IASDR07
INTERNATIONAL ASSOCIATION OF SOCIETIES OF DESIGN RESEARCH THE HONG KONG POLYTECHNIC UNIVERSITY 12TH TO 15TH NOVEMBER 2007

RESEARCH OF ALTERNATIVE GALLERY BASED ON AR

Byoung Chul Kim[1] and Jong Soo Choi[1]

[1] Dept of Image Engineering, GSAIM, Chung-ang University, Seoul, Korea, rybag, jschoi@imagelab.cau.ac.kr

ABSTRACT:

This study is for implement the alternative art gallery through the augmented reality(AR). Pure artists that must get the direct results through exhibition pay for costliness of the renting and the installation. And they don't often communicate their primary intentions completely due to the physical environment restriction, etc. even at the exhibition. In this study, we try to suggest alternatives of these restrictions through AR technology.

AR is the augmentation of the virtual objects above the real spaces unlike virtual realities. If we can make higher the visible completeness of augmented objects, we can get effects similar to the real and send more information than the real even if we don't consider the physical restrictions. In this study, we made and display the augmented virtual object as various work shapes. Participants can move and see the works through HMD or display unit. With this method, we can see the dynamic display responding to the people's react by updating the virtual objects.

We expects that these display forms can be alternatives for above restrictions because it doesn't request the configuration, installation, and transportation of the complex spaces and can send more information than the real information even if we use a minimal expense and man power.

In summary, we want to give the artists or students being in difficulties for various expression and display a little help due to the economic burden or space restriction through this study.

1. INTRODUCTION

1.1. STUDY OVERVIEW

Unlike the exhibition with the traditional form, present galleries are trying to receive the high quality request from the populace as well as various works in the today's exhibition. So do in the exhibition of contemporary arts that erase the area boundaries by combining various genres. The space is changed into spaces with more expanded meanings by introducing the multimedia for various expression and by diversifying the spaces more and more for receiving of that material.

But, for many students or artists getting the results through the exhibition, it is difficult to get the exhibition opportunity easily in these spaces. Although the renting is performed, it put a person to many costs for making and installing the work. The exhibition through the virtual spaces such as online become the alternative but we can't expect the presence of real exhibition or actual visible effect of work.

In this study, we suggest the display space configuration through the AR-Augmented Reality and the work making based on 3D model as the alternatives for the difficulty of the display space securing and high expenses. To implement the work through the digital media isn't suited for the gradual and static emotion delivery in the traditional exhibition based on the direct occupation of the physical spaces and the writer's labor. But, the interaction based on the real-time and the multiplicity that can deliver various effects simultaneously, and the diversity of the expression that can introduce various medias, etc. is signally differentiated with the previous form. Particularly, the Virtual Object in AR can be expressed based on the reality, is free about the various physical restriction, and expand more virtual areas. Therefore, if we use these AR features properly, we can make various forms of work and construct the display environment through the simple installation. Also, we can help the artists and students that must get the results through the

exhibition in the difficult environment and it can be the appropriate model even in the AR application fields.

1.2. STUDY METHOD

The method for implementing art gallery through the AR can be divided into the making of 3D models for augmenting and the implementation of the augment technology suitable for the display feature, and the configuration of the display environment.

The model is made through the graphic programming and 3D programs. by using the known works as the model. In the experiment, we use the painting works of a plain, solid such as sculpture, and installation works through the multimedia as a model. We made the solid or installation work with 3D modeling programs and wanted to get the effect similar to the real environment through the Multiple Mapping such as the still images or the movie in case of the plane.

The works in AR are implemented by the optimization of scale, lights, and hardware of the showroom. Particularly, as there are various variables according to the viewer's viewing form, we must proceed the appropriate system optimization at these points. The Marker that is the coordination for the model output have the simple pattern recognition meaning only because we can't recognize the pattern at the existing experiment. But, we can multiply the visible display effect except the simple information delivery by using various images to the pattern in this study. We expect that it can provide the work effect using the pattern itself even in the situation before implementing the AR. Also, we can expand the display spaces by patterning the spaces itself. Therefore, the recognition according to the pattern image and the system optimization study for various patterns was preceded.

The display environment visualizes the results in the AR and we use HMD(Head Mounted Device) at the experiment mostly. But, the quality of seeing works can be lowered due to the high price, relatively low resolution, and the difficulty of wearing, etc. Therefore, we made the mobile alternative display unit that can cost low making expenses and get the high resolution and used at the experiment..

We performed the experiment through these configuration and the real exhibition, and used objects such as the still image and movie, the animation model, etc. as the augmented image.

2. SUGGESTION OF THE ALTERNATIVES EXHIBITION SPACES

2.1. NEED OF THE ALTERNATIVES EXHIBITION SPACES

As the traditional form of exhibition is the one-way information delivery form in the static space, viewers can see the work using the restrained movement or the viewer's eyes only. But, the exhibition of Interactive work based on multimedia, or digital media performed by interactions of the art work and participant have many restriction to express within the limited space of one-way static form. For the installation work based on the interaction of works and spectators, we must configure the space for recognizing the viewer's request first to deliver the responding information.

For example, the form is changed according to the scale of installed works plus the author's intention. but if we install the control space for the system implementation and the additional unit for expressing the work intention additionally, the space configuration must be differentiated from the traditional space configuration. Particularly, we must manage the union between each system or units for communications through the precise space construct and convert and install the illumination on various sensors, cameras, display units properly. Walls or partitions are the major factor when we configure and install the work. Because we must premise on the restricted spaces to get the individual view area when we install the multimedia work those are composed of the images and sounds. We can't make the same form as previous display If we use the temporary method to preservation of the existing space. Namely, we must configure the space differentiated from the existing case if we display the work based on the multiple digital media such as various system installation, lighting, and space division.

Many artists or authors pay expenses to resolve these restrictions. Of course, if they have the sufficient estimates, it doesn't matter. But, if we can't plan and configure the display environment actively, we can't appreciate the good work made by a good plan. So it is the important problem for creators that must display in the insufficient environment.

Some artist is finding the alternatives of previous problem using the other form of spaces that give an advantage of installation and cut the exhibition cost not the permanent display space. Many spaces such as cafe, subway, factory, and street are used as the display space. But, these spaces can't be the concrete alternatives in accord with the display purpose and the work feature. It is because the work viewing of display's major purpose can be mistaken as the one time sight

or the instant trial due to the restriction of installation or the insufficient factors of displays. And, it is because the recognition of display can be restricted due to the space problem.

In short, for installation or display of various media, we need to get more effective display space, and various restrictions and the study of that alternatives is necessary.

2.2. ALTERNATIVE ART GALLERY

For the restriction of the alternative spaces as before, we are making increased efforts to display the existing plane-oriented work and accommodate works using various media in many galleries. These are located on the inner cities mainly and it can accommodate many people and prepare the environment for a wide range of works by expanding and configuring the space. But, works of various media implemented really don't often accommodate to these display environment. And even if the display is achieved, that intention and results can be faded due to the space restriction. There are various restriction such as the scale of work, difficulty of installations, high power consumption, damage of works, difficulty of transportation. By varying the expression material, it diversify these restrictions and suggest various alternatives according to them. We can find these causes at expansion of the genre or at pointless introduction of the rapid media but receiving various expression media actively is necessary for the creator.

These restriction need various alternative spaces. In this study, we suggest the configuration of the display space using the AR technology of various alternatives. In the experiment, the purpose of space configuration is to increase the display effects using the restricted environment actively. Any form of work must deliver the intended information, be accessed easily, and be the alternatives of the space problem or too much expenses.

The display configuration through AR can't provide the complete satisfaction of all conditions. But, it can be the appropriate alternatives for the suggested various restriction. Unlike virtual reality(VR), Augmented Reality is the augmentation for the Real World. Therefore, we can exclude from the physical restriction for the size and movement of work, and make the work being free deformation in the real environment. And, we can decrease the too much consumption because we can express various genre work without the equipment or installation by constructing the system related to Input and Output. Particularly, as we can implant the multimedia such as sound and image within system easily, we can make the work and display space more actively.

As these method can be the good example even in the AR application, we can expect the mutual developing effects.

3. IMPLEMENTATION THROUGH AR

3.1. AR

The Augmented Reality is the computer vision technology that match with the virtual image over real-time video of the real world. It is implemented through calculation from the camera and we use a uniform form of marker to render the virtual object on the actual acquired images. The marker become 3D position and orientation for virtual 3D data in real-times. And, as the movement of this coordinates is the movement of user, it can render 3D object in real time according to the user's movement. Currently, the study of markerless AR that implement the augment image by matching with the real things in the environment except the marker is proceeded actively and the application range is enlarged with it.

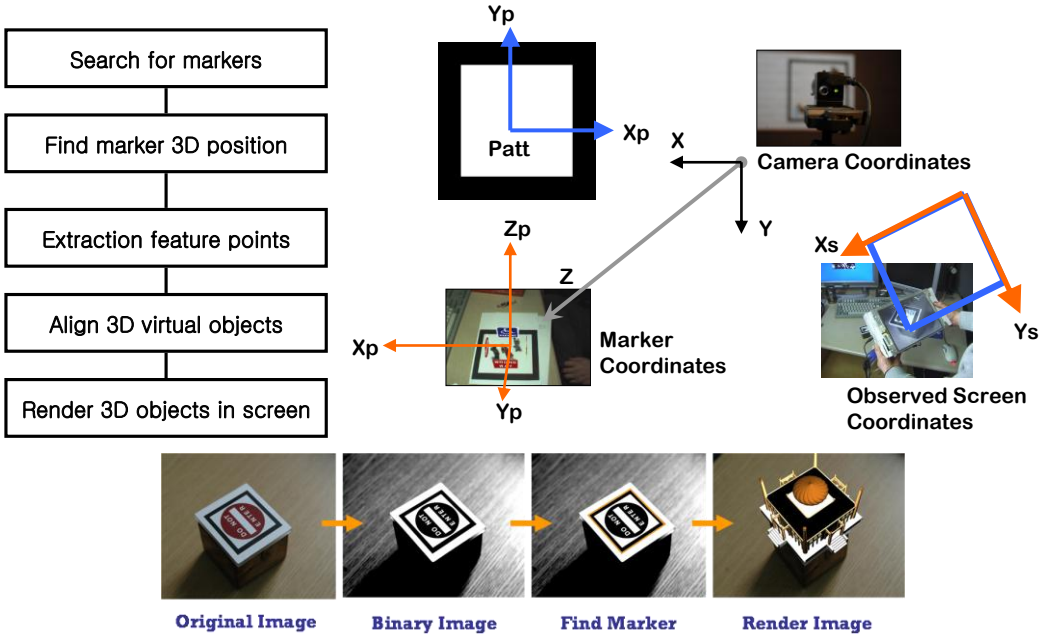

Figure 1 : Implement principles

In this study, we apply the AR using the marker to increase the visible effects of the exhibition. We can use the image of the marker itself at the display through the pattern's diversity as well as the recognition target of cameras by expanding the marker's function. And, the augment 3D object

send the work's message and it is to be visualized through multiple mapping and 3D making tools and algorithm, etc.

3.2. RECOGNITION OF THE PATTERN

The marker have the role that is the coordinates of the realtime overlay of virtual 3D images. Particularly, various patterns in the marker areas become the criteria that divide and print the augmented models and we used these patterns when we implement the virtual space by enlarging the their role in the experiment. As the pattern recognition by cameras is converted and proceeded into Binary Image, the color information of the pattern acquired really is of no significance in the image recognition. Therefore, it doesn't matter in the implementation of AR although the pattern consists of various colors and shapes.

Figure 2 : Used patterns

The image that is used in these pattern can be used even with any form such as portrait, landscape, character, and symbol. But, we can't fill all the marker areas like figure or recognize the detail image with low contrasts. Also, if it is the outer image similar to in case that the top, bottom, left, and right of image is symmetry, as the direction of coordination for printing is confused, these images can't be used as patterns. Because the lightening is the major factor, we can recognize pattern as the different pattern even if it is the same pattern due to the difference of the tiny lighting value. As the shadow according to viewers' movement is the factor that change the surrounding lights rapidly, we can use the simplicity of pattern or the light installation of system itself as alternatives. Particularly, as the configuration of pattern images is the inevitable factor for the visible effects of display like previous suggestions, we can perform various configuration and expression using colors or contrasts of image.

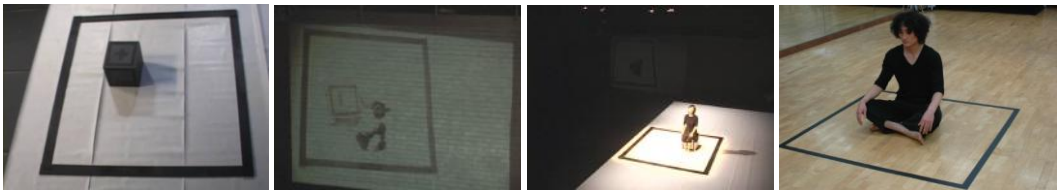

Figure 3 : Pattern making by participant

3-3. DISPLAY UNIT

We need the alternatives display equipment suitable for the AR environment because HMD or the beam project isn't suitable for the environment suggested in this study. It is very important to get the personal space at the display and we must create the environment that can see without the surrounding interference.

Therefore, we suggested the small mobile display unit that is suitable for these conditions and can implement the augment reality system in this study. This equipment consists of touch screen, 10 inch LCD, small CCD camera based on 1394, and speaker. We can see per person even in the small display and deliver the complex information through the sound effect responding to various field of view using these units. As the model implemented by AR is based on the virtual model, we can't get the information through real contacts such as the texture of work. But, as we can perform the dynamic modeling based on the animation unlike the existing case and add the descriptive factor to the screen using various 3D object such as the text, we can replace the information of the real contact. Particularly, we can maximize the information delivery as we can see in various directions using the mobile display equipment.

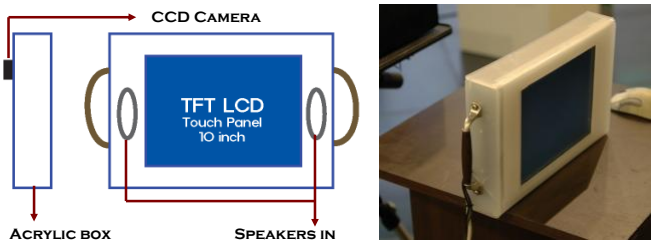

Figure 4 : Display unit structure (size : 29x21x6 cm)

We can utilize previous display unit using the small display unit such as PDA or mobile phones but recently we can't proceed the high resolution image and have the restriction of hardware to proceed the large scale image data in real time. These problems can decrease a burden on the data operation when we utilize various local network communication such as Bluetooth, RFID, etc.

and overcome the space restriction because we exclude the connection unit. We will study these parts continuously.

Figure 5 : Display implementation

4. DISPLAY IMPLEMENTATION AND EFFECT

4-1. ART WORKS BASED ON 3D MODELING

3D model to use at the display is divided into the 2D work and 3D work and is made and the form of works is largely divided into planes, solid, and installation, etc. In the plane work, we can render the plane image as the cross angle or the plane angle form above patterns and construct the environment similar to the real display. And as we can render the image, play the movie, etc. responding to the user's eyes direction. So we can render the static or dynamic image. The solid form can be showed as the same form as existing solid works through the 3D modeling making. Particularly, we can show various images according to the viewer's eyes by appling different materials to each side consisting of objects and implementing animations. As we can include the text and sound based on 3D within the image, the delivery effect of displays is multiplied. We can implement the installation work by configuring the space using the pattern combination or by expanding various display unit. As the previous form itself has various information deliveries, we can understand it as the form of installation work.

Figure 6 : Augmented virtual objects

These works is implemented by making through 3D making program and applying the various algorithm such as OpenGL. If it satisfy the hardware condition, we can represent the real target and implement the virtual environment. The virtual object augmented through the actuality films is printed from the simple polygon form applicable to works to the human body with the complex

configuration in real-times. Particularly, we can send more information for works when we use the human body animation than in the static image with the traditional method. Thus, we can deliver more sufficient values to person that request various expression.

4-2. SPACE CONFIGURATION

We need the image acquisition camera, display unit, hardware such as PC and marker for recognizing the coordination to implement the display for applying AR. In the experiment as before, we can see using the unit embedded the LCD panel plus the CCD camera. Also, the marker is made as the plane form using the wall and the solid form using the box and table. With it, we can configure the spaces as various forms responding to the work feature and the viewer's taste.

The space configuration made by these methods is similar to the display spaces made of general form. In the configuration suggested in this study, we can't see the display target to augment. It is because we construct the display environment using the pattern images only and we can see the augmented work if we must access the system and recognize the display unit according to the viewer's intention. Thus, we can rather configure simply because these configuration embed the units needed for the system implementation in the box or table within the display spaces.

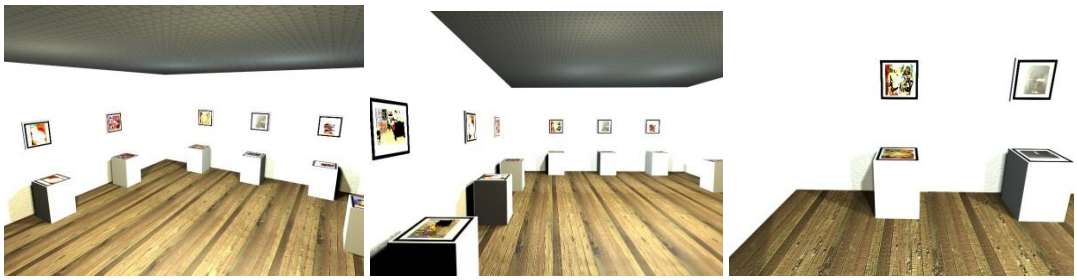

Figure 7 : Traditional forms - the plane workst

Figure 8 : Traditional forms - the solid works

The art is making by representing the target or the existing condition. Also, these representation is glorified through the target's metaphor and parable and the work augmentation by the pattern recognition intend these expression form.

4-3. SPACE RECOGNITION AND EFFECT

The implemented display space can be divided into the static space production and the dynamic space production. It is the virtual model recognition process through the display unit and the viewer's display space entrance process. The space configuration differ little from when the work is displayed on the real wall like displays of the traditional plane work. We can get the display effect using the image only applied as patterns. Also, this pattern image become the printing coordinates of the object to increase and we can see the virtual work to increase according to the viewer's movement. The patterning work get the printed information of objects to increase as well as the visual image information and we can print the writer's description or the image to expand with it. The augmenting image can be the animation such as the human body model or text and we can maximize the display effect of works by adding the sound effect. Also, we can see in the concrete by print the work making process or the related image using movies. We can send the information of the total space by patterning the space itself. Using walls and ceiling spaces, we can recognize the display intention and the whole space as the space included the active image.

In case of the solid work, we suggest by patterning the plane information of the work and print by extruding work's images on it. Particularly, we can change the printing model or the color information freely in real time but it can multiply the display effect because it can expand the expression area for works. For example, the visual value for the surface material or size of work become very great in the sculpture work. However, the method suggested in the study can't deliver these information. But, if you print the comparison image and add the sound effect after applying the surface material, you can get the similar effects. These problems must be studied continuously afterward.

In case of the installation work through multimedia, we can construct it simply through the RA system and that results can be implemented more actively. These multimedia often be configured of individually for the printed images and the sound effect and its scale is enlarged relatively. But, if we consist of the display unit only in the RA system, we can express various images on the simple marker and consist of sounds responding to it. These configuration can be used even in

the such performance as dance and we can increase that expression effect by printing the virtual model responding to the dancer's action.

Figure 9 : Various display forms

5. CONCLUSION

Various forms of materials through the high technology decorates ordinary spaces as well as the art spaces richly. But, the original target is always human and that results must be the methods to translate the human's value as more active form.

In this study, we want to find the alternatives for the space restriction and the consumption of the traditional exhibition space. It is difficult for them trying to express various values to overcome these restrictions. In this study, we suggested the making of work applied AR technology and the display space configuration as the alternatives of these restriction and trial. Unlike the existing display with one-sided delivery, The animation and sound of 3D models responding to the participant's operation, the space configurations of various pattern can be the display space form different from former times. Particularly, the form that the static image is changed into the visible message by the participant's direct participation can be the major features. Of course, the work through the virtual material and the real material have the delivery form different from the original. But, these difference can be overcome through the multiplicity and that conversion of the virtual material. Namely, the viewer's subjective sensitivity information that is gained through the work's uniqueness can be substituted to deliver the direct and active information of multimedia. But, we don't want to recognize the art area based on the human sensitivity and independent subjective as the uniform delivery media due to the virtual technology. The creators must be the subject for providing these informations. It can be performed when the faithful understanding and application of creators is given for various forms of the developing material at every moment.

To perform more advanced display, we need to apply the real-time multiple material based on a photograph taken from life, the hardware based on wireless, high resolution display, etc. It can increase real-time for the information transformation and the liveliness on the space. If this study is enlarged, we can satisfy various display condition for various expression intention and suggest the effective alternatives for various demands of person with creative wills.

ACKNOWLEDGEMENT:

This work was financially supported in part by a grant from Seoul R&BD Program, by the Ministry of Education and Human Resources Development (MOE), the Ministry of Commerce, Industry and Energy (MOCIE) and the Ministry of Labor (MOLAB) through the fostering project of the Lab of Excellency. The authors wish to thank the financial support from the Ministry of Education and Human Resources Development (MOE) under the second stage of BK21 program.

REFERENCES:

Daniel A. Siedell.(2007) Symposium: The Future of the Art Museum: Curatorial and Educational Perspectives, Journal of Aesthetic Education (Project Muse), Vol. 41

Encarnação, José L.(2006) Computer Graphics Visions and Challenges: A European Perspective, IEEE Computer Graphics & Applications, Vol. 26 Issue 4

Ron Wakkary (2005) Framing complexity, design and experience: a reflective analysis, Digital Creativity, Vol.16, No. 2

Yoshiko Burke (2005) Teaching new perspectives: digital space and Flash interactivity, Digital Creativity, Vol.16, No. 3

Andrew Senior, Alejandro Jaimes, Wolfgang Muench (2006) Presence/Absence, The 2005 ACM Multimedia Interactive Art Exhibition, Art Beat

David, Mark (2005) REAL-TIME MOTION-E CAPTURE MAKES DANCE A DIGITAL ART, Electronic Design, Vol. 53 Issue 10

Jong won Lee (2003) Ubiquitous Computing and AR , The Korean Information Science Society,

Christian Paul (2003) Digital Art, Thames & Hudson World of Art

AR Tool Kit Homepage http://www.hitl.washington.edu/artoolkit/