

Abstract Title: Feasibility of augmented reality headset use for ultrasound-guided procedures in pediatric perioperative care.

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Background:

Head-mounted displays such as smart glasses are an emerging technology with a wide variety of applications including integration with an ultrasound device. The augmented reality display places the ultrasound image directly in front of the operator's field of view to facilitate visualization of the procedure field and the ultrasound image simultaneously. Jang et al. Demonstrated improved success rates for arterial cannulation in children undergoing cardiac procedures utilizing augmented reality technology.(1) The primary outcome of the project is to identify use cases of an augmented reality display for ultrasound guided procedures in a pediatric anesthesiology training program.

Methods:

The binocular Moverio BT-35E (V11H935051, Epson Co, Japan) was configured with a portable battery and used as a head-mounted display. The video interface box was connected to an ultrasound (Sonosite, Fujifilm Sonosite, Bothell, WA) using a standard HDMI cable (Figure 1A). The battery and video interface box and cables are housed in a 3D printed housing that is placed in the operator's pocket to facilitate operator mobility with the ultrasound unit.

Results:

The ultrasound and head-mounted display configuration is fully mobile and can be incorporated for ultrasound-guided procedures at the bedside. The operator can visualize the ultrasound image in their direct field of view while standing in front of the ultrasound unit (Figure 1B). Operators with corrective lenses can wear a head-mounted display over their corrective lenses. The operator can visualize the procedure field and the ultrasound image in their direct line of sight. The head mount allows the operator to remain close to the ultrasound unit and make direct adjustments to the image. The wire connections between the headset and the ultrasound tether the operator to the ultrasound unit.

Conclusion:

We describe the configuration of an augmented reality display with a portable ultrasound device to facilitate ultrasound-guided procedures. The portable configuration can be utilized throughout the care environment including the operating room and throughout the hospital. Although the operator remains tethered to the ultrasound via the head-mounted display video

connections, they are also tethered to the ultrasound with the ultrasound probe cable. Future studies will focus on optimizing ergonomic design to facilitate routine use in clinical practice.

References:

1. Jang YE, et al. Smart glasses for radial arterial catheterization in pediatric patients: A randomized clinical trial. *Anesthesiology*. 2021 Oct 1;135(4):612-20.
2. Franzen MH, et al. Augmenting the Anesthesiologist's Cockpit with Head-mounted Displays for Image-guided Procedures: Are We There Yet?. *Anesthesiology*. 2021 Oct 1;135(4):562-3.

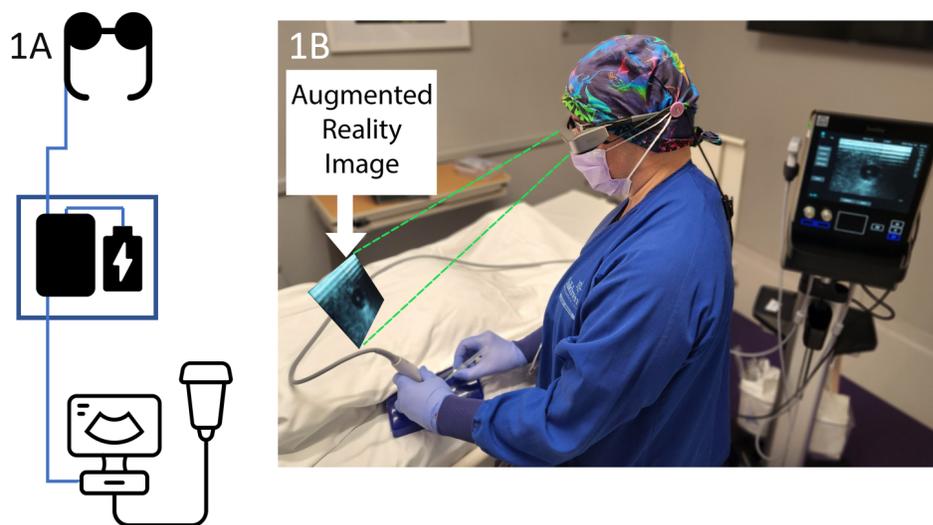


Figure Caption:

(1A) Representation of head mounted display configuration. The head mounted display is connected via a single cable to the video interface. The video interface receives power from a portable battery, both of which are encased in a 3D printed housing. The video interface is then connected to the ultrasound unit with a standard HDMI cable.

(1B) Simulation of the operator performing a bedside ultrasound-guided intravenous line placement. The operator is standing in front of the ultrasound unit and can see a virtual image directly in their field of view. The operator can stand on the same side of the bed as the ultrasound unit.