Can MRI drive a medical robot?

October 3 2011

Engineers at Children's Hospital Boston have demonstrated the ability to program the magnetic field generated by a clinical MRI scanner to motorize and control a robotic instrument – in this case, a surgical biopsy needle. They presented their work at the International Conference on Intelligent Robots and Systems 2011 (IROS 2011) sponsored by the Institute of Electrical and Electronics Engineers (IEEE) and the Robotics Society of Japan in San Francisco on September 29. Their paper, "MRI-powered Actuators for Robotic Interventions," was recognized as one of five finalists for the IROS 2011 Best Paper Award.

"We've demonstrated that MRI, in addition to providing terrific images of soft tissue, can also produce sufficient force to drive a robotic device," says senior investigator Pierre Dupont, PhD, Chief of Pediatric Cardiac Bioengineering at Children's Hospital Boston. "Our ultimate goal is to create magnetically powered robots that can either travel through the body to perform highly targeted therapies or reside inside the body as adjustable prosthetic devices.

Dupont envisions, for example, tiny ball-bearing-sized robots that could be steered through the cerebrospinal fluid or the urinary system to deliver drugs or stem cells, and implantable devices that could be adjusted to, say, regulate blood flow in the heart, or gradually enlarged to prevent the need for new, larger implants as a child grows.

His robotic biopsy device, built from LEGOS, has a freely rotating arm that swings in the direction of the magnetic field and a series of gears to convert that motion into the motion of a biopsy needle strong enough to puncture tissue (in this case, the tough tissue surrounding an animal heart) and then withdraw.

Apart from a small magnetic sphere inside the arm, located outside the area being imaged, the motor was built from plastics and non-ferrous metals that are compatible for use with MRI, as was the biopsy needle itself.

Although MRI-compatible robots have been built, no one had previously created an MRI-powered motor, Dupont says. The team has also recently demonstrated the ability to have the MRI machine's magnetic field independently control two robots at once, and also created an MRI-driven locking mechanism for the motor.

The next engineering challenge Dupont's lab has begun to tackle is to create swarms of "swimming robots" that could be steered magnetically to different destinations. Each tiny robot, several millimeters in diameter, is designed with unique characteristics to produce variations in its swimming dynamics that influence its direction and speed. "It's a lot of fun math," says Dupont.

Provided by Children's Hospital Boston

Citation: Can MRI drive a medical robot? (2011, October 3) retrieved 20 September 2024 from https://phys.org/news/2011-10-mri-medical-robot.html