Hindawi
Journal of Sensors
Volume 2023, Article ID 9769861, 1 page
https://doi.org/10.1155/2023/9769861

Retraction

Retracted: Art Design of the Real-Time Image Interactive Interface of the Advertising Screen Based on Augmented Reality and Visual Communication

Journal of Sensors

Received 13 September 2023; Accepted 13 September 2023; Published 14 September 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] Y. Chen, "Art Design of the Real-Time Image Interactive Interface of the Advertising Screen Based on Augmented Reality and Visual Communication," *Journal of Sensors*, vol. 2021, Article ID 1597236, 12 pages, 2021.

Hindawi
Journal of Sensors
Volume 2021, Article ID 1597236, 12 pages
https://doi.org/10.1155/2021/1597236

Research Article

Art Design of the Real-Time Image Interactive Interface of the Advertising Screen Based on Augmented Reality and Visual Communication

Yu Chen

School of Art and Design, Yellow River Conservancy Technical Institute, Kaifeng, 475001 Henan, China

Correspondence should be addressed to Yu Chen; chenyu20210801@163.com

Received 17 August 2021; Revised 17 November 2021; Accepted 24 November 2021; Published 13 December 2021

Academic Editor: Haibin Lv

Augmented reality refers to the use of new display technology, multimedia technology, and human-computer interaction technology to superimpose computer-generated virtual objects, virtual scenes, or various system prompts into the real scene, so as to achieve integration with the surrounding environment of the user. The user can visually feel that the superimposed virtual information is a part of the real environment around him. Under the technology of augmented reality and visual communication, this article achieves the art design of the real-time image interactive interface of the advertising screen, digitally enhances the real situation, enriches the visual sense of the advertising audience, and turns the advertisement into an interactive form. This article analyzes the specific content of the composition, graphics, color, proportion, brightness, and design principles in the advertisement. We conduct a questionnaire survey and combine them according to the above 6 indicators. Query a large number of documents for analysis, and conduct a theoretical analysis of the real-time interactive image interface design of the advertising screen based on augmented reality technology. According to the experimental results obtained in this study, the data shows the P value of the scores of the six age groups on the text in the advertisement is less than 0.05. There is a significant difference; at the same time, the P value of each index in the advertisement is also less than 0.05. The significant difference indicates that the legibility of the text is an important factor in the text interaction in the interactive interface.

1. Introduction

Augmented reality technology is a new technology that uses virtual information to enhance real scenes. Augmented reality technology has attracted great attention from academia and industry with its good sense of reality, interest, and practicality and has also been applied and developed in many different fields. It is the most popular and most popular in the global science and technology community today one of the areas of concern. In recent years, research results such as tracking technology, interactive technology combined with computer graphics, and multimedia technology have been comprehensively used in augmented reality systems. While enabling the augmented reality system to achieve a realistic visual effect of seamless integration of the real environment and 3D virtual objects, allowing users to interact with virtual world objects in a natural way has gradually become the focus of research. Secondly, interactive advertising design promotes the faster development of online interactive advertising, humanized multilevel experience, and better improves the emotional coordination of the audience. As a product of the information age, online interactive advertising is still immature in theoretical research, but its practical application has begun extensively.

Augmented reality technology is dedicated to digitally adding computer-synthesized information such as visual images and auditory sounds to the real environment. Augmented reality technology can enhance various sensory perceptions, but because visual information accounts for the largest proportion of information obtained by humans, it is

generally reflected in the enhancement of visual perception. Nah and Lee proposed that the functionality of images is of a certain aesthetic significance, so the way images are made will also lead to great changes in artistic creation [1]. Chen et al. proposed a template-based gesture recognition framework, which can detect and segment actions in time during video-based human-computer interaction. This method can process online video sequences in real time [2]. Laskari uses a TOF camera to connect to a laptop, record real-time respiratory processing results, and transmit them directly to the doctor's terminal through wireless technology to perform respiratory diagnostic functions without actually intruding the device [3]. Combining the history of interaction design development, El Ammari and Hammad deeply analyze the importance of interaction planning, study interaction design methods, and discuss how to design interactive experience prototypes [4].

Although the domestic start is relatively late, it is also rapidly researching augmented reality technology and it is very effective. Augmented reality technology has attracted the attention of major universities and research institutions at home and abroad with its huge application prospects and economic benefits, and it has spent a lot of manpower and material resources. Research on this technology has been conducted, and many laboratories have been established to study augmented reality-related technologies. Lim et al. used a TOF camera to perform 3D gesture posture imaging, and it was successfully applied in medical imaging. Collect data images through the TOF camera on the endoscope, and show a visual interface to the medical staff [5]. Deng et al. proposed that the general understanding of augmented reality in modern times has changed, emphasizing the two indications of three-dimensional and interactive, and effectively distinguished between plane postproduction technology and film and television packaging technology and augmented reality technology [6]. Gogolin and Gogolin proposed that augmented reality can promote the exchange of experience in augmented reality technology and, at the same time, provide guiding opinions for determining future research fields and future development trends [7]. Murakami et al. proposed the relationship between illustration and market economy and the important role of illustration in market development [8]. In practice, these studies have played a great role in promoting the research in the field of image enhancement technology and visual communication and have provided great value for supplementing the literature in this field, but the methods of these studies are not innovative enough. The experimental data is not very complete.

The definition and development of advertising and the characteristics and advantages of augmented reality advertising are thoroughly analyzed, and a feasibility study based on augmented reality advertising is proposed to verify the rationality and correctness of the proposed views. In terms of theoretical research and analysis, based on the current limitations of traditional advertising, research the characteristics and advantages of augmented reality technology advertising, and combine the two to explore the feasibility of augmented reality-based advertising and demonstrate that augmented reality technology can be used in advertising expression. Put forward some ideas for the application and development of interactive interface design based on augmented reality and visual communication in the field of advertising screens, and look forward to the research direction and significance of future topics.

2. Art Design of Real-Time Image Interactive Interface of Advertising Screen Based on Augmented Reality and Visual Communication

2.1. Key Augmented Reality Technology

(1) Three-dimensional registration technology

One of the most important requirements of augmented reality technology is to identify and locate objects in the real world. Accurate registration allows virtual information to accurately overlay real objects [9, 10]. Three-dimensional registration technology is used to register and superimpose real-life scene information in a virtual three-dimensional scene modeled by a computer to enhance the computer's cognition of the environment. The virtual scene is the mainstay and the real scene is the supplement.

(2) Camera calibration technology

The pictures captured by the camera lens are only two-dimensional images composed of many pixels. Establish a coordinate system for the two-dimensional image generated by these many pixels. The computer calibration technology actually obtains the corresponding conversion matrix through the projection conversion of the above-mentioned coordinate system to obtain the internal and external parameters of the camera. Finally, the camera position and orientation are calculated to provide accurate information for the final registration [11, 12]. Next, we will introduce the conversion process and mathematical derivation between these coordinate systems used during registration. As far as advertising is concerned, the current advertising is mostly in a two-dimensional era, which is a flat state. It is well known that the presentation of a flat surface will be affected by many factors, such as light and inclined surfaces, and the methods and techniques to use these factors are limited. Three-dimensional technology is a breakthrough in two-dimensional technology, and the operation is simple, and the technical level is higher. A deeper combination analysis can bring better visual effects.

Rotation transformation matrix between two-dimensional coordinate systems:

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} X \\ Y \end{bmatrix}. \tag{1}$$

Rotation matrix between coordinate systems in three-dimensional space:

$$\begin{bmatrix} x' \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & \sin\theta \\ 0 & -\sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix},$$
$$\begin{bmatrix} x' \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} \cos\phi & 0 & \sin\phi \\ 0 & 1 & 0 \\ -\sin\phi & 0 & \cos\phi \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}, \quad (2)$$
$$\begin{bmatrix} x' \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} \cos\psi & -\sin\psi & 0 \\ \sin\psi & \cos\psi & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}.$$

The above formulas are matrix transformations of three-dimensional coordinates rotating around the XYZ axis, denoted as $R(\theta)$, $R(\psi)$, and $R(\phi)$, and use these conversion formulas to describe the relative position of the object. Suppose the coordinates of the origin O in the pixel coordinate system are (u_0, v_0), and to obtain its position (x_0, y_0) in the corresponding screen image coordinate system, the following matrix transformation can be used:

$$\begin{bmatrix} u \\ v \\ 1 \end{bmatrix} = \begin{bmatrix} \frac{1}{dx} & 0 & u_0 \\ 0 & \frac{1}{dy} & v_0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}. \quad (3)$$

The working principle of homogeneous coordinate transformation is to multiply the coordinate value by a numeric matrix to obtain the new coordinate representing the transformed version of the original point and to specify the core animation value in three dimensions. Among them, d_x and d_y are the pixel pitch in the direction of the pixel distance from the xy axis, and $(u, v, 1)^T$ is the homogeneous coordinate form of the point $(u, v)^T$. According to the perspective projection ratio (triangular similarity principle), the following conversion formula can be obtained:

$$\begin{cases} x_0 = f\dfrac{x_c}{z_c}, \\ y_0 = f\dfrac{y_c}{z_c}, \end{cases} \quad (4)$$

where f represents the distance between the optical center of the camera and the plane image, that is, the focal length.

Incorporating Formula (4) into Formula (3), the conversion formula from screen image coordinates to camera three-dimensional coordinates is possible. The projection relationship can be expressed in homogeneous coordinates and matrix form as

$$z_c \begin{bmatrix} x_0 \\ y_0 \\ 1 \end{bmatrix} = \begin{bmatrix} f & 0 & 0 \\ 0 & f & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_c \\ y_c \\ z_c \\ 1 \end{bmatrix}. \quad (5)$$

The conversion relationship between point X_w $(x_w, y_w, z_w)^T$ in the world coordinate system and coordinate $X_c(x_c, y_c, z_c)^T$ in the camera coordinate system is as follows:

$$\begin{bmatrix} x_c \\ y_c \\ z_c \\ 1 \end{bmatrix} = \begin{bmatrix} R & t \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x_w \\ y_w \\ z_w \\ 1 \end{bmatrix} = M_{\text{ext}} \begin{bmatrix} x_w \\ y_w \\ z_w \\ 1 \end{bmatrix}. \quad (6)$$

The external parameter of the M_{exp} value camera is the 4×4 matrix, and 4×4 represents the rotation matrix from the world coordinate system to the camera coordinate system. Incorporating Formula (3) and Formula (6) into Formula (5), the conversion from the two-dimensional pixel plane coordinate system to the three-dimensional world coordinate system is obtained:

$$z_c \begin{bmatrix} u \\ v \\ 1 \end{bmatrix} = \begin{bmatrix} a_x & 0 & u_0 \\ 0 & a_y & v_0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} R & T \\ 0^T & 1 \end{bmatrix} \begin{bmatrix} x_w \\ y_w \\ z_w \\ 1 \end{bmatrix}, \quad (7)$$

where $a_x = fp_x, a_y = fp_y, a_x, a_y, u_0, v_0$ is the internal parameters of the camera, written in a simplified form:

$$z_c \begin{bmatrix} u \\ v \\ 1 \end{bmatrix} = M_{\text{int}} M_{\text{ext}} \begin{bmatrix} x_w \\ y_w \\ z_w \\ 1 \end{bmatrix}. \quad (8)$$

M_{int} refers to the internal parameters of the camera, and M_{exp} refers to the external parameters of the camera, which are related to the position of the camera. Suppose the three-dimensional coordinates of the template plane is $(x_w, y_w, z_w)^T$, and the point on the screen image is $(u, v)^T$. Regardless of the special case $z_w = 0$, we choose the template plane, then Formula (7) can be written as

$$\begin{bmatrix} u \\ v \\ 1 \end{bmatrix} = s \begin{bmatrix} a_x & 0 & u_0 \\ 0 & a_y & v_0 \\ 0 & 0 & 1 \end{bmatrix} [r_1\ r_2\ r_3\ t] \begin{bmatrix} x_w \\ y_w \\ 0 \\ 1 \end{bmatrix} = sH \begin{bmatrix} x_w \\ y_w \\ 1 \end{bmatrix}, \quad (9)$$

where s is an arbitrary value, r_1 and r_2 are the rotation directions of the x and y directions, respectively, and H is the homography matrix of 3×3 that is sought. In the two-view geometry, it can be understood that two cameras take two images AB in the same space. One of the images A has a transformation in the other B, and there is a one-to-one correspondence. A matrix can be used between them homography. H can be expressed as

$$H = [h_1 \quad h_2 \quad h_3] = sM[r_1 \quad r_2 \quad t]. \tag{10}$$

Decompose the equation to get

$$h_x = sMr_x. \tag{11}$$

Since the rotation vectors r_1 and r_2 are mutually orthogonal vectors in the construction process, we have

$$\begin{aligned} r_1^T r_2 &= 0, \\ \|r_1\| &= \|r_2\| = 1. \end{aligned} \tag{12}$$

So we can get the formula:

$$h_1^T M^{-T} M^{-1} h_2 = 0, \tag{13}$$

$$h_1^T M^{-T} M^{-1} h_1 = h_2^T M^{-T} M^{-1} h_2. \tag{14}$$

Formula (14) is the external parameters of the camera obtained by the homography matrix.

$$B = M^T M^{-1} = \begin{bmatrix} \frac{1}{f_x^2} & 0 & \frac{-c_x}{f_x^2} \\ 1 & \frac{1}{f_y^2} & \frac{-c_y}{f_y^2} \\ \frac{-c_x}{f_x^2} & \frac{-c_y}{f_y^2} & \frac{c_x}{f_x^2} + \frac{c_y}{f_y^2} + 1 \end{bmatrix}. \tag{15}$$

B contains the internal parameter information of the matrix. At the same time, according to the general form of Formula (15), rearrange the elements of B to form a new vector b. The following formula is obtained:

$$h_i^T B h_j = v_{ij}^T b = \begin{bmatrix} h_{i1}h_{j1} \\ h_{i1}h_{j2} + h_{i2}h_{j1} \\ h_{i2}h_{j2} \\ h_{i3}h_{j1} + h_{i1}h_{j3} \\ h_{i3}h_{j2} + h_{i2}h_{j3} \\ h_{i3}h_{j3} \end{bmatrix} \begin{bmatrix} B_{11} \\ B_{12} \\ B_{22} \\ B_{13} \\ B_{23} \\ B_{33} \end{bmatrix}. \tag{16}$$

Using the definition of v_{ij}:

$$\begin{bmatrix} v_{12}^T \\ (v_{11} - v_{12})^T \end{bmatrix} b = 0. \tag{17}$$

If there are multiple equations at the same time, combine these equations into a vector representation form, namely, $Vb = 0$.

(3) Augmented reality tracking registration technology

It mainly monitors the position and movement of people or objects and then accurately places virtual information in the real scene. Augmented reality surveillance technology uses a variety of methods to locate objects and process the detected messages. The processed information provides input technology with conversion information from the image coordinate system to the actual coordinate system [13, 14], as shown in Figure 1.

Figure 1 is the construction of the operation process of the three-dimensional registration interface, which mainly includes three parts: hybrid registration, visual interface, and hardware. The visual interface has a single perspective, a dual perspective, and a triple perspective. The computer vision-based three-dimensional registration method is accurate. The characteristics of high performance and low hardware cost have attracted the attention of more and more researchers.

2.2. Augmented Reality Interface Requirements

(1) Human-computer interface development

The man-machine system consists of three parts: man, machine, and environment. They are connected together to form a whole. There is a horizontal area of human-computer interaction, called the human-machine interface, and the exchange takes the human-machine interface as the carrier. People receive information through the screen and make corresponding judgments and decisions in the brain [15, 16]. Then, they control the controller and input a command to make the machine receive, and then, the machine executes the corresponding program of the command and displays the program. The server processes and analyzes the information provided by the man-machine operation interface and then transfers it to the command page. This process of data conversion is called an interface. This interface has an important connection in the information transmission between humans and machines in the circulatory system.

(2) Interactive interface based on augmented reality

(i) Augmented reality technology

Augmented reality technology can be regarded as one of the virtual reality technologies, but the creation of a new virtual world by virtual reality is different from virtual reality, while augmented reality emphasizes the combination of virtual reality and the real environment and virtual objects

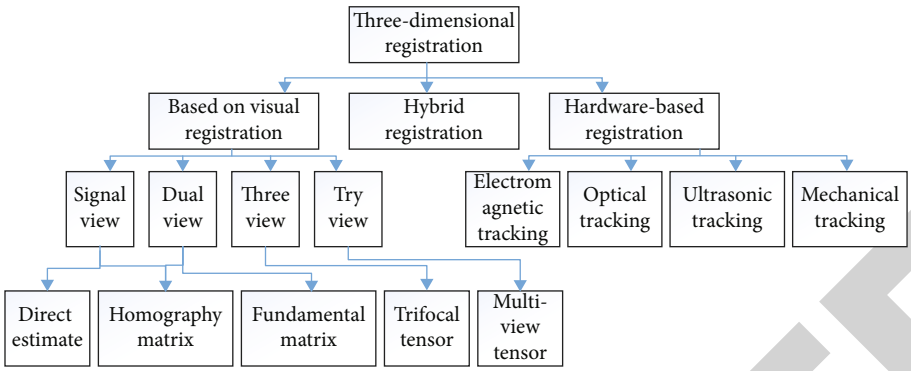

Figure 1: Classification of 3D registration methods.

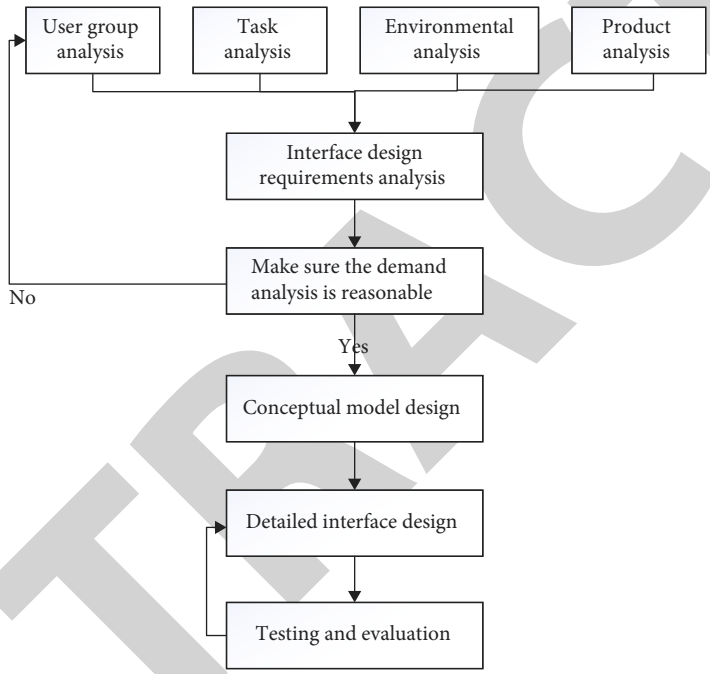

Figure 2: Design flow chart.

created. Augmented reality uses computers to create a realistic virtual environment of vision, hearing, power, touch, and motion perception, enabling users to see a virtual and real combined space of real scenes seamlessly integrated into virtual objects. Through the projector, you can immerse yourself in the environment to realize the direct physical interaction between the user and the environment. It can simulate the real scenery of the scene and is an advanced human-computer interaction interface with basic interaction and capture functions [17, 18]. Users can not only experience the realism experienced in the objective physical world through the virtual reality system but also penetrate the space, time, and other objective constraints of the virtual environment, so that users can experience the experience they cannot experience in the real world.

(ii) The prospect of augmented reality technology and the development trend of man-machine interface

Augmented reality technology has broad prospects, especially in today's internet era; the prospects for augmented reality services on mobile platforms are very broad. The increasing emphasis of various industries on the integration of augmented reality technology in mobile applications will promote the rapid development of augmented reality technology [19, 20]. Among many advertisers, the application of augmented reality technology to the positioning of advertising business information services has been highly recommended. This application can maximize the close connection between advertising products and customers and make full use of the various information of customers to closely connect with the market to maximize the benefits.

2.3. Illustrations in Print Ads in the Age of Electronic Images

(1) Graphic advertising illustration

Table 1: Summary table of reliability test results.

Category	Combination index	Alpha coefficient (α)
Composition in advertising	Centrosymmetry Decentralized heavy construction Berry Geometry	0.8796
Graphics in advertising	Specific explanation Abstract expression Image exhibition name Graphic	0.7643
Color in advertising	Warm tones Ruthless color Neutral color adjustment	0.8319
Brightness in ads	Front light Backlight Ceiling light Natural light	0.7338

Table 2: Score data table of six age groups on the composition in the advertisement.

	Beautiful	General	Passable	Abstract	Ugly
6-14 years	3.71	4.36	3.05	2.37	2.18
14-22 years	4.10	4.54	2.74	2.82	2.01
22-30 years	3.84	4.73	3.15	2.66	2.44
30-38 years	4.22	4.98	3.55	2.77	1.83
38-46 years	3.98	4.30	2.87	2.87	2.14
Over 46	4.12	4.69	3.14	2.41	1.88
P	0.016	0.005	0.013	0.011	0.019

As an art form, illustration is now widely used in various fields of design. Particularly in books, advertisements, and packaging, the role of illustrations is very important. At the same time, images have gradually become an important part of our design. As an art form of information transmission, visualization can convey information in real time through language and accurately describe the function of the product. The narrative feature of illustration design in print advertisements is to spread important advertising information and ideas to the public.

(2) The role of illustrations in print ads

The uniqueness of images has become the key to the dissemination of print advertisements and creation of works. When dealing with various graphic advertisement images, consumers' understanding and reading of product information will first focus on the graphics and images in the promotional items and then read the relevant product text content; the dissemination of printed advertising information with custom images can make consumers more receptive to products. Therefore, the unique realization and intuitiveness of graphic advertisements strongly reflect the importance and characteristics of advertising products and enhance the persuasiveness and influence of graphic advertisements.

(3) Design guidelines for illustrations in print advertisements in the electronic image age

(i) Establish a clear advertising purpose

The purpose of advertising is to spread, expand the awareness of the product in the eyes of the public, attract consumers to pay attention to the advertising product and have a strong interest in it, and stimulate people's sense of demand for the product. The purpose of print advertising is to induce consumers to consume. The design of illustrations in print advertising needs to be based on this fundamental purpose. The creative thinking of print advertising needs to focus on corporate publicity and product marketing. The use of illustrations in print advertisements in the era of electronic images makes the spread of advertising information faster. The essence of illustration in print advertising is practical art. For the purpose of illustration in print advertising, it is a direct and effective visual language. Artisticity is the creative method of illustration in print advertising. Only the purpose of print advertising can be accurately expressed so that the audience can feel the art of advertising illustrations while receiving advertising information and bring spiritual enjoyment to people.

(ii) Reflect a distinctive design theme

The design theme is an important part of all art works, embodied as a kind of idea and matter. Illustrations in print ads need to have a clear theme in the design process and deal with it through simplified means to achieve a prominent and vivid effect and attract public attention and be easy to grasp by the public. Advertising illustration is a unique way to

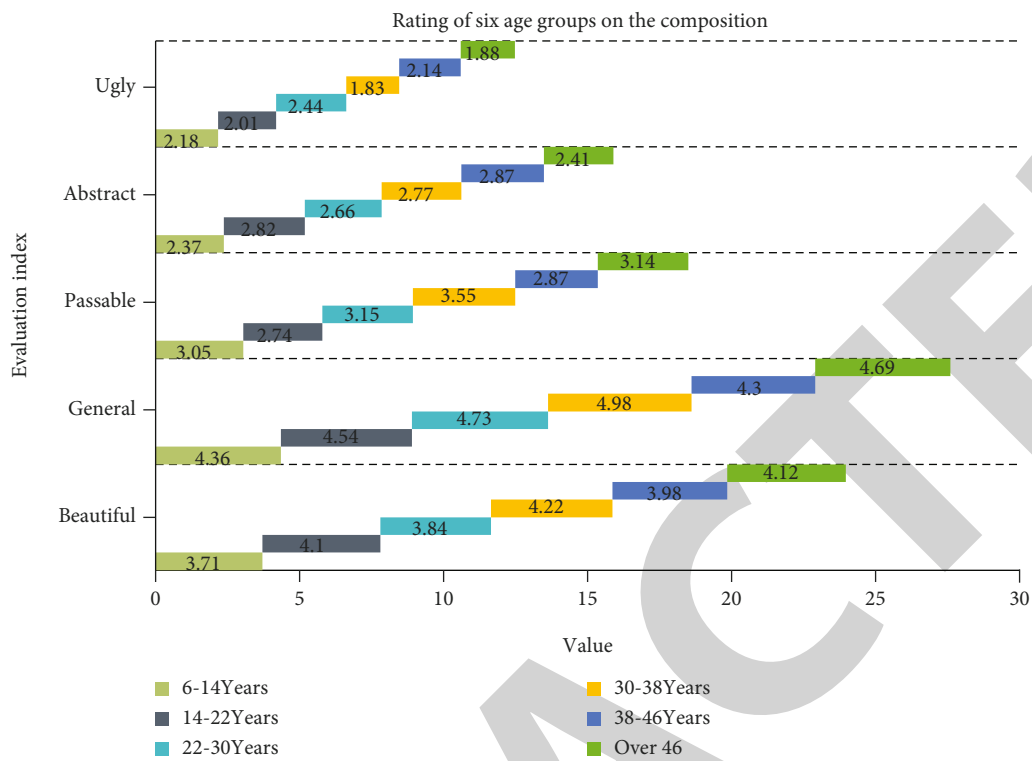

Figure 3: Data graph of ratings of six age groups on the composition of the advertisement.

Table 3: Data table of ratings for graphics in advertisements by six age groups.

	Beautiful	General	Passable	Abstract	Ugly
6-14 years	1.32	2.77	6.02	2.45	1.13
14-22 years	1.74	3.23	6.28	2.16	1.01
22-30 years	1.98	3.46	6.21	2.79	1.56
30-38 years	2.26	1.74	1.56	3.13	6.15
38-46 years	2.65	2.07	1.75	1.43	0.97
Over 46	2.38	2.99	5.56	3.77	3.82
P	0.005	0.005	0.005	0.005	0.005

convey the connotation of goods, as the so-called first think about the problem objectively, and then express the content reasonably. In the era of electronic imagery, the competition among commercial brands in the market is very fierce. In order to make one's own products stand out among the many competing products, it is necessary to have a very unique creative expression.

(iii) Stimulate the emotional resonance of consumers

Advertisements can give special symbolic meaning and connotation to the product brand, so that the target consumers will associate after seeing the advertisement, arouse emotional resonance, and finally achieve a deep and strong communication effect. In the age of electronic images, illustration design has become more and more focused on practical emotional resonance in advertising. It mainly uses warm, cheerful, and positive emotional images to achieve emotional resonance for target consumers and let people indulge in what the advertising gives. Memories and easier to accept the services and goods in the advertisement. Illustrations in print advertisements should pay attention to expressing human touch, appropriately and delicately portraying the details of life, so that illustrations can be more accessible to people.

(iv) Meet the psychological demands of consumers

In the age of electronic images, information gradually becomes visualized images, and the design of illustrations in print advertisements needs to meet the psychological demands of the audience. When designing advertising illustrations, it is necessary to highlight the main body's image and sharp color contrast to achieve the purpose of attracting the attention of the audience. Through a series of consecutively changing comic strips, illustrations with continuity can be formed, creating a continuous sense of time and space, and fully expressing the activity process in the advertisement. At the same time, it also has a strong sense of movement and rhythm, achieving a special attention. An excellent graphic advertising illustration design must have a reading effect that can convey the connotation of the design and make the target audience understand and accept it.

3. Experimental Design of Real-Time Image Interactive Interface of Advertising Screen

3.1. Realization Process of Advertising Design. Discussion and determination of specific technologies: starting from

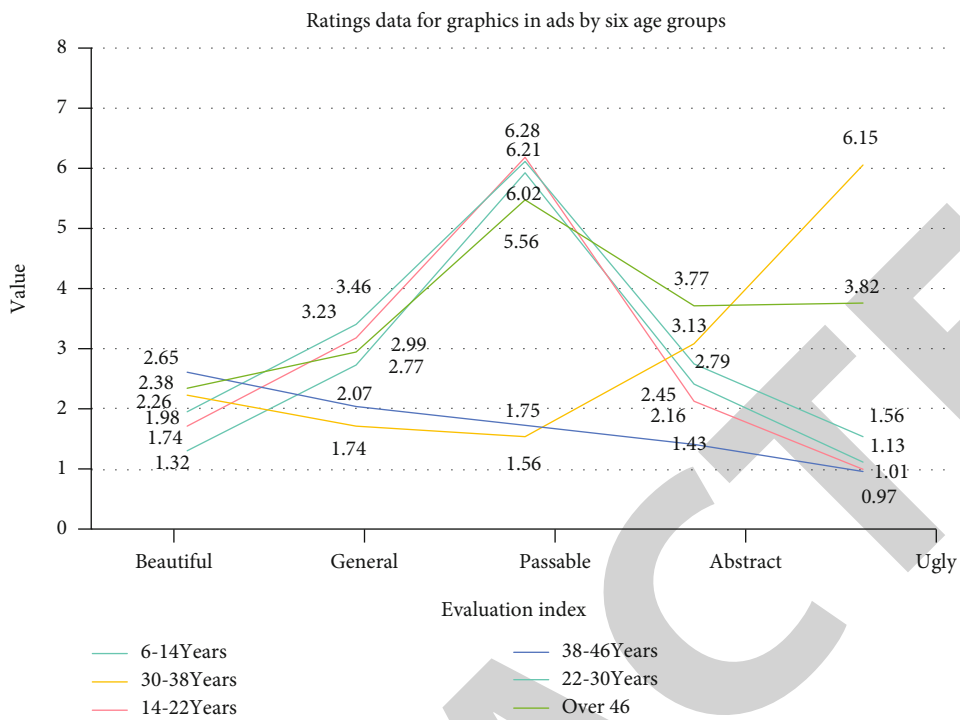

Figure 4: Graph of rating data for graphics in ads by six age groups.

Table 4: Data table of ratings of colors in advertisements by six age groups.

	Beautiful	General	Passable	Abstract	Ugly
6-14 years	2.35	3.52	3.38	3.90	4.23
14-22 years	2.59	2.75	2.70	3.97	4.76
22-30 years	1.87	3.12	3.89	3.54	4.34
30-38 years	2.56	2.79	3.48	3.43	3.91
38-46 years	1.73	2.43	3.02	3.26	3.72
Over 46	1.45	2.16	2.73	2.97	4.56
P	0.043	0.037	0.033	0.036	0.041

user experience and user needs, according to the theory of user experience elements, the required conceived augmented reality advertising design is based on five levels: strategy, scope, structure, framework, and presentation. Advertisement content design and planning plan production: according to the content of user experience elements, preliminary design, determine the general process of task completion and divide the steps, design according to the functional goals to be achieved in each step, determine the general style, here build the project based on the foundation, and finally carry out the test, as shown in Figure 2.

3.2. Test Subject. This article uses a real-time image interactive system for advertising screens based on augmented reality and visual communication technology. Analyze from the composition in the advertisement, the graphics in the advertisement, the color in the advertisement, the proportion in the advertisement, the brightness in the advertisement, and the design principles in the advertisement. Based on the above 6 indicators, 100 questionnaires were issued for each age group. All questions are divided into 5 levels. The questionnaire response rate was 100%.

3.3. Experimental Method. In the preexperiment stage, we need to enter a large amount of sample data and classify and analyze the real-time image interaction system of the advertising screen based on augmented reality and visual communication technology. We also need to query a large amount of literature to design-related questionnaires.

In the postexperiment stage, we conducted statistics on the collected questionnaires and followed the six indicators of the composition in the advertisement, the graphics in the advertisement, the color in the advertisement, the scale in the advertisement, the brightness in the advertisement, and the design principles in the advertisement. And relevant knowledge to analyze these data to get a conclusion.

3.4. Data Collection. Pixel depth refers to the number of bits used to store each pixel, and it is also used to measure the resolution of an image. Pixel depth determines the number of colors that each pixel of a color image may have or determines the number of gray levels that each pixel of a grayscale image may have. In the random forest training sample data, each sample has features. In this algorithm, simple pixel depth features are used for comparison. The feature calculation formula for pixel x is as follows:

$$f_\theta(I, x) = d_1\left(x + \frac{u}{d_1(x)}\right) - d_1\left(x + \frac{v}{d_1(x)}\right), \tag{18}$$

where $d_1(x)$ represents the depth value of the x pixel in the image, the parameter $\theta = (u, v)$ describes the offset of

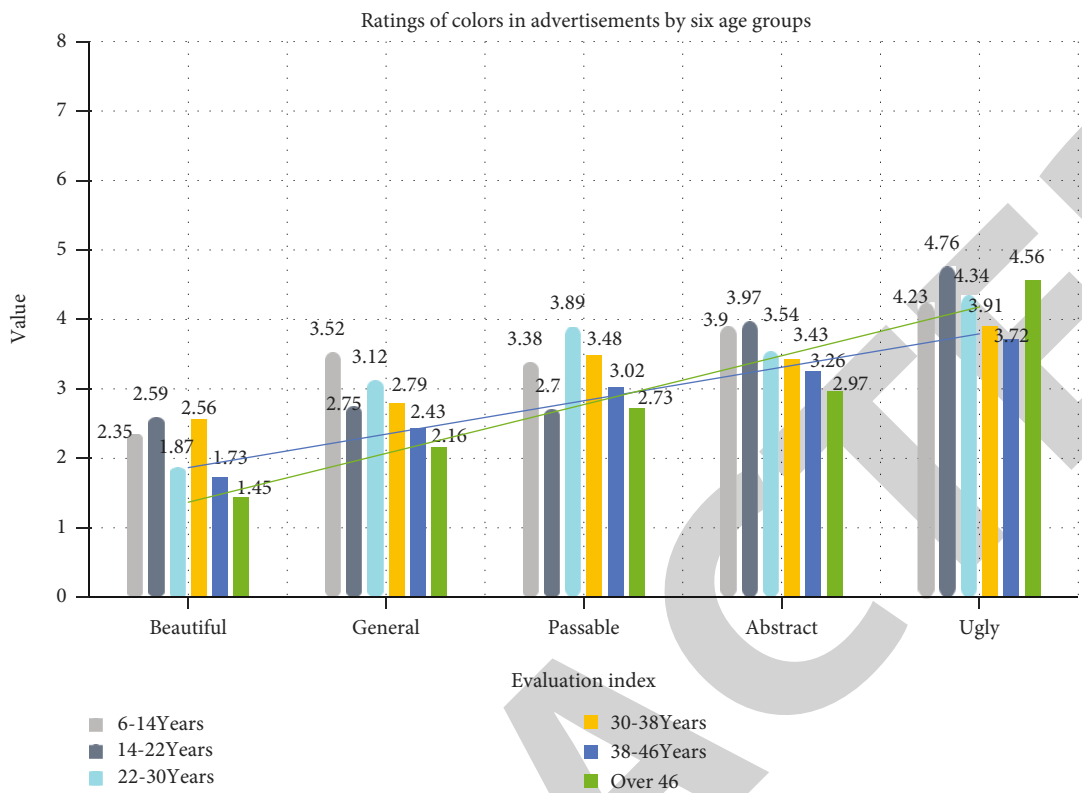

Figure 5: Data graph of ratings of colors in advertisements by six age groups.

Table 5: Score data table for the scales in advertisements for six age groups.

	Beautiful	General	Passable	Abstract	Ugly
6-14 years	2.94	7.98	4.60	3.90	3.82
14-22 years	3.38	8.21	4.41	4.14	4
22-30 years	3.55	8.74	4.87	4.13	3.86
30-38 years	3.31	7.85	4.41	4.23	3.69
38-46 years	2.98	7.94	4.92	4.45	3.39
Over 46	3.16	8.27	4.42	4.37	3.61
P	0.001	0.001	0.001	0.001	0.001

the point x in the u and v directions, and $1/d_1(x)$ represents the normalization, so that the feature is constant in the depth.

3.5. Statistical Data Processing Method. SPSS23.0 software was used for data processing, and the count data was expressed in percentage (%), k is the number of data in this experiment, σ^2 is the variance of all survey results, and $P < 0.05$ indicates that the difference is statistically significant. The formula for calculating reliability is shown in

$$a = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma^2}\right). \quad (19)$$

4. Real-Time Image Interactive Interface of Advertising Screen Based on Augmented Reality and Visual Communication

4.1. Evaluation Index System Based on Index Reliability Testing. The results of the survey on the stability and incumbency of the questionnaire are shown in Table 1.

It can be seen from Table 1 the composition of the advertisement, the graphics in the advertisement, the color in the advertisement, the scale in the advertisement, the brightness in the advertisement, and the design principles in the advertisement. The impact is acceptable ($\alpha > 0.7$). This shows that in the era of electronic images, the forms of illustrations in print advertisements have become more and more diversified, and the space for development and creation has become wider.

4.2. Visual Communication Language in Advertising

(1) Analyze the composition in the advertisement

Image symbols are the use of images to interpret and show the behaviors, objects and concepts to be expressed, so that they can be easily recognized, learned, and remembered. Image symbols help reduce the design efficiency load, save display area, and make identification and control easy to understand in all cultures. The results are shown in Table 2, and we make a bar graph based on this result, as shown in Figure 3.

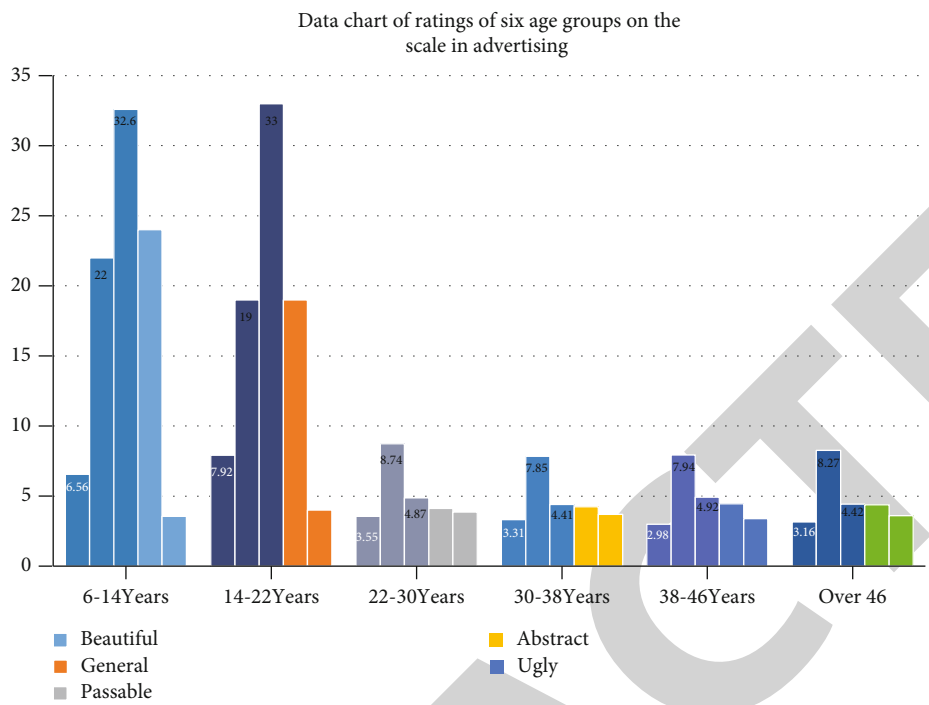

Figure 6: Data chart of ratings of six age groups on the scale in advertising.

Table 6: Data table of ratings for text in ads by six age groups.

	Beautiful	General	Passable	Abstract	Ugly
6-14 years	1.81	2.1	2.02	1.81	1.93
14-22 years	1.96	1.84	2.31	2.42	2.03
22-30 years	3.61	3.99	3.58	3.64	3.67
30-38 years	3.74	4.3	4.41	4.2	4.48
38-46 years	3.46	3.42	3.3	3.35	3.63
Over 46	0.84	1.38	1.24	1.55	0.83
P	0.027	0.031	0.023	0.017	0.019

Through the paired sample t-test, it can be found that after the experiment, the six age groups have significant differences in the P value of the composition score in the advertisement less than 0.05; at the same time, the P value of each index in the composition in the advertisement is also less than 0.05, which also shows the difference is significant. This image representation method is usually the most efficient. The specific situation is shown in Figure 3.

(2) Analyze the graphics in the ad

An interface with a mixed arrangement of pictures and text makes it easier to recall pictures rather than words. It is also found that when users browse the interface, they will spend more time on pictures than words. The results are shown in Table 3. We make a line chart based on this result, as shown in Figure 4.

Through experiments, it can be found that the P value of the graphic score in the advertisement is less than 0.05, and there are significant differences between the 6 age groups; at the same time, the P value of each indicator in the graphic in the advertisement is also less than 0.05, which is also significant. The difference shows that it is very important to appropriately use the advantages of pictures to design the interactive interface. It can make the key priority information of the interface quickly become the focus of the user's attention. The specific situation is shown in Figure 4.

(3) Analyze the colors in advertising

As a visual language, color not only corresponds to the real object but also connects with the human spirit and emotion. The results are shown in Table 4, and we made a bar graph based on the results, as shown in Figure 5.

Through experiments, it can be seen that the P values of color scores in the advertisements of the 6 age groups are all less than 0.05, and the difference is significant; at the same time, the P values of the color indicators in the advertisement are also less than 0.05, which is also significant.

(4) Analyze the metrics in advertising

The importance of proportion is one of the other visual communication elements based on the real-time image of the advertising screen. The results are shown in Table 5, and we made a bar graph based on the results, as shown in Figure 6.

Through experiments, it can be seen that there is a significant difference in the scale scores. P values of advertisements of 6 age groups are all less than 0.05; at the same time, the P value of each indicator of the advertising mesoscale is also less than 0.05.

(5) Analyze the text in the ad

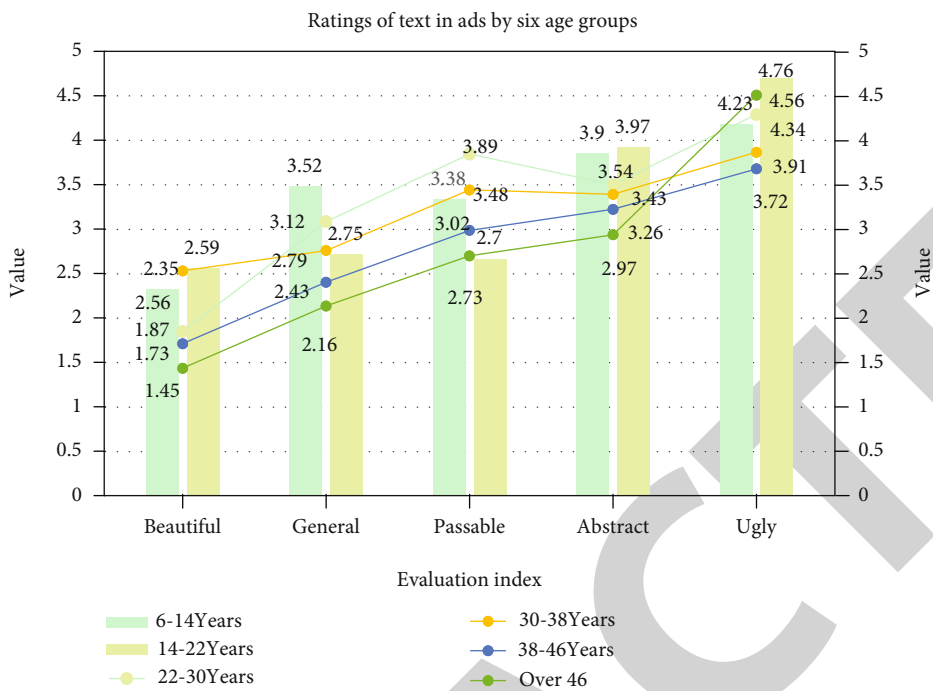

Figure 7: Data graph of ratings of text in ads by six age groups.

In the text design of the interactive interface, you should choose to use simple sentences that are familiar to the user with clear expression and avoid using too many professional terms. Try to use verbs that can accurately and concisely describe the operation, so that it is clear and easy to understand by the user. The results are shown in Table 6. We make a histogram based on this result, as shown in Figure 7.

Through experiments, it can be seen that the P value of the text in the advertisement is less than 0.05, and there are significant differences between the 6 age groups; at the same time, the P value of each index in the advertisement is also less than 0.05. There is also a significant difference, which shows that the legibility of the text is an important factor in the text interaction in the interactive interface. If the legibility of the text is reduced, the user's reading comprehension, degree, and speed will also be reduced. In terms of page design, it is necessary to reduce the difficulty of text browsing and operational design page layout so that the text has a sense of beauty, and the user's text interaction efficiency in the interactive interface is improved. The specific situation is shown in Figure 7.

5. Conclusions

With the rapid development of human society's economy and technology, people are also seeking new human-computer interaction methods that are more realistic and more immersive than traditional screen-based interaction methods. Augmented reality, as a new type of human-computer interaction technology aimed at "seamlessly" superimposing virtual information in real scenes, has become one of the most concerned scientific and technological development directions in the scientific and technological circles. The main research goal of this paper is the artistic design of interactive real-time image interface of advertising screen based on augmented reality and visual communication technology. Through the classification and analysis of the literature, the real-time interactive image interface design of the advertising screen based on augmented reality technology is analyzed theoretically. Starting from the definition and format of advertising, it studies the functions and benefits of augmented reality technology advertising and demonstrates that augmented reality technology can be used for advertising screen expression. Design advertising screens based on augmented reality technology, through interactive multisensor design, to convey information or safety warnings to users. Finally, by evaluating the advertising effect, determine whether the design is successful, optimize the drawbacks, and improve the details of the user experience. The emergence and development of augmented reality technology have brought new opportunities for advertising and can create excellent advertising. Advertising based on augmented reality will become a new reference direction for future advertising development.

Interface design research mainly focuses on the visual aspects and content. The design process and principles virtualize the design of physical products, and there are actually no major changes. With the development of information technology and the maturity of human-computer interaction technology, the author believes that this is the watershed between traditional interface design and interactive interface design. From the research progress at home and abroad, it can be seen that even for the recently published academic results, the research content is still traditional software interface design, and there is no theoretical combining for interactive interface design. Through understanding the

process design and principles of the interactive interface, this article discusses how to augment the realistic interactive interface and studies its feasibility and value.

Data Availability

No data were used to support this study.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding the publication of this article.

References

[1] S. M. Nah and Y. J. Lee, "The visual communication by augmented reality," *Journal of Digital Convergence*, vol. 14, no. 11, pp. 507–512, 2016.

[2] P. Chen, Z. Peng, D. Li, and L. Yang, "An improved augmented reality system based on AndAR," *Journal of Visual Communication and Image Representation*, vol. 37, no. may, pp. 63–69, 2016.

[3] I. Laskari, "Creating algorithmic audiovisual narratives through the use of augmented reality prints," *Technoetic Arts*, vol. 17, no. 1, pp. 25–31, 2019.

[4] K. El Ammari and A. Hammad, "Remote interactive collaboration in facilities management using BIM-based mixed reality," *Automation in Construction*, vol. 107, p. 102940, 2019.

[5] H.-J. Lim, J.-S. Choi, J.-Y. Jeon, and H.-G. Byun, "Implementation of demo program for visual communication in compliance with MPEG-21 part 22: user description," *Journal of Sensor Science and Technology*, vol. 25, no. 4, pp. 297–301, 2016.

[6] H. Deng, J. Wu, L. Zhu, Z. Yan, and L. Yu, "Texture edge-guided depth recovery for structured light-based depth sensor," *Multimedia Tools & Applications*, vol. 76, no. 3, pp. 4211–4226, 2017.

[7] G. Gogolin and E. Gogolin, "The use of embedded mobile, RFID, location based services, and augmented reality in mobile applications," *International Journal of Handheld Computing Research*, vol. 8, no. 1, pp. 42–52, 2017.

[8] E. Murakami, Y. Oguro, and Y. Sakamoto, "Study on compact head-mounted display system using electro-holography for augmented reality," *Ice Transactions on Electronics*, vol. -E100.C, no. 11, pp. 965–971, 2017.

[9] D. Fang, H. Xu, X. Yang, and M. Bian, "An augmented reality-based method for remote collaborative real-time assistance: from a system perspective," *Mobile Networks & Applications*, vol. 25, no. 2, pp. 412–425, 2020.

[10] S. Pandey, M. Jain, and S. Nivash, "Mobile robot tele operation using arc (augmented reality based controller)," *Journal of Advanced Research in Dynamical and Control Systems*, vol. 9, no. 6, pp. 1153–1163, 2017.

[11] S. Yang, B. Li, Y. Song, J. Xu, and Y. Lu, "A hardware-accelerated system for high resolution real-time screen sharing," *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 29, no. 3, pp. 881–891, 2019.

[12] J. Y. Kim, H. Kim, and B. Cha, "Move us: a study of exploring interaction methodology using an abstract interface between a real-time camera and a screen," *Contents Plus*, vol. 18, no. 1, pp. 41–54, 2020.

[13] A. Kellerman, "Image spaces and the geography of internet screen-space," *Geo Journal*, vol. 81, no. 4, pp. 503–517, 2016.

[14] Y. Yu, A. Song, and D. Chen, "Fingertip haptic rendering system for touch screen image perception," *Chinese Journal of Entific Instrument*, vol. 38, no. 6, pp. 1523–1530, 2017.

[15] H. Liu, X. T. Zhang, and X. M. Fu, "Computational peeling art design," *ACM Transactions on Graphics*, vol. 38, no. 4, pp. 1–12, 2019.

[16] W. Zhu, "Study of creative thinking in digital media art design education," *Creative Education*, vol. 11, no. 2, pp. 77–85, 2020.

[17] I. Svetlichnaya, "Methods of art design in the design of the external image of a person," *Communication Studies*, vol. 9, no. 4, pp. 68–75, 2020.

[18] Y. Zhao, "Study on the exhibition art design and technology application based on computer aided design," *Revista de la Facultad de Ingenieria*, vol. 32, no. 3, pp. 464–471, 2017.

[19] L. Chen, "Research on the art design innovation based on computer 3D aided system optimization," *Revista de la Facultad de Ingenieria*, vol. 32, no. 12, pp. 248–254, 2017.

[20] G. Li, "Research on the aesthetic concept of paper material in art design," *Boletin Tecnico/Technical Bulletin*, vol. 55, no. 11, pp. 192–197, 2017.