

Interactive Content System based on Spatial Augmented Reality and Multi Touch Screen

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Abstract. In this paper, we proposed interactive content system based on spatial augmented reality and multi touch screen. The system is designed to help people get information to easy way. People who want get information they just touch the screen, then can see the result through the spatial augmented reality display. As the result, People get information while they enjoy this system.

1 INTERACTIVE CONTENT SYSTEM

These days, we used many kinds of interface for input and output device. Generally, button and switch was the popular input device. However it changed to touch screen. One of the reason is that touch screen is easier than button and switch. When we use touch screen, we do not need broad space for a lot of buttons and switches. Touch screen will be changed for each situation. Output device is also changed like input device. We used braun tube for the monitor before the LCD is popularized. However, those are only 2D display. For the sense of the real, many techniques are developed like 3D monitor.

In this paper, we proposed interactive content system based on spatial augmented reality and multi touch screen. For this system, we application two type of technique.

- MULTI TOUCH SCREEN

It is wrapped with rear-screen onto acrylic board for multi touch. For make multi touch screen, use 8mm acrylic board and 880nm Infra-Red LED (IR LED).

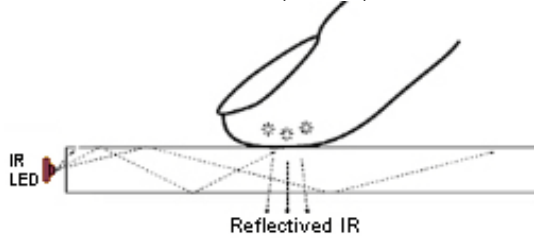


Figure 1. Movement of IR rays

IR rays are gone into the acrylic board and it diffused reflect. However, if we touch the acrylic board, then IR rays are pop-up outside. At this time, we can see the touched point through IR camera. The IR camera was removed IR-Cut filter inside a normal webcam, and use IR filter. Then

the camera only can capture IR rays, without any visible rays. As the result, we should not care about displayed image from projector. When the camera checks the touched point, we calculate the captured point to windows point; like a mouse cursor. At the calculation, camera's coordinates are changed to windows coordinates.

- SPATIAL AUGMENTED REALITY

We use the half-silvered mirror (Figure 2.b) that is one of the display ways for the spatial augmented reality (SAR). Spectators (Figure 2.e) can watch not only the diorama (Figure 2.a) through the half-silvered mirror but also the reflected image (Figure 2.c). The reflected image seems to be displayed mixed with the diorama, but it is a mirror reflected image of a monitor, which is built in Figure 2.c.

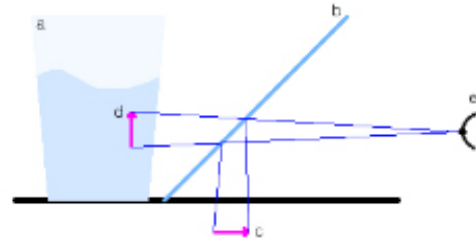


Figure 2. SAR based on half-silvered mirror

However, the reflected image is differently distorted by the leaning degree of the mirror. This undesirable situation can be fixed using the transformation matrix. As the relationship between the leaning degree of the mirror and the degree of distortion of the outcome can be calculated, it is possible to beforehand apply the converted image into transformation matrix. Then, the final image can be realized as expected.

$$R = \begin{bmatrix} 1-2a^2 & -2ab & -2ac & -2ad \\ -2ab & 1-2b^2 & -2bc & -2bd \\ -2ac & -2bc & 1-2c^2 & -2cd \\ 0 & 0 & 0 & 1 \end{bmatrix} \cdot (1)$$

The reflected world coordinates can be calculated by applying the transformation matrix (numerical formula 1) to the world coordinates. Through this method, therefore, the image distortion resulting from the leant mirror can be adjusted.

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2 CONCLUSIONS

We proposed the interactive content system based on spatial augmented reality and multi touch screen. For multi touch screen, we made acrylic rear screen and detect touched point through IR LED and IR camera. In addition, we built SAR display space with half-silvered mirror and diorama. Half-silvered mirror were mixed virtual image with real diorama.



Figure 3. Single and Multi touch

Normally, we use only one finger for single touch. However at the special scene we use more than two fingers for multi touch, then we can see the special effect.



Figure 4. Diorama display and SAR display

Use the SAR display technique, as the result we got the two kind of background. One is the original diorama mountain, and the other is the image layered mountain like a perspective drawing. Our proposed system can be applied to many kind of interactive content system, such as education and advertisement.

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