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Hong Kong develops world’s smallest multifunctional biomedical robot

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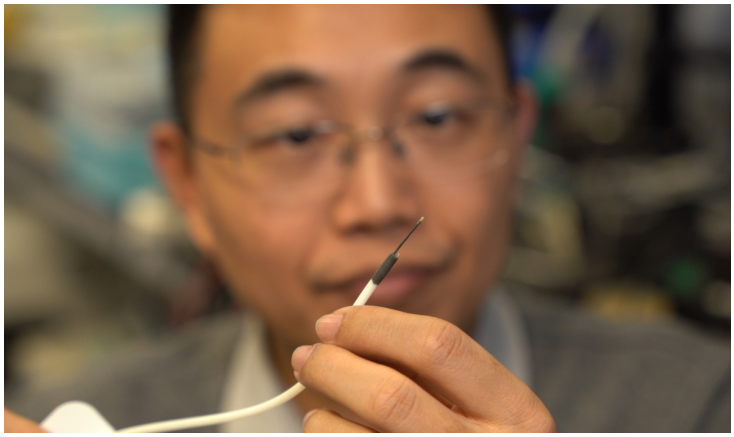

Researchers from the School of Engineering of the Hong Kong University of Science and Technology (HKUST) have successfully developed the world's smallest multifunctional biomedical robot, which is 60% smaller than current models.

Capable of imaging, high-precision motion, and multifunctional operations like sampling, drug delivery, and laser ablation, the robot offers competitive imaging performance and a tenfold improvement in obstacle detection, paving the way for robotic applications in narrow and challenging channels of the human body, such as the lung's end bronchi and the oviducts.

With a slim profile of just 0.95 mm, 60% smaller than current endoscopic robots, this robot has accomplished an "impossible trinity" by simultaneously integrating all three significant specifications in one robot. It offers competitive imaging performance and extends obstacle detection distance up to ~9.4 mm, a tenfold improvement from theoretical limits. It also achieves remarkable motion precision (less than 30 ?m) and substantially widens the imaging region by ~25 times the inherent view.

The robot's tiny size is made possible with four major components. These include an optical fiber array for capturing images inside the body, a custom tool for delivering treatments precisely where needed, a hollow skeleton to hold the fibers and tools in place, and a functionalised skin that enables precise control of the robot's movements. The hollow skeleton is created by a microscale 3D printer, while the functionalized skin is produced through a magnetic spray technique, which helps keep the robot small and allows it to glide easily during surgery. It also features a gel-like outer layer that reduces friction. The team has tested this robot within in vitro bronchial models and ex-vivo porcine lungs, demonstrating smooth navigation in tight spaces while successfully capturing clear images and performing treatments on difficult areas.

Building on this successful invention, the research team plans to further refine the robot's features to fit them into practical settings.