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New hunt is on for robot top dog

24 April 2006
NewScientist.com news service
Chelsea Wald

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WHEN the last of Sony's Aibo robotic dogs rolled off the production line last month, it wasn't just consumer fans who mourned its passing. For years robotics researchers have been using Aibo to test artificial intelligence systems, and they were dismayed by its demise. Their online chatter has been littered with panicked requests for advice on getting hold of remaining stocks and concern over the future of their research projects.

Since its birth in 1999, Aibo has quietly become one of the most widely used robotics research tools. Its skills as a soccer player that could be programmed to compete in teams for the annual RoboCup Four-Legged Challenge are what first attracted many research labs. Soon it was being used much more widely, and it became the closest thing researchers had to a "standard" programmable robot.

So when Sony announced earlier this year that it would be ending its commercial robotics programme on 31 March, researchers were left wondering what, if anything, would take its place. Some are still hoping for a miraculous resurrection, if not of Aibo, at least of Sony's robotics programme. A group of researchers who compete for the RoboCup are compiling a volume of some 150 papers they have published on research using Aibos. They plan to present it to Sony in the next few weeks to alert the company to the amount of work carried out, in the slim hope of changing its mind. "Even I was surprised by collecting all these papers," says Manuela Veloso, a computer scientist at Carnegie Mellon University in Pittsburgh, Pennsylvania, who is editing the volume. "We knew the research was being done and the papers were being published, but we didn't realise there was such a substantial amount."

"Some are still hoping for a miraculous resurrection of Sony's robotics programme"

Although Aibo was not designed as a research tool, it came equipped with a camera, sensors, computer chip and the ability to walk - all the attributes needed for testing AI programs - which saved scientists the trouble and expense of building their own robots. Because many teams used Aibos, researchers were able to compare their results and determine whose algorithms performed best.

Take Aibo's walk, for example. In the RoboCup competition, Aibos scoot around on their forearms, trapping the ball between their arms as they run. In the first four-legged competition in 1999, most teams programmed this gait by hand, and reached speeds of up to 25 centimetres per second. Since speed is a crucial factor in winning soccer matches, the researchers soon began to experiment with programs that enabled their dogs to "learn" the best gaits for themselves. For example, the winners of the 2005 competition, a collaboration of four German universities called GermanTeam, used a genetic algorithm that "bred" possible gaits and then selected the two most successful from which to spawn offspring with the best characteristics of both. As a result, their robot reached a speed of 45 centimetres per second.

Of course the Aibo won't disappear overnight, as researchers have been gently reminding each other on the Four-Legged league's mailing list. Sony has promised to continue servicing the latest model for seven years. However, some teams have been unable to find new Aibos in shops or online, and a recent attempt by the league's coordinators to work with Sony to stockpile dogs for the RoboCup was unsuccessful. "Anybody who is planning to restock now is out of luck," says Peter Stone, an artificial intelligence researcher at the University of Texas at Austin. Stone believes the league will be able to continue until 2008 by fielding the robots the teams already have. After that, the future of the league is up in the air, he says. There is now an urgent need for an inexpensive, programmable robot to fill Aibo's shoes.

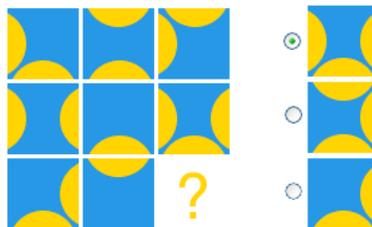
One possible successor is Robosapien, a humanoid consumer robot built by WowWee Robotics of Hong Kong. The robots are not fitted with the complete package of sensors and processing power like Aibo, but inventor Mark Tilden hopes researchers will modify the robot to suit their needs. "As I am a frustrated robotics researcher myself, I have specifically - though not officially - made all our Robosapien line flexible, adaptive and inexpensive enough for modification and improvements," he says. "We even colour-coded and socketed all our internal cables for ease of modification."

Two universities have already fielded modified Robosapiens in the RoboCup's humanoid league. To make their Robosapiens autonomous, the teams replaced the head with a hand-held computer and a camera. A team from the University of Freiburg in Germany bought and modified a Robosapien for less than \$1000, half the price of an Aibo. Other teams are also beginning to modify Robosapiens, but it is not clear if these robots will ever be great soccer players, or whether it would make sense to devote an entire league to them. "While it's possible to dribble a ball with the robot, Robosapien is unable to perform the powerful kick needed for penalties," the Freiburg team reports.

Perhaps a better solution would be to design and build a robot specifically for researchers. Daniel

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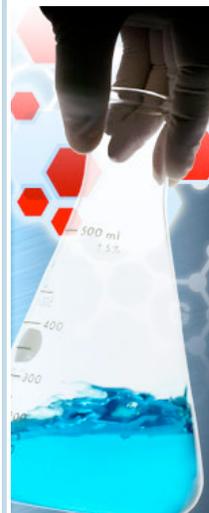
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Koditschek, a robotics engineer at the University of Pennsylvania, Philadelphia, is developing just that. It's called EduBot and, standing still, looks as lacklustre as its name implies. It is shaped like a brick, with six semicircular appendages that look as if they would be better for swimming than walking. However, EduBot comes into its own when it moves. It can leap, flip, run and prunk - jumping straight up in the air by pushing with all its legs at once, like a springbok. Using four of its legs, EduBot can also bound like a gazelle, and it runs much faster than Aibo, with its speed expected to exceed five body-lengths per second. This compares very favourably with the Aibo record of 1.4 body-lengths per second.

In September Koditschek's team will begin testing EduBot as a teaching and research tool. Some 10 robots will be used in engineering classes at the University of Pennsylvania, and other EduBots will be shared with robotics labs at other universities. If all goes well, the team hopes to begin selling EduBots commercially in 2007. They also plan to create a website where researchers can exchange experimental techniques and results - an important step to making the robot a standard research tool. The robots will cost around \$5000 initially, but Koditschek expects this to drop significantly once they are produced in large numbers.

A final, more idealistic option for replacing Aibo is for AI researchers to collaborate to design a robot that fits all their needs. By working together to build a robot, AI researchers would no longer be at the mercy of a single company or university, which would ensure the device was with them for years to come. That, at least, is the dream of roboticist David Calkins of San Francisco State University.

Calkins's ideal robot would also be brick-shaped and include a standard computer "brain". From that base it would be completely modifiable. Researchers could snap on different heads, legs, cameras and sensors, he says. It could even be made in different sizes: "the difference between a toy poodle and a German shepherd", he says. It would also not be limited to four legs like Aibo: it could have two, four, six, or even 12 legs, according to each researcher's needs.

"Now is the time for us to stop being lazy and using Sony's platform," Calkins says. "We need to get together and build a better system."

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