Robin is the Design Diva.

## Intro: Solar Powered Owl Blinky LED Pendant Jewelry

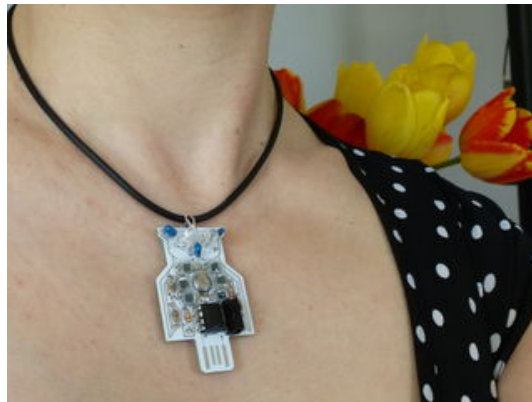
This instructable is for solar powered Owl with amber LEDs for eyes. It measures about 2" by 1.25", including the USB tab. It has one hole through the top of the board, making hanging easy. Wear it as a necklace, earrings, bond on a pin, or hang it in a window. The possibilities are up to you, and we'd love to see what you do with them.

The schematic and parts list are included. You are welcome to wire up your own, copying is the sincerest form of flattery. We also have the kit available in our [Store](#).

If you have soldered projects before, this will be easy. There are only 19 pieces to solder onto the board, and all but one is through hole. Depending on your soldering savvy it may take anywhere from 30 to 45 min.

So lets begin!

[Owl Kit01.mp4](#) from [Robin Lawson](#) on [Vimeo](#).



## Step 1: Tools

Here's what you need:

- A soldering iron
- Solder
- Diagonal cutters

Helping hands are optional, but helpful.



**Image Notes**

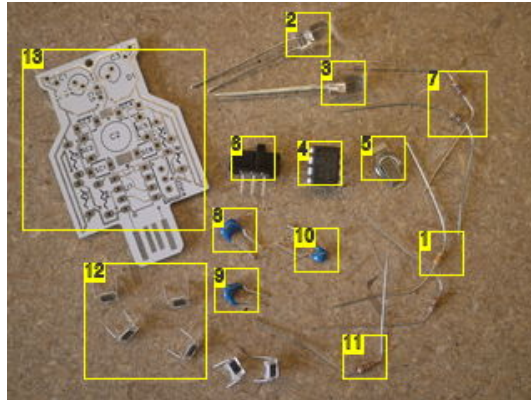
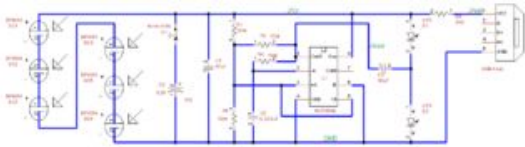
- 1. Soldering Iron
- 2. Solder
- 3. Diagonal cutters
- 4. Helping Hands

**Step 2: Schematic and Parts List**

Schematic is above.

Parts list is below, in the suggested order of assembly.

- C1 - 47uF ceramic capacitor (medium blue one)
- C3 -10uF ceramic capacitor (little blue one)
- C5 - 0.033uF Timing capacitor (TINY tan one)
- U1 - MCP6542 dual micro-amp comparitor
- SC1 through SC6 - BPW34 photo-diode
- R6 - 330ohm resistor
- R1, R3, R4, R5 - 10M resistor
- D1 and D2 - amber LED to blink
- Switch - SPDT switch 3-pin 0.1 spaced
- C2 - 0.022F coin super cap



**Image Notes**

- 1. R6
- 2. LED
- 3. LED
- 4. Chip
- 5. Storage Cap
- 6. Switch
- 7. Resistors
- 8. C1
- 9. C3
- 10. C5, may be Tan in your kit
- 11. Resistor
- 12. Photo Diodes (mini solar cells)
- 13. Owl Circuit Board

### Step 3: Capacitors

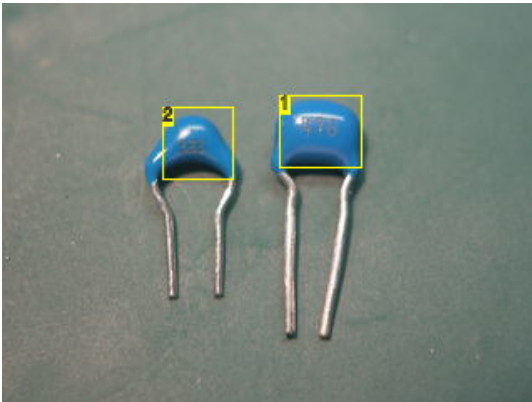
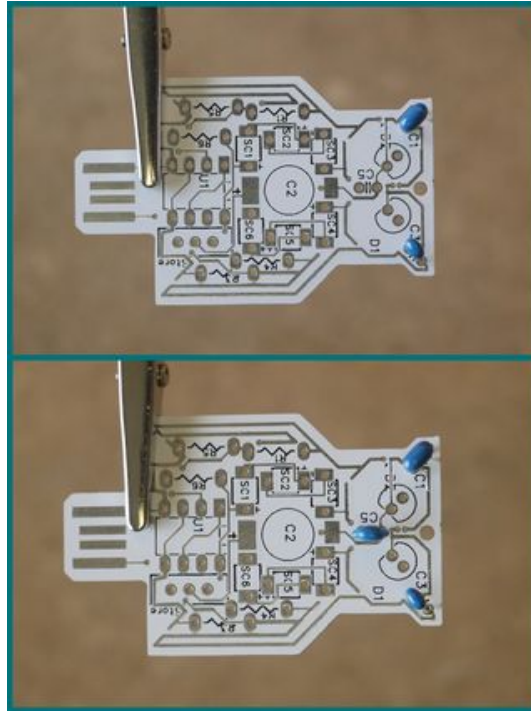
Start with the three small caps. You may need to bend the leads to make them fit. They may all look similar, but it is important that the correct one go in the correct slot. BTW, they don't have a polarity, so once you figure out which is which you can't get it backwards. Below is a short description of how to read the numbers on them, but for more detail check out this [cool electronics wiki](#).

C1 is the medium one. The tiny numbers on it read "476". The first two digits are the value, the third is the multiplier. Capacitors are measured in pico-Farads. So 476 is  $47 \times 10^6$  pico-farads.

C3 is little, and has 106 written on the side.

C5 is TINY and has 333 written on the side. Our picture shows a blue capacitor, your kit may have a Tan one. We switched the color so it isn't confused with C3.

Solder on the top side as shown.



#### Image Notes

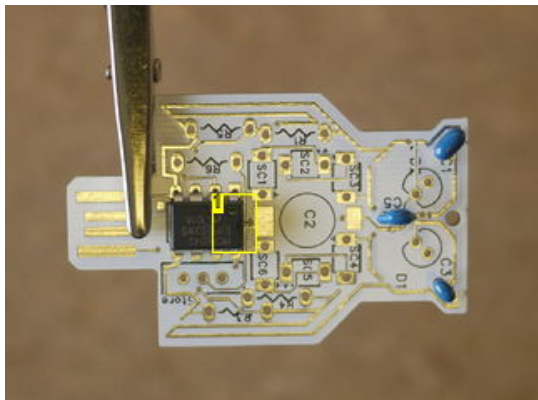
1. C1
2. C3

### Step 4: Chip

Next the chip. Be very careful of stray electric shocks, they may fry the chip. We know this from experience, ouch. Ground yourself before handling the chip by touching a large metal object first. We find the bolts on outlets are usually grounded, and often nearby.

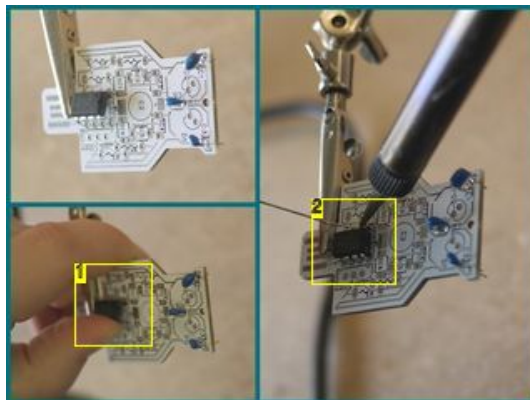
Line up the chip on the board, U1. The cutout on the chip should match the square on top of the board chip footprint. You can see it in the picture. You may have to squeeze the leads on each side to get it to snap in.

Solder on top as usual.



#### Image Notes

1. Top of chip



#### Image Notes

1. Bend the leads to slide it in.
2. Soldering

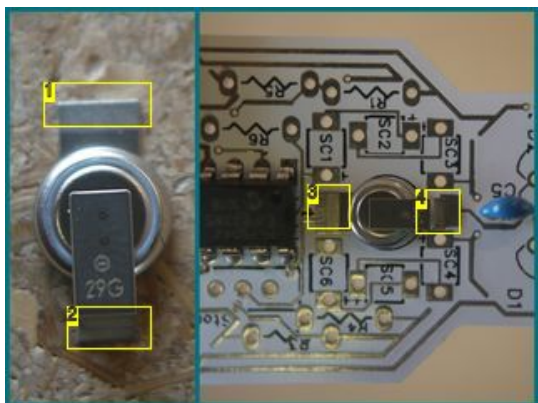
### Step 5: Super Cap

Next the SUPER CAPACITOR! This puppy will keep your cute little owl blinky for 90 minutes after dark. The orientation on this one does matter, but we've made it super simple. Depending on your kit you may have a silver or a black super cap. The manufacturer discontinued the silver one, so we substituted the black one. It BARELY fits on older board revisions, but on the new revisions it goes right through the board (labeled ThroughOwl 5002 on the back).

1. Silver super cap: The large cap tab goes on the large board pad, and the small cap tab goes on the small board pad.

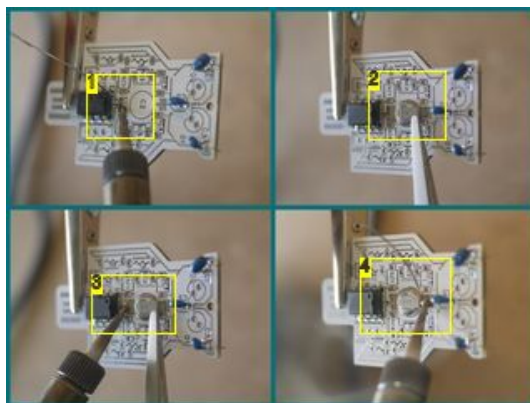
2. Black super cap: Bend the leads out as shown and trim them so they fit on the pads. It will be a tight fit, so we recommend putting the photo diodes (next step) into their locations first. The negative lead is on top of the super cap and marked with a tiny minus sign in a circle. This lead connects to the top pad, the one underneath connects to the bottom pad.

Because this is surface mount, we recommend first adding solder to the pad on the board. Then using a tweezers or pliers, hold the cap in place while melting the solder. Once this has solidified, solder on the other tab. You can go back and add a little solder to the first tab to make it nicer if you want.



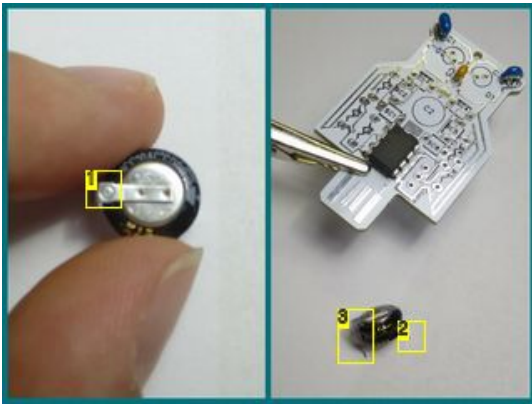
#### Image Notes

1. Large cap tab
2. Small cap tab
3. Large cap tab, unsoldered
4. Small cap tab, unsoldered

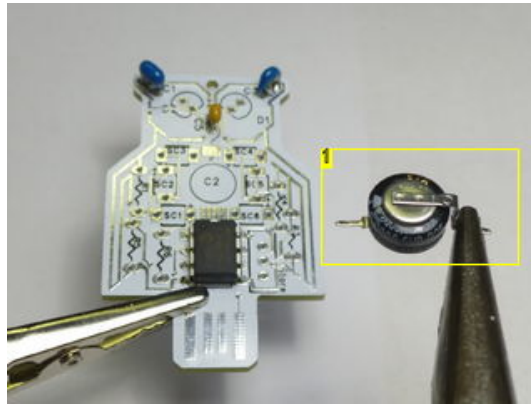


#### Image Notes

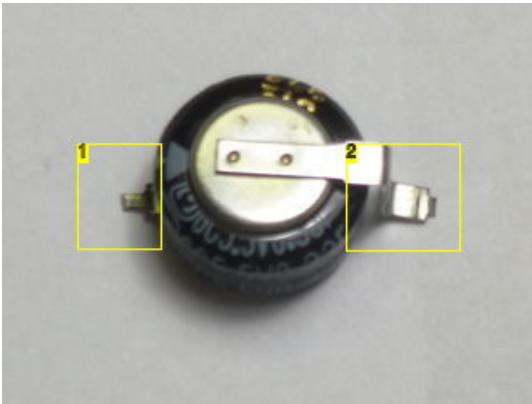
1. Solder on board tab
2. Hold cap in place with tweezers.
3. Melt solder pad
4. Solder other end of the cap onto the board



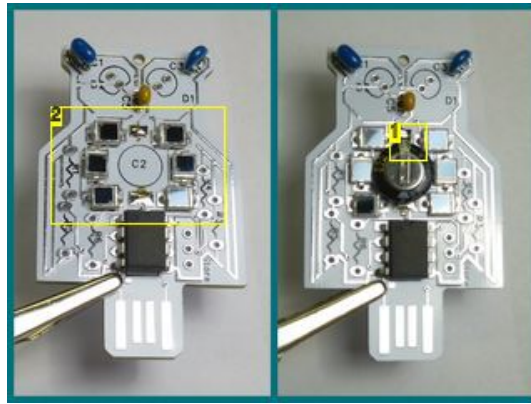
**Image Notes**  
 1. Negative lead  
 2. positive  
 3. negative



**Image Notes**  
 1. Bend leads flat



**Image Notes**  
 1. Trim leads  
 2. trim leads



**Image Notes**  
 1. negative up  
 2. put in photo-diodes, the cap is a tight fit

### Step 6: Photo-diodes (AKA Mini solar cells)

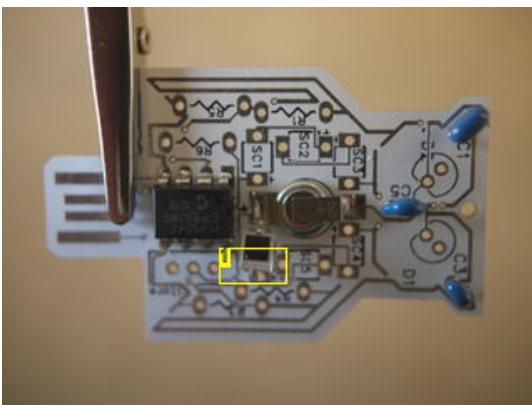
Next the photo-diodes, aka the mini solar cells. It really REALLY matters that these are put in correctly, and we have two revisions of the board. Look at the back of your board.

1. If it is labeled "ThroughOwl 5001" or "ThroughOwl01", it is revision one.
2. If it is labeled "ThroughOwl 5002", it is revision two.

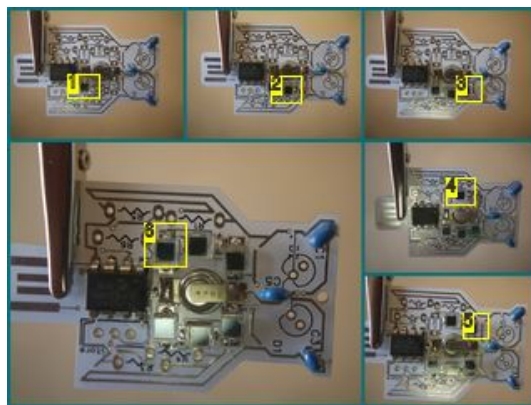
Regardless of your revision, the positive end of each photodiode is marked on the board with a +. The positive on the photo-diode has a TINY dot, as well as a metal end which turns into the pin.

Match that up with the + on SC1 through SC6. Like with the switch, you may have to gently squeeze the leads together to make it slide into the holes. Solder them on from the top one at a time.

Tip - Because they are so tightly packed together, it may be easier to solder SC2 and SC5 before the other two.

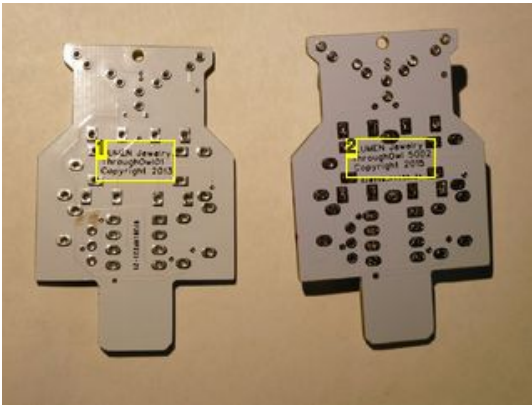


**Image Notes**  
 1. Positive end. Tiny dot and metal end.

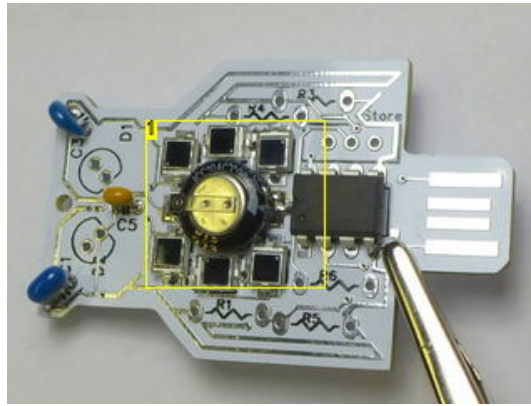


**Image Notes**  
 1. SC6

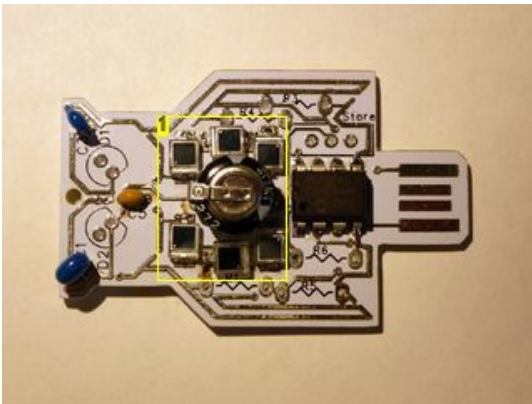
2. SC5
3. SC4
4. SC2
5. SC3
6. SC6. You're done.



**Image Notes**  
 1. Revision 1  
 2. Revision 2



**Image Notes**  
 1. Revision 1 photo-diode orientations.



**Image Notes**  
 1. Revision 2 Photo-diodes

## Step 7: Resistors

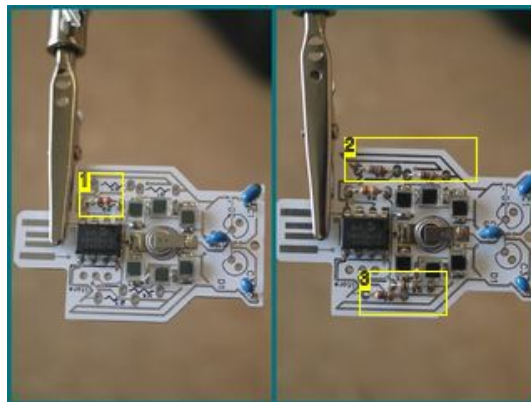
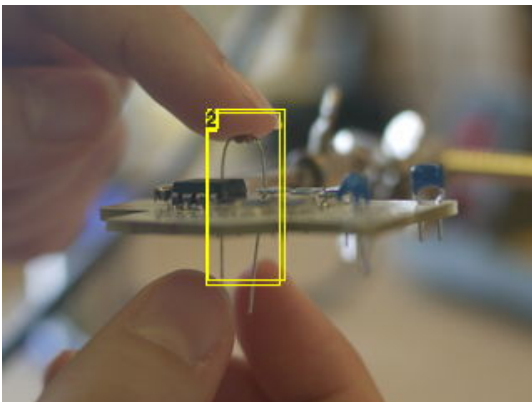
Next the resistors. They don't care which direction. Bend the leads so they fit, and pull them through the board so they are nice and tight.

We recommend starting with with R6, its the orange odd one out. Check out this handy dandy link for how to read resistors. Unfortunately, they are tough for color blind people to decipher. But, I hear there is an App for that. ;)

Again, solder from the top.

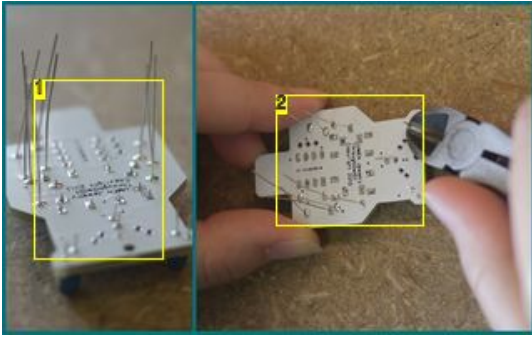
The remaining 4 resistors are all the same, brown black. Pull them through and solder them from the top.

We recommend flipping it over and trimming the leads at this point.



### Image Notes

1. Pulling resistor through
2. Pulling resistor through



### Image Notes

1. Flip
2. Trim

### Image Notes

1. R6
2. Resistors
3. Resistors

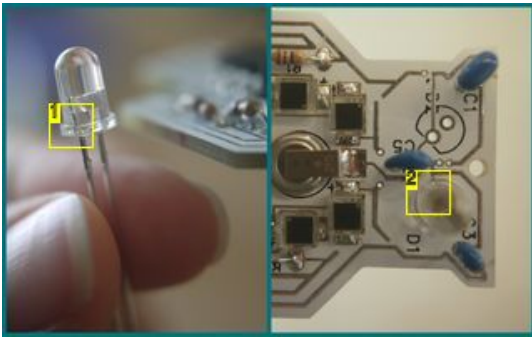
## Step 8: LED! Blinky!

Now for the fun part, the blinky bits! D1 and D2 are the amber blinky LED. It is also important that they be soldered in correctly. But luckily it is easy to tell the polarity. The circle around their holes has a flat side. Line that up with the flat on the LED and you have the polarity correct.

You can also install the switch at the same time as the LED's. It doesn't matter which way you put it in. One warning, the switch is made of low temperature plastic, so it will easily melt if the soldering iron touches it. By this time you should be a pro at soldering so I wouldn't worry too much about overheating the pins and melting the switch.

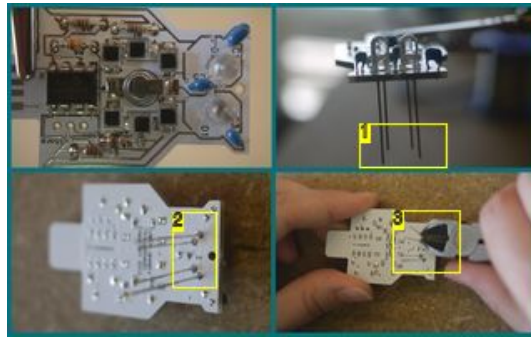
We recommend soldering while upside down, as the LED and switch cover the pads on the top. Flip it over and solder it on.

What is the best part about this step? You're done! AND if you are in a bright naturally lit room, and soldered it all correctly, IT WILL NOW BLINK! The LED's will run directly off the ambient light collected by the photo-diodes. Or for even more power, stick the USB tab into any available socket and they'll REALLY shine. WINNING!



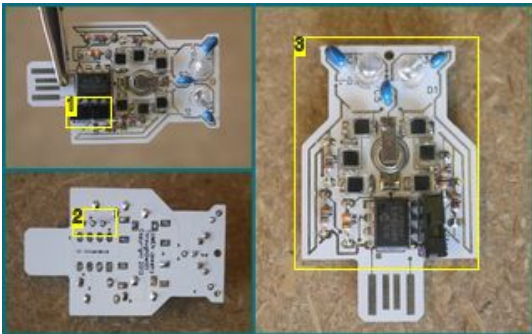
### Image Notes

1. LED flat
2. LED flat



### Image Notes

1. Notice the shorter leads are closer together.
2. Flip, solder
3. Trim



### Image Notes

1. Switch
2. Solder
3. You're Done!

## Step 9: FUNction!

The first time you charge your lovely owl we recommend conditioning the super caps. What does this mean? Charge it above and beyond full capacity and store this for a few hours. It keeps the caps from having a memory and undercharging. We also recommend cleaning off the flux with orange clean. The flux may corrode the leads over time. See the next step for details.

But you are probably impatient to PLAY WITH THE BLINKY!! We understand. The operation of the owl is super simple. It has two modes of behaving controlled by the switch. We call them "Store" and "Direct." Watch it in action below.

Owl kit02.mp4 from Robin Lawson on Vimeo.

How to play:

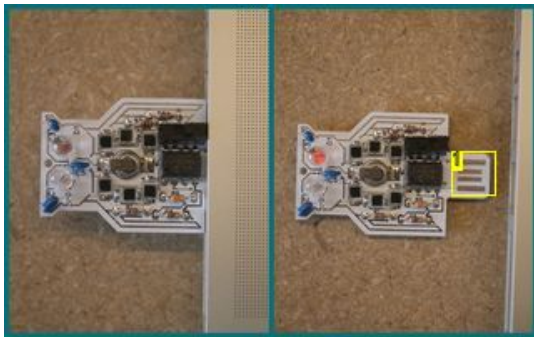
1. Switch into "Direct" mode (unlabeled). The owl now gets its energy directly off the surrounding light. If it's dark, NO blinky. If it's bright, blinky awesomeness for all!
2. Not all light sources are the same, have fun figuring out which ones make it wink.

How to charge:

1. Switch into "Store" mode (labeled).
    - a. USB – plug it in. Wait 2 minutes till its really, really bright. If the LED's are constant, its full.OR...
    - b. Solar – find a light source it likes and leave it under for 10-15 minutes. See step 2 of "How to play" to figure out what light it likes.
  2. Enjoy the blinky awesomeness now.
- Otherwise...
3. Store the charge for later by flipping the switch to "Direct".

Endurance: In "Store" mode the owl will run about 3 hours on a full charge in complete darkness. In "Direct" mode it'll blink as long as the room is bright. It's powered by SCIENCE!

Cleaning: Wash it with a warm damp soapy cloth. It may stop blinking when wet, don't panic. Let the owl dry out and it will start blinking. Do NOT put it in the dishwasher or washing machine (if you can help it). Both are too hot and may damage components.



### Image Notes

1. USB Tab

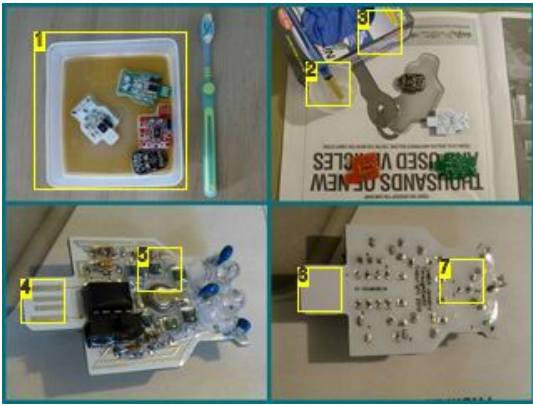
## Step 10: Extra Credit

You are welcome to string up your awesome owl as a necklace, pair of earrings, key chain, or simply window dressing. You can also bond a pin onto the back and wear it on a backpack or shirt. However, make sure there is an insulating layer of epoxy or glue between the metal pin and the back of the circuit board. The owl is very low power, and can easily be shorted out by touching the back (or sweating on it, ew.) A metal pin will short it out and then it won't work properly.

If you want to go the extra mile you can seal it in epoxy, which is easy to do. Here's how:

1. Clean it. Its best to remove the solder flux before sealing, so the flux doesn't discolor over time or corrode the metal.
  - a. The owl must be completely dead before cleaning. Let it run down overnight or in a dark place, and keep the switch in "Store". Then when cleaning flip the switch to "Direct" so it doesn't re-charge.
  - b. We recommend full strength orange clean and a toothbrush to remove all the flux. Scrub it thoroughly.
  - c. Rinse with cold water
  - d. Allow it to dry overnight.
2. After cleaning, do your best not to touch it with your fingers. Rubber gloves are recommended. The oil on your skin may discolor the metal, and interfere with the epoxy adhering to the parts and board.
3. Clear 5 or 10 min epoxy will work great for sealing. Just work fast, the epoxy gets gummy quick and hard to work with. We recommend mixing the epoxy in small batches, not more than an ounce. You can always mix up more if you need it.
4. Using a disposable brush seal one side. Avoid sealing the switch and USB tab. Everything else can be covered with epoxy and continue working, even the photo-diodes.
- 5 Allow the epoxy to completely cure. You'll know its done when it stops being sticky. This usually takes 12-24 hours, however don't be too impatient as un-cured epoxy will retain your finger prints. You want your blinky to be shiny don't you?
6. Repeat steps 4 and 5 for the other side. You're done!





**Image Notes**

1. Orange Clean
2. Epoxy and brush
3. Rubber gloves
4. No epoxy
5. Epoxy
6. No epoxy
7. Epoxy

