Weird "assembly line" assembles cockroach robot in one minute

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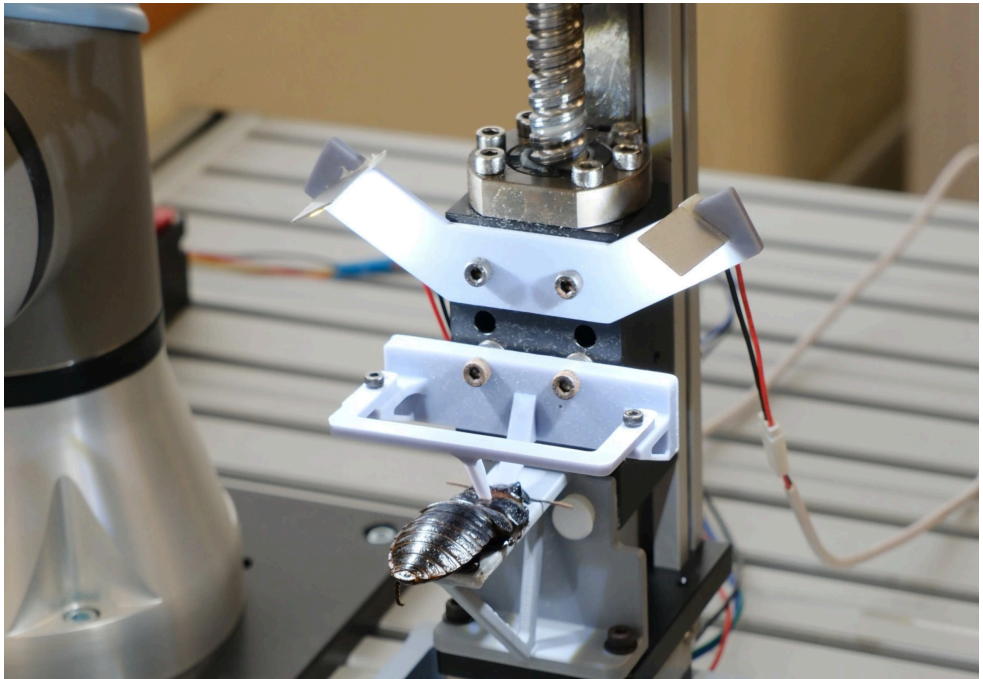
summary:

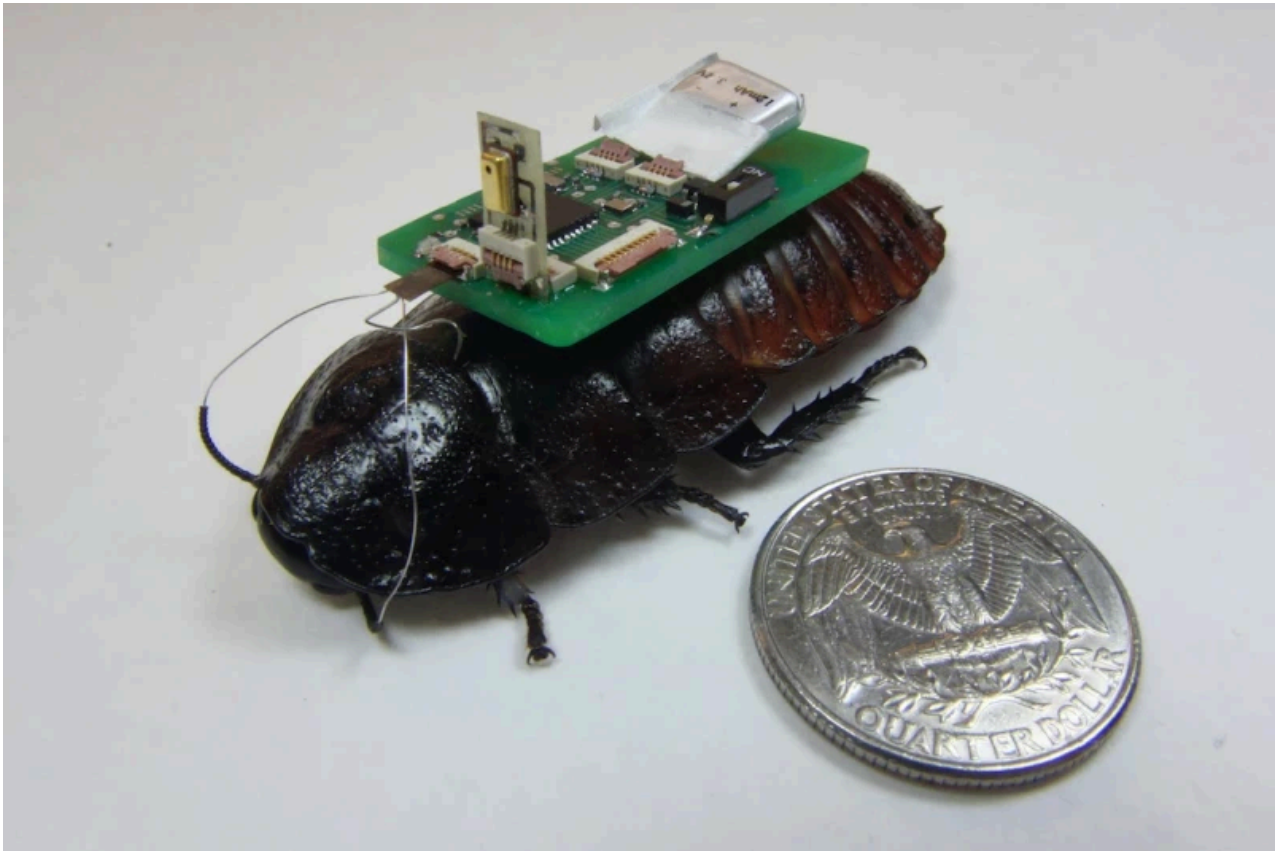
Rather than the time-consuming and laborious task of designing and building microrobots from scratch, some scientists are turning existing insects into remote-controlled robots. A new "assembly line" could help, transforming cockroaches into robots much faster than manual labor.



An anesthetized cockroach waits for its electronic backpack in an assembly line.

In simple terms, a robotic insect typically consists of a larger insect (usually the Madagascar hissing cockroach) equipped with a small electronic backpack. Remotely controlled electrodes in the backpack stimulate body parts such as the insect's antennae or eyes, causing it to start and stop walking and turn left or right.

Of course, this whole thing isn't just about morbid curiosity. One of the main uses for this robot is searching for survivors trapped in rubble at disaster sites. Equipped with a remote-controlled camera, the "cockroach" robot can squeeze through otherwise impassable gaps in the rubble and transmit real-time images and the coordinates of any survivors it encounters.

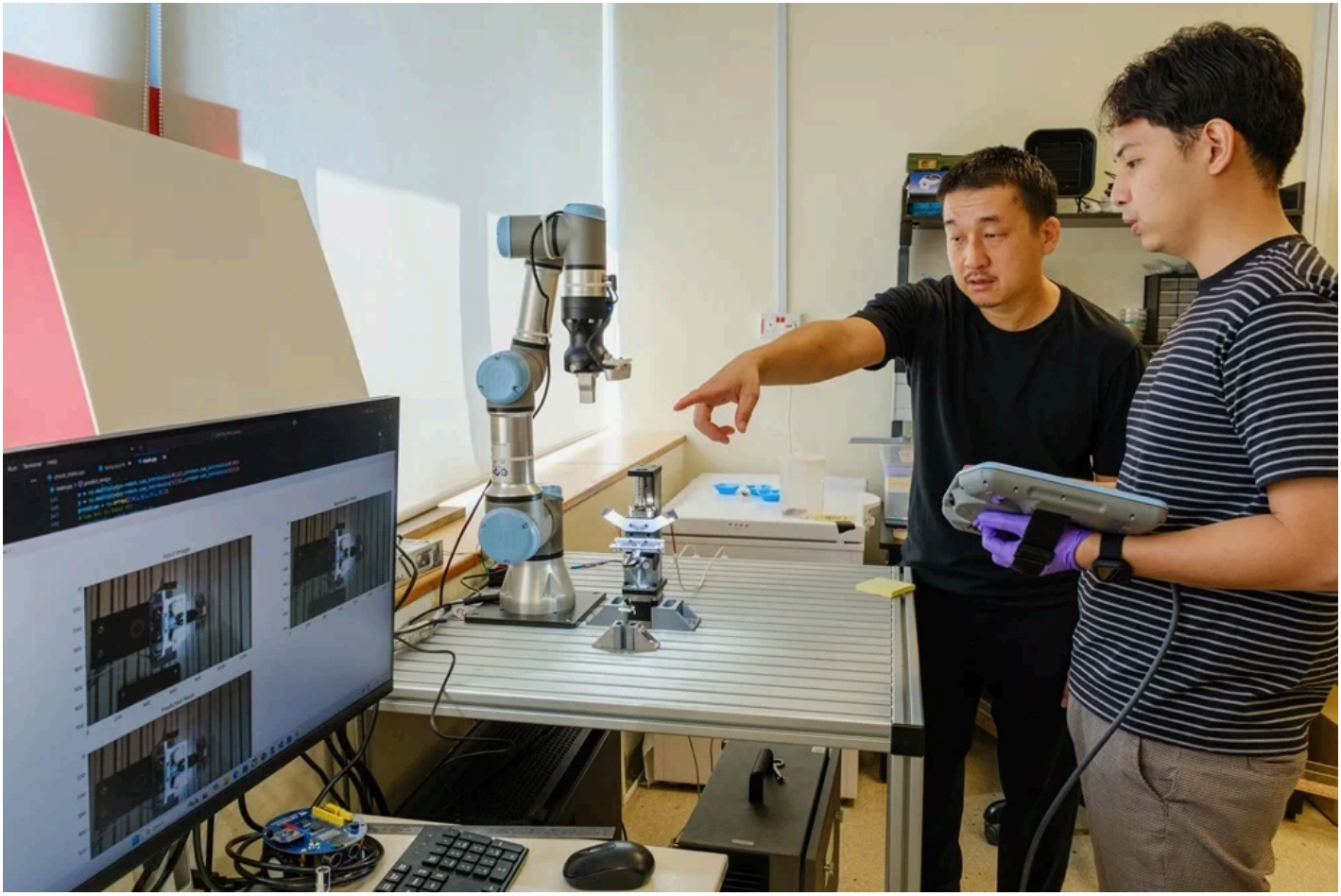


Robotic cockroach developed by North Carolina State University

However, for such a large-scale task, just a few robotic cockroaches are not enough.

It's envisioned that swarms of insects would be deployed across ruins, perhaps even coordinating their search routes through wireless communication between their backpacks. For example, if two robots' paths overlap, their backpacks could guide them apart.

For this technology to work, cockroaches can't be painstakingly engineered by hand... they need to be produced quickly through an automated process. That's where the assembly line comes in.



The development of the assembly line (pictured) was supported by the Japan Science and Technology Agency.

The computer-controlled system, developed by Professor Hirotaka Sato and colleagues at Nanyang Technological University in Singapore, consists of a platform to hold the insect, an Intel RealSense depth-sensing camera, and a UR3e robotic arm with a Hand-E robotic gripper.

After the anesthetized cockroach is secured to the platform, motors slide the device into place, and a computer vision system assesses the cockroach's size and position. A portion of the cockroach's outer cuticle is then pulled back, revealing a membrane between the cockroach's pronotum and mesothoracic segment.

Next, a preassembled 2.3-gram backpack is placed inside the cockroach, and two bipolar electrodes at the front of the backpack are implanted on the left and right sides of the cockroach's exposed peritoneum. The main backpack is then gently pressed against the cockroach's mesothorax until it snaps into place. Finally, the platform is slid out, releasing the still anesthetized cockroach.

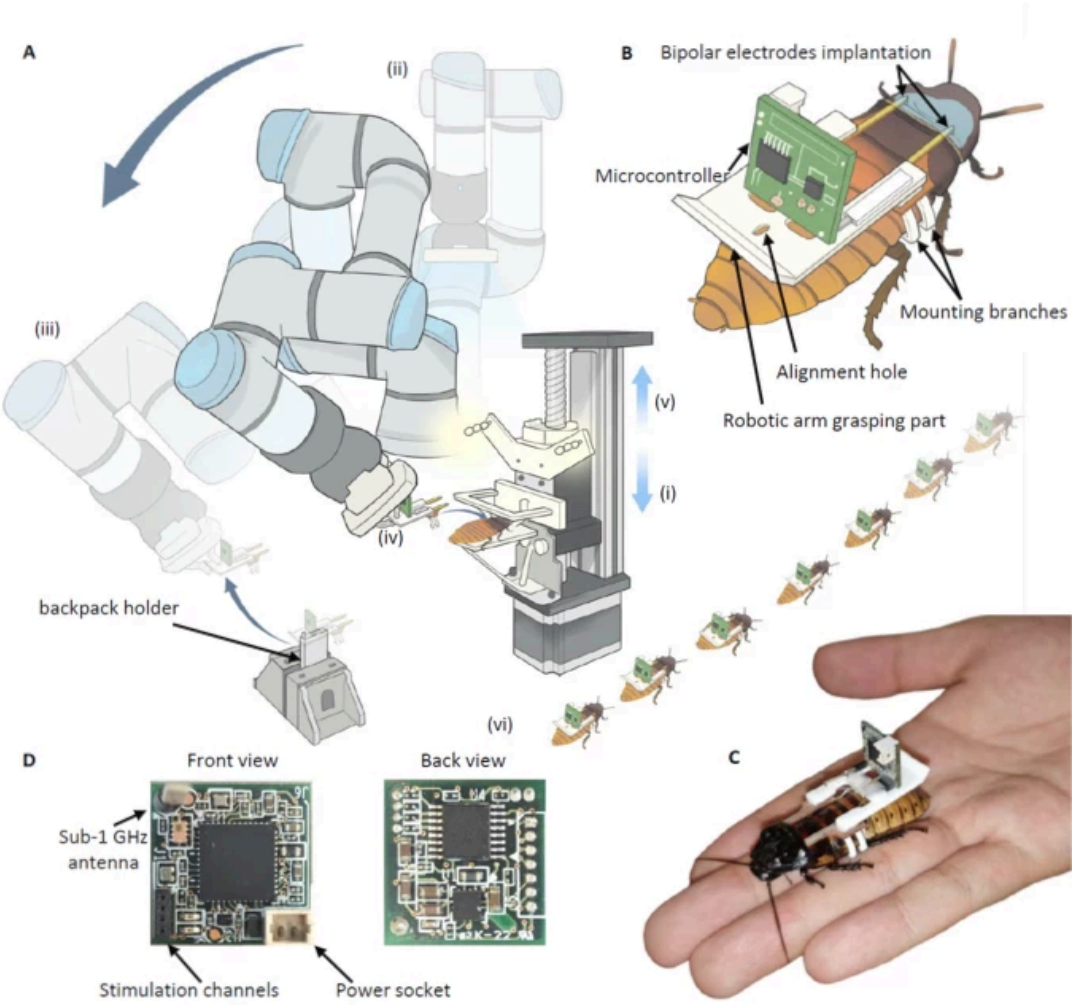


Diagram of an assembly line and robotic cockroaches - hand-assembled robots have been field-tested following the 7.7 magnitude earthquake in Myanmar

The entire process took 68 seconds per cockroach, while the same task would take between 15 minutes and an hour to complete manually. In tests on assembly-line cockroaches and hand-assembled robotic cockroaches, both groups performed similarly on teleoperated tasks, such as following an S-shaped path and exploring obstacles.

This particular robotic setup has an added benefit for the insects (and the backpack's batteries): it requires only 40% of the stimulation time and 75% of the stimulation voltage of similar systems. Furthermore, the backpack can be removed between missions.

"Our innovation makes the dream of deploying large numbers of robotic insects in real-world scenarios more realistic," said Sato. "Through automated processes, we can quickly and continuously produce insect hybrid robots. This will enable us to produce them at scale, which is crucial for time-critical operations such as post-disaster search and rescue."

A paper on the research was recently published in the journal Nature Communications .