



Capsule Robotics

In the future, all surgery will be “non-invasive”

Anyone who has experienced the odd discomfort of a colonoscopy would, no doubt, readily opt to swallow instead a 22x11mm medical device (about half the size of a wine cork) that can perform the same procedure as a colonoscope...and much more.

Technology for such a new medical device has been developed and may be at an inflection point that much sooner than later pushes it into the marketplace for widespread use.

With an astounding [19 million colonoscopies](#) performed annually in the U.S., capsule robotics could dramatically reduce the average \$3,081 (non-insurance) cost of the procedure, not to mention the relief from dread for millions of patients.

A new study by Pierre Dupont et al, [A decade retrospective of medical robotics research from 2010 to 2020](#) (Science Robotics 2021), explains how instrument-free, noninvasive diagnosis and therapy inside the digestive tract will be performed through a new branch of robotics: capsule robotics.

Around the year 2000, Given Imaging (now Medtronic) put forth the possibility of collecting images deep inside the bowel just by swallowing a “pill”. It revolutionized the field of gastrointestinal endoscopy and sparked a brand-new field of research.

Download full report:

Pierre Dupont et al, [A decade retrospective of medical robotics research from 2010 to 2020](#) (Science Robotics 2021).

The All-Robot Auto Plant

During a tour of Nissan's auto plant in Bangkok, I was treated to a seemingly endless train of individual mini-AVGs, loaded with automobile parts, following a floor track and winding their way from one work station to another throughout the facility.

I remarked that it was amazing to watch. I was told in polite English: "You ain't seen nothing yet."

In Japan, it seems that only "smart" robots need apply for work at Nissan's brand new ["intelligent" auto plant](#).

Nissan Executive Vice President Hideyuki Sakamoto said: "Up to now, people had to make production adjustments through experience, but now robots with artificial intelligence, analyzing collected data, are able to do it. The technology has developed to that level."

The aforementioned "all-robot production adjustments" include all of the welding, joining, mounting ...even painting—which the robots QC themselves—plus, installing EV, hybrid, or combustion engine powertrains in succession on the same production line.

The factory, in Japan's Tochigi prefecture, is scheduled for full production mode in April 2022. Nissan said the innovations being tested in Tochigi will be gradually rolled out at its other global plants, including French alliance partner Renault's factories.

Nissan has announced plans for \$1.14 billion in enhancements of its global factories; \$290 million was invested in the Tochigi plant. Tochigi is the third key production facility for Nissan in Japan after Kyushu and Oppama, each with a production capacity of about [250,000 units annually](#). That's over 2,000 thousand vehicles a day per auto plant.

Of course, with a global shortage of computer chips ongoing, those lofty production numbers may be hard to pull off.

The Five-fingered Cobot Hand

What's the next big breakthrough tech for the cobot. How about a dexterous, sophisticated five-fingered hand?

How about the next time you go to the symphony, the conductor is just a pair of hands on a podium. Say a clone of Stravinsky's hands conducting in the exact same way Stravinsky conducted The Rite of Spring?

In Francesca Negrello's [Hands in the Real](#), featured in Robotics and AI, she writes: "The human hand's ability to interact with the world for crafting, exploring and even conveying emotions is one defining human characteristic that has inspired scientists and inventors for centuries."

Well, maybe not as glorious as Bernini or Rodin's hands of stone, technology is closing in on a dexterous, sophisticated, five-fingered hand for cobots.

Cobotics that first gave us that marvelous arm, and lately filled it with sensors, compute power, and machine learning, now may be readying to offer up the ultimate tool, a five-fingered hand, a near-clone of our own.

Of the near two dozen, global R&D projects for five-fingered hands, only two have been certified for real-world marketplace: [QB Robotics SoftHand](#) and [SCHUNK's SVH](#) for collaborative operation.

Lately, "[artificial intelligence firm OpenAI](#) gave it a try with Dactyl using their humanoid robot hand to solve a Rubik's cube with software that's a step toward more general AI, and a step away from the common single-task mentality. DeepMind created "RGB-Stacking," a vision-based system that challenges a robot to learn how to grab items and stack them."

Now comes [PhD student Tao Chen](#), a member of the MIT's Improbable AI Lab and the lead researcher on a dexterous-hand system that can reorient over 2,000 different objects, with the robotic hand facing both upwards and downwards. This ability to manipulate anything from a cup tea to a tuna can...could help the hand quickly pick-and-place objects in specific ways and locations — and even generalize to unseen objects.

“Our system,” says Chen, “will allow a multi-fingered hand to dexterously manipulate tools, which opens up a new area for robotics applications.”

Still a ways away from Negrello’s Hands in the Real World, this breakthrough could well be the cobots next great gift to industry.

Imagine the sight of a factory floor filled with cobot arms...and dexterous, five-fingered hands tending CNC machine as elegantly as Stravinsky conducted.

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