

Robots: Computers on the Go

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Introduction

Everybody likes the idea of having a human-like machine to do our work. Imagine how much more free time you'd have if there was a robot to do your "grunt work." No more cleaning, no more cooking, no more mowing the yard on Saturday afternoons.

The idea of robots has been around since authors first started writing science fiction books. The 1926 silent movie *Metropolis* was the first film to present a futuristic society with robots. The first robot with a speaking role was the Tin Man in the 1939 movie *The Wizard of Oz*. These robots looked like people. Robots that resemble people are called *humanoid robots*. It's extremely difficult to make a robot that thinks and acts like a person. Even so, let's take a look at some of the robots being used today.

What Is a Robot?

A **robot** joins together machine vision with movement. That is, it makes movements in response to its environment. **Machine vision** takes a lot of forms. Many of today's robots have cameras. The person operating the robot can see what the robot sees and then uses controls to move the robot accordingly. Other robots use built-in sensors and lasers to locate objects.

One goal of engineers is to provide robots with **artificial intelligence**. We want robots that "think" like humans. At first, this seems to be a straightforward task: define the robot's function, and you define how smart it should be. However, making the robot respond in different ways to different situations is hard. To be truly useful, a robot must be able to learn. Learning means remembering the results of your actions and adjusting your behavior accordingly. The robot learns to repeat those efforts that get the desired results (success) and not repeat the efforts that don't (failure).

Your Very Own Domestic Servant

Let's face it—there are just some household duties that are no fun. These jobs include vacuuming carpets and mowing the lawn. Wouldn't it be great to have someone do this work for you?



Well, there are robots available now that can take these tasks off your hands. For example, iRobot is now offering a robotic home vacuum cleaner called the Roomba. Simply

place the Roomba in the middle of a room, enter in the size of the room on the display, and start it up. The Roomba moves in a spiral, cleaning the floor as it goes. It incorporates machine vision to maneuver around obstacles, such as tables and chairs.

If you like the idea of Roomba, you might also want to try out Robomower from the Friendly Robotics Company. Simply bury a wire along the perimeter of your mowing area, and this electric machine quietly mows your lawn for you. It uses machine vision to allow it to navigate around obstacles such as trees, sprinklers, and so on.

Medical Miracles

Dr. Mehran Anvari is a highly skilled Canadian surgeon. He sometimes operates on patients who live in remote areas where there are few surgeons. However, he doesn't have to spend hours traveling to his patients. He uses a three-armed robot named Zeus. Dr. Anvari uses hand controls to tell the robot how to move. These instructions are sent to Zeus over the Internet.

Robotic surgery need not be performed long-distance. Usually the surgeon is in the same room as the patient. The surgeon sits at a special console where he or she guides the robot's work. When a robot is used to perform delicate surgery, the surgeon's hand movements can be scaled down. For example, if the surgeon moves a finger one centimeter, the robotic arm might move only one-tenth of a centimeter. This allows the surgeon to perform extremely precise surgery.

Industrial Specialists

Robots have been heavily used in industry for many years. They perform useful, exacting duties such as spray-painting automobiles and assembling parts.

These types of robots do not look like humans. They usually stay in one place and don't have recognizable arms or legs. Instead, they are built with their function in mind.

Companies appreciate the advantages of robotic workers, particularly on assembly lines. Robots can be programmed to perform the same actions exactly the same way, over and over. They are much less likely to make a mistake than a human and will not become injured or tired.

Do you have claustrophobia (the fear of small spaces)? Can you imagine what it would be like to be a sewer repair worker? These workers have to examine hundreds of miles of sewer lines to make certain they don't have cracks or aren't blocked. In some cities, sewer workers are using robots to inspect these lines. The robots can crawl into lines that are too small for humans. Images of the inside of the lines are sent back to the human controller.

Robots are also starting to be used in mining. Mining is a dangerous activity for humans. The air is often filled with dangerous fumes and the workspace is cramped. There is always a danger of cave-ins. The robots are guided by miners who are at a safe, remote location. Everything the robot "sees" is mapped by its cameras and lasers. One of the great things about these robots is that if they become buried in a cave-in they are strong enough to dig themselves out.

Another useful robot is the "People Finder." This robot was introduced in January, 1999, at the Robot Grand Prix in Yokohama, Japan. A team from the Tokyo Technical University developed it. The People Finder's function is to locate victims buried under the rubble created by earthquakes. Like the mining robots, these robots save humans from being placed in dangerous situations.

Military Hero

Robots played a small but important role in the U.S. war in Afghanistan during 2002. The robots, called “Packbots,” can go over any terrain. They can even climb stairs. The army needed to check hundreds of caves for enemy soldiers. Packbots were sent into these caves. A soldier using a joystick guided the Packbot. A camera on the Packbot let the soldier see what the robot was “seeing.”

The Packbot is capable of detecting chemicals. This lets soldiers take any needed precautions, such as putting on protective masks and suits. If necessary, it can even be outfitted to fire weapons. All in all, the Packbots can keep soldiers out of harm’s way.



Packbots can search dangerous areas in place of soldiers.

Toys

One of the first questions asked about any new technology is “What can it do?” The second question is “What can we do with it?”

The Lego Company offers the Robotics Invention System, which allows you to “create robots you can bring to life and control.” The set comes with a microcomputer, a CD-ROM with software, motors, sensors, and a transmitter. You can create many types of robots with this set (and others like it). Ultimately, most people want

to share their successes with others. Which brings us to competitions.

Competitions

There are a number of national and international organizations offering the chance for your robot to compete against other people’s robots.

Some competitions, such as the FIRST Robotics Competition Championship in Florida (“the Super Bowl of Smarts”), offer high school students the chance to build robots. Students form teams that compete against one another. Each team builds a robot to perform a specific task. They have six weeks to build the robot. They then meet, and the robots compete against one another to see which one can best perform the assigned task.

At the 2002 Eurobot competition in France, robots participated in a time trial called “Flying Billiards.” In this competition, eight red balls and four black balls are placed on a flat table. The robots have 1 minute 30 seconds to put the red balls on one side of the table and the black balls on the other side.

Some competitions are open to people of all ages. Mechwar, in Minnesota, is the mechanical equivalent of a boxing match: The robots attempt to destroy each other. At the UC Davis Picnic Day MicroMouse contest in California, the micromouse robot contestants must find the shortest path through a maze.

Looking Ahead

At the moment, robots exist more in our imagination than in real life. Domestic servants that perform our every wish are still years away. However, today’s robots are able to do many routine tasks that would be boring, dangerous, and even impossible for humans. The potential rewards these mechanical companions offer continue to capture our imaginations.



Review Questions

1. What is meant by *machine vision*?
2. Why would a business person want to have robots on an assembly line?
3. List at least three advantages of using robots for jobs such as mining, earthquake rescue, and sewer line inspection.
4. Explain how robots are used in surgery.



What Do You Think?

1. Some philosophers believe that humans are basically lazy and that they build robots just to have slaves. Do you think this is true? If you owned a robot, what would you have it do?
2. Do you think robots will ever be able to think and have emotions like humans do? Explain your answer.
3. Imagine that you are a pet dog or cat. How would you view a domestic robot if it joined your family?

Glossary

artificial intelligence The ability of a machine to mimic the way that humans think, learn, and make decisions.

machine vision The ability to “see” the environment. This can be accomplished by using sensors and lasers. A simpler way is

to use a camera to send pictures to a human operator.

robot A mechanical computerized device that can move and typically has some type of artificial vision.