

# Surgical Control Assistant: Live-tablet Platform for Enhancing a Laser-Integrated Robot (SCALPEL-IR)

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## OVERVIEW

Robotic surgical lasers have improved clinical outcomes over traditional counterparts due to their consistency, precision, and reduced post-op recovery time. However, they require significant investment and personnel training.

The goal of this project is to integrate with existing robotic laser hardware, enhance ergonomics, and improve surgical outcomes.

We developed a **stylus-tablet interface** for mapping user input to robot motion. This resulted in improved accuracy and usability on practice targets compared to traditional laser control methods such as manual free-hand operations.

## Key Takeaways

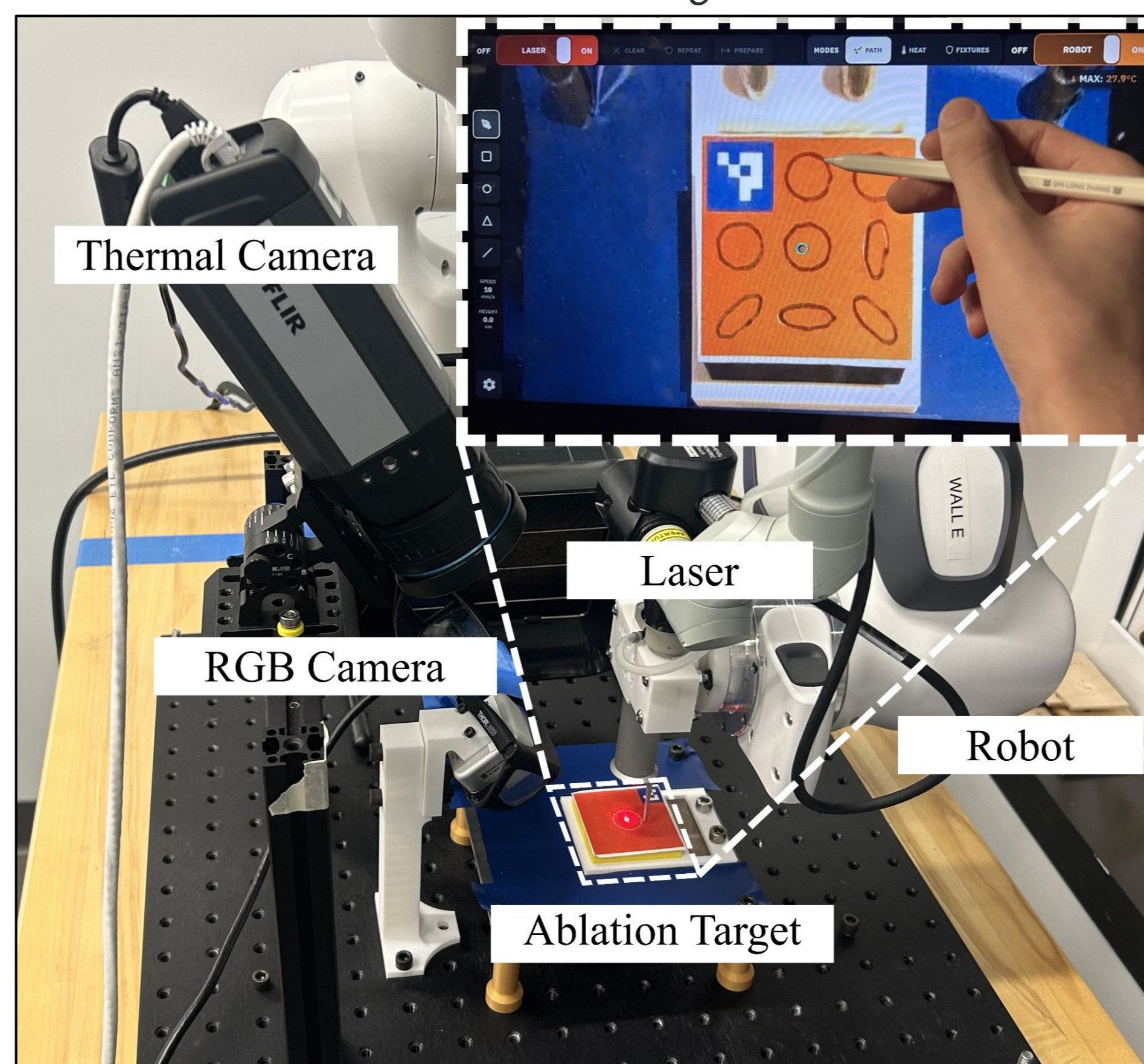
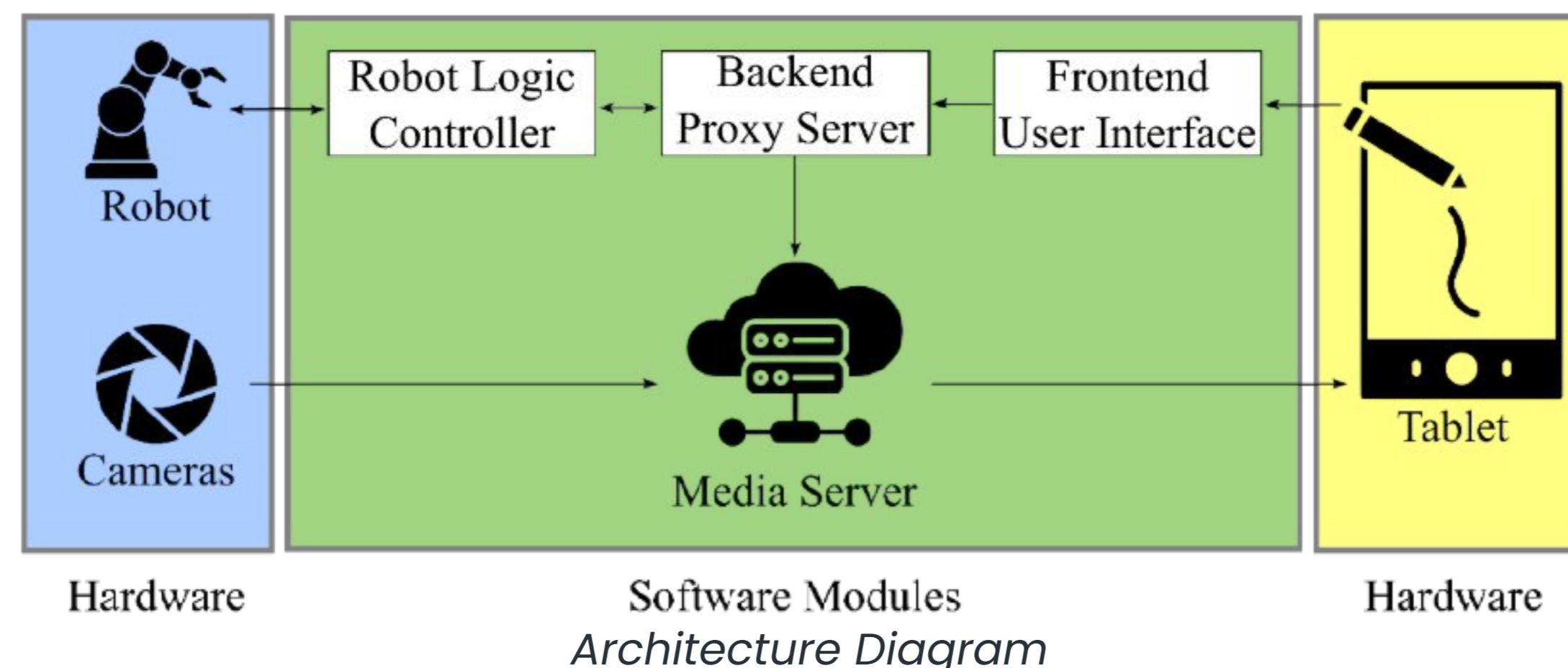
**A stylus-tablet interface** is a suitable control modality for laser-based dermatology procedures.

**Robotic control** reduces operator cognitive load by automating tasks such as laser focusing and trajectory execution.

**Future work** will focus on 3D visualization of the workspace and track flexing tissue.

## Design and Implementation

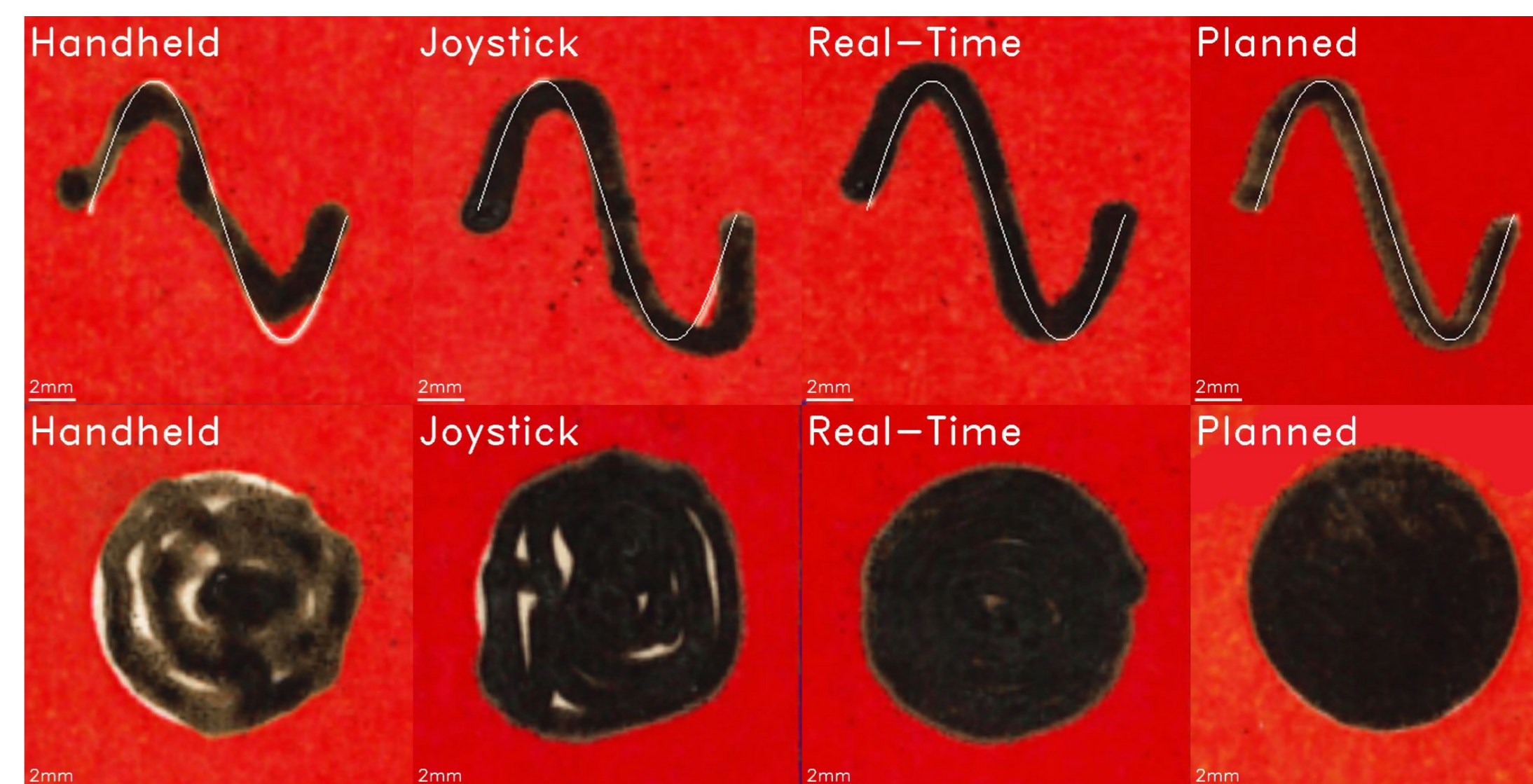
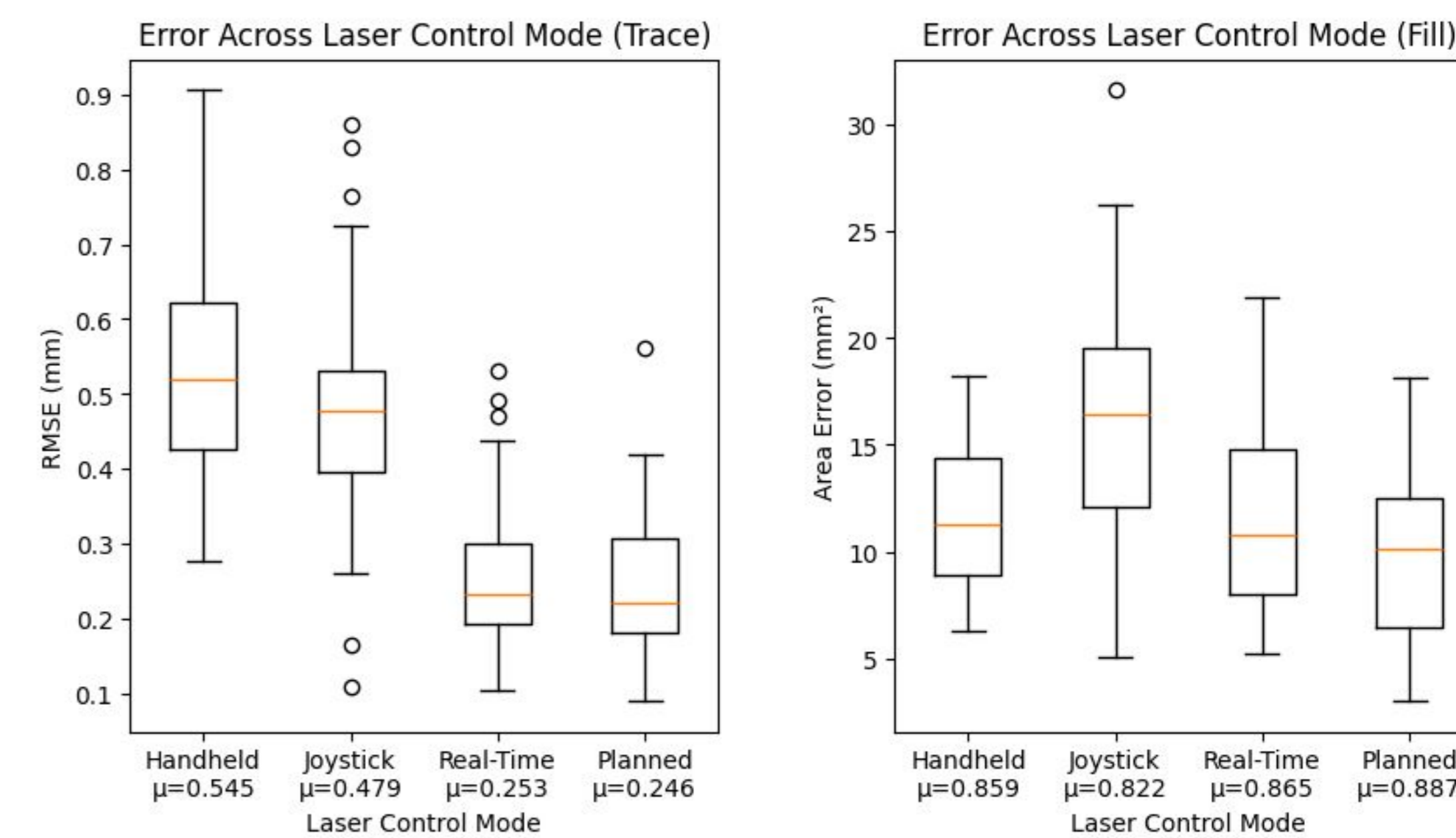
The system consists of a 7-DOF robotic manipulator, RGB & thermal cameras, and a tablet-based user interface. This built upon previous work in the  $\mu$ RALP project, a similar system for transoral laser microsurgery. Our system enables low-latency video and input, thermal imaging, real-time control, planned trajectory execution, and integrated safety features.



Hardware setup and target as seen through tablet interface.

## Results

Four participants traced ablation targets across each laser control mode. Results show **stylus-based control** for planned and real-time **significantly reduced error** compared to manual handheld and joystick control when tracing.



Median performance per laser control mode. Top: Trace, Bottom: Fill

Qualitative feedback gathered from surveys and interviews expressed the stylus-tablet interface was **easy to learn, ergonomic, and prevented mistakes.**