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'In-body GPS' that can help track tumours

ReMix is a wireless system that works like an "in-body GPS". ReMix can pinpoint the location of ingestible implants inside the body using low-power wireless signals, according to researchers from MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) who developed the system in collaboration with Massachusetts General Hospital (MGH).

In animal tests the research team, led by MIT professor Dina Katabi, demonstrated that they can track implants with centimetre-level accuracy, and said that one day similar implants could be used to deliver drugs to specific regions in the body.

To test ReMix, Katabi's group first implanted a small marker in animal tissues. To track its movement, they used a wireless device that reflects radio signals at the patient, and a special algorithm to pinpoint the exact location of the marker. The team used a wireless technology that they have previously demonstrated to detect heart rate, breathing and movement.

Interestingly, the marker inside the body does not need to transmit any wireless signal. It simply reflects the signal transmitted by a device outside the body, without needing a battery or any other external source of energy.

"The ability to continuously sense inside the human body has largely been a distant dream," says Romit Roy Choudhury, a professor of electrical engineering and computer science at the University of Illinois, who was not involved in the research. "One of the roadblocks has been wireless communication to a device and its continuous localisation. ReMix makes a leap in this direction by showing that the wireless component of implantable devices may no longer be the bottleneck."

One potential application for ReMix is in proton therapy, a type of cancer treatment that involves bombarding tumours with beams of magnet-controlled protons. The success of this treatment hinges on something that's actually quite unreliable: a tumour staying exactly where it is during the radiation process. If a tumour moves, then healthy areas could be exposed to the radiation.

The research team hopes that by using a small marker like ReMix's, doctors could better determine the location of a tumour in real-time, and be able to either pause the treatment or steer the beam into the right position to deal with the movement. (To be clear, ReMix is not yet accurate enough to be used in clinical settings – Katabi says a margin of error closer to a couple of millimetres would be necessary for actual implementation.)

The MIT-MGH researchers are working towards improving ReMix, for example, by continuously

reassessing the system algorithm. They also plan to combine the wireless data with medical information like MRI scans to further improve the system's accuracy.

"We want a model that's technically feasible, while still complex enough to accurately represent the human body," says PhD student Deepak Vasisht, lead author of the study. "If we want to use this technology on actual cancer patients one day, it will have to come from better modelling a person's physical structure."

The research team says that such systems could help enable more widespread adoption of proton therapy centres, of which there are only about 100 globally.

Source: Massachusetts Institute of Technology
Image Credit: Simon Simard

Published on : Wed, 22 Aug 2018