

Stereo Video - See - Through

{wildpink, yndk@sogang.ac.kr}

The User Interface of Button Type for Stereo Video - See - Through Device

Youngju Choi and Yongduek Seo

Department of Media Technology, Graduate School of Media Communications, Sogang University

see-through
가 , 가 AR
가

Abstract

This paper proposes a user interface, on see-through system environment which shows the images via two different cameras, that also ordinary user can control the computer systems or other various processes easily. For that, we include an AR technology to synthesize the virtual button to the image which is captured by the camera real-time. And we were looking for the hand position in the image to judge whether the figure selects the button. And the result of judgment visualizes through changing of the button color. The user can easily interact with the system by selecting the virtual button in the screen with watching the screen and moving her fingers at the air.

1 “ ” (see-through device)

HCI 가 가

, 가 ,
(Nickerson and Landauer, 1997)

[1]. PC

see-through

device

(AR: Augmented Reality)

가 가 AR

(user's sensory perceptions) 가

가 (virtual information) 가(adding)

(computer display)

see-through device

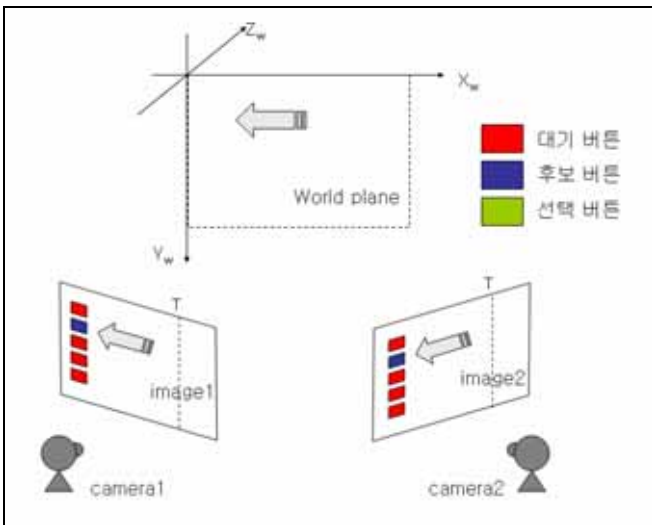
image- i

(T)

[2]

(depth)

[1]

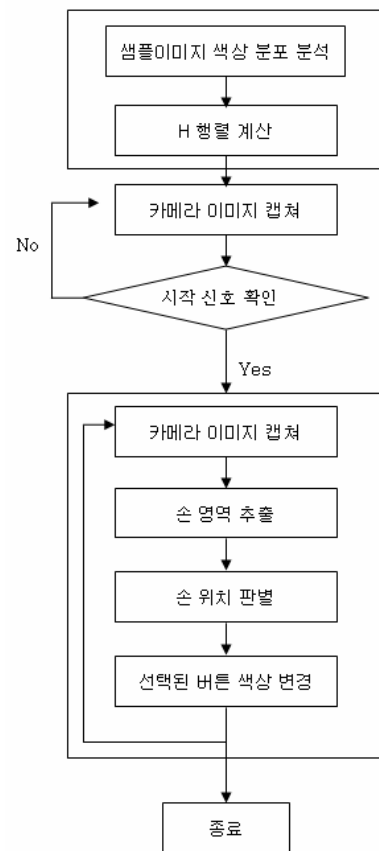


1.

(world coordinate)

(world plane)

(image- i , $i \in \{1,2\}$)



2.

Homography matrix
world plane
가
(image-i)
가
plane
가
world plane
world plane
image plane
plane

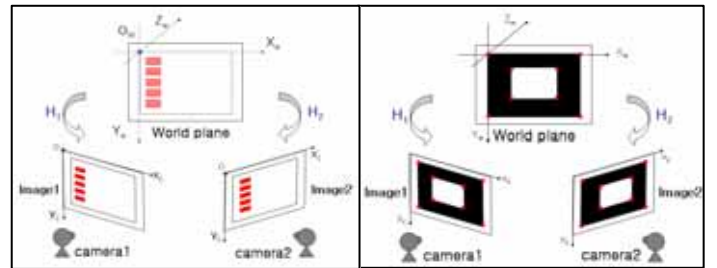
Homogeneous Transformation
H
[4]

(Image_w)

image plane world plane H



3. () ()



4. world plane image plane ()

가 가

world point point

가

가

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} u \\ v \\ w \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} & h_{13} \\ h_{21} & h_{22} & h_{23} \\ h_{31} & h_{32} & h_{33} \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \quad 1)$$

x, y world plane , x',
y' image plane

가

$$x' = \frac{u}{w} = \frac{h_{11}x + h_{12}y + h_{13}}{h_{31}x + h_{32}y + h_{33}} \quad 2-1)$$

$$y' = \frac{v}{w} = \frac{h_{21}x + h_{22}y + h_{23}}{h_{31}x + h_{32}y + h_{33}} \quad 2-2)$$

2 (가)

$Ah=0$ H h (subtraction) CCL
 h_{33} 1
 H h_{33}
 8 가 2 3.1
 4
 H $W \times H$
 8 H
 $Ah=0$ 3) 가 A
 ($j * 2 \times 9$) 가 , j



5. : <153x122>, <153x122>

$$\begin{bmatrix} x_1 & y_1 & 1000-x_1 & -x_1 & -y_1 & -x_1 \\ 000 & x_1 & y_1 & 1-y_1 & -x_1 & -y_1 \\ \dots & & & & & \\ x_j & y_j & 1000-x_j & -x_j & -y_j & -x_j \\ 000 & x_j & y_j & 1-y_j & -x_j & -y_j \end{bmatrix} \begin{bmatrix} h_{11} \\ h_{12} \\ \dots \\ h_{32} \\ h_{33} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ \dots \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

A h

A row column 가
 ($m \times n$) A SVD
 (singular value decomposition) $\|h\|=1$
 $\|Ah\|$ h

SVD: $A = UDV^T$

V column $\|Ah\|$
 eigenvector가 H
 world plane H₁ H₂ H
 2-1) 2-2)
 가

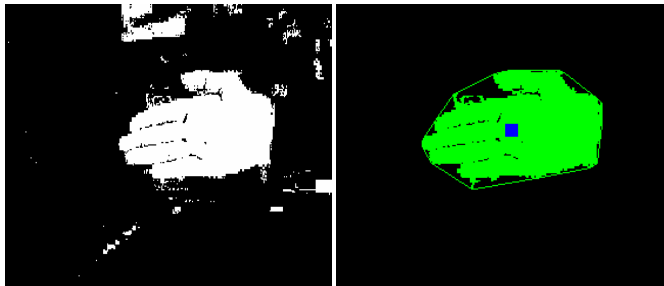
RGB color space 3
 (illumination)
 (H), (S), (V)
 HSV space V H

S
 (hm, sm) ($h\sigma, s\sigma$)
 가 H S

$$\left| \frac{hm^i - h_{x,y}^i}{h\sigma^i} \right| < 2.5 \quad \text{I} \quad \left| \frac{sm^i - s_{x,y}^i}{s\sigma^i} \right| < 2.5 \quad i = \{1,2\} \quad 4)$$

3 2
 2
 (pixel) 가 ,
 가 [6]

Component Labeling)



6. (), CCL

가

. CCL

[6]

4.

가
2

가

가

가

[7] Histogram

y

가 가

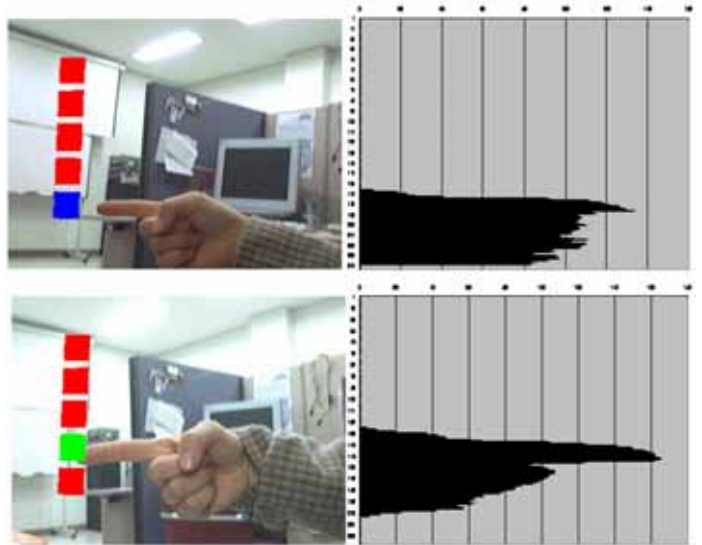
y

가

가 y y

가

가



7. (), () Histogram

2

가

5.

Quickcam pro5000

320x240

Logitech

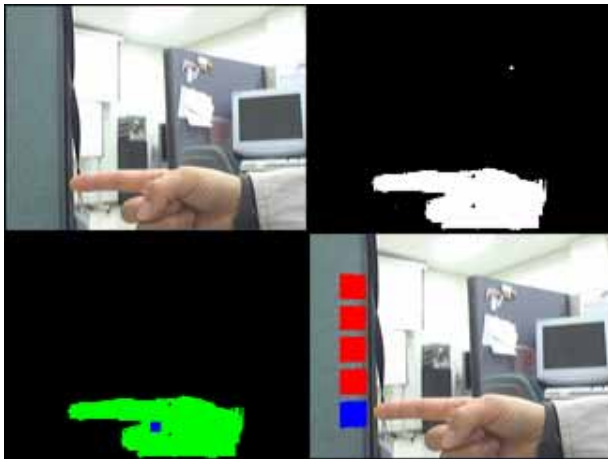
. CCL

openCV

[8] 4 320x240

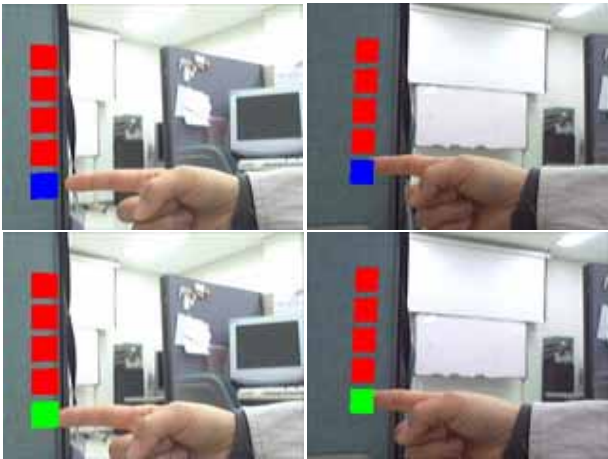
CCL

가
가



8.

[9]



9. (), ()

[9]

가

가

[9]

가

6.

see-through

AR

가 가
가

가

가

가

see-through

가

7.

[1] Richard Hartley and Andrew Zisserman, Multiple View Geometry, p24-64, 2003.

[2] Rafael C. Gonzalez Richard E. Woods, Digital Image Processing, p282-344,2001

[3] R.Jain, R. Kasturi and B.Schunck, Machine Vision

[4] B.K.P.Horn, Robot Vision

[5] , Human Computer Interaction :

[6] Intel Open Computer Vision Library, <http://sourceforge.net/projects/opencvlibrary>