Arm-Hidden Private Area on an Interactive Tabletop System

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ABSTRACT
Tabletop systems are used primarily in meetings or other activities wherein information is shared. However, when confidential input is needed, for example when entering a password, privacy becomes an issue. In this study, we use the shadowed area nearby the forearm when the user places their forearm on the tabletop. And our tabletop security system is using that hidden-area to show a confidential information window. We also introduce several potential applications for this hidden-area system.

Author Keywords
Forearm, Interaction techniques, Tabletop display, Shadow mapping, Privacy, Security.

ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces – Interaction styles.

1. INTRODUCTION
Many solutions have been proposed for the security of tabletop systems. Isogawa et al. [1] used a three projector setup wherein the rear one projected a graphical image while the two front ones projected a complementary image. Anderson et al. [2] proposed an interface that prevents others noticing that the user is accessing or inputting information. However, in these studies, the concealed information could not be guaranteed to be hidden from the view of others. In this study, we proposed an interactive tabletop system that can present personal information within a personal space on the tabletop display that is inaccessible to other users.

2. METHOD
We based our approach on the gesture wherein a forearm is placed on the tabletop [3]. This allowed information to be hidden while adopting a natural posture. Using a shadow mapping technique, from the onlooker's point of view, the area behind the forearm is in shadow (Figure 1), and invisible to the onlooker. The principle underpinning this technique is that when viewing an object from a point at the source of the light, anything behind the object is invisible. Williams [4] introduced the concept as the mapping of a linear transformation of the X,Y,Z points as the X,Y,Z points in the observer's view. In our approach, the position of the onlooker was taken to be the source of light. Therefore, from the onlooker's point of view, the area behind the forearm is in shadow, and invisible to the onlooker.

The tabletop surface had a projection surface area of 1.52 m by 0.82 m. A projector was placed beneath the tabletop. The positions of user's hands and onlookers are detected by a motion capture system.

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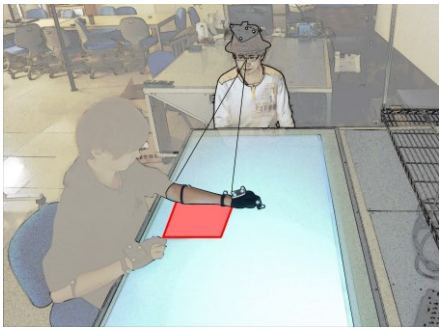

Figure 1. Area hidden from co-worker

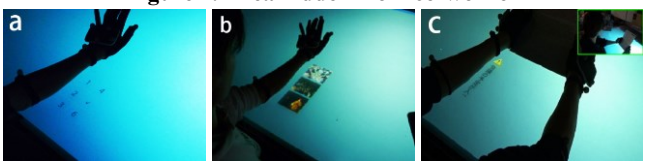

Figure 2. Applications using the hidden-area.(a) Input Password (b) Secret Photo Viewer (c) Urgent Information Checker.

3. APPLICATIONS
Input Password (Figure 2 (a)) is an application to conceal the users' password from other people working at the same table. When users place their forearm on the table, a keyboard with randomly arranged keys appears in the users' hidden-area. The Secret Photo Viewer (Figure 2 (b)) is another application to view pictures secretly or to select a picture without displaying a personal picture database to other people. The Urgent Information Checker application (Figure 2 (c)) is for the users checking the names and profiles of the meeting attendees secretly in the hidden area. It can also display a schedule and provide alerts for the users to subtly view their agenda.

4. CONCLUSIONS
This paper demonstrates an idea to manage privacy issues by taking advantage of a person's natural posture when working on a tabletop. When a user places a forearm on the tabletop, a display window will appear and information will be projected within the hidden-area.

5. REFERENCES
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