SAI: STEREO ASSISTED INTRAVENOUS THERAPY

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Conventional intravenous (IV) access involves using a tourniquet to engorge veins, followed by palpation to identify a suitable vein and finally inserting the catheter needle. These veins are not sufficiently visible as they are deep under the skin or very thin, making the needle intrusion procedure difficult and risky. Incorrect trials and multiple needle penetrations are especially endemic in paediatric, geriatric, and cancer patients. Stereo Assisted Intravenous (SAI) Therapy is a 3D vein insertion guide system designed to image peripheral vein mapping beneath the human skin and determine the depth of the vein vessel. This is achieved using a robotic arm that performs the intrusion with feedback from a 3D Vein Viewer module. The 3D Vein Viewer module is a stereo camera-based imaging system: the selection and positioning of optical components for enhanced vein visualization are conducted through simulation in Zemax Optics Studio, employing a nine-layer skin model. Artificial Intelligence (AI) is employed to detect veins and remove the background with an accuracy of approximately 99%, effectively eliminating around 70% of non-vein-related images and enhancing the overall process speed by at least 5 times. Subsequently, utilizing an in-house developed algorithm, we achieve real-time 3D reconstruction of veins at approximately 10 frames per second, with a depth accuracy of around 0.4mm. These coordinates are then fed to the robotic arm for intravenous procedures, guided in real-time by the feedback system.

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