

**wet1**

Wanderer (5,086 posts)

08-22-01, 02:00 AM

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One of the truly difficult tasks to get a robot to do is walk. Multilegged robots have a better track record when it comes to mobility. But two legged creations have a more difficult time of it due to balance, texture of the ground, and it inherent necessity of partially falling forward to move. Here is a news article from USA TODAY on a few successes.

Dinosaurs walk again, thanks to technology  
By Kathleen Fackelmann, USA TODAY

<http://www.usatoday.com/life/cyber/...obot-inside.jpg>

It took Peter Dilworth five years to create Troody, a robotic dinosaur. But putting Troody together, bolt by bolt, was the easy part. Dilworth's goal was to give Troody the gift of motion. To do that, he had to give the robot a brain — a computer that would tell Troody's legs to move forward despite a changing terrain. In short, Dilworth was trying to teach Troody to walk. On Oct. 20, Dilworth achieved his dream. It was 3 a.m. at the Massachusetts Institute of Technology Leg Laboratory in Cambridge. Dilworth had just gotten Troody to balance on one leg. He didn't think the robot was ready to walk yet, but a last-minute hunch made him send a signal to the robot's computer.

To Dilworth's amazement, Troody started to walk. "It was a slow Frankensteinian kind of walk," he says. "But it made it all the way across the desk."

That walk put Troody in the vanguard of a small group of elite robots that can walk, run, hop and even perform tucked somersaults. As it turns out, getting robots to walk on two legs is a surprisingly difficult task.

"Troody is the first walking 3-dimensional, two-legged dinosaur ever," Dilworth says. He's understandably proud of the robot, which at 18 inches tall and 4 feet long was built to look like a young Troodon, a vicious meat-eating dinosaur that prowled the Earth during the late Cretaceous period, about 75 million years ago.

**Far-reaching capabilities**

Troody is the prototype for a bigger, sturdier robot that Dilworth hopes to build. Such robots would give museum visitors a better idea of how Troodon dinosaurs actually moved in real life, Dilworth says. But Troody's impact goes far beyond the rarified world of museum exhibits. The technology used to make Troody will one day help scientists build smart wheelchairs, robotic legs or other devices that will help disabled people walk again, says Gill Pratt, director of the MIT Leg Lab.

Tiny but ever more powerful computers will allow robotic researchers to begin fashioning such futuristic devices — possibly within the next decade, says Tucker Balch, an artificial-intelligence researcher at Carnegie Mellon University in Pittsburgh.

But to realize that dream, researchers must first figure out how to make robots that walk just like their biological counterparts. That's where Troody comes in.

About five years ago, Dilworth began to build Troody with an assortment of odd-shaped aluminum rods, springs, screws and other parts made to order by the MIT machine shop.

The robot weighs about 10 pounds. Its head and neck are made of foam and painted to look like a real Troodon, which was about 6 feet long when fully grown.

"It looks like a big chicken," Dilworth says.

Real Troodon dinosaurs looked something like big birds, but they were no chickens when it came to hunting prey, says dinosaur expert Michael Brett-Surman of the Smithsonian's National Museum of Natural History in Washington, D.C. Troodon dinosaurs would literally run down and rip apart their prey, usually small mammals or lizards, he says.

Taking dino baby steps

It took Dilworth two years to put together the aluminum bolts and springs that make up Troody's body. To give Troody the brainpower to walk, Dilworth put a small computer in the robot's chest. That computer is attached by wires to 32 sensors in the joints of Troody's feet and legs. The wires and sensors, like nerve cells in the human body, constantly take note of the hardness or softness of the ground, and relay that information to the computer.

The computer also gets information from several other sensors in the chest that tell the computer whether Troody is tilting to the side or has started to fall.

When Dilworth works a joystick to signal the robot to move forward, Troody's computer reads that information and sends a signal to 16 electric motors that power Troody's legs and feet.

Each time Troody puts down a foot, the computer adjusts for a variety of factors and tells Troody to take the next step. Most of the time, that means Troody can walk without falling.

But Troody does fall — and to prevent damage, the wire connecting the joystick to the robot doubles as a safety line, Dilworth says.

Getting Troody to walk sounds easy, but it took Dilworth one year to get Troody just to stand up. After another year, he got Troody to step side to side. Three years later, he got Troody to balance on one foot. In the end, five years had passed before the fateful October night when Troody took her first steps.

"I was elated," Dilworth says. It may not sound like much. After all, a 1-year-old human learns to walk, usually without any help at all. Robotic researchers have long been able to build robots that walk on four legs. But it's much harder to create a machine that can balance and walk about on two legs, Balch says. In fact, Troody is one of the first two-legged robots in the world to achieve the goal of walking, he says.

M2 is all legs

In 1997 Japanese scientists at Honda were the first in the world to create a walking two-legged humanoid robot. More recently, Sony scientists did the same. Japanese researchers have been the leaders in building humanlike robots that walk, Balch says.

MIT researcher Daniel Paluska hopes that his M2 robot will change that. Paluska's robot is a metal torso on a pair of legs, with no head — at least not yet. Just like Troody, this robot has a computer that reads information from the feet and legs and adjusts each step.

M2 can step side to side, but it has trouble walking forward. Paluska hopes to get M2 to walk and turn reliably well. To do that, he and the other MIT researchers are racing to unravel the complex mechanism that allows humans to walk, and turn, and run without really thinking about it.

If scientists can build a machine that can walk the way a human walks, they might be able to design devices that would replace braces or a wheelchair, Pratt says. For example, he envisions a future in which a disabled person

slips on a pair of robotic pants that read sensor information and then give signals to the leg and feet to walk forward.

As for Troody, the robot is now on display at the Boston Museum of Science. Such exhibits will help educate the public about Troodon dinosaurs, which scientists consider the smartest of all dinosaurs, says dino expert Don Lessem, president of Dinosaur Productions, a consulting firm in Newton, Mass.

Troodon dinosaurs had a brain that scientists considered massive for the time, Lessem says. A bigger brain probably allowed Troodon dinosaurs to hunt in packs, a relatively complex task that allowed them to attack larger animals, he says.

Right now, Troody can't solve problems or think or strategize. Dilworth wasn't even trying to give Troody such abilities. It was hard enough to get the robot to walk, he says. Yet that's clearly where the field of artificial intelligence is headed, Balch says. Could scientists one day make a robotic dinosaur with a better brain, one that could plot and carry out an attack on a mammal?

Absolutely, Dilworth says.

Stay tuned for Jurassic Park IV.



**Cris**

In search of Immortality (6,054 posts)

08-22-01, 09:58 AM

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wet1,

Nice article.

Here is a link to some movie clips tha show ASIMO walking. ASIMO is a humanoid style walking robot built by Honda after 20 years of research.

<http://world.honda.com/ASIMO/movies/index.html>

Have fun  
Cris

**Anon1268**

Junior Member (9 posts)

08-25-01, 11:18 AM

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I agree, a nice article, and a very fine accomplishment.

However, I have always wondered *\*why\** robots need to 'walk'. i can understand it from the research perspective; i.e. we want to understand how walking *\*works\** and marvel at the complexity of a bipedal system, but truly - could not robots achieve motion in other, more machine-efficient ways?

A robot is, after all, a machine - usually specifically designed for a task. The issue of tough terrain no longer *\*is\** an issue if a robot is only designed for a specific environment... and multi-purpose 'travel apparatus' could follow from this; hovering is an almost perfect solution, if it were only more energy efficient.

Im not trying to bash the article or the robot, i think its fantastic - and i know this is my first post etc, but it does seem rather blinkered to me to be trying to get robots to 'emulate' human physiology and behaviour. I guess this makes the technology more 'approachable' to the human mind...

I don't know, I just see the 'robots of the future' being machine-like, because thats what they ARE. I agree with the premise that we have a LOT to learn from nature and our world, but I do not think that this should mean we don't respect our own thoughts and designs.. it is very possible that we have evolved to be *\*more\** intelligent than nature, and i think this is often scorned or frowned upon.