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31 Build a Geiger Counter to Monitor a Radioactive Cat

When my cat, Maxwell, needed radiation for an overactive thyroid, a Soviet-era surplus Geiger tube and an Arduino Uno were pressed into service to monitor the cat's radiation levels. In the end, we learned Maxwell was safe to handle and the treatment was complete.

By Eric Bogatin

42 Solar Power Monitor

Applying a data acquisition system (DAQ) to record sunlight intensity throughout the day makes for a fun and interesting project. By using an Arduino Uno and the MakerPlot Data Automation software, the required hardware is minimal, and working through the related software challenges is a great learning experience.

By Ken Fisher

51 Open Communication

Going the Distance with Wireless

There's a growing need for wireless technologies that can cover longer distances. Such applications are usually industrial in nature. The traditional wireless standards generally do not have the range capability to handle such use cases. As a result, a whole new batch of wireless technologies has emerged to fulfill the need for longer range. Here is a summary of these new standards.

By Ron Ganey

54 The Design Cycle

Advanced Techniques for Design Engineers

Try the RAD B4 for ESP8266 Coding

The ESP8266 has become a very popular way to implement Wi-Fi in embedded devices. If you're ever programmed in Visual Basic, you'll be able to put an ESP8266 to work in a hurry using a free Rapid Application Development tool call B4. This month, we'll write some B4 code to enable a connection between an Android phone and an ESP8266-equipped WebMD D1 Mini.

By Craig Lindley

63 Nuts and Volts Projects

Develop Perspectives

Want a break from microcontrollers and MEMS devices? Try tubes. They're deceivingly simple to work with, but — as with most things — take years to fully master. If you're a guitarist or know of a guitarist who plays with tube amplifiers, then the easiest way to work with tubes is to perform a modification or mod. There are dozens of guitar amp mod shops on the web; some offering individual component upgrades and others offering extensive kits. Mercury Magnetics is my go-to source for transformer and choke mods. They're not the cheapest option on the Web, but they've modded four amps with their power, output, and choke upgrades with great success. By upgrade, I mean that the replacement transformer is beefier, has a higher quality core, more current carrying capacity, and — in general — results in a better sound. More affordable sources for tube amp magnetics are available on the Web, but cheap rarely means upgrade.

More invasive modding involves changing components in the amp — especially the power supply electrolytic filter capacitors, the capacitors in the primary signal path, and the tube bias circuitry. For power supply capacitors, the goal is usually to provide greater capacitance, lower internal resistance to AC, and increased longitudinal. This usually means going from a $3 capacitor to a $5 or $6 electrolytic capacitor. Of course, you could opt for a gold plated component with a super audiophile rating, but that would be a waste of $20.

Modding the capacitors in the signal chain of a tube amp is more

subtle. Generally, the component values remain the same, but the type of capacitor is changed; for example, from a disc ceramic to a silver mica. The result is a change in tone that may or may not be better than the original. The decision about what capacitor technology to use for a given tone is simplified by vendors that sell mod kits and advertise a certain tone, such as “Fender Tweed” or “Bluesy” that they’re targeting.

I just finished modding my Fender Blues Junior amp with a capacitor kit from Fronel Electronics (www.fronelelectronics.com) and it was easy. This mod — together with swapping out a Mercury Magnetics for the output transformer — essentially gave me a new amplifier. A basic capacitor kit from Fronel or similar suppliers is about $35. I’ve also used a basic tube amp mod kit from http://billmaudio.com: a one-man shop specializing in Fender amps. The basic mod sells for about the same price as the Fronel kit.

Of course, you can also mod a tube amp by changing the speaker, installing a different brand of tubes, and by moving the entire assembly to a high quality cabinet made of real wood (I’m just focusing on the circuitry here.).

The next step in a tube journey is a full tube amp kit. The most popular guitar amp kits are patterned after the Fender S1 and SE3 amps. The S1 is a small 5W bedroom amp with a single output tube, and is usually paired with an 8" or 10" speaker. The SE3 is a full practice amp, with 15W output to a 12" speaker. There are at least a half dozen companies selling these kits; my favorite being Boot Hill...