

Real-Time, Tracked, Mobile Augmented Reality Display for Surgical Navigation: Usability Study on Simulated Patients

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Purpose Navigation using medical image guidance is applied in clinical practice for various needle interventions. Commonly, images are acquired throughout the needle insertion process to track progression of the needle path. This process may lead to patient discomfort from procedure length, and the possibility of multiple needle insertions. Augmented reality (AR) image overlay systems have been proposed to limit the number of images required, the number of failed insertions, and patient discomfort. Though not translated to clinical settings due to a lack of portability and robustness, overlaying a single image slice on a patient makes it simpler for clinicians to navigate to targets and insert needles correctly. We present a lightweight, robust, system for intraoperative AR guidance.

Methods Our AR image overlay system can be handheld or mounted to a table at the patient bedside to allow operators to navigate scanned patient images. We built software on the open-source 3D Slicer and PLUS platforms and used optical tracking to acquire real-time position of the image overlay system. The system provides operators with an augmented intraoperative view by overlaying preoperative images directly onto patients (Figure 1). Physicians were asked to navigate patient images using this system, and plan needle insertions using the overlay (Figure 2).

Results Five physicians responded to a series of questions to assess handheld and table-mounted forms of the image overlay system by rating them on a Likert scale. Responses showed that the participants felt it was simple to learn how to use the system, and that it was simple to understand where the projected image was located on the patient. Participants also indicated that there was an increase in how demanding the handheld version of the system was to use over the table mounted version. Additionally, participants felt they could position themselves more comfortably and navigate images more easily using the table-mounted system.

Conclusions Participants identified the image overlay system as being simple to use and understand. Results show promise for use in clinical interventions. Further assessment of the image overlay system in a real-world clinical setting represents next steps in our research.

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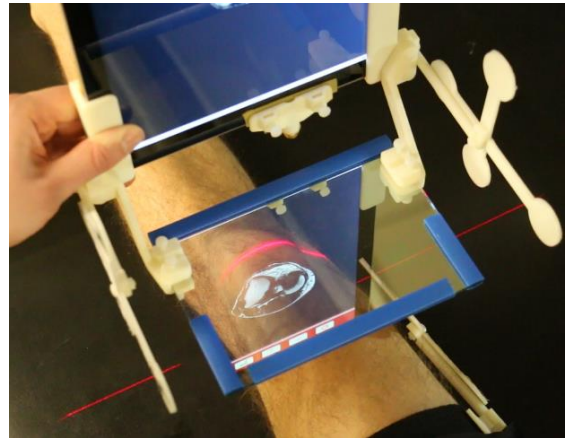


Figure 1: User's view of overlaid image on a patient's leg while using the image overlay system.



Figure 2: Participant using the system and adjustable table-mounted arm to plan a needle insertion path.