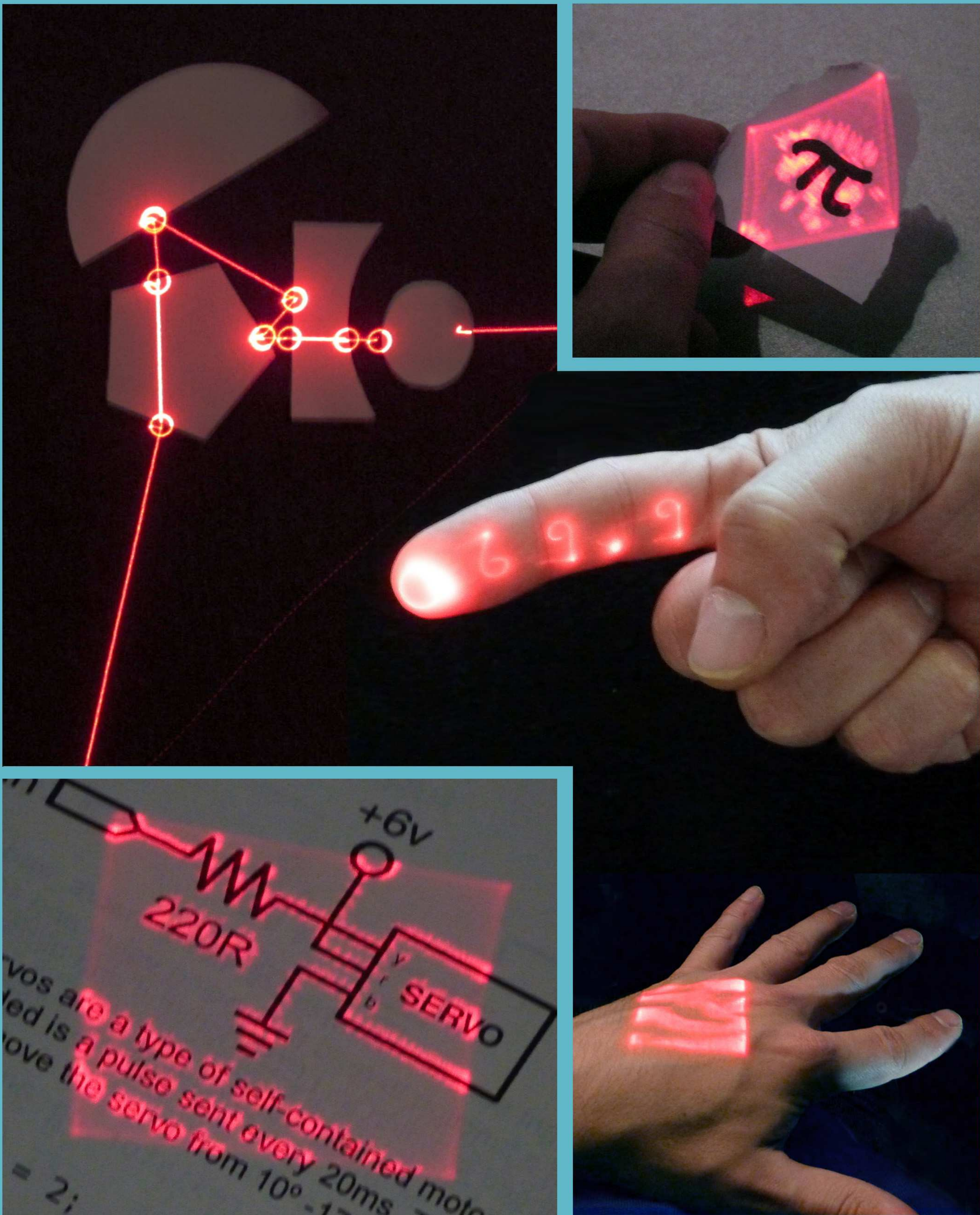
Camera-less Smart Laser Projector

for spatial augmented reality



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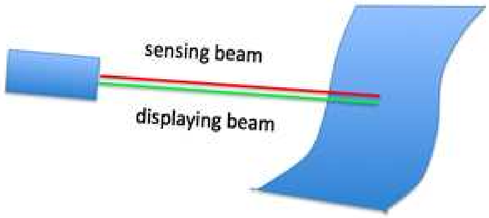
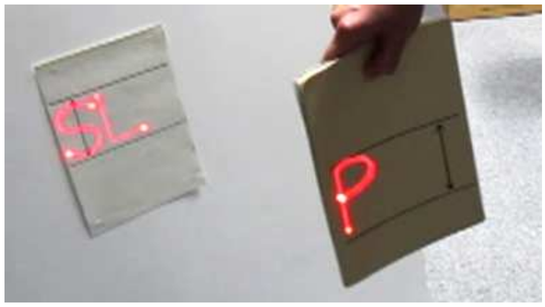
Smart Laser Projector

Abstract





The Smart Laser Projector (SLP) is a laser-based projector that displays images while, at the same time, functioning as a LIDAR probe that gathers information about the projection surface: shape, position, orientation, texture, and spectral reflectance. This approach has several important advantages for implementing spatially augmented reality. For example, it does not require projector-camera calibration and it enables precise spectral-reflectance measurements. Because the SLP can also detect and track objects or fingers above the projection surface, it is an adequate system for implementing ubiquitous interactive displays.

This project demonstrates raster-scan and vector-graphics applications on two different hardware prototypes. The first relies on a pair of galvano mirrors to demonstrate simultaneous tracking and display (iconic or alphanumeric) on the palm of the hand, depth-based active contours for spatially augmented surveying for instance), and interactive laser games. The other relies on a single two-axis MEMS mirror working in resonant mode to demonstrate edge enhancement of printed material and "artificial fluorescence" (direct visualization of invisible watermarks or even polarization) with perfect projection registration by construction.

The short-term goal of this project is to develop a wearable MEMS-based prototype that can transform the space around the wearer into an interactive laser-based AR environment or "laser aura". Future applications of may include: dermatology (enhancement of superficial veins, direct visualization of anomalous polarization induced by cancerous cells, and even "smart" phototherapy), non-destructive control (visualization of microscopic scratches or surface mechanical stress inducing changes in polarization), authentication (by exploiting artificial fluorescence), and augmented-reality applications that project laser icons or full-fledged raster-scan images on any available surface.

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http://www.k2.t.u-tokyo.ac.jp/perception/SLP