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Friday, Mar 02, 2007

The Journal Gazette

Posted on Mon, Feb. 26, 2007

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Second nature to robots

Engineers ape animals to improve machinery

By Bryn Nelson
Newsday

SAN FRANCISCO – Robots already are driving cars, vacuuming rooms, tracking wildlife, climbing up walls and spying on nannies. In the not-so-distant future, a new generation of machines might be driving for us, watching our children and dispensing medicine, according to a panel of experts at the recent annual conference of the American Association for the Advancement of Science.

The potential has engineers and computer scientists thinking big even as other researchers ponder our increasingly complicated relationships with the machines we've endowed with ever-greater artificial intelligence.

"Not only must they be intelligent, but they must be able to go anywhere," said Robert Full, a biologist at the University of California, Berkeley.

And with nature as a source of inspiration, many are doing just that. Full's studies of how a cockroach runs, for example, led to the collaborative development of a robot known as RHex and its smaller sibling, EduBot – each equipped with six legs that can independently move forward or backward and climb over a variety of terrains.

Stanford University engineering graduate student Sangbae Kim took similar inspiration from geckos to design Stickybot, a four-limbed robot equipped with gecko-like foot pads that allow it to climb vertical glass surfaces. The same principle allowed him to develop an adhesive that Full likened to "Velcro without needing the other side."

Ken Goldberg, an engineering professor at Berkeley, said robots can return nature's favor by acting as active environmental observatories in places where the working conditions might be difficult and dangerous.

While working to automate a high-resolution camera that "can read a credit card from across the

Associated Press

Honda's Asimo robot – for Advanced Step in Innovative Mobility – dances at a technology fair in New Delhi, India. It is billed as the world's most advanced humanoid robot.

YBOT will work the Fort Wayne Police Department Hazardous Devices Unit on a minirobot to join the unit's full-size robot, shown removing old dynamite from a home this month.

room," Goldberg heard about a Cornell University-led search for the ivory-billed woodpecker, long believed extinct but potentially spotted in 2004 in an Arkansas bayou. Goldberg helped develop a statistical program that allows a twin camera system aimed at the sky to discriminate among the possible images it tracks, keeping only one in every 10,000 images and helping researchers zero in on birds.

Now running continuously for three months, the camera has captured images of a red-tailed hawk, a flock of geese and a blue heron, Goldberg said, encouraging him that the project is on the right track. Other researchers already have expressed interest in using similar setups to track bears, penguins and gorillas.

Robots soon might be working in more urban settings. In 2005, a team of Stanford engineers took top prize in a challenge requiring a robotic car to travel 132 miles through a desert course. The next challenge, said Stanford robotics expert Sebastian Thrun, "is making a car that drives where we live," including densely populated cities and suburbs.

The Stanford Racing Team has designed a robotic car named Junior to compete in the 2007 DARPA Urban Challenge, a fall competition sponsored by the Defense Advanced Research Projects Agency that will require cars to conduct simulated military supply missions while navigating through traffic.

The older robotic cars couldn't distinguish a car from a bush, Thrun said. The new ones not only must make that distinction, but also operate with a 360-degree field of sensing that will allow them to back out of a driveway, change lanes and avoid other vehicles. Beyond serving as chauffeurs, robots might be

designed to become effective domestic companions and caregivers, said David Calkins, a professor of robotics and computer engineering at San Francisco State University. Nannybots, for example, are WiFi-connected robots that allow parents to check in on their children. Despite the huge potential, some technical limitations are still apparent. A Roomba might do a reasonable job of vacuuming your floor, Calkins said, but it can't distinguish between a human and a chair leg. And the independently moving EduBot scurrying past him across a meeting room carpet had to be freed from the tall gold curtains by the window.

Calkins agreed that the push for robots to perform more detailed tasks is a "slippery slope" toward increasing dependence but a trend that he's not particularly anxious about. Despite the ubiquity of automatic dishwashers, he said, everyone still has a sink and dish soap and is capable of doing dishes.

"I think the net benefit is radically in favor of the technology saving more lives," Calkins said.

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