Chapter 1

So, You Want to Build a Robot?

In This Chapter

- Introducing the robotics revolution
- Finding out what a robot can do for you

Ever since the early days of science fiction, people have dreamed of little metal men running around doing our chores, alerting us to danger, performing the dirty jobs (such as going into deserted alien mine shafts on Mars to measure deadly radioactive rocks), and generally embodying technology in a quasi-human form.

How far have we come from these early fantasies? Quite a ways, but much progress is still to be made — maybe more than you think. Because our idea of robots comes mainly from the big screen, our view is skewed. Instead of robots doing our dishes and playing basketball with the kids, today's robots are mainly used to automate repetitive and boring manufacturing tasks and in dangerous jobs, handling bombs or radioactive material.

The lack of movie-style robotic technology may make you think that the fun stuff is so far away that it's not worth pursuing. Nothing could be further from the truth. In fact, now is the time to jump on the bandwagon and get involved — you'll be able to tell your grandkids that you were one of the pioneers.

Robotic technology is in its infancy, just like personal computers were in the '70s. Back then, computers were built by a few special people known as geeks, they cost a lot of money, and they could barely balance a checkbook. Robotics will be one of the next great technological revolutions, and you're getting in on the ground floor!

In this chapter, you find out about the state of robotics today, elements you'll encounter when working with robots, and some cool uses for robots. So come with me on a tour of robot world, and prepare to be amazed.

The Robotics Revolution

Welcome to the robotics revolution. You're reading this book, so you're already intrigued by robotics. But to really become a card-carrying revolutionary (robot builders unite!), you should understand a bit about where all this interest in robots comes from and where it's going.

Where have we been?

Computers are used to program robots, so it's not surprising that the growing interest in robotics is tied to the rapid advancement of computer technology.

It used to be that only the U.S. government, large corporations, or major colleges could afford to own a computer. Over time, computers got cheaper and smaller until finally even hobbyists could afford to own one. With all these cheap computers floating around, it wasn't long until robotic kits began to appear. Kits such as Heathkit's Hero robot kit brought robotics into the age where everyone could own and build their own autonomous personal robots, complete with real computer brains. And they could download programs to control their robots from their handy desktop PC.

That's when robot clubs such as the Dallas Personal Robotics Group and the Seattle Robotics Society started popping up all across the country. Robot fever had begun. People with their new robot sidekicks wanted to talk to other people who had the same interests, and the availability of Internet newsgroups, discussion boards, and chats fueled the robot fire. Robotics groups grew in number and in size. Many robotics groups with huge member lists became modest organizations equipped with newsletters, Web sites, and e-mail lists. Nowadays, you can pretty much find a robotics group in every nook and cranny of the country. Bottom line: A lot of people want to build robots these days.

Are we there yet?

A robot is simply any mechanical unit that detects its surroundings, is capable of decision making based on input about those surroundings, and performs some operation based on those decisions. In many ways, we have arrived in a world where robots are a reality. We don't have a humanoid-looking robot helper serving cocktails in every house yet, but robotic devices have been installed in many homes across the United States. You may have one lurking in your own house and not even know it.

For example, you might not think of motion detectors and electronic thermostats as household robots, but both devices sense their surroundings,

make electronic decisions, and perform some action based on what they sense. Likewise, dishwashers and clothes washers look more like big white boxes than like robots, but their combination of electronic and mechanical operations make them at least distant cousins to robots. VCRs and DVD players have sensors that read media as well as computers that make decisions and adjustments many times a second to control motors and video output. Personal computers, phone answering machines, and clock radios could be considered robotic. Take a look around your house, and you may find other electronic devices that perform helpful robotic chores without your intervention.

But household appliances aren't really where it's at for those of us who live, eat, and breathe robots. Most people want to see a robot walk, talk, flash alarm lights, or roll around on its own. If you're one of those people, you'll be glad to know that several "real" robots are available today. For example:

- Large robotic couriers prowl the corridors of many of our hospitals, ferrying blood samples to medical labs and intelligently avoiding objects in their paths.
- A robot called Wisor lurks beneath the streets of New York City, repairing old steam pipes in places where people would just as soon not go.
- A remote-controlled robot named Predator was used by the U.S. military for surveillance duties in Afghanistan.
- Federal emergency teams have robots that can move between open spaces in rubble to help find trapped earthquake victims.
- NASA uses the MER rovers *Spirit* and *Opportunity* to explore Mars.

Not all robots are developed by large corporations or the government. Many robotic devices begin as the daydream of a hobbyist, who then becomes an entrepreneur and goes on to create a company to make and sell robots. What was once a vacuum-cleaning robotics game is now a viable household appliance. What was once a robotic builder's dream and a robotic group's ongoing hypothetical discussion is now a robotic lawnmower. What was once a geek's plaything is now a doctor's telepresence in the form of a geriatric monitoring device.

Many companies offer marketable robot products including do-it-yourself kits for the robot enthusiast. Robots are beginning to make it into the mainstream, albeit slowly.

Where are we going?

In twenty years, people will look back at the movies of today and laugh at what we thought robots would be like in the future. We've all heard the promises of a robot in every house and flying cars zooming around with a

robot at the wheel, a la George Jetson. We're all waiting for the day when a robot will do all the household chores. But aren't these just fantasies with no more foundation than rumors of Elvis's latest sighting?

Actually, all these possibilities could come true in the not-too-distant future. With so many people getting involved in robotics and with robot parts and electronics getting cheaper day by day, you're likely to see robot advancements in just about every area of life.

In the future, you could see humanoid robots doing all the work. But, who says robots have to look humanoid? Your car could have a computer brain installed and become the robot that drives — no, flies — you to work. Perhaps clothes could be a robotic exoskeleton that helps you lift heavy objects or helps the physically challenged to walk. The U.S. military, for example, is experimenting with specially enhanced robotic combat fatigues (as reported by robotic news sites such as `www.robots.net`).

In the future, whatever their form, robots will be around at your beck and call to assist you and serve you.

Robot Uses

The word *robot* first appeared in the English language in 1923, and comes from the Czech word, *robata,* meaning drudgery or servitude. Early robot enthusiasts clearly saw robots as mechanical servants meant to give us a life free from the more mundane tasks.

So if robots aren't yet flying us to work or washing the dog, what are they doing? Today, robots are being used more and more for jobs that are too tedious or too dangerous for people to do, such as fitting parts on assembly lines or sensing landmines in war zones. Robots are also going to places that are too distant and dangerous for humans, such as the crushing depths at the bottom of the ocean, highly radioactive areas, and the hostile environments of Mars. In this section I take you on a tour of some intriguing robot activity.

Security

If Mr. Worf had had a robot to handle security, the Starship Enterprise would have been a different place. No Klingon angst. Just good, functional, robot security patrols.

Today, several types of robots can perform basic security functions. Robots roam the halls of museums and detect movement, humidity level, and fire.

Robots handle entry management for secure buildings. Airports have robotic devices that scan luggage for bombs, and robotic cameras that can do retinal scans and perform face recognition analyses. Police departments use remotely-operated robots for disarming bombs and negotiating with potentially dangerous criminals (put down your gun . . . beep).

Because security involves both the tedious (endlessly walking the halls of buildings at night) and the dangerous (disarming bombs and drawing gunfire), robots and robotic devices are a vital part of today's security force and will be even more so in the future.

Surveillance and exploration

Robots today go where no man has gone before, from the top of a volcano to the wreck of the Titanic in the depths of the ocean. Why are robots showing up in these odd spots? They go there to perform surveillance operations no one in their right mind would try to do.

NASA and other space agencies have found that it's cheaper and smarter to use robots to explore our solar system. To keep an eye on our own planet from space, robotic spy satellites view and remotely monitor the earth's surface from hundreds of miles above the earth. *Spy bugs,* as these satellites are called, have tiny legs (making them truly look like bugs) and use tiny color cameras to view their surroundings.

Contests

What's the point of building a little robotic buddy if you can't make a sport of it? More than thirty years ago, the first robot contest occurred in a hallway at MIT. The subject of a mechanical engineering class, this experiment was the precursor to today's robot contest boom.

Most robotics groups hold contests that range from simple robotic navigational contests to robotic vacuum-cleaning contests and robotic fire-fighting contests. Robot contests are exciting and draw members into robotics clubs like flies to honey. Once hooked, members drag in friends and relatives and the sport just gets better as the number of participants grows.

National contests sponsored by those ranging from wealthy technology entrepreneurs to the U.S. government draw tens of thousands of enthusiasts, sometimes for large cash prizes. For example, in 2004, the military is sponsoring a robot race from Los Angeles to Las Vegas with a grand prize of one million dollars — all to inspire new ideas about how robot-controlled vehicles might navigate rough terrain in military operations.

Robotic contests serve useful purposes: They help to further the acceptance and growth of robotics, stimulate research into new robot technology, and educate students about technology in a fun and creative way.

Your own grocery store may monitor its parking lot with remote cameras that can pan in response to movement. Some home security systems can monitor the front doorstep or the back driveway and send alerts if a presence is detected.

In short, robots are great tools for observation, and robotic surveillance has become commonplace. As this robotic application becomes more prevalent, there could be some bumps along the way — namely, issues with human privacy.

Human helper

You probably won't be surprised to hear that several robots are already ready and willing to help out with those pesky household chores. Currently, robots can vacuum your floors, mow your lawn, and more. Most of these robots are not humanoid at all, but rather resemble low-to-the-ground golf carts.

Because your average person likes a human face on a machine, much research is going on in the area of humanoid helper-type robots, from figuring out how to make a robot such as Honda's Asimo walk, to giving robots human-like facial expressions. Mitsubishi's Wakamaru, a home-caregiver robot now in development, is rumored to be capable of everything from sending e-mail to a family member in an emergency to giving its human charge a great big hug.

As robots and humans interact, various social, economic, and safety issues arise. Is the Sony Aibo dog a substitute for a real pet? Do robots make us lazy? How can robots help — or hinder — our humanity and human relationships? Robots haven't advanced so far that we need to stay up nights worrying about their effects on us, but it's a good idea to keep in mind Isaac Asimov's Revised Laws of Robotics:

- **Zeroth Law:** A robot may not injure humanity or, through inaction, allow humanity to come to harm.
- **First Law:** A robot may not injure a human being or, through inaction, allow a human being to come to harm, unless this would violate the Zeroth Law of Robotics.
- **Second Law:** A robot must obey orders given it by human beings, except where such orders would conflict with the Zeroth or First Law.
- **Third Law:** A robot must protect its own existence as long as such protection does not conflict with the Zeroth, First, or Second Law.

Building robots introduces us to this brave new world.