'On-the-Fly' 3D System Allows for Quick Changes While Printing

3D printing has become a powerful tool thanks to its ability to customize designs and speed up the prototyping process. But what happens when an engineer decides to make changes?

Researchers at Cornell have designed an interactive prototyping system that prints what you're designing as you design it. This allows the engineer to pause the printing process at any time to test, measure, and, if necessary, make changes that will be made directly to the model that's still in the printer.

The On-the-Fly Print system builds on the already successful WirePrint printer, designed in partnership with the Hasso Platner Institute in Potsdam, Germany. With WirePrint, a nozzle extrudes a quick-hardening plastic to create a frame that represents the surface of the solid object designed in CAD. The idea is to improve printing time by creating a model of the shape of an object instead of printing the entire solid.

The new system features five degrees of freedom, allowing the printer's platform to be rotated to present any face of the model facing up to meet the vertical nozzle. The nozzle has been extended so that it can reach through the wire mesh of the model to make changes within. A removable base anchored by magnets allows for the removal of the model for measurement or testing. The system also features a cutter.

The software integrates easily into Autodesk software (the company supported the project, along with the National Science Foundation) and allows for manual interruptions. Printing can continue while the designer works on the CAD file, but will resume when that work is done and incorporate any changes into the print job.

As a demonstration, the researchers created a model of a toy airplane to fit into a Lego airport set. This involved adding wings, cutting out a cockpit for a Lego pilot and frequently removing the model to see if the wingspan is right to fit on the runway. The entire project was completed in just 10 minutes.

The paper, "On-The-Fly Print: Incremental Printing While Modeling" was authored by graduate student Huaishu Peng' François Guimbretière, associate professor of information science; Steve Marschner, professor of computer science; and doctoral student Rundong Wu.

Photo courtesy Cornell University

A wire frame prototype of a toy aircraft for a Lego kit was printed in just 10 minutes, including testing for correct fit.

Injectable Computers Can Broadcast from Inside the Body

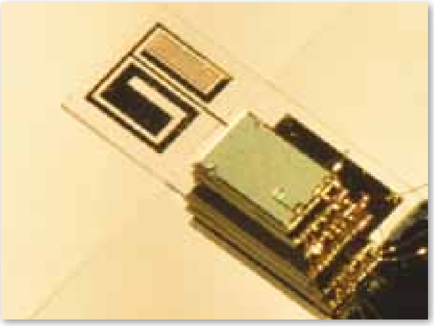
Professors at the University of Michigan have designed a new, low-power sensing system that can be injected into the body through a syringe. Unlike other millimeter-scale radios, these new devices are able to broadcast through the body to an external receiver.

The project, spearheaded by Professors David Blaauw and David Wenzloff, is from the Integrated Circuits Lab, the same lab responsible for the Michigan Micro Mote (M^3) – currently the world's smallest computer. Measuring in at less than half a centimeter, the M^3 is a fully autonomous computing system that acts as a smart sensing system.

Once a device is implanted, its ultimate usefulness depends both on its ability to assess essential information and to transmit the data to someone who can act on it. A typical radio would need an antenna larger than the M³ to transmit more than a few centimeters, and more power than could be generated from the computer's tiny battery alone.

Building on the success of the M³, the professors paired the computer with a new type of antenna to transmit signals to a computer 50 cm away. To achieve the burst of power needed to transmit the data, the team integrated a capacitor into the device that is able to gradually build up a sufficient amount of power from the tiny battery before passing it along to the antenna, enabling data transmission in periodic bursts.

Photo courtesy the University of Michigan



The M³ computer with a temperature sensor and custom antenna to increase range.

The research was presented earlier this year at the International Solid-State Circuits Conference. The team is currently collaborating with researchers at UM's medical school to test the device.

Meet Jackrabbot, the Social Robot

If you stroll through some Stanford classroom buidings these days, you may notice a new kind of student in the halls: the Jackrabbot.

Named after the jackrabbits frequently seen on Palo Alto, CA, campus, Jackrabbot was designed by the Computational Vision and Geometry lab as a way for engineers to experiment with how robots can better mingle with humans in crowded places. Measuring three feet tall, the robot is equipped with sensors to be able to understand its surroundings and navigate streets and hallways.

In particular, the researchers are looking to see how a robot can learn the unwritten rules of pedestrian behavior—like how to behave in crowds, or share public resources like sidewalks or parking spots. Because these social conventions aren't governed by explicit signals (like lane markings or traffic lights that autonomous cars can see and obey), it's becoming increasingly important to understand how robots can learn from social cues.

The team, led by assistant professor Silvio Savarese, is using machine learning techniques to create algorithms that will allow the robot to recognize and react appropriately while in pedestrian traffic. The team has been collecting images and video of people mingling on campus, transforming those images into coordinates, and building the algorithm from those coordinates.

Jackrabbot already moves autonomously and can navigate without assistance indoors. The team is still working on the robot's self-navigation capabilities outdoors. The next step is implementing aspects like deciding rights of way on the sidewalk. The work has already been demonstrated in computer simulations.

Perhaps most importantly, Jackrabbot does not have the humanoid look of many other robots designed for human interaction. Savarese says "they [social robots] should be designed to look as lovable and friendly as possible."

Photo courtesy Stanford University

Stanford's newest student is a three foot tall robot that's learning how to interact with pedestrians.

The paper, "Social LSTM: Human Trajectory Prediction in Crowded Spaces" was authored by Alexandre Alahi, Kratarth Goel, Vignesh Ramanathan, Alexandre Robicquet, Li Fei-Fei, and Silvio Savarese. The team presented their findings at the 2016 Computer Vision and Pattern Recognition earlier this year.

Improving Accuracy Through Indirect Measurement

The accuracy of machine tools is key. By measuring a number of points, verification allows characteristic information to detect the influence of a machine's geometric errors and improve its accuracy. While the direct measurement of errors has been widely used, researchers from Universidad de Zaragoza, Spain, propose that traditional techniques will be replaced by technology based on indirect measurement techniques, which significantly reduce maintenance and overall verification time.

The paper presents all the verification processes on a real milling machine, studying the principal steps and influence factors, such as the kinematic model of the machine tool, the influence of the verification points distribution, convergence criteria, the defined identification strategy and the compensation procedure. The adequacy of the mathematical compensation provided by this method is validated using traditional verification methods based on a laser interferometer and new ones based on a laser tracker.

"Improving a real milling machine accuracy through an indirect measurement of its geometric errors" was published in the July 2016 edition of SME's Journal of Manufacturing Systems and can be read in full online here: http://tinyurl.com/ImprovingAccuracy.

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