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A ROBOT IN EVERY HOME: THE LEADER OF THE PC REVOLUTION PREDICTS THAT THE NEXT HOT FIELD WILL BE ROBOTICS

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ABSTRACT:

Imagine being present at the birth of a new industry. It is an industry based on groundbreaking new technologies, wherein a handful of well-established corporations sell highly specialized devices for business use and a fast-growing number of start-up companies produce innovative toys, gadgets for hobbyists and other interesting niche products. But it is also a highly fragmented industry with few common standards or platforms. Projects are complex, progress is slow, and practical applications are relatively rare. In fact, for all the excitement and promise, no one can say with any certainty when—or even if—this industry will achieve critical mass. If it does, though, it may well change the world.

Keywords: Robotics, Electronic, Mainframe, Computer club, Project

INTRODUCTION

Although a few of the domestic robots of tomorrow may resemble the anthropomorphic machines of science fiction, a greater number are likely to be mobil peripheral devices that perform specific household tasks.

Paul Allen and Bill Gates launched Microsoft. Back then, big, expensive mainframe computers ran the back-office operations for major companies, governmental departments and other institutions. Researchers at leading universities and industrial laboratories were creating the basic building blocks that would make the information age possible. Intel had just introduced the 8080

Microprocessor, and Atari was selling the popular electronic game Pong. At homegrown computer clubs, enthusiasts struggled to figure out exactly what this new technology was good for.

But what Bill Gates really has in mind is something much more contemporary: the emergence of the robotics industry, which is developing in much the same way that the computer business did 30 years ago. Think of the manufacturing robots currently used on

automobile assembly lines as the equivalent of yesterday's mainframes. The industry's niche products include robotic arms that perform surgery, surveillance robots deployed in Iraq and Afghanistan that dispose of roadside bombs and domestic robots that vacuum the floor.

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Electronics companies have made robotic toys that can imitate people or dogs or dinosaurs, and hobbyists are anxious to get their hands on the latest version of the Lego robotics system.

Meanwhile some of the world's best minds are trying to solve the toughest problems of robotics, such as visual recognition, navigation and machine learning. And they are succeeding. At the 2004 Defense Advanced Research Projects Agency (DARPA) Grand Challenge, a competition to produce the first robotic vehicle capable of navigating autonomously over a rugged 142-mile course through the Mojave Desert, the top competitor managed to travel just 7.4 miles before breaking down. In 2005, though, five vehicles covered the complete distance, and the race's winner did it at an average speed of 19.1 miles an hour. (In another intriguing parallel between the robotics and computer industries, DARPA also funded the work that led to the creation of Arpanet, the precursor to the Internet.)

What is more, the challenges facing the robotics industry are similar to those we tackled in computing three decades ago. Robotics companies have no standard operating software that could allow popular application programs to run in a variety of devices. The standardization of robotic processors and other hardware is limited, and very little of the programming code used in one machine can be applied to another. Whenever somebody wants to build a new robot, they usually have to start from square one.

Overview/The Robotic Future

- The robotics industry faces many of the same challenges that the personal computer business faced 30 years ago. Because of a lack of common standards and platforms, designers usually have to start from scratch when building their machines.
- Another challenge is enabling robots to quickly sense and react to their environments. Recent decreases in the cost of processing power and sensors are allowing researchers to tackle these problems.
- Robot builders can also take advantage of new software tools that make it easier to write programs

That work with different kinds of hardware. Networks of wireless robots can tap into the power of desktop PCs to handle tasks such as visual recognition and navigation.

SCIENCE FICTION TO REALITY

The word "robot" was popularized in 1921 by Czech playwright Karel Capek, but people have envisioned creating robotlike devices for thousands of years. In Greek and Roman mythology, the gods of metalwork built mechanical servants made from gold. In the first century A.D., Heron of Alexandria—the great engineer credited with inventing the first steam engine—designed intriguing automatons, including one said to have the ability to talk.

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Leonardo da Vinci's 1495 sketch of a mechanical knight, which could sit up and move its arms and legs, is considered to be the first plan for a humanoid robot. Over the past century, anthropomorphic machines have become familiar figures in popular culture through books such as Isaac Asimov's I, Robot, movies such as Star Wars and television shows such as Star Trek. The popularity of robots in fiction indicates that people are receptive to the idea that these machines will one day walk among us as helpers and even as companions. Nevertheless, although robots play a vital role in industries such as automobile manufacturing— where there is about one robot for every 10 workers—the fact is that we have a long way to go before real robots catch up with their science-fiction counterparts.

One reason for this gap is that it has been much harder than expected to enable computers and robots to sense their surrounding environment and to react quickly and accurately. It has proved extremely difficult to give robots the capabilities that humans take for granted—for example, the abilities to orient themselves with respect to the objects in a room, to respond to sounds and interpret speech, and to grasp objects of varying sizes, textures and fragility. Even something as simple as telling the difference between an open door and a window can be devilishly tricky for a robot.

But researchers are starting to find the answers. One trend that has helped them is the increasing availability of tremendous amounts of computer power. One megahertz of processing power, which cost more than $7,000 in 1970, can now be purchased for just pennies. The price of a megabit of storage has seen a similar decline. The access to cheap computing power has permitted scientists to work on many of the hard problems that are fundamental to making robots practical. Today, for example, voice-recognition programs can

identify words quite well, but a far greater challenge will be building machines that can understand what those words mean in context. As computing capacity continues to expand, robot designers will have the processing power they need to tackle issues of ever greater complexity.

Another barrier to the development of robots has been the high cost of hardware, such as sensors that enable a robot to determine the distance to an object as well as motors and servos that allow the robot to manipulate an object with both strength and delicacy. But prices are dropping fast. Laser range finders that are used in robotics to measure distance with precision cost about $10,000 a few years ago; today they can be purchased for about $2,000. And new, more accurate sensors based on ultrawideband radar are available for even less

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BETTER PROGRAMMING MEANS FEWER TUMBLES

Handling data from multiple sensors—for example, the three infrared sensors pictured on the robot at the right—can pose a dilemma. Under the conventional approach (below), the program first reads the data from all the sensors, then processes the input and delivers commands to the robot's motors, before starting the loop all over again. But if sensor A (red) has new readings indicating that the machine is at the

Edge of a staircase and the program is still processing the old sensor data, the robot may take a nasty fall. A better approach to dealing with this problem of concurrency is to write a program with separate data paths for each sensor (bottom right). In this design, new readings are processed immediately, enabling the robot to hit the brakes before falling down the stairs.

BILL GATES is co-founder and chairman of Microsoft, the world's largest software company. While attending Harvard University in the 1970s, Gates developed a version of the programming language BASIC for the first microcomputer, the MITS Altair. In his junior year, Gates left Harvard to devote his energies to Microsoft, the company he had begun in 1975 with his childhood friend Paul Allen. In 2000 Gates and his wife, Melinda, established the Bill & Melinda Gates Foundation, which focuses on improving health, reducing poverty and increasing access to technology around the world.

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Should We Call Them Robots?

How soon will robots become part of our day-to-day lives? According to the International Federation of Robotics, about two million personal robots were in use around the world in 2004, and another seven million will be installed by 2008. In South Korea the Ministry of Information and Communication hopes to put a robot in every home there by 2013. The Japanese Robot Association predicts that by 2025, the personal robot industry will be worth more than $50 billion a year worldwide, compared with about $5 billion today. As with the PC industry in the 1970s, it is impossible to predict exactly what applications will drive this new industry. It seems quite likely, however, that robots will play an important role in providing physical assistance and even companionship for the elderly. Robotic devices will probably help people with disabilities get around and extend the strength and endurance of soldiers, construction workers and medical professionals. Robots will maintain dangerous industrial machines, handle hazardous materials and monitor remote oil pipelines. They will enable health care workers to diagnose and treat patients who may be thousands of miles away, and they will be a central feature of security systems and search-and-rescue operations. Although a few of the robots of tomorrow may resemble the anthropomorphic devices seen in Star Wars, most will look nothing like the humanoid C-3PO. In fact, as mobile peripheral

devices become more and more common, it may be increasingly difficult to say exactly what a robot is. Because the new machines will be so specialized and ubiquitous—and look so little like the two-legged automatons of science fiction—we probably will not even call them robots. But as these devices become affordable to consumers, they could have just as profound an impact on the way we work, communicate, learn and entertain ourselves as the PC has had over the past 30 years.

CONCLUSION

Replacing employees with robots is an inevitable choice for organizations in the service sector, more so in the health care sector because of the challenging and sometimes unhealthy working environments, but, at the same time, the researchers propose that it should be done in a manner that helps in improving the employment and motivation of employees in this sector.

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