Remote Interactive Graffiti

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ABSTRACT

We present an installation that allows distributed internet participants to "draw" on a public scene using light. The iLight system is a camera/projector system designed for remote collaboration. Using a familiar digital drawing interface, remote users "draw" on a live video image of a real-life object or scene. Graphics drawn by the user are then projected onto the scene, where they are visible in the camera image. Because camera distortions are corrected and the video is aligned with the image canvas, drawn graphics appear exactly where desired. Thus the remote users may harmlessly mark a physical object to serve their own their artistic and/or expressive needs. We also describe how local participants may interact with remote users through the projected images. Besides the intrinsic "neat factor" of action at a distance, this installation serves as an experiment in how multiple users from different locales and cultures can create a social space that interacts with a physical one, as well as raising issues of free expression in a non-destructive context.

Keywords

camera/projector systems, augmented reality, annotation, remote collaboration

Categories and Subject Descriptors

H.5.3 [**Information Interfaces and Presentation**]: Group and Organization Interfaces – Synchronous interaction; H.5.1 [**Information Interfaces and Presentation**]: Information Systems – Artificial, augmented, and virtual realities

General Terms

Algorithms, Human Factors

1. INTRODUCTION

iLight [1] is a camera-projector system that allows a user to draw on a video image of a real-world scene using digital ink[1]. The drawn marks are projected onto the scene, and are visible to the drawer through the video image, as well as to anyone in the vicinity of the projector. The iLight system thus allows a remote user to draw on real-world objects using an active video interface. Because the iLight drawing tools are web enabled, participants around the world will be able to draw on a real-world object such as a New York City sidewalk.

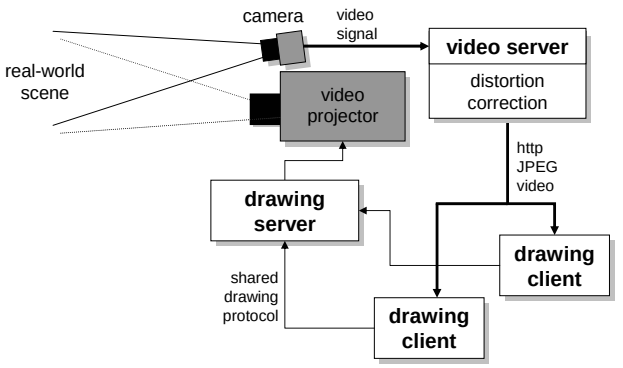

Figure 1: iLight system architecture

1.1 User Experience

The system has two classes of viewers: local and remote. Local users see the projected images, and possibly interact with them (see Section 1.3. Remote users have a richer set of possibilities: they may passively view the projected images, or they can add to or alter the images using text and drawing tools in the iLight palette. Though the drawing tools are fairly rudimentary (at least by comparison with professional image creation software) they are easy to use and don't necessarily hinder creativity. For example, the image in Figure 3 was created with similarly limited drawing tools by an anonymous user. Because multiple remote users will access the same virtual canvas, they may interact with each other both creatively and destructively. Note that there is no practical way to monitor and/or censor the projected images. If access is unrestricted, this may result in potentially offensive text or drawings being projected. However, any remote user also has the ability to erase or comment on anything projected, so it is likely that truly offensive content will be short-lived. This tension is an inherent part of the installation.

[1]Though "tele-graffiti" might be a particularly apt name, we respect the priority of an existing system with that name [3].

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Figure 2: Remotely and locally shared whiteboard graffiti

1.2 Installation

Many aspects of this installation are site-specific. An ideal site is both visible to the public and close enough to a secure location where the camera/projector setup can be installed. The system requires power, internet connection, and climate control to maintain a typical PC and video projector. Ideally the projected area will be publicly visible and free of obstructions and direct sunlight. Candidate locations might include a window overlooking a sidewalk or in view of a wall.

1.3 Local Interaction

An interesting twist allows local viewers to interact with the projected images. The simplest case is to direct the iLight system at a whiteboard, so that local participants may draw with physical dry-erase markers in concert with remote user's projected drawings. Simple interactivity is to let local users control the color of the ink used by remote drawers. Small regions of the camera's view may serve as color or texture sources for the projected ink, like the "ink dropper" tool familiar to Adobe Photoshop users. Changing the physical color in those regions changes the color of one or more of the projected figures. Thus holding a colored object in that region will render the projected figures in that color. On a whiteboard, colored magnets are a simple way to set projected colors, by moving them into and out of the color source regions. Note that this allows local users to de-emphasize projected drawings by making the color source region resemble the background. It is even possible to construct a voting system such that local users may vote for or against a particular image. Popular images (with many "for" votes) can be archived to a "gallery;" unpopular images can be deleted.

2. RELATED WORK

Space does not permit a comprehensive review, but we mention a few particulary relevant precursors. iLight is primarily inspired by the 1993 Digital Desk from Xerox's EuroPARC [4]. That system allowed users to interact with a computer via physical documents in a camera/projector system. significantly simpler and more robust. Ken Goldberg's Telegarden [6] system was a pioneering system featuring

Figure 3: Image created by anonymous user with basic drawing tools

shared remote control of a physical resource. Jonah Brucker-Cohen's "Public Desktop" system allows remote participants to enter text, which is displayed on the background desktop of a given computer [2]. The Tele-Graffiti system [3] is a related camera-projector system designed for remote drawing on paper; it requires cameras at both ends of the connection and is not suitable for use as a web application.

3. REFERENCES

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