

Low-cost Allergy Fighter

Red-light phototherapy: give it a go

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Allergies sadly are common and affect our daily lives, from the odd sneeze and watery eyes in full summer right up to skin rashes and debilitating migraine attacks. Desperate times call for desperate measures, and every sufferer of allergy will need to find, apply and tweak his or her personal medication or alternative treatment method. Electronics is all about thinking out of the (pill)box, so here we boldly add a DIY nasal red light to the range of not-so-common therapeutic devices.



Phototherapy—does it really work?

There are several portable devices out there to treat the effects of allergies like hay fever, by means of red light. Its creators claim that these treatments make the walls of the mast cells less penetrable, causing them to react slower to pollen and as a result less histamine is released. Some commercial examples of these gadgets are Medisana Medinose, Sinus Laser or Bionase (all trademarks acknowledged). Browsing the reviews, the overall opinion is favorable, with a lot of satisfied users. However all-positive reviews from a consumer audience triggers skepticism on part of electronic engineers always keen to reveal cases of the Placebo effect. Even if a person is satisfied with a product, he or she might actually be deceived by it. The quickest way to accrue basic knowledge in this area is to google the keywords “light allergy treatment” [1] or similar.

Placebo or not, there’s no harm in trying, especially when we can make one of these devices ourselves. Market prices of red-light anti-allergy devices start at about \$40 (€30), going up to almost \$165 (€125). Our design

costs about \$7.00 (€5.00) to build, making it really easy on the wallet. In short, it’s definitely worth trying!

Keeping it simple (and affordable)

Typically these devices consist of two red LEDs (or laser diodes) and a timer as the main parts. The LEDs usually have a wavelength of 660 nm. Apart from that, all you need is an ATtiny45 microcontroller, a pushbutton, 4 resistors, 2 capacitors, and an optional DC buzzer. The whole design is plain vanilla and easy to fathom, see **Figure 1**.

The supply voltage, V_{cc} , can range from 2.7 V up to 5.5 V. Don’t forget to adjust the value of the LED series resistors R1 and R2 using this formula:

$$R1 = R2 = (V_{cc} - 1.8) / 0.02 [\Omega]$$

The prototype shown in **Figure 2** uses two AA size 1.5-V batteries, so V_{cc} is exactly 3 V. Doing the math above yields 60 Ω for R1 and R2, but in practice 56- Ω resistors should work fine too.

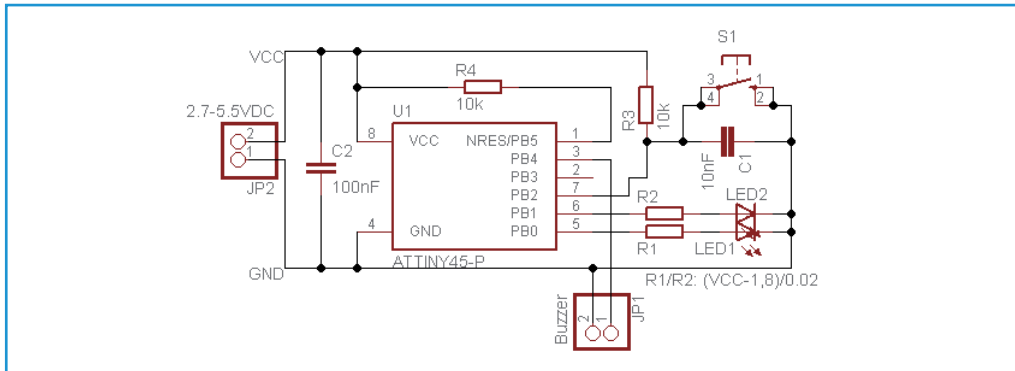


Figure 1
Schematic of the phototherapy device.

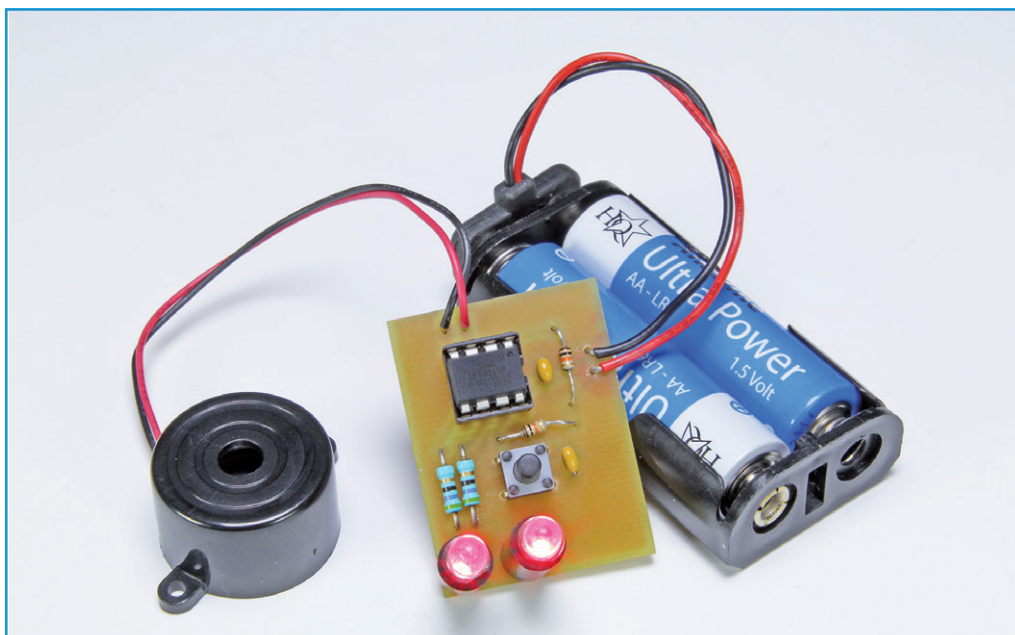


Figure 2.
Lab prototype, ready with a buzzer and two AA batteries.

Although the supply voltage can be as low as 2.7 V, keep in mind that most DC (i.e. active) buzzers need a minimum supply of 3 V. As an alternative to dry batteries, consider the use of a single 3-V CR2032 battery.

To make things easy at your end a PCB has been designed, and the EAGLE and Gerber files may be downloaded from the Elektor.LABS page created for this project [2]. The board includes two additional jumpers, one for the power supply and another for the optional buzzer. In terms of cost cutting, the circuit is easy enough to breadboard, and the jumpers may be omitted if you want to spend even less money.

Software rules

In this design, the best way to get an understanding of the circuit operation is to take a look at the software. When

the pushbutton is pressed, an interrupt is generated. During this interrupt the program checks if the timer is already running. If that's not the case, the timer gets started. Once started, the LEDs come on for 4 minutes, and then go off again. Next, a High level is issued on pin PB4 for half a second, then a Low level for another half second, but twice over. As a result, the optional DC buzzer emits a two-beep audible notification. Later the ATtiny45 will go into Sleep mode, keeping power consumption down to a minimum—a crucial feature to have whenever powering a circuit from batteries.

The source code for the ATtiny45 is richly commented and can be downloaded free of charge as an AVR Studio 5 project from the Elektor.LABS page [1]. The archive (no. 130225-11.zip) also contains the AVR HEX (object code) file.



Figure 3.
The LEDs or laser diodes
have to be inserted gently
into the nasal channels.

I love the smell of red light in the morning

The working procedure consists of putting the LEDs (or very low power laser diodes) in the nasal passages, push the button, and wait until the LEDs turn off again (4 minutes by default). **Figure 3** depicts Ingrid using the anti-allergy device. Apply it once to three times a day, depending on your allergy sensitivity. Okay, you may look like Rudolph the Red-Nosed Reindeer for a while but it's definitely worth trying. Just lean back and relax. Important advice: results may vary...

Internet Links

[1] <http://goo.gl/D9dZ9>

[2] www.elektor-labs.com/130225

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