

A Portable and Self-Contained Approach for Surgical Telementoring: Towards Remote, Point of Injury Care

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Learning Objectives

- Identify the necessary capabilities of a portable surgical telementoring to provide assistance during austere settings.
- Describe the benefits of Augmented Reality (AR) as a technology to convey surgical expertise remotely.
- Recognize the benefits of stabilized visualization of mentee's operating field.

Background

Prompt and adequate treatment is crucial for the survival of critically injured combat casualties. Nonetheless, these requirements cannot always be guaranteed in austere scenarios. Telementoring systems have been used to deliver surgical guidance to mentees in scenarios where expertise is not readily available. However, current telementoring systems are ill-suited for austere settings.

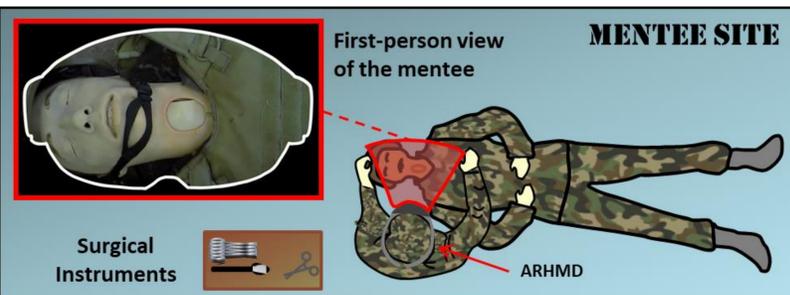


Figure 1. Schematic of the mentee site, deployed in an austere setting



Figure 2. Remote mentor creating surgical instructions via touch interactions

Platform Overview

We present a telementoring platform that is self-contained, portable, and provides the mentor with a stabilized first-person view of the operating field. A corpsman wears an AR Head-Mounted Display (ARHMD), which records the operating field with a built-in camera. The video is transmitted to the mentor, where it is stabilized. The mentor creates annotations on this stabilized video, which are transmitted back to the mentee to be visualized in 3D, superimposed onto the patient's body.

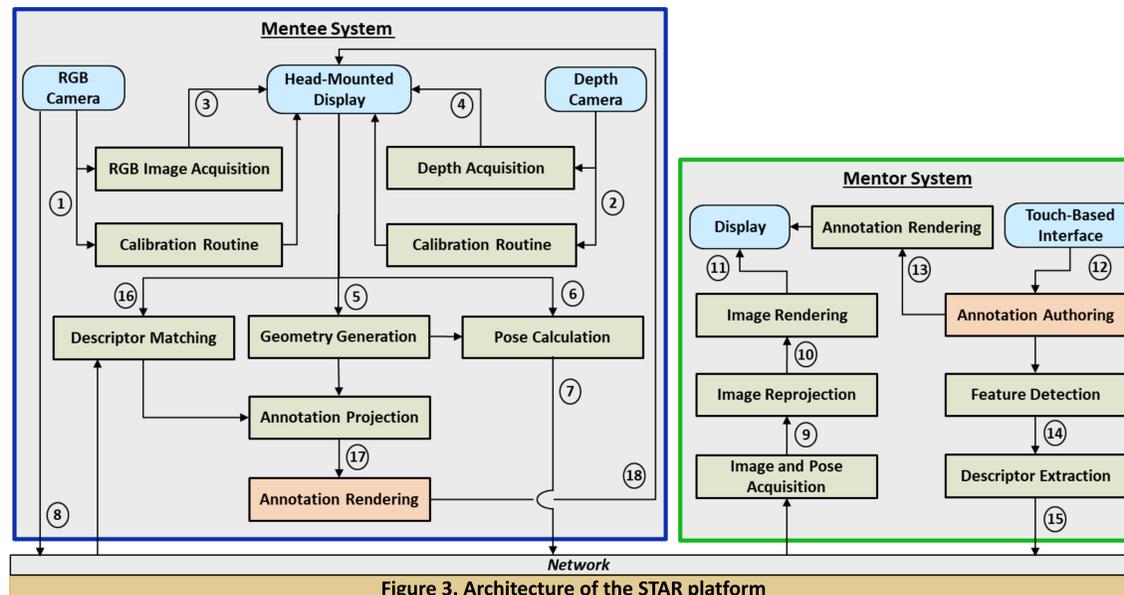


Figure 3. Architecture of the STAR platform

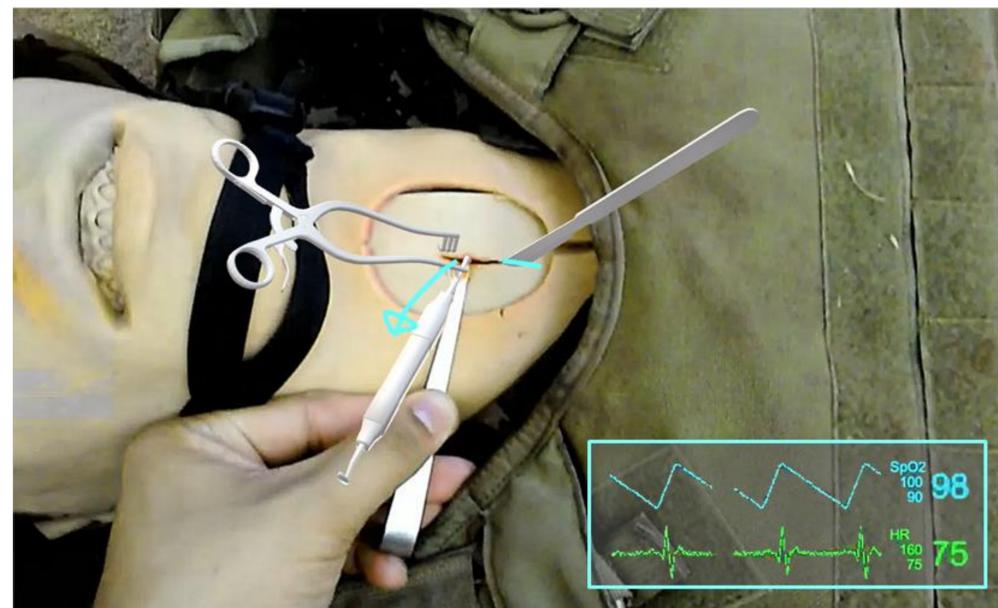


Figure 4. First-person view of mentee with augmented reality surgical instructions

User Study

A user study with twenty US Navy corpsmen compared our telementoring system (ARHMD condition) against an audio-only telementoring scenario. Two remote surgeons guided each corpsman through two cricothyrotomies in a simulated austere scenario. Two expert surgeons performed on-site evaluation of the participants using military criteria for successful cricothyrotomy performance.



Figure 5. Experimental Conditions. STAR vs. Audio-only telementoring

Results

Participants in the ARHMD condition obtained higher scores in all performance-related criteria, with statistically significant differences in three sub-criteria. Moreover, participants in the ARHMD condition received higher scores in all non-technical criteria scores, with statistically significant differences in three sub-criteria. Additionally, evaluators considered the procedure was performed significantly safer in the ARHMD condition.

Conclusions

Our study demonstrates that our self-contained ARHMD-based telementoring platform provides beneficial capabilities to provide assistance during austere, Point of Injury scenarios.

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