International Conference on Artificial Reality and Telexistence
Eurographics Symposium on Virtual Environments (2016)
D. Reiners, D. Iwai, and F. Steinicke (Editors)

Automatic Display Zoom Using Face Size of Camera Image

Yuki Satale[1], Kenji Funahashi[1]

[1]Nagoya Institute of Technology, Nagoya, Japan

Abstract

When it is hard to see a small font size document that is in your hand, you usually move it closer to your face. When you want to see the whole of a large sheet such as a map, you usually get it away from your face. On the other hand when you get into a same situation on a PC screen and tablet device, you zoom it using a mouse or doing pinch operation. So we consider zooming display appropriately referring the distance between a face and a screen also when using PC and tablet. If the distance value is mapped to the zoom scale parameter directory, it always changes according to the slight change of the posture. Therefore the presence or absence of the scale change is determined from the distance change in a predefined period. In this paper, we propose corresponding about the distance change and scaling, also described for the experimental system in order to confirm the validity of this idea.

Categories and Subject Descriptors (according to ACM CCS): H.5.2 [INFORMATION INTERFACES AND PRESENTATION (e.g., HCI)]: User Interfaces—Interaction styles (e.g., commands, menus, forms, direct manipulation)

1. Introduction

When it is hard to see a small font size document that is in your hand, you usually move it closer to your face. When you want to see the whole of a large sheet such as a map, you usually get it away from your face. On the other hand when you get into a same situation on a PC screen and tablet device, you zoom it using a mouse or doing pinch operation [Wel91] [GWF95]. So we consider zooming display appropriately referring the distance between a face and a screen also when using PC and tablet. There is a related work, that realizes stereoscopic viewing with motion parallax by recognizing the face position [Fra11]. If the distance value is mapped to the zoom scale parameter directory, it always changes according to the slight change of the posture. Therefore the presence or absence of the scale change is determined from the distance change in a predefined period. In this paper, we propose for the relation of this scale and the distance, then describe the pilot system in order to confirm the validity of this idea.

2. Scaling determined to face distance

Although it is conceivable to use a range sensor for measuring the distance between a face and a screen, we use a image camera that can be easily prepared. In the case of a PC, a web camera is put at the top of the monitor. In the case of a laptop or tablet, the built-in camera of the screen side is used. First a face area is recognized using the OpenCV library from the captured image. The height: $h(t)$ and width: $w(t)$ of the face area are obtained at the time: t (figure1), it should be noted the face is assumed to be upright. In order to avoid the influence of a camera noise and a recognition

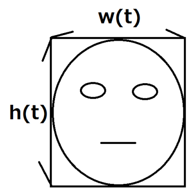

Figure 1: *Height and width of face*

error, the average values $H(t)$ and $W(t)$ are obtained in a predefined period. This period D is F/f (sec), where F is determined as 6 frame empirically for $f = 30$ frame/sec processing speed. Next, the average $H(t)$ is compered with $H(t-D)$. The average $W(t)$ is also compered (Formula1).

$$H'(t) = H(t) - H(t-D)$$

$$W'(t) = W(t) - W(t-D) \tag{1}$$

Those values are possibly affected by a slight change of the posture for example sitting up again. So the display is zoomed in as s with smooth animation effect in period D,

$$s = \frac{e}{2}\left(\frac{H'(t)}{H(t-D)} + \frac{W'(t)}{W(t-D)}\right) \tag{2}$$

when the change is more than $c_1 (\times 100[\%])$ and less than c_2;

$$c_1 < \frac{H'(t)}{H(t-D)} < c_2$$

© 2016 The Author(s)
Eurographics Proceedings © 2016 The Eurographics Association.

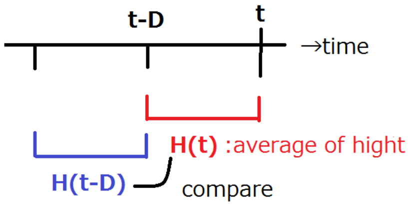

Figure 2: *Average and comparison of hight*

$$c_1 < \frac{W'(t)}{W(t-D)} < c_2. \tag{3}$$

Or the display is zoomed out as $-s$ with animation effect, when the change is more than c_1 and less than c_2;

$$c_1 < -\frac{H'(t)}{H(t-D)} < c_2$$
$$c_1 < -\frac{W'(t)}{W(t-D)} < c_2, \tag{4}$$

where c_1, c_2 and e are positive value, and are set as $c_1 = 0.05$, $c_2 = 0.5$, and $e = 1.0$ empirically.

3. Experiments and results

We used desktop PC and web camera to develop the system we proposed. The OpenCV library was used to recognize a face. The camera was set under the display for the experiment. The system appearance is shown in Figure3. Figure 4 shows the flow that the person moved away from the display then moved closer to the display, and the map image was zoomed out and in.

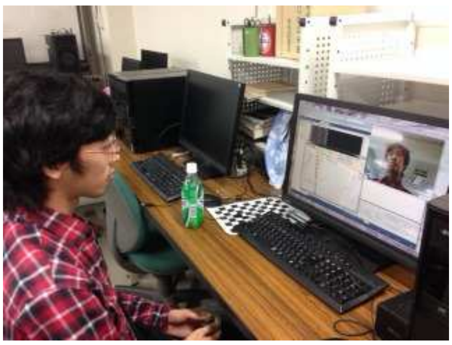

Figure 3: *System appearance*

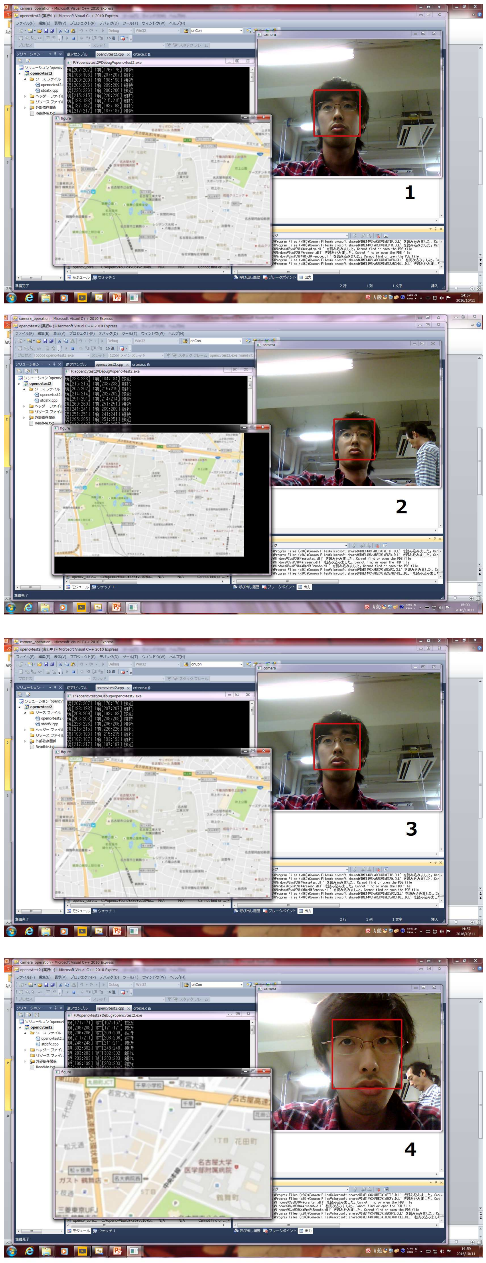

Figure 4: *Display zoomed according to the distance*

4. Conclusion

In this paper we proposed new approach to zoom display appropriately referring the distance between a face and a screen when using PC. When you moving closer to display, it is zoomed in. Getting away from display, it is zoomed out to see the whole. It is expected to improve the operability to zoom. In the future, we should implement this proposed model to a tablet device to verify the effectiveness of this idea. The empirical parameters should be also considered and determined.

References

[Fra11] FRANCONE J.: Laurence nigay, using the user's point of view for interaction on mobile devices. *Proceedings of the 23th ACM International Conference of the Association Francophone d'Interaction Homme-Machine (IHM2011)* (2011), p.p.25–31. 1

[GWF95] GEORGE W. FITZMAURICE HIROSHI ISHII W. A. S. B.: Bricks: laying the foundations for graspable user interfaces. *Proceedings of the CHI '95* (1995), 442–449. 1

[Wel91] WELLNER P.: The digitaldesk calculator: tangible manipulation on a desk top display. *Proceedings of the UIST '91* (1991), 27–33. 1

© 2016 The Author(s)
Eurographics Proceedings © 2016 The Eurographics Association.