Getting Back to Our (Hardware Hacking) Roots: Building Robots with Vintage Computer Parts

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There was once a time, before home computers, before the Internet, before mobile phones, PDAs, wireless networking, and video games, when hardware hacking was what every aspiring engineer did with their free time. What better way to spend an evening or weekend than trying to create a hovercraft out of vacuum cleaner parts or building a robot with pieces lying around in your junk bins?

Hardware hacking arguably dates back almost 200 years. Charles Babbage and his Difference Engine in the early 1800's was a mechanical form of hardware hacking. William Crookes discovered the electron in the mid-1800's, possibly the first form of electronics-related hardware hacking. Throughout the development of wireless telegraphy, vacuum tubes, radio, television, and transistors, there have been hardware hackers - Benjamin Franklin, Thomas Edison, and Alexander Graham Bell to name a few. As the newest computers of the time were developed, the ENIAC, UNIVAC, and IBM mainframes, people from academic institutions fortunate enough to have the hardware came out in droves to experiment. With the development and release of the first microprocessor (Intel 4004) in November 1971, the general public finally got a taste of computing.

Then something happened. Things got easier. Transistors became miniaturized and millions were able to fit onto a single silicon wafer. Computers became commonplace. Software took over our lives. The art of hardware hacking and experimentation all but disappeared. For some of us, the diehards who have lived and breathed hardware since our inception, it wasn't that easy to just turn a blind eye to what we loved. If you're reading this newsletter, you can likely relate.

Times are changing again. Computers are pervasive. People are bored with sitting in front of a monitor for hours on end. Technology has become a disposable commodity, and what better thing to do with unused hardware than to turn it into something.

When Evan contacted me to write this article, initially inspired from an e-mail about a local robotics competition, I thought he was out of his mind. Why would you want to desecrate the holiness of vintage computers by tearing them apart to build a robot? But, after a few deep breaths, I realized that such a thing doesn't require you to necessarily destroy your vintage collection. You can just take advantage of loose odds and ends that might be collecting dust.

Whatever way you choose to go about it, there are certainly a number of novel ways to incorporate vintage computer components into a robotics project. This article isn't a "how to". It just scratches the surface as to the possibilities that are out there and is meant to serve as a starting point into an exciting world. It's far from complete in any way, shape, or form.

Whether you build a robot using vintage computing parts or off-the-shelf components, for competition or entertainment, you'll still need to decide on a number of your robot's features. We'll separate these into three categories: Brains, brawn, and beauty.

Brains

How intelligent do you want your robot to be? Will it be a "dumb" machine in which it just receives directional signals and commands from an infrared remote control or a keyboard from an old PC? Or will it be a more self-contained, autonomous being that has internal sensors and enough processing power to function on its own? Forget using a small, general-purpose microcontroller like most modern robots do (for example, the Parallax BASIC Stamp or Microchip PIC). How about using an old motherboard running DOS or some other antiquated piece of hardware with a proprietary OS? As long as you can program the system and have some semblance of direct access to the hardware (to interface sensors, motors, etc.), then you're on the right track.

What is the desired function of your robot? Do you just want it to follow a line? Maybe solve a maze, bring you a beer, or walk the dog? All of these things will determine what types of components you'll want to use and how your robot will take shape. Maybe you could program the robot using punch cards or paper tape, if you happen to have some of those (and a reader) lying around.

Brawn

In order to have a sturdy, mobile robot, you'll need some muscle. Not only will you need to decide on a platform for the robot (possibly formed out of an old metal enclosure or housing that you don't need anymore), you'll also have to determine how your robot will move (if at all). Locomotion is usually an important aspect of a robot's feature set, unless you expect your robot to just be a large metal paperweight.

How will your robot move? Will it roll on wheels or tank treads? Will it walk like the popular Robosapien? Will you have a propeller or wings so that it can fly or glide? How about using some stepper motors from old disk drives, tape drives, or printers? Remember the behemoth printer from Coleco's ADAM? Now you can finally do something useful with it! Depending on your robot's brains, you could use a PC parallel port to control the motors and take in digital inputs from sensors. The beauty of vintage computers is that things are less integrated than their newer brethren and you can scavenge many parts that may suit your needs.

Beauty

Don't forget to accessorize! The beauty of making your own robot is that you can customize it however you want. Almost any components from vintage computers could be used to add some personal flavor and artistic elements to your design: face plates, indicators, vacuum/nixie tubes, switches, and other electronic, electromechanical, or mechanical bits and pieces.

Designing robotics, and hardware hacking in general, really has no set guidelines (unless, of course, you're building something for a contest which may have specific rules). There are plenty of resources available in the form of books, web sites, discussion forums, robotics clubs, and electronic kits, which could all keep you busy for months on end. Let your creative side take over and remember that there is no wrong answer! If it works, it's right, and that's what makes hobbyist electronics and robotics so much fun.

So, in a few years when we have all become hopelessly addicted to the robotics community, have run out of spare parts, and have scrapped our vintage computer collections to support our robotics habit, we can thank Evan and the Computer Collector Newsletter.

RESOURCES

Web Sites and Magazines

* Servo Magazine, www.servomagazine.com
* Nuts & Volts, www.nutsvolts.com
* MAKE, www.makezine.com
* Parallax, www.parallax.com
* Roomba Community: Discussing and Dissecting the Roomba, www.roombacommunity.com
* Arrick Robotics, www.robotics.com

Books

* Robot Builder's Bonanza, Gordon McComb, ISBN 0071362967
* Robot Builder's Sourcebook: Over 2,500 Sources for Robot Parts, Gordon McComb, ISBN 0071406859
* Hardware Hacking: Have Fun While Voiding Your Warranty, Joe Grand, et al, ISBN 1932266836

Tools, Components, etc.

* Digi-Key, www.digikey.com
* Mouser Electronics, www.mouser.com
* Newark Electronics, www.newark.com
* Jameco, www.jameco.com
* Hobby Lobby, www.hobbylobby.com
* McMaster-Carr, www.mcmaster.com
* Radio Shack, www.radioshack.com

BIO

"Goofy, high-strung, obsessed with work," answers Joe Grand when asked to describe himself. He grew up in Boston and has been involved in electronics since he was seven years old. "Hardware hacking is, to me, a perfect example of 'anti-establishment'. Make a product do something it was never intended to do or improve upon an existing idea. Not just buying a product and using it as-is."

Joe is the author of the books "Game Console Hacking" and "Hardware Hacking: Have Fun While Voiding Your Warranty." He holds a Bachelor of Science degree in Computer Engineering from Boston University. Besides working on secret projects involving the invention and design of video game accessories, toys, and consumer electronics for his company, Grand Idea Studio, Inc. (www.grandideastudio.com), Joe lives in San Diego where he occasionally gets out of the office to be a competitive triathlete.