National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Health, Medicine and Biotechnology

Subcutaneous Structure Imager

Uses near-infrared imaging to improve health providers' ability to locate veins in patients

Scientists at NASA's Glenn Research Center have successfully developed a novel subcutaneous structure imager for locating veins in challenging patient populations, such as juvenile, elderly, dark-skinned, or obese patients. Spurred initially by the needs of pediatric sickle-cell anemia patients in Africa, Glenn's groundbreaking system includes a camera-processor-display apparatus and uses an innovative image-processing method to provide two- or three-dimensional, high-contrast visualization of veins or other vasculature structures. In addition to assisting practitioners to find veins in challenging populations, this system can also help novice healthcare workers locate veins for procedures such as needle insertion or excision. Compared to other state-of-the-art solutions, the imager is inexpensive, compact, and very portable, so it can be used in remote third-world areas, emergency response situations, or military battlefields.

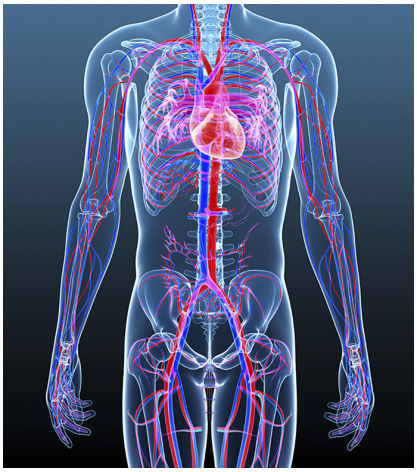
BENEFITS

- Inexpensive: Uses commercially available electronic and optical components and requires minimal operator training
- Portable: Takes up little space and is self-contained
- Robust: Utilizes durable system components that are easily serviced or replaced
- Battery-powered: Does not require an external power supply, so the imager can be used in emergency or other non-hospital environments
- Fast: Displays images in real-time and in easily interpretable form
- Versatile: Can provide 2D or 3D images

THE TECHNOLOGY

Current subcutaneous vessel imagers use large, multiple, and often separate assemblies with complicated optics to image subcutaneous structures as two-dimensional maps on a wide monitor, or as maps extracted by a computer and focused onto the skin by a video projection. The scattering of infrared light that takes place during this process produces images that are shadowy and distorted. By contrast, Glenn's innovative approach offers a relatively compact and inexpensive alternative to the conventional setup, while also producing clearer images that can be rendered in either two or three dimensions. Glenn's device uses off-the-shelf near-infrared technology that is not affected by melanin content and can also operate in dark environments.

In Glenn's novel subcutaneous imager, a camera is configured to generate a video frame. Connected to the camera is a processor that receives the signal for the video frame and adjusts the thresholds for darkness and whiteness. The result is that the vein (or other subcutaneous structure) will show very dark, while other surrounding features (which would register as gray) become closer to white due to the heightened contrast between thresholds. With no interval of complex algorithms required, the image is presented in real-time on a display, yielding immediate results. Glenn's advanced technology also allows the operator to achieve increased depth perception through the synchronization of a pair of imaging devices. Additionally, the novel use of a virtual-reality headset affords a three-dimensional view of the field, thereby improving the visualization of veins. In short, Glenn's researchers have produced an inexpensive, lightweight, high-utility device for locating and identifying subcutaneous structures in patients.



Glenn's innovative image-processing method can provide two- or three-dimensional, high-contrast visualization of veins and other vascular structures

This imager is rugged, compact, and portable, making it ideal for use in battlefield medicine

APPLICATIONS

The technology has several potential applications:

- Biomedical: Facilitate vein access for challenging patient populations, in emergency situations, aboard aircraft, and in areas with fewer skilled practitioners
- Diagnostics: Diagnose conditions currently tested with ultrasound techniques, such as stenosis of leg veins; pre-screening to determine whether a costly MRI is needed
- Screening: Provide rapid non-invasive initial screening for sub-surface lesions such as cancers and venous malformations

PUBLICATIONS

Patent No: 10,062,356; 10,977,776

Please contact NASA Glenn Tech Transfer for companion software.

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More Information

National Aeronautics and Space Administration

Agency Licensing Concierge

Glenn Research Center

21000 Brookpark Road
Cleveland, OH 44135
202-358-7432
Agency-Patent-Licensing@mail.nasa.gov

www.nasa.gov

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