

# STAR – A SYSTEM FOR TELEMENTORING WITH AUGMENTED REALITY

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## 1. Motivation & Approach

Telementoring can support surgeons at forward operating bases by providing guidance in real time from a remote expert.

With a conventional surgical telementoring system, the operating field annotations generated by the expert are provided to the surgeon on a nearby monitor.

The surgeon has to shift focus repeatedly from the operating field to the monitor, and to map the annotations mentally onto the operating field, which can lead to delays or even surgical errors.

*We propose a novel telementoring system that integrates the annotations directly into the field of view of the surgeon using an Augmented Reality transparent display.*

## 3. A User Study

We compared STAR to a conventional surgical telementoring system. 20 medical and pre-med students performed two tasks under telementored guidance (Fig. 3).

STAR significantly reduced placement error (57%) and focus shifts (65%).

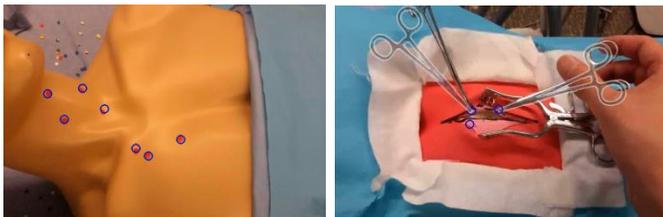


Figure 3. Images shown on the transparent display in the STAR condition. The first task was to place stickers (left) and the second task was to place surgical instruments (right) at locations indicated by the expert through graphical annotations.

## 2. First STAR Prototype

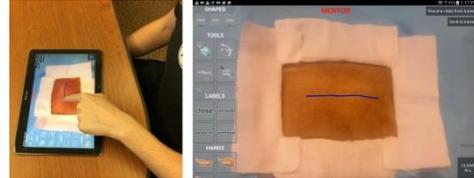


Figure 1. Expert annotates a video frame of the operating field with an incision line using a touch-based interface.



Figure 2. The surgeon views the operating field through a transparent display that shows the annotations generated by the expert. The annotations are integrated directly into the field of view of the surgeon. When the display is repositioned, the annotations remain anchored to the operating field entities that they describe.

## 4. Improving Transparency

We are developing displays that provide an accurate transparency effect (Fig. 4).

The operating field is acquired and rendered from the surgeon's viewpoint. The surgeon sees what they would see if the display were not there.



Figure 4. Left: hand-held, self-contained transparent display prototype built from tablet computer enhanced with on-board user head tracking and geometry acquisition accessories. Right: first test of transparent display in the surgical telementoring context. The accurate transparency effect provides visual continuity between the parts of the operating field seen directly and the parts seen through the display.

