Researchers create robotic cheetah

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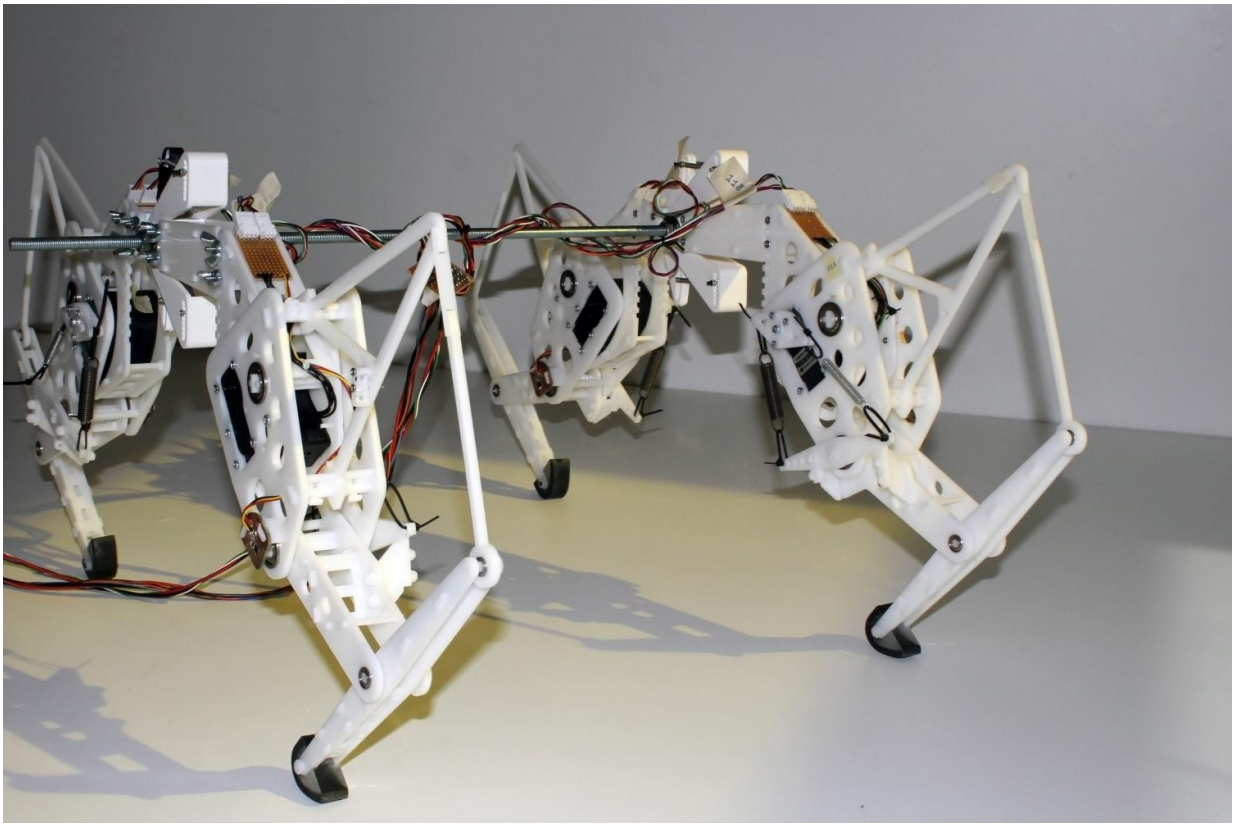

Credit: University of Twente

University of Twente researcher Geert Folkertsma has developed a prototype cheetah robot. Folkertsma has dedicated four years of research and development to constructing a scaled-down robotic version of the fastest land animal in the world, with a view to replicating its movements. Relatively speaking, the robot moves using only about

fifteen percent more energy than a real cheetah. Folkertsma's doctoral defence of this unique project will take place on 21 April 2017 at the University of Twente.

"As you might expect of the fastest land animal in the world, the cheetah makes very efficient use of its energy," Folkertsma explains. "I wanted to create a robot that runs the same way, with the aim of applying this knowledge to the development of new robots. Robots are bound to play an increasingly important part in our daily lives and we therefore have to ensure that they can move effectively in our environment. My robot vacuum cleaner, for example, cannot climb stairs or even cope with thresholds. We therefore need to develop robots that can walk and when it comes to moving around efficiently, there's a lot we can learn from the cheetah."

Useful applications

While walking robots tend to be large and heavy, taking cumbersome steps that use a lot of energy, the cheetah runs swiftly and smoothly. "By applying knowledge about the movement patterns of the cheetah, you can develop robots that walk more elegantly and above all efficiently," Folkertsma continues. His research provides valuable knowledge that can be used to optimize the robots of the future, designed to support us in areas such as healthcare or housekeeping. The knowledge gained from the project can also be put to good use in rehabilitation robots or advanced prosthetics that are equipped with robotics.

Research

Folkertsma studied extensive video footage of cheetahs and used software to analyse their movements. The backbone proves crucial to the power this big cat generates. Bending and extending its spine enables the

cheetah to move efficiently, run exceptionally fast and make huge leaps. "The main difference between existing walking robots and my cheetah robot is therefore the backbone," Folkertsma says. "The trick was to imitate it without complicating matters unnecessarily: instead of vertebrae and intervertebral discs, we worked with a cleverly placed spring which delivers approximately the same effect. Cheetahs are also able to store a lot of energy in their muscles for later use. This too is something we have imitated by fitting carefully selected springs in our robot's legs."

Results

"My robot can be seen as a simulated skeleton, complete with muscles and joints. Not every element is where you would find it in the animal, but the spine, shoulders and hips occupy the same position. A real cheetah not only runs, but also climbs trees for example. That is not something our robot needs to copy. After all, the aim was not to reconstruct a cheetah, but to reap the rewards of its efficient way of running. By way of illustration, the robot does not have a normal foot, but a light-weight mechanism with springs which turned out to be more efficient."

The prototype developed by Folkertsma weighs in at 2.5 kg and is 30 cm long: twenty times lighter than a real cheetah and four times smaller. Taking into account the weight difference, the robot moves using only about fifteen percent more energy than a real cheetah. The robot can currently reach a speed of about one kilometre per hour. "That's quite a pace for such a small robot," Folkertsma observes. "More research is needed to enable it to run as fast as a real cheetah, relatively speaking. That would entail getting up to a speed of around twenty kilometres per hour. A Master's student is currently working on a newly developed robotic leg and the first tests, focusing on a single leg, are already promising. With four legs of this type, the robot will be able to run much

faster; I think this will help us make genuine advances."

Geert Folkertsma will defend his PhD thesis entitled Energy-based and biomimetic robotics in the Prof. G. Berkhoff hall, in the Waaier Building on the University of Twente campus on 21 April. He conducted his doctoral research at the Department of Robotics and Mechatronics (RAM), under the supervision of Prof. Stefano Stramigioli.

Provided by University of Twente