

September 2011



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Innovations

Robots!



interaction, and how to handle the unexpected. What does the robot do at an intersection, if the "WALK" signal is blinking, but there is a fire truck with lights and sirens blaring, about to go through the red light?

What if it starts to rain, and the robot forgot to bring an umbrella? What if a dog chases, or even bites, the robot? What if the robot accidentally steps on someone's toe?

The fields of Computer Science and Artificial Intelligence still have a long way to go before it will be possible to build a successful "valet" robot. And, there will be legal and ethical issues to work out as well. Who is responsible if a robot commits a crime – the owner, the manufacturer, the programmer, or the robot? What if a robot gets a "virus" that causes it to misbehave? Issac Asimov explored some of these issues, and proposed the

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ROBOT FACTS

Would you believe, the term "Robot" is 90 years old? It originates from the Czech word "Robota", meaning forced work, labor, or drudgery. In 1921, Czech playwright Karel Capek coined the word for his play, *Rossum's Universal Robots*, in which the robots develop emotions and overthrow their human masters.

A robot has 4 basic parts: controller (brain that runs it), mechanical (parts that move), sensors (tell about the surroundings), and a power supply.

This year the National Robot Safety Conference takes place on Sept 19-21 in Knoxville, Tennessee.

The idea of a mechanical man is nothing new. Why can't I buy one?

For decades, science fiction authors have portrayed worlds where robots handle most of society's hard work. Industrial robots have been in use for nearly 40 years. They build our cars, handle precision medical procedures, defuse bombs.

Why can't I send my robot down to the 7-11, to pick me up a six-pack?

I asked my Computer Science professor that question over 10 years ago. The answer, then as now, is that human intelligence is far more complex than we realize. A trip to the 7-11 seems simple to us, but requires a wide range of skills, experience, and knowledge about the world. The robot not only needs to know how to navigate and communicate, it must also understand traffic regulations, weather, social

Be one of the FIRST!

As the school year resumes, you and your family members might be thinking about extra-curricular activities to take part in this year. Do you know about the US FIRST Robotics Competition?

Founded in 1989, it is a nationwide program consisting of nearly 27,000 teams competing at four levels, from kindergarten through high school. The objective is to provide a competitive environment for students interested in science, engineering and computer programming, as an alternative to sports.

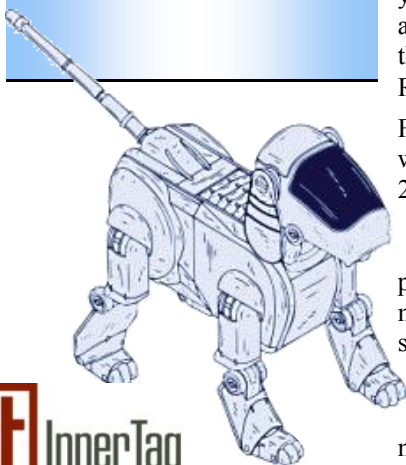
Each year in the fall, projects are announced and teams receive their kits. Based on game objectives and constraints, and with the help of adult volunteers and sponsors, student teams design and build robots over a

six to eight week period. Then they participate in regional qualifying tournaments, leading to the National Championships in April.

Apart from the experience, technical skills, camaraderie, and knowledge gained, a student who is a member of a FIRST Robotics team is more than 50% more likely to attend college, and almost 9 times more likely to obtain an internship or co-op position during their freshman year. Also, there are a number of scholarships available only to FIRST alumni.

Parents or other interested adults can participate as well. Teams are always in need of sponsors and mentors. Find out if a school near you has a US FIRST team, or if not, start a new one!

For full details, check out www.usfirst.org.



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Robots!

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“Laws of Robotics”, in his novel “I Robot”.

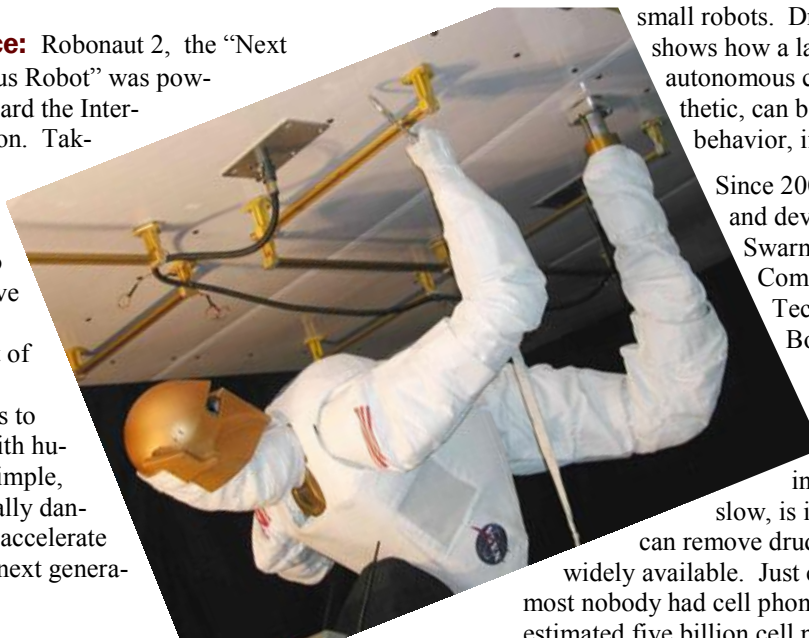
Robots that can help with simple household chores have been available for years. Besides vacuuming (Roomba), you can now get reasonably priced robots to help with mopping, ironing, mowing the lawn, and cleaning the kitty litter.

For an advance look at a robot that can wash dishes, go to his.anthropomatik.kit.edu/english/65.php. There you can see videos of Armar III, developed by researchers at the Humanoids and Intelligence Systems Lab at the Karlsruhe Institute of Technology in Germany. With advanced sensory and motor capabilities, and the ability to adapt autonomously to changing environments, this robot is intended to safely coexist with humans, interactively communicate, and usefully manipulate objects in human-centered environments.

Today, Asimo, the “world’s most famous robot” manufactured by Honda, is pictured on billboards and seen waving on TV. Asimo resembles a human being in size, shape, and gait. Asimo has toured the world, attending automobile shows in Switzerland and England, and science festivals in Italy and Scotland. In the United States, Asimo can be seen daily at Disneyland in California, and at world.honda.com/ASIMO/.

But at a cost of \$1 million a pop (or leased at \$166,000 per year), Asimo is way too pricy for most of us. Plus, despite the very high-tech mechanisms that provide the robot with the ability to walk, react, recognize people, and talk, Asimo can’t really do that much. The trip to 7-11 would be overwhelming. Still, Honda’s goal is “a future where humanoid robots help people in their everyday lives.”

Our robot in space: Robonaut 2, the “Next Generation Dexterous Robot” was powered up recently aboard the International Space Station. Taking advantage of the zero-G environment, it consists of just a head and torso (although it does have a single detachable leg). A joint project of General Motors and NASA, its mission is to work side by side with humans, to take over simple, repetitive, or especially dangerous tasks, and to accelerate development of the next genera-



tion of robots and related technologies for use in the automotive and aerospace industries.

A “true” robot is one that is autonomous – in other words, once programmed, it is able to function independently without a human controller. Most so-called robots used for hazardous duty, such as bomb disposal or earthquake recovery, are really remote-controlled machines. The same is true of drone aircraft used in combat. They are unmanned, but not pilotless; rather, they are piloted via satellite, from Air Force bases in Nevada. A new generation of remote-controlled military combat hardware is under development, as described by P. W. Singer in the book *Wired for War: The Robotics Revolution and 21st Century Conflict*. But so far, military planners intend to always keep humans “in the loop”.

If you have never seen the movie *Fast, Cheap, and Out of Control*, order it from Netflix today. This documentary examines the use not of larger, more powerful robots, but of teams of small robots. Drawing parallels from nature, the film shows how a large number of small, simple, and autonomous creatures, whether biological or synthetic, can be capable of amazing organizational behavior, if programmed the right way.

Since 2000, there have been parallel research and development efforts using this idea – the Swarm-bots project, under the European Commission on Information Society Technologies, and the iRobot Swarm-Bot, by the makers of Roomba.

Like the flying car, the affordable domestic robot might be one of those things that is always 10 years in the future. But progress, though slow, is inevitable. Eventually, robots that can remove drudgery from our lives will become widely available. Just consider that twenty years ago, almost nobody had cell phones. As of last year, there were an estimated five billion cell phones worldwide – that’s almost as many phones as people. So when I finally send my robot to the 7-11, I’ll make sure he takes along his cell phone.

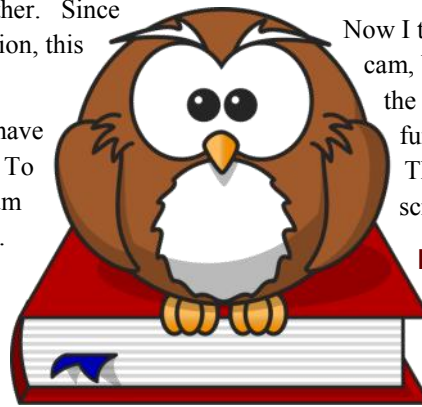
Manual Labor

This month I decided to try and get the webcam working on my new computer. Getting it started became an adventure. I learned new ways to find and understand instructions, and I also learned that tech support can actually help!

When working with a new device, I like to have a printed document with that tells me the functions and what they can do. My monitor came with only a software CD and a one-page “quick-start” guide, showing the front panel buttons on one side and the basic startup steps on the other. Since I grew up with devices doing only one function, this was not enough information.

First, I thought the webcam program might have already been pre-installed on my computer. To check, I just clicked on START. The webcam was listed under programs, so I clicked on it. Now I had a basic screen, but the buttons would not do anything. Obviously I was missing something. I needed a user manual.

Without a printed document, I didn’t know what the next steps were, or even where to go find them. I decided to go to the monitor manufacturer’s site and search for the manual. There it was! I found it! After downloading it, I found the section on starting the webcam.



I learned that I had to load some additional software. It was on the CD that came with the monitor, and luckily I remembered where I had stored it. I dug it out, inserted it, and began the setup again.

The installation process stopped without finishing, for some unknown reason. Don’t you hate it when that happens? I sure do. Good thing that I know how to uninstall a program and start over. The second time through, it worked fine.

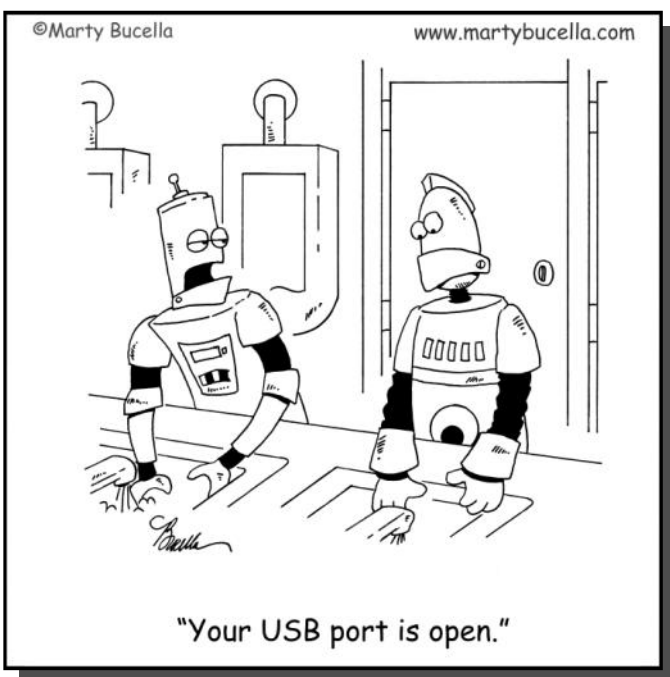
Now I thought I was ready to begin. I opened the webcam, but still could not see myself. I was able to see the options on the buttons, and open some other functions and see what they did. But no picture. Then I saw the error message at the bottom of the screen: The webcam was not found.

I went back to the manual. To my delight, I found both the error message and the resolution for it. It said to make sure the monitor cable was connected. I checked the cable and it was fine. I looked at the chart again. I had followed the instructions, or so I thought. But still no picture. Needless to say, by this time I was very frustrated!

Finally I contacted technical support, via the “chat” link on the manufacturer’s web site. After telling them that I had already done everything that they were suggesting, I was escalated to the supervisor. Suddenly the comment was made about a second cable. Second cable? How was I supposed to know about the second cable?

I looked at the monitor setup instructions again. In the lower left corner, in very light print, was a step about connecting the USB cable. I completely missed that step the first time through! After finding the second cable, I turned the computer off, and then connected it. Suddenly the webcam worked!

In a user manual, I think the print should be easy to read – not blend into the background. Pictures should be big enough, and clear enough, to see the details. Maybe reading a manual online is better – then you can always zoom in. But just in case, I now keep a magnifying glass handy.





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Inquiring Minds...

BUILD YOUR OWN ROBOT, AND CONTROL IT WITH YOUR ANDROID PHONE! Robots aren't just for automobile factories and academic institutions anymore. For under \$300, you can buy a kit with all the parts, instructions, and software you need to build and operate your own creation.

The LEGO MINDSTORMS NXT 2.0 Robotics Kit is available from Amazon or at your local Toys 'R Us store. Now, perhaps you're thinking, "Lego, aren't those the multi-colored blocks with the pegs that stick together — basically a kid's toy?" But if you haven't noticed, the Lego company has expanded way beyond the world of toys. This is a full-fledged, 619-piece kit for the home hobbyist. Most of the pieces are plastic, and it's not industrial strength, but it's hardly a toy.

The kit includes three servo motors, sensors with touch, sight, and ultrasonic capabilities, gears, wheels, axles ... there are complete instructions to get you up and running with a basic starter robot within a half hour. After that, you can move on to several other more advanced designs. Best of all, there are resources on the web where other users have contributed their custom robot designs, all buildable using the same kit.

The software that comes with the kit is even more amazing. It provides an animated 3-D design environment, so you can try out various configurations of parts before you actually start building. And once your design is complete, it can print out a step-by-step assembly guide with pictures showing exactly how to fit the pieces back together. This makes it incredibly easy to share designs with others.



The heart, or rather the brain, is a NXT controller unit.

This stores programs that you can create on your computer, giving the robot instructions to move or react to stimuli. What's more, the device includes Bluetooth communication. With a free app from the Android Market, you can have your robot roaming around the house while you control it with your cell phone.

Speaking of phones, we couldn't let this month go by without mentioning the "Retro Phone Handset". When I first saw someone with one of these plugged into their cell phone, I nearly dropped my lunch. Yes, it's a big old-fashioned curved plastic telephone handset, like you would expect to find on a rotary desk phone, but it plugs into your mobile. Sure to get a reaction!



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