Tiny magnetic tracking and sensing device uses magneto-mechanical resonators

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Bee equipped with marker for tracking. Credit: B. Gleich, I. Schmale, T. Nielsen, and J. Rahmer, Philips Research Hamburg, Germany

A group of bio-engineers at Philips Research has developed a tiny magnetic tracking and sensing device that uses magneto-mechanical

resonators to provide feedback. In their study, reported in the journal *Science*, Bernhard Gleich, Ingo Schmale, Tim Nielsen and Jürgen Rahmer designed the sensor and tested it under various scenarios.

For several years, scientists around the world have been looking for better in vivo imaging techniques to improve diagnostics and also possibly provide new ways to administer therapies. To that end, a large number of tiny robots have been developed, each using a novel approach to travel through the body without causing damage.

Thus far, none have been approved for use by doctors, however. In this new effort, the research team developed a simple sensor that can be controlled using current from external electromagnetic coils.

The sensor was made by placing two opposing magnets inside of a cylindrical housing, where only one of magnets is held in place. The whole thing is just one millimeter in diameter. As the device is moved using small electric pulses, the free magnet vibrates and moves around inside the housing.

By measuring the amount of oscillation, expansion and contraction and the distance between the two magnets, the sensor can provide accurate measurements of temperature, location and pressure—enough to track things like blood pressure and the impact of medication, or it could even perhaps be used to conduct biopsies.

The researchers tested their sensor in a variety of scenarios. One involved placing it inside a winding tube to emulate the intestinal tract, where it was used to provide positional data. The success of the test suggested it could be used to track bowel movements in people with IBS or other gut ailments.

Another test involved taping the sensor to the back of a honeybee and

then releasing it into a controlled environment. The team could accurately track both its movements and orientation, regardless of its speed. They conclude that their sensor appears to be useful for a variety of medical applications. Much more testing is required to ensure it is safe before trials in humans can be performed.

More information: Bernhard Gleich et al, Miniature magneto-mechanical resonators for wireless tracking and sensing, *Science* (2023). DOI: 10.1126/science.adf5451