A robotic system for ultrasound-guided vein localization

Unmet Need

Robotic instruments are increasingly used in medical care, with robot-controlled surgical and radiological tools becoming increasingly common across a range of specialties. However, certain specialties have not yet benefited from advances in medical robotics, as the available tools continue to require significant human intervention and control. For example, robotics could greatly enhance technologies for ultrasonic vein detection or laser tissue resection by reducing physical requirements on clinicians, though no suitable tools currently exist for these areas. There is a need for improved robotic control devices that can enable these technologies to be applied more precisely and effectively.

Technology

Duke inventors have developed a robotic system for the autonomous ultrasound-guided vein localization. This is intended to be used to collect 3D localized volumes of peripheral vessels. The design is a fully integrated system which demonstrates the capability of autonomous collection of peripheral vessels. Specifically, the system integration of an ultrasound probe and RGB-D camera to a 6-DOF robotic arm allows for the performance of autonomous peripheral vascular localization. Additionally, a PID control strategy allows the robot to move smoothly with a safe force threshold, and a 3D vessel localization system allows for automated vessel detection, tracking and contour reconstruction. This has been demonstrated in a phantom arm that is similar to the human arm in curvature, vasculature size and elasticity. Due to the fact that human vessels are more heterogeneous in tissue structures and that the current data assumes a still patient, future work to explore the accuracy of the vision system in human subjects and the system on humans is needed.

Other Applications

This technology could also be expanded to have integrated interventions built into the robotic system. This could include the ability to insert IV's and central line placements.

Advantages

- Ability to assist all medical personnel in finding vessels that are hard to identify at the skin surface
- Robotic controlled ultrasound system that reduces time and clinician expertise to locate veins
- Fully integrated system that allows for autonomous collection of peripheral vessels with built-in safety measures for human testing/future use

Duke File (IDF) Number

IDF #:T-007716

Meet the Inventors

Oca, Siobhan
Buckland, Daniel
Codd, Patrick
Ma, Guangshen

Contact For More Info

Krishnan, Shweta
919-681-7541
shweta.krishnan@duke.edu

Department

Mechanical Engineering and Materials Science (MEMS)

Publication(s)

External Link(s)

- From the lab of Dr Siobhan Rigby Oca
- From the lab of Dr Daniel Buckland
- From the lab of Dr Patrick James Codd