

# A Portable System for Anywhere Interactions

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## ABSTRACT

Interactions have taken off from the confinement of a single screen into various personal devices. Projected an interface onto different parts of a physical environment is an escape beyond traditional display devices. Imagine that any walls or floors can turn into a direct manipulation space without a lot of effort. This demonstration of ED-lite, a combination of a laptop, custom software, off-the-shelf digital camera and projector, shows projected interfaces with interactions on any surfaces including those not necessarily perpendicular to the projector. ED-lite is a derivation of our previous work on Everywhere Displays (ED) and steerable interfaces. This portable version has an automatic calibration feature that makes applications usable on any surfaces in a drop. More importantly, it is now possible to be taken on the road for demonstrations.

## ACM Classification Keywords

H5.1. Information interfaces and presentation (e.g., HCI); Multimedia Information Systems; Artificial, augmented, and virtual realities

## Keywords

Augmented reality; interactive spaces; ubiquitous computing, projected interfaces vision-based interactions

## INTRODUCTION

Alternative to using head-mounted displays, our version of augmented reality uses a projector to superimpose images on physical objects and surfaces [1]. Interactions are recognized through a vision-based recognition component [2]. The steerable interface system as a whole was previously reported in [3] while a related study on the interactive store application was reported in [4].

The early steerable interface system as reported in these papers has not been easily transported for off-site demonstrations. The projector coupled with the rotating mirror for steerability, its mounting structure, and a heavy-duty tripod for mounting the projector amounts to a bulky set of equipment. In addition, it requires a considerable amount

of setup time to define new surfaces and to perform surface calibration.

Our recent incarnation of the steerable interface system, ED-lite, is not so steerable but has other features to compensate for it. It consists of just a laptop, an inexpensive digital camera, and a projector (which is now lighter). ED-lite is designed to be portable and will lend itself to applications both similar to and different from those suitable for the original steerable interface system. Figure 1 demonstrates all that is necessary for ED-lite.

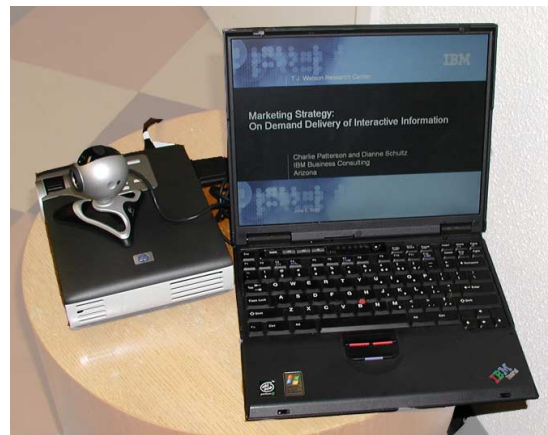


Figure 1. ED-lite System for Everywhere Interactions

## RELATED WORK

Non-desktop computing via projecting graphical contents onto physical environments were developed in various research prototypes [5, 6, 7, 8, 9, 10]. While these systems relied on fixed location projections, our system [3] has steerability as the key differentiation, enabling its use in transient pervasive applications. ED-lite on the other hand projects on a fixed location similar to these previous research prototypes but yet allows the setup to be easily recalibrated for a new location.

Related work regarding the vision-based recognition system can be found in [2].

## APPLICATIONS, AND ENVIRONMENTS

### Projection with Interactions without Steerability

Figure 1 illustrates one of the applications of ED-lite. A slide presentation can be projected onto any walls of choice. Controls were displayed for the user to advance the presentations without having to manipulate the laptop.

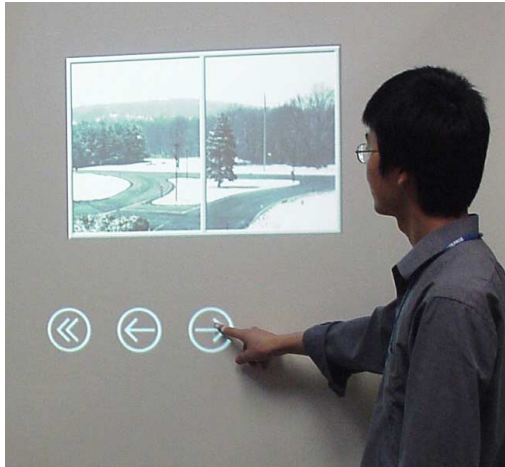


Figure 2. A slide presentation on any wall

### Projection with Interactions Anywhere with Steerability

Figure 2 illustrates an interactive store application. The application uses the same vision and projected display components as ED-lite while leveraging the system's steerability to project to multiple locations in a section of a store. The components of this application can be displayed via ED-lite with each display individually calibrated.



Figure 3. Interactive store application.

### Automatic Calibration

One of the key features that makes ED-lite usable on a drop is the automatic calibration support. While applications must be developed in advance, the actual pinpointing of a location can be done on the spot. The calibration process involves aiming the camera in the intended location and indicating the four corners of the desired projected area. The system flashes and detects calibration points at the four corners to determine the intended orientation and scale. This set up can then be saved for the application.

### Application Environment

The steerable interface and ED-lite architecture was implemented in Java and C++. The applications as shown in this abstract were developed in Java, Macromedia Director and Macromedia Flash. The demonstration consists of the automatic calibration process, various applications, and how interactions are created in Flash.

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