tPad: A Contact Augmented Reality Implementation to Support Active Reading

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ABSTRACT

Author Keywords

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General Terms

INTRODUCTION

Transparent displays allow showing digital information while maintaining visible the physical objects in the background; making them ideal for applications like car wind-shields [1], vending machines [2] and shop-windows [3]. Such displays are also used for augmented reality purposes, that is, linking the digital information to the real world objects behind the display [4]. Upcoming portable transparent displays enable a new kind of augmented reality where the display rests directly on top of the physical object it augments; we call it *Contact Augmented Reality* (CAR).

In this paper we explore the notion of CAR by identifying *device registration* as the main challenge and exploring novel opportunities for interaction. For CAR, device registration deals with determining the 2D location and orientation of the device in relation to the surface of object over which it rests. Handling device registration clears the way for novel opportunities for interaction including dual side output and device composition by stacking.

We built two prototype CAR devices: a low-fidelity tabletop emulation and a 7" portable device called the tPad. The tabletop prototype relays the registration problems to an external 3D tracking system, and allowed us to explore the different interaction techniques with minimal implementation demands. The tPad prototype addresses the registration problem by using a camera-based feature tracking approach. The tPad uses a capacity-overlay for touch input. Finally, a controller board detects the tPad's

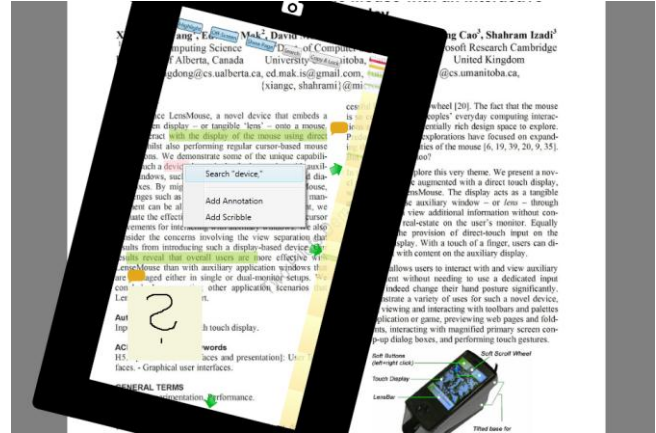flipping or whether it's stacked with another one.

Figure 1: tPad screen capture showing highlights (green) , text and free-hand annotations, and off-screen pointers (arrow).

We explore CAR and the tPad in an Active Reading scenario [5]. Active Reading describes a combination of reading with critical thinking and learning. Through a user-centered design process we built the ActiveReader, an application for the tPad that allows users to underline, highlight, scribble comments, search content, and look-up references. Users access special information by flipping the tPad, and two tPads can share content when staked-up. Users can later retrieve their annotations from their personal computer.

We studied the ActiveReader tPad application with users in active reading tasks. The task required using all the tPad features like touch, flipping and staking. Initial feedback shows that using the tPad is highly intuitive and learn-able. Moreover, users highlighted the value of reading on paper, having the digital features when needed, and being able to access their annotations digitally.

Our contributions are at the conceptual, interaction design, and technical levels. First, we introduce the notion of Contact Augmented Reality and propose a series of interaction techniques. Second, we present a prototype implementation called the tPad. Third, we show how the tPad and the CAR notion can be applied to the active reading scenario. Fourth, we collect initial user feedback that shows how active reading benefits from the tPad and its

ActiveReader application. Fifth, we identify a series of everyday situations where tPad applications can be useful.

REFERENCES

1. OR A. Doshi, S. Y. Cheng, and M. M. Trivedi, "A novel active heads-up display for driver assistance," IEEE Trans. Syst., Man, Cybern. B, Cybern., vol. 39, no. 1, pp. 85–93, Feb. 2009.

2. Japan's transparent display vending machine. http://techcrunch.com/2011/12/20/video-japan-vending-machine-2-0/

3. Abhijit Karnik, Walterio Mayol-Cuevas, and Sriram Subramanian. 2011. MUST-D: multi-user see through display. In Proceedings of the 24th annual ACM symposium adjunct on User interface software and technology (UIST '11 Adjunct). ACM, New York, NY, USA, 77-78.

4. M. J. Adler and C. Van Doren. How to Read a Book. Revised edition, Simon and Schuster, New York, 1972.

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