

Could a Robot Soon Replace Your Doctor?

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Robots. They're cute, inventive, and highly advanced. Watching mobile robotic rovers scoot around the surface of Mars, beaming back information while taking photographs and analyzing soil samples, raises the question, what can robots do for us here on earth? A lot, according to MIT graduate Colin Angle. Robots can already liberate humans from the daily drudgery of household chores. Angle's company iRobot Corporation, has sold more than 1.5 million little robots known as Roomba® and Scooba® that vacuum the carpet and scrub the floors while you sleep. Don't be fooled into thinking they are just a clever assemblage of a computer and a set of wheels-they do, in fact, work. The little robot's bigger cousins can even go where no man has gone before. Trekking into the battlefields of war torn Iraq, iRobot's PackBot® tactical mobile robots identify snipers and diffuse bombs. A noble role to be sure, that ultimately saves lives. Even more futuristic battlefield extraction and retrieval robots from Vecna Technologies can pick up wounded soldiers right in the middle of an

ongoing firefight. The government is spending millions of our tax dollars on development and deployment. Are we getting our money's worth? Robots carry a high price tag to be sure, but no one would argue they aren't worth every penny when you consider the value of the life of a soldier.

To help advance existing technology, the United States Department of Defense Advanced Research Projects Agency (DARPA) offered a \$2 million, winner-take-all prize to the best engineering teams in the nation, for the first driverless automobile to race across the Nevada desert and cross the finish line. There were 46 entries and at least one winner. Not to be outdone by their American counterparts, Japanese and Korean automobile manufacturers will soon be showcasing their robotic automobiles at the Beijing Olympics in 2008. Promising to be more fun to watch than the Olympic events, these ordinary appearing vehicles will shuttle Olympians from the airport to the Olympic village, *without drivers*.

But don't reach for your checkbook just yet. There are still significant technological limitations and a high price to be paid for a Rosie-the-Robot. Robots must be able to navigate complex spaces while operating for days, weeks or months without human supervision. It can be done, just not with today's technology.

Similar to the way the movie robot R2D2 helped its Star Wars buddies out of trouble, robots could soon play an important role in keeping us healthy. Already in some rural hospitals, doctors are making their rounds, reviewing charts and talking with their patients through a robotic computer system, without the need to be physically present. These surrogate robot doctors move freely from room to room carrying a camera and a video screen that enables the doctor (who may be hundreds of miles away in his office) to see a patient while the patient sees the doctor. A robotic doc-in-the-box brings new meaning to the expression “laying on of the hands.”

Mobile robots can play a less glamorous role as well. Capable of seamlessly working in the background, they potentially could free the hospital staff from the routine and mundane labors of moving patients and goods. MobileRobotics is a company that is putting the final touches on an agile robot that can transport patient’s specimens to the laboratory or retrieve a patient’s drugs from the pharmacy. It navigates the halls of a hospital with ease, avoiding obstacles and can even be programmed to open a door or get on an elevator.

Robots acting as nurse surrogates, could provide needed comfort and assistance for those who live alone and need a little

extra help. From Japanese robotic pets that can ease the pain and suffering of the infirm, to full-scale humanoid assistants that can administer medication, there seems to be no upward limit to the potential roles these androids could fill.

Could a real robot save a life much in the same way the imaginary surgical robot did when it stitched Darth Vader back together and averted his sure death from a blazing inferno? Yes. It’s not just science fiction anymore-robotic surgery exists today-and not in a galaxy far, far away. Medical robots are being used to transport the injured to the hospital, treat cancer, and perform unparalleled precision surgery beyond the reach of human capabilities. Destined to become invaluable assistants in the operating room, robots are beginning to make their surgical debut.

Russell H. Taylor, PhD Professor of Computer Science at Johns Hopkins University is developing computer programs to analyze surgical procedures, and help build safety and reliability into surgical robotic systems. The result-a *Surgical Assistant System* that is designed to work along with surgeons to enable precise surgery in ways the unassisted hand could not accomplish alone. The implications of such advances could mean less medical errors and improved patient outcomes.

Several companies are developing robots that can assist surgeons performing neurosurgery, orthopedics, ear-nose-throat and eye surgery. One such company, MicroDexterity Systems, based in Memphis, Tennessee, along with engineers from Nasa's Jet Propulsion Laboratory, co-developed what they call Robotic-Assisted MicroSurgery (RAMS). RAMS uses *teleoperation*, a sophisticated joystick-like hand-controlled device that eliminates tremor and jerkiness that can interfere with surgery. With a steady hand the surgeon can attempt more complex and delicate surgery. A system like this one could do for the surgeon's hand what a microscope does for his vision. The catch? To avoid the risk of patient movement, all robotic surgery must be performed under general anesthesia. As many of today's procedure are performed with local anesthesia and take place in an outpatient surgical center, there may be little demand for a device that requires an investment of more than \$400,000.

A fully approved surgical robot for use in the USA that is already creating a brave new world in the operating room, is the Da Vinci® surgical system, named for the 15th century artist and inventor who was well ahead of his time. Used for surgery in more than 400 hospitals worldwide it can assist surgeons working on the heart and urinary system. Does it really

work? You might wonder considering its size, complexity and cost. At millions of dollars each, it's a substantial investment to be sure. But for those who have used this surgical system, the price is justified. With it Pedro Del Nido, M.D., Chief of Cardiac Surgery at Childrens Hospital Boston, has repaired heart defects in infants, newborns and even an unborn fetus. In procedures urologists perform on the prostate and bladder, robotic surgery has proven itself more precise with less complications than with conventional surgery.

The surgical operating room of the future may look very different from the images we see on TV today. Although robots may not take over the primary responsibilities of a surgeon any time soon, there is little doubt that surgeons will be looking to robotic assistants to attempt increasingly more delicate and difficult surgery that would otherwise be impossible without robotic assistance. Robotic assistants could free up the doctor, surgical assistants and nurses who simply do not have enough time to perform custodial tasks. Robots could carry charts, escort patients, administer medication and anesthesia, and yes, even stabilize a patient during the surgical procedure, making local anesthesia possible. Imagine a robotic surgical assistant operating within the precision of a micron, monitoring a thousand movements a second and creating a motion-free operating

environment. Surgery-related complications could become as rare as a case of small pox.

Will these miraculous new technologies eliminate waste, decrease errors and reduce health care costs? Probably not. Robotics and the information technologies they depend upon are more than likely to increase the already spiraling costs of healthcare. So why would any reasonable hospital setting pursue them? Robots may be our only hope in alleviating the already shrinking resource of trained health care personnel, nurses and physicians.

It will take only 15 years for the world's population to increase to 7.52 billion, just about the length of time it will take to achieve the level of technology required to create the perfect robot. With the number of people aged 65 years or older increasing from 425 to 677 million during this time, and with fewer and fewer doctors and nurses to go around, robots may become the only solution to the unequal distribution and shortage of healthcare providers. If robots become as widespread in medicine as they already are in industry, there could be an unprecedented rise in the quality and availability of healthcare. With more than \$1.3 trillion; 17% of the gross domestic product, spent every year on healthcare in the U.S., we need to be spending smarter. Our government and the private sector must grant the funding of the

research today; other countries already are. The multitude of benefits to an already overtaxed healthcare system would more than pay for itself tomorrow.

Medical robots offer a distinct advantage to the consumers of health care over their human counterparts. They don't take a lunch break, need a day off or go on vacation. So it's more than likely that real soon, a robot will be on it's way to a doctor's office near you. Just ask any android.

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