

# Press release

First magnetic teleoperated endoscopy

## Operating from 9,300km away

Zurich, 26 August 2024

**Researchers at ETH Zurich and The Chinese University of Hong Kong have succeeded for the first time in using remote control to perform a magnetic endoscopy on a live pig. The researchers controlled the probe from Zurich while the animal was on the operating table in Hong Kong.**

Key points:

- Researchers at ETH Zurich and The Chinese University of Hong Kong have had their first success in performing a magnetic endoscopy in Hong Kong from Switzerland.
- This breakthrough was made possible by a secure, fast internet connection as well as a magnetic navigation system developed at ETH Zurich featuring a magnetically operated endoscope.
- In the future, the technology could enable better surgical care in remote areas – especially for procedures for which no local expertise is available.

It's three o'clock in the morning, and Alexandre Mesot is in a room in Zurich operating an endoscope. The doctoral student in ETH's Multi-Scale Robotics Lab, headed by Professor Bradley Nelson, looks at a screen displaying live images of the endoscopy as he manipulates the joystick of a PlayStation controller. The operating theatre, however, is in Hong Kong – over 9,300 kilometres away.

With a delay of only around 300 milliseconds, a 4-millimetre-thick probe responds to the signals from Zurich as it moves around the stomach of a live (anaesthetised) pig in the operating theatre in Hong Kong. Mesot guides a camera to examine the animal's stomach wall and takes tissue samples with a tiny gripper arm. This procedure is the first ever remote-controlled magnetic endoscopy. Details have just been published in the journal *Advanced Intelligent Systems*.

Two things were crucial for this breakthrough: a magnetic navigation system developed at ETH Zurich with a magnetically operated endoscope, and a secure, fast internet connection to the operating theatre.

### Safety first

In the operating theatre, the remote-controlled procedure was supported and monitored by surgeons from the Faculty of Medicine at The Chinese University of Hong Kong. Before Mesot took over the navigation of the probe in Zurich, it was tested in the operating theatre by a team from the Multi-Scale Robotics Lab and by the Hong Kong surgeons. The latter also inserted the magnetic endoscope through the pig's mouth into its stomach.

The endoscope is controlled by a magnetic field generated by Navion, a surgical navigation system that ETH Professor Nelson and his team developed. "Not only can the endoscope be bent in any

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direction thanks to its magnetic head; it's also smaller and easier to manoeuvre than conventional devices," Mesot explains.

### **Magnetic endoscopies are less stressful**

Thanks to the superb flexibility of the magnetic endoscope, Mesot was able to carry out a manoeuvre called a retroflexion in the animal's stomach without any problems: after entering the stomach cavity, the endoscope is bent backwards 180 degrees to inspect the stomach's entrance. This complex procedure shows that magnetic endoscopes can be manipulated remotely at least as flexibly as standard devices.

In addition, the smaller endoscope can also be inserted via the nose in humans rather than via the oesophagus, as is usual with conventional endoscopies. This is less stressful, as patients don't have to be fully sedated and can stay awake during the procedure to provide feedback. The magnetic endoscope is also potentially suitable for use in children, for whom the usual probes are too large.

### **Minimally invasive cancer screening and better care in remote areas**

Professor Nelson from the Multi-Scale Robotics Lab at ETH Zurich is already thinking ahead: "In the next step of our research, we hope to carry out a teleoperated endoscopy on a human stomach. There's a lot of potential in this technology. Here I'm thinking of minimally invasive procedures in the gastrointestinal tract, such as cancer screening."

Dr Shannon Melissa Chan, Assistant Professor in the Faculty of Medicine at The Chinese University of Hong Kong, also points out: "Teleoperated endoscopy can be used not only for training surgeons, but also for providing diagnostic and surgical care in remote areas, especially in places where there's a lack of local expertise. We could even provide trained nurses with instructions from a distance on how to carry out the procedures."

### **Reference**

Mesot A, Mattille M, Boehler Q, Schmid N, Lyttle S, Heemeyer F, Chan SM, Chiu PWY, Nelson B, Teleoperated Magnetic Endoscopy: A Case Study and Perspective, *Advanced Intelligent Systems*, 18 August 2024, doi: [10.1002/aisy.202400522](https://doi.org/10.1002/aisy.202400522)

### **Image and video material**

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