Scientists reach the heights with gecko-inspired tank robot (w/ video)

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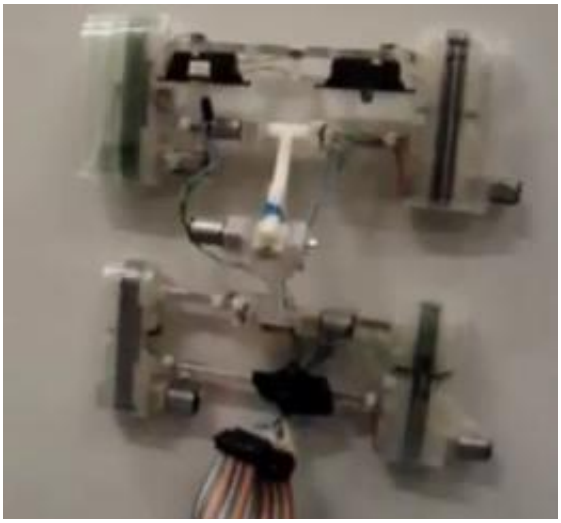


(PhysOrg.com) -- Researchers have developed a tank-like robot that has the ability to scale smooth walls, opening up a series of applications ranging from inspecting pipes, buildings, aircraft and nuclear power plants to deployment in search and rescue operations.

Their study, published today, November 1, in Smart Materials and Structures, is the first to apply this unique, bioinspired material to a robot that operates in a tank-like manner.

This method offers an alternative to the magnets, suction cups, spines

and claws that have all been presented as possible mechanisms, but seem to fall at the same hurdle – the ability to climb smooth surfaces such as glass or plastic.

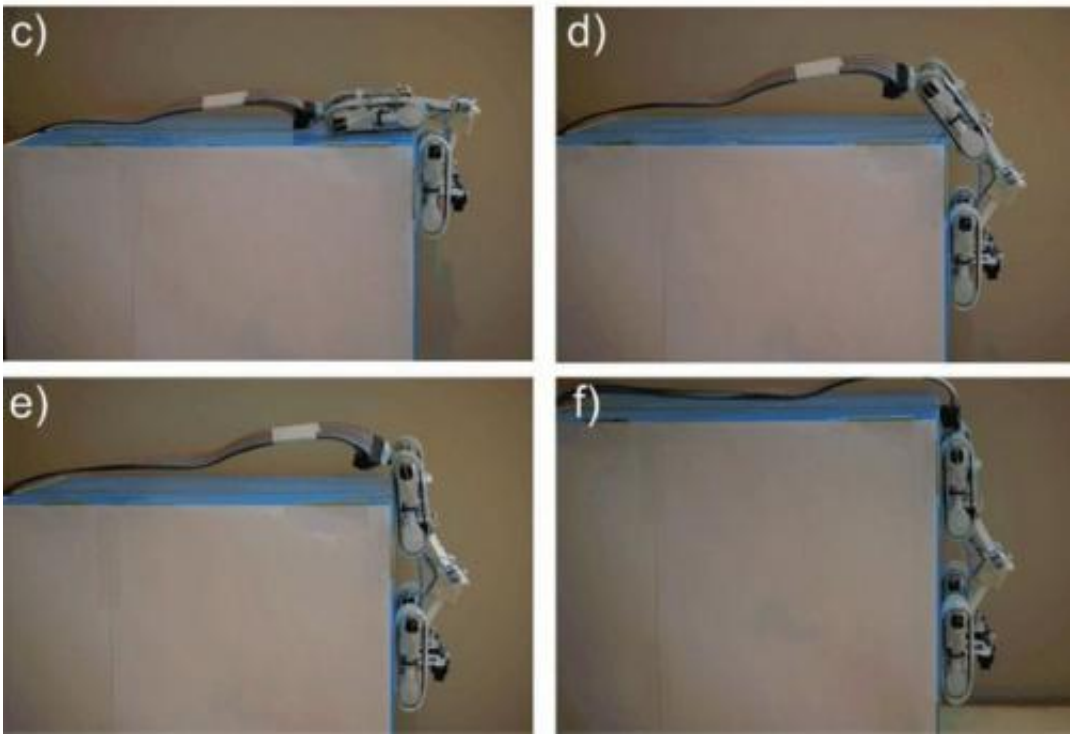
Drawing inspiration from the gecko, researchers have been able to create adhesives that carefully mimic the toe pads of the lizard that give it the amazing ability to climb smooth vertical surfaces and shuffle across ceilings.

Tank-like robots, driven by belts rather than a set of legs, are advantageous in that they have a simplified mechanical design and control architecture, have an increased mobility and can be easily expanded, just like a train, if you need to increase the load the robot is carrying.

The new, 240g robot, also known as the Timeless Belt Climbing Platform (TBCP-II) and developed by researchers at Simon Fraser University Burnaby, is capable of reliably transferring from a flat surface to a wall over both inside and outside corners at speeds of up to 3.4cm/s.

TBCP-II is also fitted with a multitude of sensors that are able to detect the surroundings of the robot and change its course of action accordingly.

Lead author, researcher Jeff Krahn, said: "With an adequate power supply, our robot is capable of functioning fairly independently when it encounters larger-scale objects such as boxes or walls. However, we are still developing a control strategy to ensure the robot is capable of fully autonomous functionality."



A tank-like robot that can scale vertical walls and crawl over ledges without using suction cups, glue or other liquid bonds to adhere to the surface. The 240-gramme (6.9-ounce) beast has tracks that are covered with dry microfibres modelled on the toe hairs of the gecko, which can famously zip up windows and along walls almost without effort.

The toes of geckos have amazing characteristics that allow them to adhere to most surfaces and research suggests that they work as result of van der Waals forces – very weak, attractive forces that occur between molecules.

These dry, but sticky toe pads, also known as dry fibrillar adhesives, were recreated in the lab using the material polydimethylsiloxane (PDMS) and were manufactured to contain very small mushroom cap shapes that were 17 micrometres wide and 10 micrometres high.

"While van der Waals forces are considered to be relatively weak, the thin, flexible overhang provided by the mushroom cap ensures that the area of contact between the robot and the surface is maximized.

"The adhesive pads on geckos follow this same principle by utilizing a large number of fibres, each with a very small tip. The more fibres a gecko has in contact, the greater attachment force it has on a surface," Krahn continued.

More information: "A tailless timing belt climbing platform utilizing dry adhesives with mushroom caps" J Krahn et al 2011 *Smart Mater. Struct.* 20 115021. iopscience.iop.org/0964-1726/20/11/115021

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