To improve the rate of first-stick success, we have developed a portable autonomous venipuncture device that robotically servos a needle into a suitable vein under image guidance" Balter et al (2015).

Reference:

Balter, M.L., Chen, A.I., Maguire, T.J. and Yarmush, M.L. (2015) The System Design and Evaluation of a 7-DOF Image-Guided Venipuncture Robot. IEEE Transactions on Robotics. 31(4), p.1044-1053.

Abstract:

Accessing the venous bloodstream to deliver fluids or obtain a blood sample is the most common clinical routine practiced in the U.S. Practitioners continue to rely on manual venipuncture techniques, but success rates are heavily dependent on clinician skill and patient physiology. In the U.S., failure rates can be as high as 50% in difficult patients, making venipuncture the leading cause of medical injury. To improve the rate of first-stick success, we have developed a portable autonomous venipuncture device that robotically servos a needle into a suitable vein under image guidance. The device operates in real time, combining near-infrared and ultra-sound imaging, image analysis, and a 7-degree-of-freedom (DOF) robotic system to perform the venipuncture. The robot consists of a 3-DOF gantry to image the patient's peripheral forearm veins and a miniaturized 4-DOF serial arm to guide the cannula into the selected vein under closed-loop control. In this paper, we present the system architecture of the robot and evaluate the accuracy and precision through tracking, free-space positioning, and in vitro phantom cannulation experiments. The results demonstrate sub-millimeter accuracy throughout the operating workspace of the manipulator and a high rate of success when cannulating phantom veins in a skin-mimicking tissue model.

Full Text

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