

**Non-Confidential Description - PSU No. 4500**  
**“Haptic Robot Trainer for Central Venous Catheter Placement”**

**Keywords:**

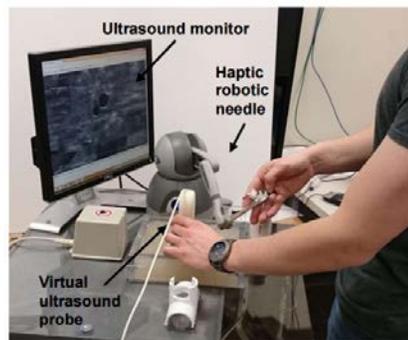
Simulation, central venous catheter CVC, haptic robotics, medical training, catheter, surgery

**Links:**

[Inventor website](#)

**Inventors:**

Scarlett Miller, Jason Moore, David Han, Katelin Mirkin, David Pepley, Mary Yovanoff, Inki Kim



**Background**

Properly training medical residents to perform central venous catheter (CVC) placement is important to ensure patient safety. Mechanical complications such as arterial puncture, pneumothorax, hemothorax, and failed puncture commonly occur in CVC procedures. These complications can be reduced by improving the mechanical skills of medical residents before they operate on human patients. Currently, surgical residents practice CVC insertion on manikins featuring an arterial pulse and self-sealing veins. These manikins allow for multiple needle insertions and practice trials without consequence or training feedback, but they are static in nature and only represent a single anatomical configuration.

**Invention Description**

The disclosed invention describes the Dynamic Haptic Robot Trainer (DHRT), a CVC placement training device that can present variations in patient anatomy using both visual and tactile feedback. The DHRT includes two components: a haptic robot arm and a position tracker. The robot arm includes a haptic feedback system and holds a custom syringe in place. The position tracker includes a position tracking probe outfitted as a virtual ultrasound probe. The scanning surface is a soft pad made from phantom tissue. Simulation software receives the 3D positioning data from the syringe and probe, then generates a virtual ultrasound environment which resembles an actual ultrasound image. The user receives a real time feedback in the form of a haptic feel through the robot arm and a virtual ultrasound image visible on the screen. By changing the on-screen visuals and forces enacted by the arm on the syringe, DHRT creates a variety of anatomical scenarios. The software continuously assesses the user’s performance. New tasks are recommended by the software to improve the areas of CVC placement where the user struggles most.

**Advantages/Applications**

- Provides real time visual and haptic feedback to the user
- Provides quantitative assessment of user performance and allows them to learn at their own pace without consequence
- Provides a wide variety of realistic anatomical scenarios (unique patient weight, high tissue density, coagulopathy) to more universally train the resident
- Numerous tools could be affixed to the haptic robotic arm other than the syringe in order to train other exercises outside of CVC (e.g. scalpel, drill, dilator)
- Mobile design to be easily transportable around its training center

IP Status: Provisional application filed on August 9, 2016.

**Contact:** Lidia Sobkow  
Technology Licensing Officer  
The Pennsylvania State University

**Phone:** (814) 863-6336  
**Fax:** (814) 865-3591  
**E-mail:** lks5393@psu.edu

{DATE}>May 17