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## Marathon robot: 'Ranger' sets a world record by walking 40.5 miles non-stop on a single battery charge

By [Daily Mail Reporter](#)

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Engineers have set a new world record after their robot walked 40.5 miles on a single battery charge without stopping or even being touched.

Pulling an all-nighter, and then some, the walking automaton - dubbed Ranger - broke the record in a leisurely 30 hours, 49 minutes and two seconds.

It covered the 307.75 laps (0.13 miles per lap) of Cornell University's sports hall at a 1.3mph amble.

**Scroll down for video**



**Marathon: Cornell University's Ranger robot broke the world record for continuously walking without needing to be recharged or even touched by engineers**

To warm up for the feat, Ranger - donating a participation fee - walked 30 laps in the American Cancer Society's Relay for Life the day before.

Ranger, built and programmed in Cornell's Biorobotics and Locomotion lab, had been set a goal of a full 26.2 mile marathon.

But after it passed this mile-stone in just over 20 hours it just kept going... and going.

The goal of the project, funded by the National Science Foundation, is to understand walking by reinventing it, said Andy Ruina, the mechanical and aerospace engineering professor who led the team that built Ranger.

But to mimic that most essential of human actions requires a big dollop of engineering nous. Ranger has six small onboard computers executing about 10,000 lines of computer code, run in a repeating loop every 1/500th of a second.



**Don't stop me now: The Ranger's marathon effort had engineers wishing it would fall over so they could call a halt to the trial and get some rest**

The robot's total weight is 22lb, of which 6lb are the lithium-ion batteries that power the electronics and the motors.

One of these motors extends the outer ankles, another extends the inner ankles and a third swings the legs. A fourth smaller motor twists the inner legs for steering.

The motors consume about 11.3 watts, and the electronics a further 4.7 watts. At 16 watts total, the specific cost of transport (COT, energy per unit weight per unit distance) was a relatively stingy 0.28 joules per newton-meter.

Most robots use much more energy (with a typical COT of 1.5 or more), Professor Ruina said. But Ranger still isn't as efficient as a human; we can walk with a COT of about 0.2.

Ranger's present COT of 0.28 is an improvement on its COT last summer of 0.49. Pranav Bhounsule, the graduate student in charge of the control system, said: 'We've improved the control in various ways since then. But I think we can still do better.'



**It's for charity: To warm up for the feat, Ranger - donating a participation fee - walked 30 laps in the American Cancer Society's Relay for Life the day before**

While most legged robots achieve stability by carefully controlling all of the joint angles in their bodies, Ranger achieves its low energy use by, as much as possible, letting the legs swing as they will, Professor Ruina explained.

Also, most bipedal robots stand on flat feet. Ranger can't stand upright at all; instead, it balances by falling and catching itself at each step - just like a human.

As anyone who's watched a baby learning to take her first steps will know, the trick is to make the catch at the right time and place.

Professor Ruina said: 'Our challenge is to lower the energy use while still maintaining balance,

'The achievement is to have gone 186,076 steps on 5 cents worth of electricity, and without falling down.'

But the team have also learned important lessons about human energy conservation from the marathon record attempt.

'If we try for another record it will be with automatic steering,' Professor Ruina said.

'After about 24 hours of walking in circles, we half hoped the thing would fall on its face.'