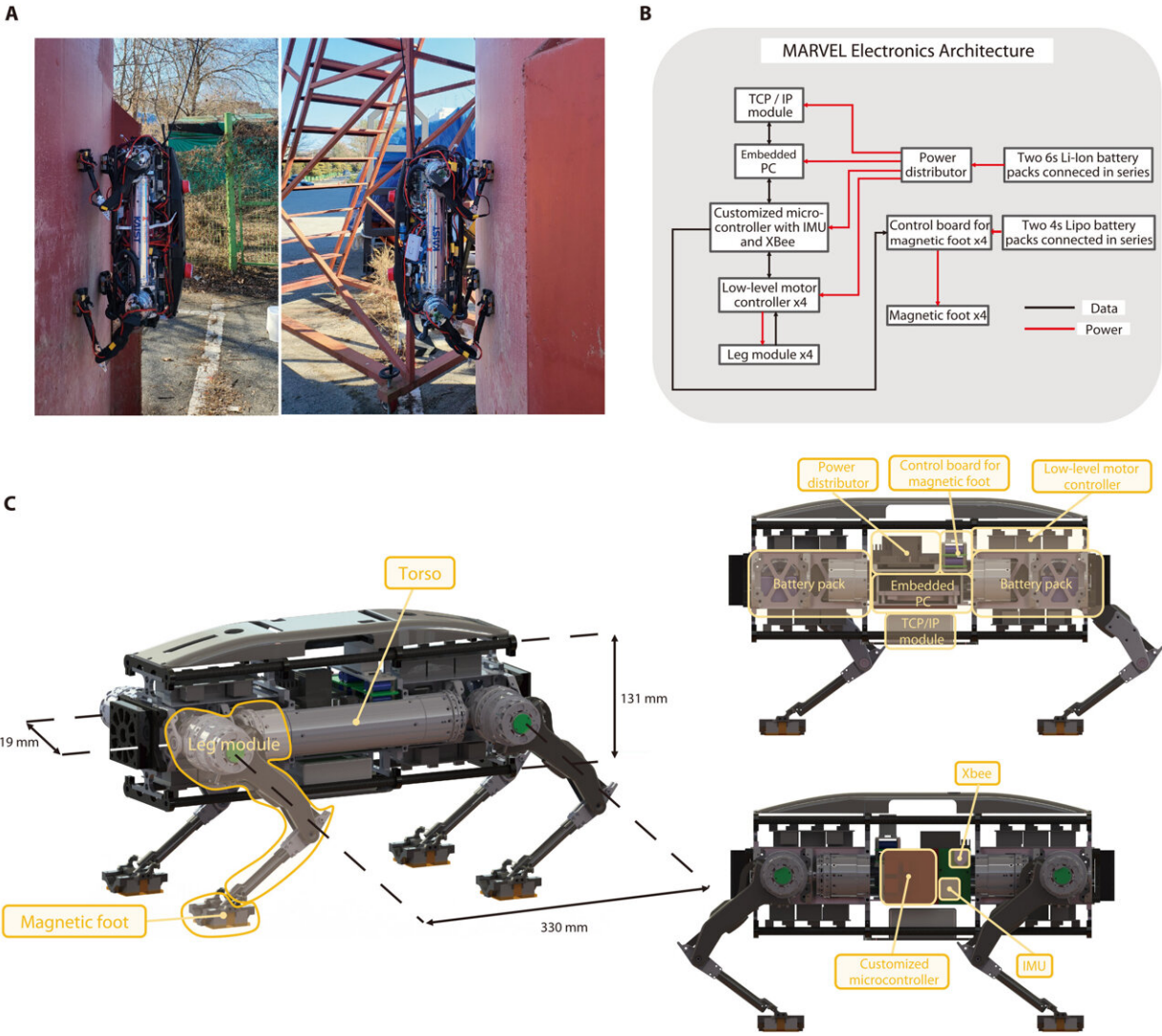


Quadruped robot with magnetized feet can climb on metal buildings and structures (video)

December 15 2022, by Bob Yirka



MARVEL description. (A) MARVEL clinging to a steel storage tank. (B)

MARVEL electronic architecture. (C) Mechanical and electronic components of MARVEL. Credit: *Science Robotics* (2022). DOI: 10.1126/scirobotics.add1017

A trio of researchers at Korea Advanced Institute of Science and Technology, working with a colleague at the University of Illinois at Urbana-Champaign, has designed and built a working quadruped robot with magnetized feet that can climb on the walls and ceilings of metal buildings and structures.

In their paper published in the journal *Science Robotics*, Seungwoo Hong, Yong Um, Hae-Won Park and Jaejun Park describe their [robot](#) and how well it worked when tested under real world conditions.

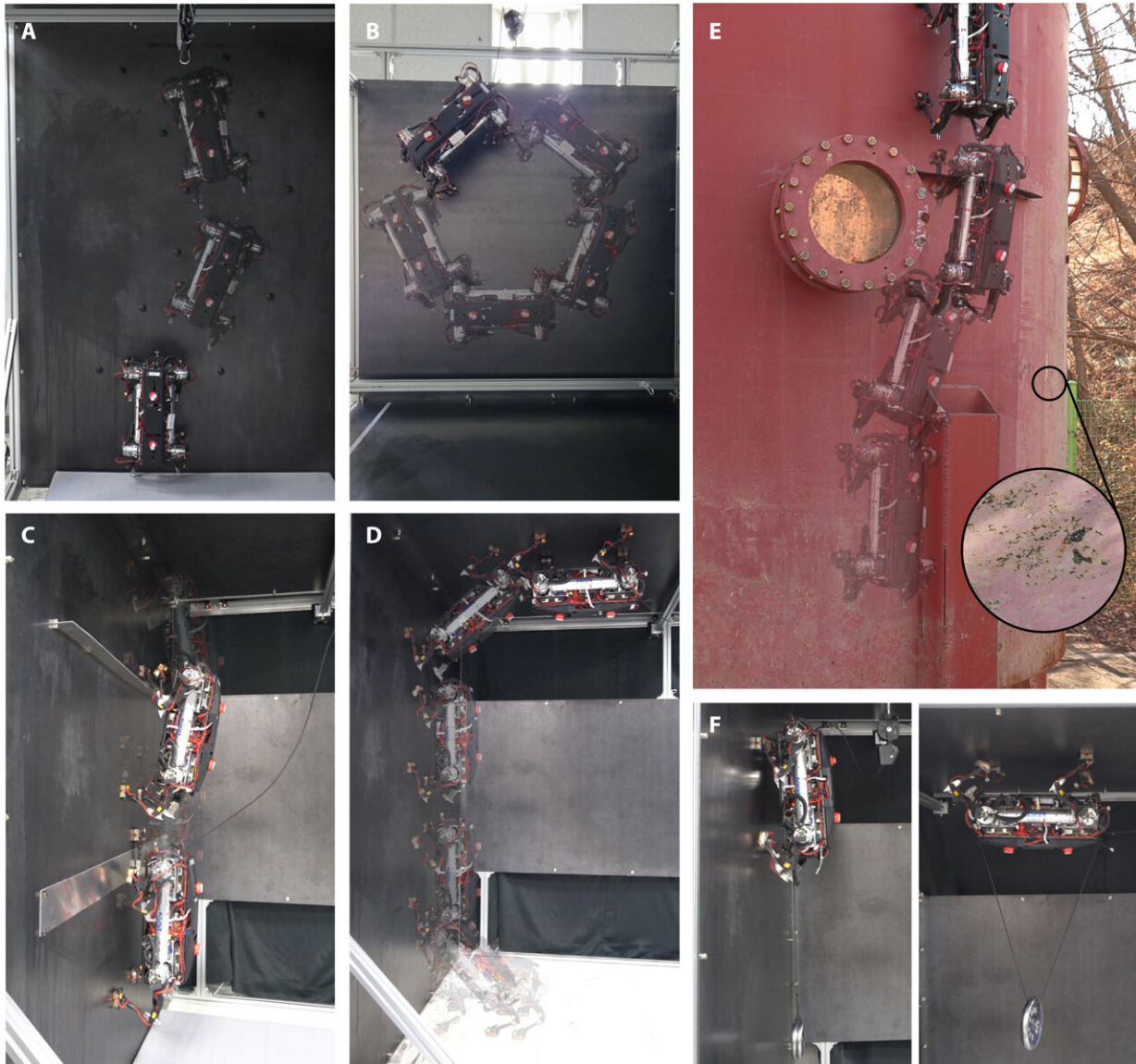
As the [technology](#) used to build robots improves, engineers find more ways to use them. In this new effort, the researchers set out to build a robot that could assist with [maintenance work](#) on large metal structures such as bridges, oil tanks and some buildings. They constructed a four-legged robot that could walk around on a [flat surface](#), then approach a wall and walk straight up its side like a spider—and then continue across the ceiling if need be.

The robot was uses both magnetic elastomers and electro magnets. Together, they allow the robot feet to magnetize and demagnetize on demand. By turning the magnetism on and off, the robot is able to have a single foot cling to a vertical spot on a wall and hold on while other [feet](#) are adhered—and then to let go with one foot at a time to take steps.

The researchers also had to program the robot to allow for first beginning a climb and then for moving around or over obstacles. For this, they simulated the way a cat tests a surface before moving forward, taking tiny first steps with its front paws before adding the action of

back paws.

Testing showed the robot capable of climbing metal walls and walking across ceilings in their test lab. Further testing showed the robot was able to climb up an old outdoor storage tank with walls orange with rust.



MARVEL performing various locomotion tasks. (A) Turning movement on a vertical wall. (B) Turning movement on a ceiling. (C) Traversing a gap (10 cm)

and an obstacle (5 cm). (D) The transition from floor to wall and from wall to ceiling. (E) Vertical locomotion on a storage tank, where the surface is covered with paint, rust, and dust. (F) Carrying (left) a 2-kg payload on a wall and (right) a 3-kg payload on a ceiling. Credit: *Science Robotics* (2022). DOI: 10.1126/scirobotics.add1017

Not only was it able to climb the tank, it was able to climb over spots that lacked metal and to move around obstacles. It was also found capable of carrying a payload up to 3kg. It moves at variable speeds depending on the terrain, with a top speed of 0.7/ms.

More information: Seungwoo Hong et al, Agile and versatile climbing on ferromagnetic surfaces with a quadrupedal robot, *Science Robotics* (2022). [DOI: 10.1126/scirobotics.add1017](https://doi.org/10.1126/scirobotics.add1017)

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