

## 증강현실 기술의 전시 환경의 응용에 관한 연구

이재영\*, 권준식\*\*

### 요약

본 연구에서는 전시 환경에서 증강 현실을 이용한 전시 보조역할의 주석 정보 시스템을 제안한다. 일반적인 전시장에 그림이나 사진의 설명을 안내책자나 오디오 기기를 활용하는 방법 그리고 사람이 설명하면서 전시를 관람하는 형태의 방법이 사용되고 있다. 우리는 이러한 기존 방법과 더불어 증강현실 기술을 이용하여 전시물에 대한 다양한 정보를 텍스트와 사진, 영상 그리고 오디오의 다양한 멀티미디어 매체를 활용하여 제공하고자 한다. 관람객이 손에 들고서 사용할 수 있는 스마트폰, 태블릿 기반의 장비에서 증강현실 기술을 적용하여 전시 관람의 보조 역할을 하게 된다.

키워드 : 증강현실, 전시, 주석, 상호작용, 정보

## A study on the Application of Augmented Reality Technology Exhibition Environment

Jae-Young Lee\*, Jun-Sik Kwon\*\*

### Abstract

In this study, we propose an annotation system exhibits a secondary role using augmented reality in the exhibition environment. Common methods that utilize the description of the picture or photo booklet or audio device to the exhibition and in the form of viewing the exhibits while people describe method is used. We are using augmented reality technology, in addition to these conventional methods to provide a variety of information about the exhibits utilizing text, photos, video and audio of the multimedia medium. Where visitors can use a smart phone in hand deulgoseo, the exhibition becomes a secondary role by applying the Augmented Reality technology in tablet-based devices.

Keywords : Augmented Reality, exhibitions, annotation, interaction, information

## 1. Introduction

### 1.1 Augmented Reality

Augmented Reality(AR) is a technology that

shows a three-dimensional virtual objects superimposed on the real world, you see the eyes in real time. Helping to improve realism and understanding of the information society in the coming future human-centered services has been the subject of much attention as the core user interface technology. With the advantage of mobility with latest mobile hardware due to the development of augmented reality and unity of getting more attention. Using augmented reality mobile anytime, anywhere suitable for ubiquitous computing environment in which users can obtain the desired information in the real world without the constraints. Augmented

※ Corresponding Author : Jun-Sik Kwon

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\* Namseoul University, Dept. of Multimedia

\*\* Semyung University, Dept. of Electrical Eng.

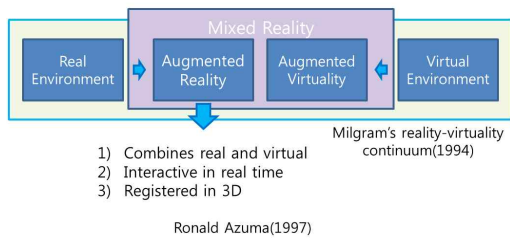
Tel: +82-43-649-1774 , Fax: +82-43-649-1774

email: jskwon@semyung.ac.kr

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reality with endless development possibilities are being utilized for military, medical, construction, science, games, shopping, and a variety of fields. In particular, the education sector and augmented reality can be a good synergy. (Figure 1) is an illustration showing the definition of Milgram and Azuma by the definition for the AR [1][2].

(Figure 1) Relationship between the real world and virtual world



### 1.2 Exhibition Environment

Augmented reality technology in the exhibition space is a trend that is gradually increasing utilization of new technology. By moving away from monolithic exhibition and dissemination of existing smart phone it will have a new fusion of technology and art, which are increasingly popular. It shows the performance in the virtual co-star of the fusion cast by exposing the holographic technique of performing this method, such as the additional information to convey the information in progress. The museum is helping the overall learning and information about the introduction and movement of various artifacts and exhibits of the museum space[3]-[6].

In this paper, the implementation of existing augmented reality-based smart learning-based information delivery system to be applied to the exhibition and performance space. First, talk with them and explain about the development direction, and exhibit space

application of augmented reality learning system for augmented reality learning system implemented in an existing computer.

## 2. Proposed method

### 2.1 Augmented Reality

The proposed system uses a smart learning-based augmented reality image and at the same time taking advantage of the existing e-learning system. By presenting the user is difficult to observe directly, or through a 3-D virtual objects and difficult part represented by book learning can be enhanced by causing the user's attention and interest. To find the characteristics of the object by using a camera mounted on a mobile device to implement the augmented reality on the mobile device to obtain the desired coordinate position through this synthesis is that the object [7].

In the real world it creates a natural feature point extraction markers and natural trace out a lot through the AR System are enhancing the object. The advantages of the markerless based AR System is that the access to the user because it does not use a marker of a predetermined particular type can configure the AR System in a more natural sense because convenience. What we have done in the natural characteristic point detection light tracking algorithm SURF(Speeded Up Robust Features)[8] is the algorithm.

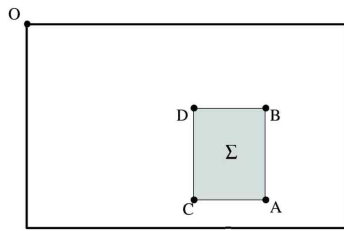
SURF algorithm generates the cumulative image, scale spatial configuration, localization, the main direction is assigned, it can be divided into the descriptor extraction process. Cumulative image generation is the following formula (1) used as part of the process leading to the same. After the picture image(Figure 2) of the cumulative value of the square area A point obtained difference image B, C point, adding the accumulated value of the duplicate D can obtain the sum of the

square area. This method using the three calculation process as shown in equation (2), regardless of the size of the area is determined by the sum of the specified rectangular region.

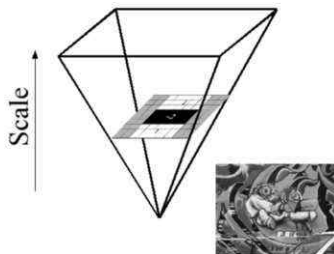
$$X = \sum_{i=0}^x \sum_{j=0}^y I(i,j) \tag{1}$$

$$= A - B - C + D \tag{2}$$

(Figure 2) Integral image computation method

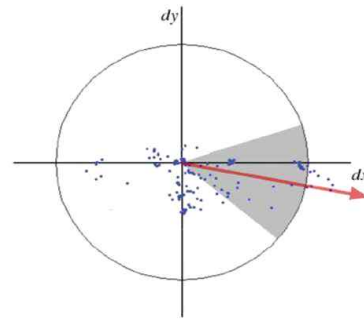


(Figure 3) Convolution way to find the features: change the size of the rectangular filter



(Figure 3) in the scale space configured as to configure the image pyramid shape are adjusted to the size of the filter to control the filter without changing the size of the image in such a way that the effect of the scale change aliasing does not appear. The localization process is to compare the candidate point discovered in the course of the front and the surrounding values. Judges a portion having the maximum value in a similar point, the feature point extraction.

(Figure 4) Orientation allocation



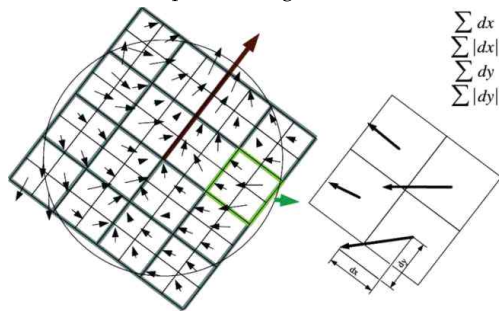
Haar wavelet Response calculates a feature point candidates for the x, y direction in the neighboring one of the 6S (Scale) around the feature point candidate in operation to find the main direction of the feature point. (Figure 4) it is a blue dot in a circle on the response values are values that are distributed. It will be indicated by red arrows vector to calculate the sum of the response in the region of about 60 degrees of arc in size. 60 the sliding window size and kill x, y calculate the sum of the response to create a vector, and a die length of the vector, the longest vector is assigned to the orientation coming from [14].

(Figure 5) Calculated as the haar wavelet: images distributed to the 4x4 descriptor window



(Figure 5) After performing the presenter orientation as (descriptor) window back to a 4 x 4. At this time, each of the divided areas are pre-calculates the feature points distributed in a size of 5x5 Haar wavelet. (Figure 6) shows that the SURF robust to changes in brightness. Simply kill x, y, as well as the sum of the absolute value of the sum of the response values for the dead also shows that using strong variation in brightness.

(Figure 6) Dividing the slope for the descriptor configuration



## 2.2 Installation System

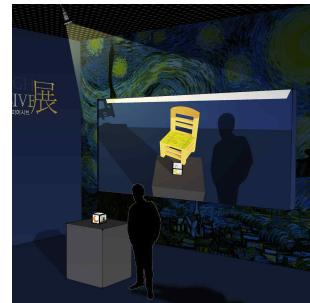
In the display area in the form of installation of the system constituting the space area it will have a specific spatial structure of the user entering the room. This space is made up in various ways, such as space for projecting an image, viewing the staying space. When you configure it as the exhibition space it can be divided as follows:

- Entrance: an overview and configuration of the exhibition space
  - Each section: Description of the zone, using realistic images and field sketches I Video Description
  - Special Areas and rest area: the main content area and relax and enjoy the technology and video
- Finally, space and experience space:

Configure your space clean and audience participation for the entire exhibition

(Figure 7) to apply the concept of augmented reality kiosk applied in such a manner that the exhibition space as above. While watching the display screen, the user is shown a marker and an object of the type specified on the table in front of the user in the form for obtaining a camera to synthesize a virtual image in real time while the work on the table in the form that can determine the augmented reality.

(Figure 7) Augmented Reality installation of exhibition space

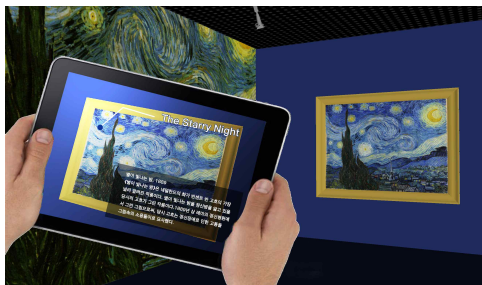


## 2.3 Move system

A system using a user smart devices (smartphones, tablets, etc.) in the exhibition space. User time by using the camera of the smart devices, the space can be used without restriction in all the exhibition. Display-related media information delivery in every area (an image, shape, etc.) can act. In addition, real-time updates are possible words, which are used as a form Visitors take pictures of the exhibition be shown to be admitted to a particular exhibition space you can use the content of the exhibition, not a one-way interactivity. (Figure 8) That additional information relating to the exhibition graphics using smart devices are visitors using a

marker or goods of a particular type in the vicinity of such framed picture of exhibit space, such as, the description of the textual description of the picture type, may use the description of the video type, a variety of additional information, such as described in the form of sound that can experience the structure[9][10].

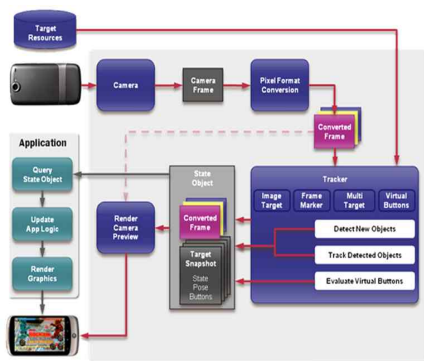
(Figure 8) Augmented Reality portable of exhibition space



### 3. Experiment and Evaluation

The experiment Intel (R) i5-4690 CPU 3.5 GHz, 8 GB, was carried out using a 640 × 480 resolution, the USB camera operating at 30 frames per second. Mobile environment was tested based on the Android-based smartphones (Galaxy Note 2) and Smart Pad (Galaxy Note 10.1).

(Figure 9) QCAR SDK development Environment



(Figure 9) shows the environment of The Qualcomm Augmented Reality (QCAR) for use Qualcomm AR implementations to implement augmented reality in Android-based smart devices. Search of the feature point by using a camera input image by using the position and orientation of the 3-dimensional space shows a method for synthesizing a virtual object. QCAR is available under the name of the current 'Vuforia'. QCAR from image acquisition processing part is integrated into the Target Management System using the Vuforia became a strength that can be used conveniently with a variety of development environments. Pictures in the method proposed development environment marker (Image Target) of the text and the three-dimensional virtual object in real time by recognition was synthesized by implementing the communication tools of the display area AR [11].

Source used in the experiment was used a lot of paintings of Vincent van Gogh known to the public as a source. (Figure 10), flowering almond trees (Almond Blossom) 'and' Cafe terrace in the night '(Café Terrace, Place du Forum, Arles)' were tested using two kinds of targets as an image source.

(Figure 10) Image Target source(Van Gogh)



#### 3.1 Augmented Reality application content

AR content is used in the display space for the purpose of transmission of various pieces of information about the picture. Illustration

for an additional text-based communication, picture drawn age and life carries information of the environment, such as using the 2D-based photography, reconfigure the hard part to deliver a 2D to 3D, passing the three-dimensional information, using the sound as the method for delivering an audio guide to reinforce the start transfer and the like can be applied to various contents [12]. We conducted a test for visual transmission method in the dual. (Figure 11 and Figure 12) When tested using the augmented reality content delivered utilizing the 3D model using text and picture information.

(Figure 11) Text augmented reality test



(Figure 12) 3D models augmented reality test



(Figure 11) using augmented reality technology on top of the target image shows the name and year of production of the work in the form of text. This is shown by giving basic information about the works in the

exhibition space you do not know can solve the questions of the audience. In addition, 3D model-based approach can be applied in a manner interesting for the audience in a way that the introduction and description of yourself or a curator or a well-known commentator appeared the works of painting on the artist also cause explains also capable of (Figure 12) have.

(Figure 13) Installed base of augmented reality test



### 3.2 Augmented reality system according to installation forms

The exhibition space may, depending on how the planning and design of space-specific markers, text and images by utilizing the integrated and exhibition space to implement augmented reality. In addition, the exhibition tickets, Pam flat, can also be applied to the augmented reality technology by using a variety of printed materials such as posters. Configuration space and can also create a zone of specific space systems to apply the augmented reality environment Augmented reality implements the room by configuring make the user to feel experience, the exhibition space the entire audience is smart devices with space for a growing reality It can be applied in the form of augmented reality to experience all the exhibition space using.

The way to decorate a particular space that was first noted (Figure 13) is a way to put together and ready to install in the form of a kiosk. (Figure 13), the installed base of augmented reality as a way of laying a good way to convey the information furnished as exhibits to a particular area intended. Interior and surrounding area of the graft to have more effect in such a way that the user can double ticket, using brochures can lead to interesting.

The second mentioned method is feeling fun as jeonte exhibition space using augmented reality approach the exhibition space of the interior one is a treasure hunt imaginary from users exhibit space in the manner provided by creating a "image targets" for users exhibition content, as well as interior space and will be able to feel curiously at. (Figure 14) is an imaging test augmented reality using smart devices. With the smart device to move the place marker and medium strength been attached to the middle, as the virtual image information using the exposure method of the user moves.

(Figure 14) Movement-based augmented reality test



Using augmented reality technology in the exhibition space through experimentation looked to test for the provision of various information. The augmented reality system was manufactured in the form of mobile augmented reality system with PC-based installation type, progress also applies to the content suitable for the exhibition was to use them to experiment. One of the exhibition through a separate experiment, experiment by placing emphasis was also to apply in the

performance space and take advantage of access to the technology to the user. For ease of use and ease of installation it is also determined that there is a problem.

#### 4. Conclusion and further research

Studies in a variety of settings to match the development of a variety of augmented reality technology has been actively carried out. Smart devices in the traditional way using a PC-based research, the development of various forms of HMD is a trend that is also being advertised a lot of entry-level devices. In this way they look in a particular environment, exhibitions and performances that can be applied in various ways. In particular, this method is a trend using the smart device that is common to the users. This trend is now mobile and wearable computing and HMD-based research has been done actively. In such an environment it can be used as a real-time augmented reality technology in a variety of information and a smart-learning techniques. The development of the mobile sector in the market because of ongoing development and dissemination smartphone is made by throwing more rapid will be the development acceleration. Exhibition utilizing mobile applications and content in a variety of augmented reality based on this research, plans to further develop the application of the performance area. In addition, a variety of sensing techniques have been developed and applied since the interaction between the user and the system (interaction) and the interface technology, with research, it has been developed. In which we will live and interact and this allows for all space activities occupy a large part of the exciting cause under delivery of exhibition viewers using this information.

Research for the exhibit space application of augmented reality technology through the application of continuous technology development and the content of progress and to continue, and further extension of the user's readiness Tangible video experience content through the grafting of the hologram technology. If applies augmented reality and holograms into a single solution of exhibition space it will be possible via a digital display of cutting-edge information delivery.

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### 이재영

2007 : 중앙대학교 첨단영상대학원(공학석사)  
 2013년: 중앙대학교 첨단영상대학원(공학박사)

2007년 ~ 2014년: 세명대학교 전기/전자공학과 강사  
 2013년 ~ 2013년: 강남대학교 컴퓨터미디어정보공학부 강사  
 2010년 ~ 현재: 남서울대학교 멀티미디어학과 강사  
 2014년 ~ 현재: (주)미디어엔아트 책임연구원  
 관심분야 : 영상처리, 증강현실, 상호작용, 모션그래픽, 3D 맵핑, 미디어파사드 등



### 권준식

1986년 중앙대학교 전자공학과 졸업(공학석사)  
 1995년 중앙대학교 전자공학과 졸업(공학박사)

1986년 ~ 1987년: 현대전자  
 1987년 ~ 1991년: 금성통신  
 1995년 ~ 현재: 세명대학교 전기공학과 교수  
 관심분야: 영상신호처리, 컴퓨터비전, 수리행태학, 영상정보온닉 등