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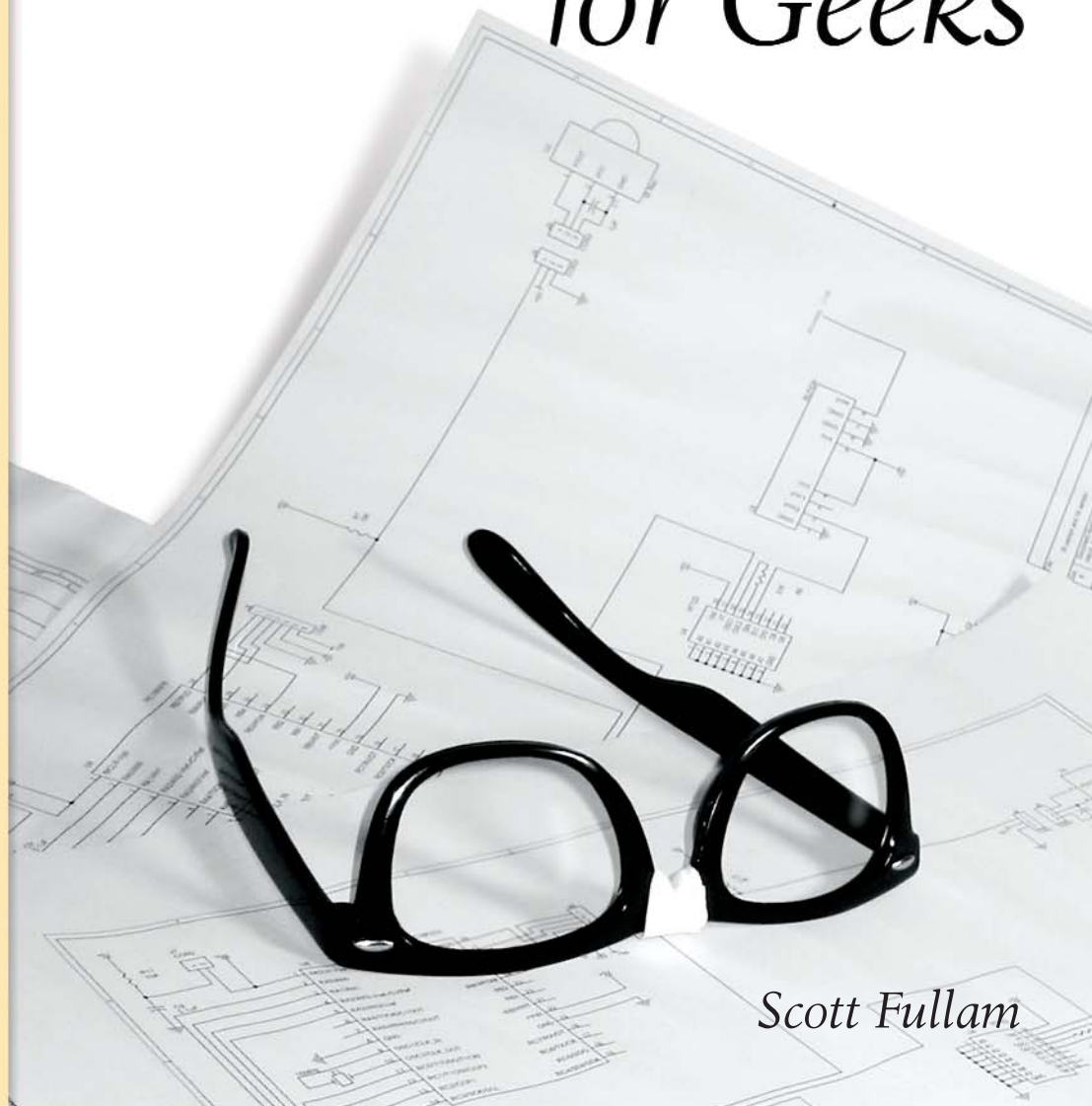
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HARDWARE HACKING PROJECTS

for Geeks



Scott Fullam

Toaster Technologies

Nichrome wires are an older heating technology that you see in most toasters. Nichrome is a metal alloy made from nickel and chrome, and can heat to several hundred degrees Fahrenheit when a 120-volt current passes through it. It does not melt, is easily bent and shaped, and does not grow brittle with use and time. Nichrome is a common heating element used not just in toasters but also in many industrial heating applications. The wire in a toaster loops over a sheet of mica board, which tolerates very high temperatures without burning or changing properties and does not conduct electricity. It is a very effective base upon which to place the nichrome wire.

The quartz rod heating element I found in a few newer toasters uses a single piece of quartz, which heats when a 120-volt current passes through it. Quartz is not a metal and is not easily bent. This heating rod is mounted in front of a curved reflector to evenly spread its heat to the object being toasted.

Project Overview

Robin Southgate has documented his Toasty project quite well at <http://news.bbc.co.uk/1/hi/sci/tech/1264205.stm>. His project uses a Java controller and a different mask material from what I use here. If you want to experiment with various techniques, check out his web site.

This project requires you to open up the toaster and modify the heating coils. Next you will create a “mask” pattern that will cause a pattern to be toasted onto the target bread. Finally, you will build a small microcontroller board that will accept commands via a PC serial port and select a toasting mask pattern.

Some Background First

When I started this hack I had a number of goals in mind:

- I must be able to use a standard toaster
- I should not have to completely gut and rebuild the toaster to make this hack work
- I should be able to toast a variety of patterns onto the bread
- I should be able to create a toaster interface that is simple and easy to modify

I started by opening up an extra toaster I had lying around to see what was inside. I found a lot of breadcrumbs, layers of thin sheetmetal, and mica sheets wound with nichrome wire.

I also spent some time at a local appliance store to see what new toaster technologies were available. I found two types of toasting elements: nichrome wires and quartz heating elements with reflectors (see the sidebar).

After this examination, I thought about the various ways of “printing” to a piece of bread. I came up with the following ideas:

- Two-dimensional heating element matrix
- Linear heating element
- Heat shield mask

The two-dimensional heating element matrix would consist of 100 heating points arranged in a 10-by-10 pattern positioned in front of the bread. One hundred transistors or other solid state switches would be needed for control. This could get expensive; a completely new heating array would have to be constructed, and little of the original toaster could be reused.