

Telerobotics and the Shadow Hand

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For the Science section in Wired magazine earlier this month, author Matt Simon provided a description of his experience with the Shadow Hand; quite possibly the most complex robotic hand on Earth. What makes this robotic hand so advanced and complex is its ability to *feel*.¹

While in San Francisco, Simon was fitted with a special haptic glove. Through this glove, he was able to control the robotic hand, located in London. Each of the fingertips of the robotic hand is fitted with a sensor that can essentially *feel* and simultaneously transmit the sensation of touch to the haptic glove.

Simon was able to perform tasks such as picking up a toy basketball and then dropping it into a plastic cup. All of this was done through a 4G cell connection, while Simon monitored the robotic hand and the toy ball on split monitors.

Telerobotics and the New Ability to *Feel*

This sort of technology is known as “telerobotics”: the act of piloting machines remotely. To be sure, telerobotics has been in use for some time through the use of bomb disposal robots and the Da Vinci medical devices for robotic surgery as examples.

But, adding *feel* to telerobotics would seem to offer tremendous advancement and practicality to the field of robotics, which until this point has largely been characterized by machines that have to perform precisely calculated and repetitive tasks, as in manufacturing, or slowed down to a level where operators can monitor and shutdown the machines when issues arise and before greater damage is done.

“Robots without touch are forced to either work in environments where everything is in a known position with known properties, or are forced to move very slowly so problems can be detected before they are too severe,” says Jeremy Fishel, co-founder and CTO of SynTouch. “The sense of touch solves this.”²

This system represents the early days of robotics can respond and adapt as we do, based on an ability to touch and feel.

The Companies Involved

“This new system is made of components from three different groups, each with their own area of research expertise: the glove with haptics was designed by HaptX, the robotic hand came from Shadow Robot Company, in England, outfitted with fingertips from SynTouch. The project is funded by ANA Holdings, the parent company of All Nippon Airways.”³

¹ Simon, Matt. How I Became A Robot in London—From 5,000 Miles Away. Science. March 1, 2019. Available at: <https://www.wired.com/story/how-i-became-a-robot-in-london/>. Accessed on March 29, 2019.

² *Ibid.*

³ *Ibid.*

The SynTouch robotic hand is characterized by fingertips that contain 24 electrodes, covered with a skin of silicon. An injection of saline between these electrode sensors and the silicone covering creates a pressure sensitive sea of fluid. The electrodes can effectively detect the change in resistance and relay the sensory information in fine detail.

Some further detail and a schematic are provided on Syntech's Website: The Future of Machine Touch.⁴

Michael Eichermueller, director of R&D and the lead on HaptX's telerobotics project explains how this relayed sensory data is interpreted and passed on to the user of their haptic glove: "A light brush will trigger a partial inflation of our actuators, lightly displacing the skin on the user's fingertips. ...A full squeeze of a ball will trigger a full inflation and activate our force-feedback exoskeleton, simultaneously pressing the skin and restricting finger motion around the edges of the ball."⁵ It's this restriction that mimics the feeling of holding a solid object.

HaptX provides further description of its haptic glove technologies on the technology section of its website.⁶

Implications for the Future of Robotics

Through the replication of a sense of touch, the hope and expectation is that telerobotics will be able to relay greater and greater subtlety to include not only the lightness or firmness of touch, but also textures and softness of objects. These are the sorts of cues that humans use to enable a sophisticated ability to manipulate materials and objects, and the performance of highly dexterous tasks.

We may not be on the cusp of a real world application of the sort of science fiction scenarios and technologies in the movie *Avatar*. But, the concept is much the same. And, both practicality and functionality of robotics will be significantly greater as the ability to *feel* evolves.

⁴ The Future of Machine Touch. SynTouch Website - News Section. June 8, 2018. Available at: <https://www.syntouchinc.com/en/the-future-of-machine-touch/>. Accessed on March 29, 2019.

⁵ Simon, Matt. *op. cit.*

⁶ HaptX Website - Technology Section. Available at: <https://haptx.com/technology/>. Accessed on March 29, 2019.