Creating an artificial material that can sense, adapt to its environment

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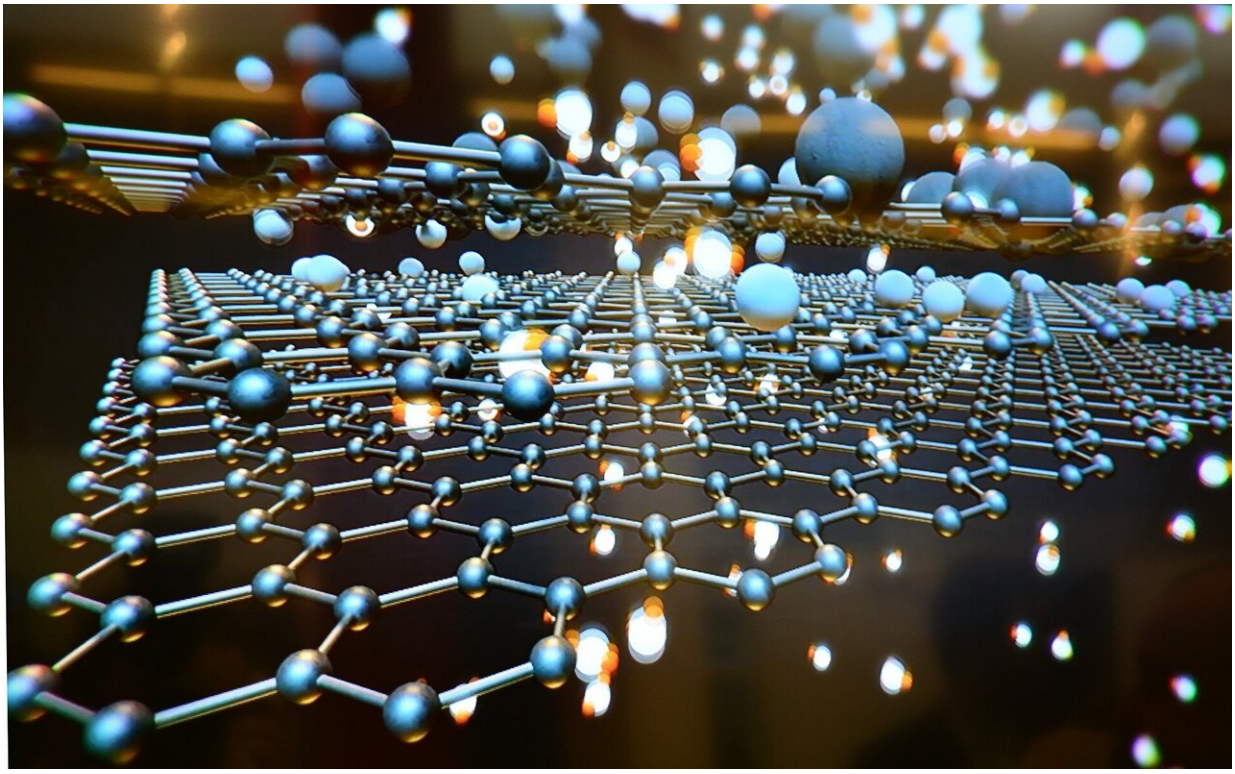

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Move over, Hollywood—science fiction is getting ready to leap off the big screen and enter the real world. While recent science fiction movies have demonstrated the power of artificially intelligent computer programs, such as the fictional character J.A.R.V.I.S. in the Avenger

film series, to make independent decisions to carry out a set of actions, these imagined movie scenarios could now be closer to becoming a reality.

In a recent study published in *Nature Communications*, a journal of Nature, researchers at the University of Missouri and University of Chicago have developed an artificial material, called a metamaterial, which can respond to its environment, independently make a decision, and perform an action not directed by a human being. For example, a drone making a delivery might evaluate its environment including wind direction, speed or wildlife, and automatically change course in order to complete the delivery safely.

Guoliang Huang, Huber and Helen Croft Chair in Engineering, and co-author on the study, said the mechanical design of their new artificial material incorporates three main functions also displayed by materials found in nature—sensing; information processing; and actuation, or movement.

Some examples of these natural materials include the quick reaction of a Venus fly trap's leafy jaws to capture an insect, chameleons changing the color of their skin to blend into their surroundings, and pine cones adjusting their shapes in response to changes in air humidity, Huang said.

"Basically, we are controlling how this material responds to changes in external stimuli found in its surroundings," Huang said. "For example, we can apply this material to stealth technology in the aerospace industry by attaching the material to aerospace structures. It can help control and decrease noises coming from the aircraft, such as engine vibrations, which can increase its multifunctional capabilities."

The material uses a computer chip to control or manipulate the

processing of information that's needed to perform the requested actions, then uses the electrical power to convert that energy into mechanical energy. The researchers' next step is to implement their idea in a real-world environment.

"Realization of active metamaterials with odd micropolar elasticity," was published in *Nature Communications*.

More information: Yangyang Chen et al, Realization of active metamaterials with odd micropolar elasticity, *Nature Communications* (2021). DOI: 10.1038/s41467-021-26034-z

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