Haptic solution for modelling industrial designs

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(PhysOrg.com) -- Industrial design modelling, used to make prototypes of home appliances or mock-ups of car parts, could soon make the leap from the world of plaster, plastic and sticky tape into the digital domain thanks to an augmented reality design system developed in Europe.

The system, developed by a team of researchers from six EU countries, merges touch-sensitive haptic technology with 3D digital modelling and computer-aided design (CAD) to allow professional designers to feel and shape their creations physically and virtually. Implemented commercially, the system promises to save companies time and money, raise designers' productivity and improve the quality of new products.

“Though designers use computer programs to create mathematically precise models of products, they still need to be able to see and handle the model physically. Until now, the only way they have been able to do that is to turn to a model-maker to create a real, physical sample. It’s a labour-intensive, time-consuming and costly process,” explains Monica Bordegoni, a professor at Politecnico di Milano university in Italy.

Haptic technology, which uses mechanics and/or special materials to transmit and receive information through the sense of touch, offers a practical solution, providing many of the benefits of physical models with none of the drawbacks. The team of researchers, coordinated by Bordegoni and funded by the European Union in the SATIN project, therefore saw haptic technology as the logical next step in the evolution of industrial design.

A first for industrial design

“Haptics is far from a mature technology, and this project was one of the first to build a haptic system for industrial designers,” Bordegoni notes.

The multimodal and multisensory SATIN system consists of two FCS-HapticMASTER devices, in essence robotic arms more commonly used for remote welding or dental surgery, which position and rotate a robotic spline, an electronic version of the flexible strip of material, typically wood or metal, long used by designers to draw curves. Fitted with actuators and sensors, the spline automatically twists and bends to the shape of a digital representation of the product uploaded by the designer into the system.

Standing in front of a workstation and wearing 3D glasses, the designer views, through a set of mirrors, a virtual 3D model of the product superimposed where the spline actually is. By pressing the centre or pushing or pulling the ends of the robotic spline with their hands, the

designers can reshape and reform the 3D model. Models can be saved and compared, and any changes made much more quickly and simply than using traditional modelling methods.

“It is a two-way system. The spline both responds to inputs made to the digital model on the computer and outputs changes made by the designer to the physical interface,” the project coordinator says.

Additional information about the model that cannot be perceived tactilely on the spline, such as discontinuities of a curve or inflection points, is transmitted through audio signals as the designer runs a finger along it.

“Haptic technology is still not advanced enough to provide all of the information about a surface. The SATIN system, for example, can only represent curves. However, we expect improvements in materials and mechanics over the coming years to lead to systems that will allow designers to feel, handle and reshape any kind of object surface,” Bordegoni says.

Commercial spin-off planned

The SATIN team is planning to continue its research in that direction, and some of the partners are considering setting up a spin-off company to commercialise the SATIN system. It is an endeavour for which they are actively seeking investors and partners.

Bordegoni says a commercial version could be put to use by any company that currently makes use of industrial design processes, from car and home appliance manufacturers to furniture makers and producers of building materials.

“Trials we conducted with industrial partners and designers from

companies outside of the project showed that there is a lot of interest in our solution. They can see the benefits in terms of cost and time savings as well as improved product quality," Bordegoni notes. "In addition, designers said they like it because they feel they have more artistic control over their creation."

More information: SATIN project - www.satin-project.eu/

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