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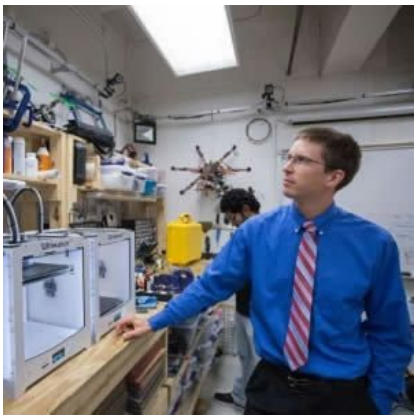
MRI-powered Mini-robots for Targeted Treatment



Researchers from the University of Houston and Houston Methodist Hospital are developing millimetre-sized robots that can travel the body's venous system as they deliver drugs or a self-assembled interventional tool. Magnetic force from an MRI scanner will be utilised to steer the tiny robots through the body. Control algorithms, imaging technology and ultrafast computational methods are needed to deploy the robots.

See Also: Demand Grows For Radiology Oncology Surgical Robots

"We want to move from science fiction to science feasibility," said Aaron Becker, assistant professor of electrical and computer engineering at UH and principal investigator for a $608,000 Synergy Award from the National Science Foundation to develop prototypes suitable for animal testing.

To tackle this unprecedented challenge, the award involves two additional investigators: Nikolaos Tsekos, associate professor of computer science and director of the Medical Robotics Laboratory at UH, who has expertise in MRI and computational methods, and Dipan J. Shah, a cardiologist and director of cardiovascular MRI at Houston Methodist Hospital, who brings expertise in clinical MRI and focusing the effort to find solutions that are clinically necessary and valuable.

The milli-robot development and control work is an outgrowth of Becker's previous research. The team's current models are up to two centimetres and Becker said the goal is robots that range from 0.5 millimetres to two millimetres. MRI provides enough magnetic force to steer the robots through the body's blood vessels but can't penetrate tumours or other tissue. This project is working with two designs, both powered by the MRI scanner, to address that problem, one based on the principle of mechanical resonance and the second modelled after a self-assembling surgical tool, a Gauss gun.

A key issue is real-time control, Becker said, noting that blood vessels move around in the body, making it crucial to be able to see both the anatomy and the robot as it moves in order to keep it moving correctly.

The goal is to use the power of an MRI to steer large numbers of robots throughout the body, according to Becker. While one milli-robot could target a single lesion, delivering chemotherapy or another intervention, that isn't practical for a late-stage cancer, for example.

"Targeting delivery with dozens of microsurgeons is my goal," he said. In this case, those "microsurgeons" would be robots, guided by a physician.

Source: University of Houston
Image Credit: University of Houston

Published on : Fri, 10 Mar 2017