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Overview

Bliplace is a wearable, hackable, sound-activated blinky light toy. It uses a small microcontroller and a mix of hardware and software feedback to automatically synchronize with and adapt to the sounds around it – it should pulse along with the ambient noises around you no matter if you're in a quiet park or a thunderously loud concert.

Bliplace uses ubiquitous CR2032 coin-cell batteries, which should be available virtually anywhere. The average power draw of Bliplace is well under 2 milliamps – a single battery should power it for around 150 hours, or a week of continuous use.

The Bliplace design is open-source, and all code and design documents are freely available via <http://tanjent.com>

Parts List

- 1x Bliplace board
- 1 ATtiny25v microcontroller, pre-programmed
- 1 electret microphone (silver cylinder)
- 3 ultra-bright white LEDs (clear cylinders)
- 1 ceramic capacitor (yellow bead)
- 2 electrolytic capacitors (black cylinders)
- 5 resistors (beige bead with stripes)
- 1 black plastic battery holder
- 1 coin cell battery in a separate plastic bag

Tools you'll need

- A soldering iron
- A foot or so of flux-core solder (preferably the no-clean kind)
- A flush-cut wire cutter

Assembly Notes

First things first, let's make sure you've got the board right side up. The top side has all the part outlines & part names printed on it, the bottom side has the mounting hole labels and the outline of the battery holder on it. As we go through the assembly steps, you'll be matching each part with its outline, sticking its leads through the holes in the board, bending the leads down on the opposite side to hold the part in place, soldering it to the board, and finally clipping the excess leads off.

Step 1 – Mount Chip

Find your ATtiny chip in your parts bag and note that one corner of the chip has a small circle embossed on it. This circle matches up with the circle printed inside the rectangular chip outline in the center of the board. Insert the chip into the board and double-check that the embossed circle is at the bottom left - you really don't want to solder the chip in backwards as there's no easy way to undo it. Solder the chip into place and cut the leads as flush as possible against the board without cutting into the board itself.

Step 2 - Mount Resistors & Ceramic Capacitor

Orientation for these parts does not matter.

Bend the leads of the resistors close to the resistor body so the resistor forms a staple-like shape. Insert the resistors and capacitor into their marked locations until they sit flush with the board, then bend the leads flat against the board on the other side to hold them in place. Solder and clip all leads.

- R1, R3 = 1000 ohm resistor, stripe code Brown Black Red Gold
- R2 = 330 ohm resistor, stripe code Orange Orange Brown Gold
- RD, RU = 10000 ohm resistor, stripe code Brown Black Orange Gold
- CN = 0.1 uF ceramic capacitor

Step 3 - Mount LEDs, Microphone, and Electrolytic Capacitors

Orientation for these parts does matter. The long leads of the LEDs and capacitors go in the square holes on the board, and the microphone will only fit one way.

The two electrolytic capacitors look nearly identical so be sure to double-check their labels before mounting them. The mic leads are rather stubby - either tape the mic down while soldering or lay the board down on a flat surface to keep it steady. Solder and clip all leads.

- L1, L2, L3 - Ultra-bright white LED
- MIC - Electret microphone capsule
- CP - 47 uF, 6.3v electrolytic capacitor
- CC - 4.7 uF, 50v electrolytic capacitor

Step 4 - Smoke Test & Battery Holder

(Note - If you're planning on sewing your Bliplace onto clothing, or interfacing it with other electronics projects, you might want to leave the battery holder off - it'll be easier to hack without it.)

Now it's time to do a quick test before we mount the battery holder - Place the battery into the battery holder with the battery's printed side facing out. Then insert the battery holder so that it matches the outline printed on the board - it should be centered and not hanging off the side of the board. Hold the board with one hand and twist the battery holder with the other so that the pins make contact with the sides of their holes - the LEDs should light up, do a short test pattern, and then begin responding to sound.

If anything doesn't seem to work, go to the Troubleshooting section. If everything seems OK, remove the battery (squeeze the metal clip holding the battery in and it should pop out) and solder the battery holder leads into place from the front side of the board. Replace the battery, and you're done! Blinka blinka blinka!

Hacking Ideas

Here's some other fun stuff you can do with a Bliplace -

Sewing your Bliplace Onto Stuff, Or Connecting It To Other Stuff

The four large holes at the top and bottom of the board are there to allow you to sew your Bliplace onto clothing. They're large enough to pass a small needle - with some care and a reel of electrically-conductive thread, you can both bind the Bliplace to a shirt or jacket and power it at the same time.

The top two large holes can also be used to connect the board to an external power source. Anything from 2.6 to 5 volts will work, though the LEDs will be dim at 2.6.

The bottom two large holes are for line-level audio input - connect a cable here and you can plug your Bliplace into your iPod or whatnot.

Standard 22-gauge insulated wire will also fit through the mounting holes – run a loop of wire through a hole and you can wear your Bliplace as a necklace, just be sure not to short out the pins by connecting them to bare wire or anything metallic (a metal necklace chain would be a bad idea).

The side mounting holes can be used to reprogram the chip or to trigger external devices. The holes will accept standard 0.1" pin headers, so you can plug your Bliplace into a breadboard for experimentation. Follow the labels on the back of the board to connect it to any AVRISP-compatible in-circuit programmer - the chip should be programmed at a ISP rate of 125 khz or less, otherwise the firmware may be corrupted. The holes labeled MOSI, MISO, and SCK are connected to pins 5, 6, and 7 of the ATtiny and can be used as general-purpose I/O pins.

Making Your Bliplace Really Quite Excessively Bright

Bliplaces are already bright, but they can be hacked to be much, much brighter. Replacing the included R1/R2/R3 resistors with lower values will increase the amount of current going through the LEDs – they'll run brighter, but the batteries won't last as long. Resistor values down to 33 ohms should be fine, though the Bliplace's internal feedback loop may become unstable (the LEDs will pulse even if there's no sound) if the LEDs draw more than 5 milliamps of current - if you're going for max brightness you'll want to make the power supply capacitor CP bigger to keep things stable. There's enough room on the board that you should be able to squeeze up to 1000 uF of capacitance in there.

If you would like to use the Bliplace board to make even higher power loads blink (huge 5-watt white LEDs, fluorescent lights, barbecue grills), drive the load from a separate power supply and use a logic-level N-channel MOSFET to turn the load on and off. Connect the MOSFET source pin to the power supply ground, the MOSFET drain pin to the load ground, and the MOSFET gate pin to the Bliplace mounting hole labeled MISO. Then connect one of Bliplace's ground mounting holes to the power supply ground. When the Bliplace blinks, the load should turn on. Bliplaces have been used to sound-activate many many watts' worth of LEDs and random lightbulbs using this setup.

Other Ideas

With a bit of software modifications, Bliplace's microphone can be used as a button – when the microphone is touched or tapped, the sound of that tap shows up as a spike in the digitized audio signal. By adding some spike-detection code to Bliplace's main loop, you can make it change patterns or modes whenever the mic is tapped.

Troubleshooting

Before you freak out, double-check your soldering. There should be solid connections to all the chip, LED, capacitor, and resistor pins – from the back of the board, all the mounting holes should appear full of solder and any remaining bit of pin or lead should be completely covered. If the hole looks hollow, add a small drop of solder.

My Bliplace keeps blinking even when there's no sound to be heard

This is a known issue - after your Bliplace has been on for around half an hour it should stabilize. The problem in a nutshell is that the voltage of a brand-new battery is "wobbly" until it's been running for a while, and the wobble creates electrical noise that the Bliplace interprets as external sound.

Nothing happens when I insert the battery

Check that the battery is fully seated in the holder, flat side out. Check that the holder pins are making solid contact with their mounting holes. Check that the battery voltage is at least 2.6 volts. Check that the chip is oriented with the circular mark on the bottom left.

One of the LEDs doesn't light up

Check the orientation of the LEDs – Hold the board horizontally so that you're looking at the LEDs from the outside. In each LED you should see a small metal wedge - those wedges should be pointing RIGHT.

Check for shorts between the R1/R2/R3 resistors and neighboring pins. If you find a short, wipe it away with a clean soldering iron.

The LEDs light up, but the Bliplace doesn't seem to respond to sound

Check capacitor placement – the 47 microfarad capacitor goes on the left and the 4_point_7 microfarad capacitor goes on the right. The grey stripes on the capacitors should be on the LEFT.

Check the microphone - the resistance between the two microphone pins should be around 2,000 ohms. If it's less than 100, the microphone is probably shorted against something.

My Bliplace is still broken, what should I do?

If all your parts are mounted correctly, you've checked all your parts for shorts, and something is still broken - don't freak out, just e-mail me and let me know what went wrong. I should be able to walk you through fixing it or send you a few replacement parts.