Soft robotics 'toolkit' features everything a robot-maker needs

September 19 2014

The Soft Robotics Toolkit is an online treasure trove of downloadable, open-source plans, how-to videos, and case studies to assist users in the design, fabrication, modeling, characterization, and control of soft robotic devices. Credit: Eliza Grinnell, Harvard SEAS.

A new resource unveiled today by researchers from several Harvard University labs in collaboration with Trinity College Dublin provides both experienced and aspiring researchers with the intellectual raw materials needed to design, build, and operate robots made from soft, flexible materials.

With the advent of low-cost 3D printing, laser cutters, and other advances in manufacturing technology, soft robotics is emerging as an increasingly important field. Using principles drawn from conventional rigid robot design, but working with pliable materials, engineers are pioneering the use of soft robotics for assisting in a wide variety of tasks such as physical therapy, minimally invasive surgery, and search-and-rescue operations in dangerous environments.

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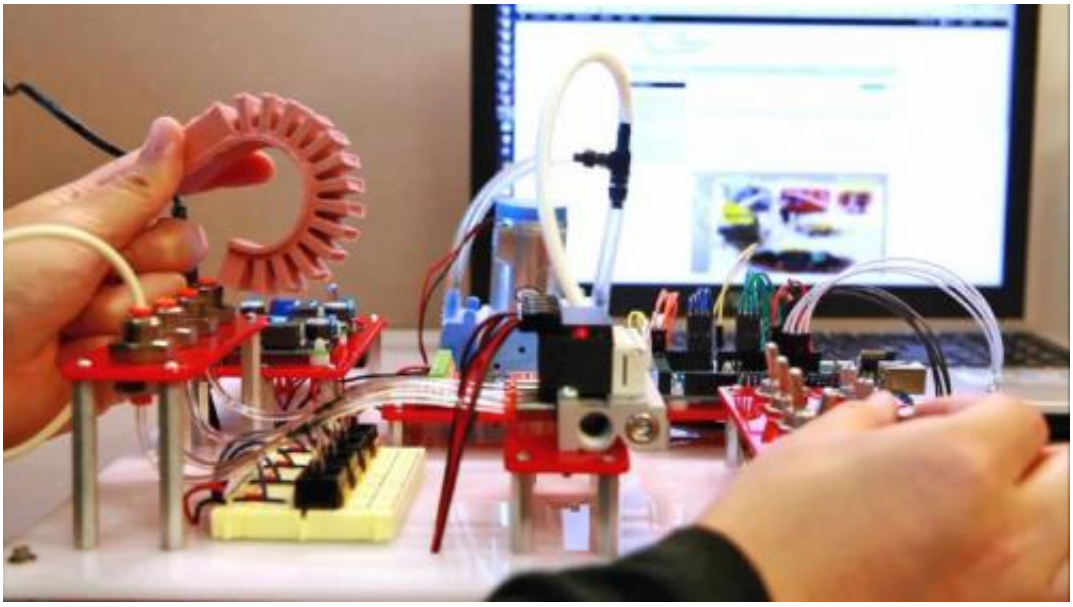
"The goal of the toolkit is to advance the field of soft robotics by allowing designers and researchers to build upon each other's work," says Conor Walsh, Assistant Professor of Mechanical and Biomedical Engineering at the Harvard School of Engineering and Applied Sciences (SEAS) and a Core Faculty Member at the Wyss Institute for Biologically Inspired Engineering at Harvard University.

By creating a common resource for sharing design approaches, prototyping and fabrication techniques, and technical knowledge, the toolkit's developers hope to stimulate the creation of new kinds of soft devices, tools, and methods.

According to Walsh, who teaches a popular course in medical device design at SEAS and is founder of the Harvard Biodesign Lab, soft robotics is especially well suited to shared design tools because many of the required components, such as regulators, valves, and microcontrollers, are largely interchangeable between systems.

Dónal Holland, a visiting lecturer in engineering sciences at SEAS and graduate student at Trinity College Dublin, is one of the lead developers of the toolkit and is especially interested in the toolkit's potential as an educational resource.

"One thing we've seen in design courses is that students greatly benefit from access to more experienced peers—say, postdocs in a research lab—who can guide them through their work," Holland says. "But scaling that up is difficult; you quickly run out of time and people. The toolkit is designed to capture the expertise and make it easily accessible to students."



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Just as open-source software has spurred far-flung innovation in computing, "open design" hardware platforms—coupled with advances in computer-aided engineering and more accessible prototyping capabilities—have the potential to foster remote collaboration on common mechanical engineering projects, unleashing crowdsourced creativity in robotics and other fields.

"Open design can have as disruptive an influence on technology development in this century as open source did in the last," says Gareth J. Bennett, assistant professor of mechanical and manufacturing engineering at Trinity College Dublin and a coauthor of a paper in *Soft Robotics* that describes the toolkit development. Additional coauthors are Evelyn J. Park '13, a SEAS research fellow in materials science and engineering, and Panagiotis Polygerinos, a postdoctoral fellow in the Harvard Biodesign Lab at SEAS and the Wyss Institute.

More information: Paper: online.liebertpub.com/doi/abs/ … .1089/soro.2014.0010

Provided by Harvard University