Dis-Tansu

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Abstract

Dis-Tansu is a three dimensional image presentation box that requires no equipments attached to the viewer. The box looks like a drawer and holds an LCD display in it. The key of Dis-Tansu is motion parallax. When the drawer slides in/out, the models are rendered according to the assumed viewpoint and the position of the drawer, which provides the recognition of depth. A user can also feel the movement of inner objects by the force feedback system.

The original system was created for the participation in Intercollegiate Virtual Reality Contest (IVRC) held in Japan in 2003. [Takada et al. 2003] The better control of force feedback and the newer contents with shaders have been implemented.

1 Introduction

"Dis-Tansu" derives from a Japanese word "Tansu", a drawer. It seems like a drawer, but in fact it is not. It also implies a word "distance", the key of this simple system.

Dis-Tansu looks like a drawer. The box contains an LCD display which diagonally slanted toward the depth direction.(Figure.1) The slant is to keep the LCD closer to right front of the user than placed flat, so that it can show correct color of an image.

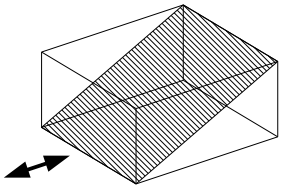

Figure 1: LCD Display Placement

The software content of Dis-Tansu is a miniature garden. You can create winds and waves by moving the drawers, and affect the garden thereby. The waves make you feel the drawer move. As time goes by, the scenery itself would change. You can feel the beauty of Japanese nature with Dis-Tansu.

2 Exposition

The viewpoint one looks into the drawer can be assumed. As the drawer runs in a line, the distance from the closed position determines where the drawer is. (Figure.2) Consequently, the projection matrix is given only by the opened distance *d*.

For this purpose, we need a projection matrix onto the frame not in right front of the user. Microsoft DirectX(c) function:

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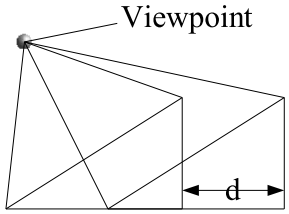

Figure 2: Determination of Projection

`D3DXMatrixPerspectiveOffCenterRH`

is used.

The images are continuously updated according to the projection matrix, so the user is able to have dynamic parallax when sliding the drawer. A stereoscopic perception can be given by the parallax without using any other equipments.

The velocity and the acceleration of the drawer is also calculated from the differentials of the position. They are used to affect the objects inside. The calculated moves of inner objects are displayed to the user via a force feedback system. This enables the user to feel the objects even when the drawer is closed.

There are two points that make a drawer suitable for our system. One is that you cannot see the inside of the drawer beforehand, which makes one expect what the box holds. The other is that anyone know what a drawer is and how it works, which enables one to use the system with no instructions.

3 Conclusion

The combination of motion parallax and interactions with velocity/acceleration brought the possibility of Dis-Tansu. To start an interactions, you naturally need to slide the drawer, and the feedback is not only the force but the sense of depth. Furthermore, everyone know how a drawer works, so there is no need of instructions.

The system is applicable to a presentation system for science museums, so that anyone can have interactions with objects with no instructions. The physics or the time scale inside the box could be different from ours.

To improve the system, the following implementations can be used. One: Passive detection of user's viewpoint, using ultrasonic sensor or image processing. Two: Utilizing more accurate/complex rendering shaders. Three: Use of LCD monitors that can generate stereoscopic information without glasses.

References

TAKADA, Y., MATSUMURA, S., AND SANO, S. 2003. Distansu. In *Proceedings of the Virtual Reality Society of Japan: the Eighth Annual Conference*, vol. 1, Virtual Reality Society of Japan, 288.