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Retraction

Retracted: Dynamic Display Design of Cultural and Creative Products Based on Digital Augmented Reality Technology

Mobile Information Systems

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret 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 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] Z. Zhang and L. Zhang, "Dynamic Display Design of Cultural and Creative Products Based on Digital Augmented Reality Technology," *Mobile Information Systems*, vol. 2022, Article ID 7770599, 13 pages, 2022.

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Research Article

Dynamic Display Design of Cultural and Creative Products Based on Digital Augmented Reality Technology

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The development of science and technology has brought about a change in life, and this has also caused people to use technology more and more frequently. In the dynamic display design of cultural and creative products, people are also beginning to look for a technology that can better deal with it. Its characteristics are displayed, which is the research of this article. This article aims to study how to carry out a dynamic display design for cultural and creative products. To this end, this paper proposes a method of digital augmented reality technology, optimizes the visual search technology in augmented reality technology, studies and analyzes its specific digital implementation process, divides and understands the technical principles, and designs relevant experiments to study its specific display effect and carry out the relevant effect analysis in the analysis part. The experimental results of this article show that the improved augmented reality technology can better enhance the consumer's interactive experience. At the same time, the consumers' purchase intentions have also been improved by 43%. It can be said that the dynamic effects of cultural and creative products are well demonstrated.

1. Introduction

We are in a new era of digital technology development and innovation and integration. The spread of digital images through the Internet, digital TV, mobile phones, and other mobile terminals penetrates all corners of our lives, and our thoughts and daily behaviors can be affected. With the advent of the new media era, contemporary cultural and commercial art products' expression methods have also been continuously innovated. As a cultural and creative product that inherits the characteristics of traditional regional culture, it is constantly innovating. Technology advances, materials are diversified, tools are becoming more and more abundant, and the methods of artistic expression are becoming more and more diversified. Information civilization and technological development have gradually transformed visual communication from static and planar in form to dynamic and comprehensive.

Augmented reality is currently a frontier hotspot where experts and scholars in related fields at home and abroad are actively engaged in research. However, regarding the research on the combination of augmented reality and digital development and protection, there is currently a lack of relevant scientific research results and practical case references in China. In this case, this research has important academic research value. Comprehensive use of augmented reality technology, computer graphics, multimedia, digital animation, network communications, cloud storage services, art design, intangible cultural heritage, folk art culture, and other related fields of theoretical knowledge is a useful exploration and attempt for the integration of culture and technology and the integration of interdisciplinary research. The contribution of this paper lies in the following: Works on digital display can be reprocessed by visitors, shortening the distance between exhibits and visitors and between authors and visitors, and designers can use the web to interpret information about their work. The social background, design process and experience, etc. are disseminated to better interact with the audience, which all contribute to the comprehensive presentation of the information.

With the rapid development of science and technology, more and more technologies have begun to move into daily life. Among them, the application of augmented reality technology in product display is becoming more and more popular, and the effect is getting better and better, and this has also promoted a large number of scholars to begin to invest in related knowledge research. Bellalouna introduced the application of augmented reality technology (AR) in the industrial field. Based on industrial case studies, the implementation of two AR applications and their potential to digitize product life cycle processes will be discussed. These use cases were developed in a collaborative project between Karlsruhe University of Applied Sciences and a fire truck manufacturer. The purpose of the case study is to investigate the application of AR in industrial environments and its ability as a digital conversion technology in the product life cycle [1]. Ibanez believes that augmented reality technology has a positive impact on the learning-related outcomes of Mexican middle school students. However, the impact varies depending on whether the student is a public school or a private school. He designed an augmented reality application that allows students to practice the basic principles of geometry, and a similar application, which contains the same learning objectives and content, and is deployed on the Web [2]. Zehao introduced the current situation and development trend of the virtual reality (VR) and augmented reality (AR) industries. In terms of display technology, the main technical solutions of current VR/AR devices are reviewed, and the advantages and disadvantages of these technical solutions are compared in detail. In response to the problems of these technical solutions, he proposed the advantages of holographic optical technology and clarified the role of holographic optical technology in the VR/AR industry [3]. CHEN researched the virtual 3D display method of the product by Inventor, a parametric 3D design software developed by Autodesk for efficient modeling and animation. By discussing the method of part feature creation and assembly design, the real simulation of the product is carried out. He uses three-dimensional animation techniques such as fade animation, component animation, and camera animation to describe product features and animation effects [4]. Bianchi-Aguiar considered two innovative features in the sales rules: layered product series and display direction. In his research, he proposed a novel mixed integer programming formula for shelf space allocation. On the basis of the formula, a heuristic method based on mathematical programming is also developed, which uses product series to decompose the problem into a series of subproblems [5]. Meredith proposed that because users can use gaze, gestures, and voice commands to interact with modern augmented reality technology, the technology allows easy and instant access to programs, security requirements, and other information and documents without the user having to get out of the glove box. It can also be used to help plan complex material movements, view operation videos during operation, or allow managers to watch the evolution process through remote viewing [6]. Zhu built an augmented reality electronic publication dissemination effect model (ARE-PCEM) based on the technology acceptance model (TAM) and analyzed the data of adolescents. The study found that the primary indicators (use and recognition) and secondary indicators (external variables, perceived usefulness, perceived ease of use, satisfaction, and dependence) are positively correlated with the recognition of teenagers [7]. Science proposed that when the signal between the brain and one eye is wrong, the input from the other eye may dominate. This condition is called amblyopia or "lazy eye." New research shows that people may be able to use wearable augmented reality technology to reduce this visual difference when performing daily activities [8]. The abovementioned documents are very detailed in the research of related key technologies, and they have a comprehensive description of the use of some technologies. However, it is a pity that the augmented reality technology and the display of cultural and creative products have not been combined and the two have been merged.

The innovation of this article is to first have a general understanding of augmented reality technology and then conduct a detailed analysis of the key visual search technology and supporting technology and optimize and improve it so that the improved visual search technology can be more suitable for dynamic display of cultural and creative products.

2. Dynamic Display Method

2.1. Augmented Reality Technology. It is generally believed that AR technology originated from the growth of virtual reality (Virtual reality, VR for short), but there are significant differences between the two. Augmented reality (AR) is a new media technology that uses computer programming to generate H-dimensional virtual information to enhance users' perception of the real environment [9]. VR technology presents the effect of completely immersing the user in the virtual world, which is to rebuild a world; however, AR technology displays virtual information in people's real world and strengthens the perception of the real world through sensory information (touch, listen, see, smell, etc.), achieving a fundamental change from "human adaptation to machines" to "technical human-oriented" [10].

When designing an AR application, the first step is to analyze the time and environment in which the service is used. These factors will obviously affect the AR design, because the AR layer is based on the physical environment as a fictitious excitation [11]. The typical AR application is rooted in reality, just like using real tools to deal with real problems in specific places and time.

2.1.1. Classification of Augmented Reality: AR Is Roughly Divided into the Following Two categories at the Application Level

(1) Skillful Augmented Reality. Informatization enhances reality, as its name implies, adding text or multimedia information to the ingenious reality we have seen. Some applications will cooperate with electronic compass, map (Google Map), and (GPS) global positioning system to provide regional services.

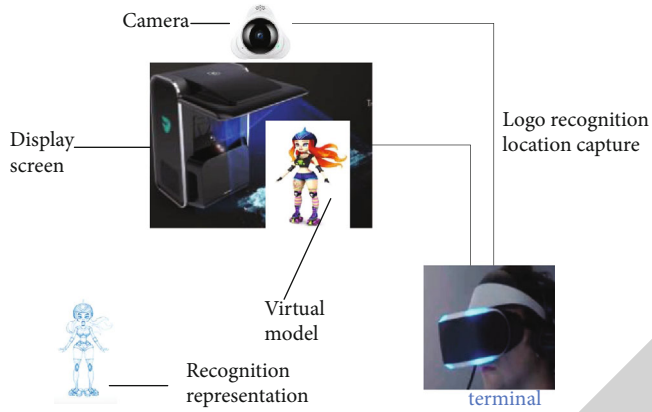

Figure 1: The recognition principle diagram of AR technology.

There are many practical applications of information enhancement in life, such as application in mechanical maintenance and medical surgery. BMW applied this technology to car maintenance [12]. Maintenance personnel wear glasses with augmented reality display, combined with the function of voice control; when the maintenance personnel face the engine, the glasses will display the operating procedures and positions of the corresponding parts. It not only saves the time of reading the operation manual, but also saves the maintenance time and reduces the chance of error.

(2) The Interactivity of the Subject Increases the Reality. In fact, whether it is "information" or "subject interaction," people are the main body. The biggest difference between the two lies in the direction of the lens. The lens of the former and our line of sight are in the same direction, while the lens of the latter is facing the "subject" and our line of sight is in the opposite direction. This subject will appear in the image at the same time and can produce interaction [13]. The recognition principle of AR technology is shown in Figure 1.

In China, the Internet and mobile phone industries have also made great strides into the realm of growth. China's augmented reality industry is mainly composed of AR software companies, ecological AR companies, AR hardware companies, and AR derivatives companies. The development of this technology has formed China's augmented reality industry chain, and the number of participants and product categories will continue to increase in the future. The specific industrial chain is shown in Figure 2.

Eco-level-augmented reality companies have the ability to develop high-quality content materials, strengthen the core underlying technology reserves of reality, and combine content materials with underlying technologies to turn them into augmented reality products; it has the ability to control the international industrial chain and can combine industrial resources such as augmented reality media and community platforms and augmented reality hardware [14]. Companies that can reach such a high level at home and abroad are very rare. Even the ecological layout established by Apple and Google with strong capital lacks the internal promotion of content factories and the external support of industrial alliances. In the Chinese market, companies close to this ecological level are as follows: Liangfengtai Technology, Yangshu Culture, and Tap Manufacturing.

2.1.2. Augmented Reality Technology 3D Model Design. The most direct way to express AR is 3D models, such as characters, buildings, and objects. A 3D model can not only be a single individual, but also can be used as a 3D scene display; it is not just a stack of several 3D models. The scene display includes many visual elements, such as many particle effects and gravity simulation. Entertainment interactive applications and next-generation platform games have all begun to use this method to display scenes [15]. AR scenes are based on real scenes. AR augmented reality is a technology that superimposes virtual images in reality, which converts 2D image information into 3D visual experience. Plane graphics generally extract design output through elements, design three views according to their style and sense of space, and model them in 3D software. Afterwards, Unity3D is imported for certain trimming and operation, and it is released to mobile terminals of IOS or Android system through augmented reality platforms such as Qualcomm [16].

(3) Design Method of Cultural and Creative Product Display with Augmented Reality Intervention. In summary, the specific process of cultural and creative product display design based on augmented reality technology includes the following:

(1) Extraction framework of regional cultural elements based on landscape prototype; this is the most basic part of display design, including the collection, sorting and classification of landscape elements, and cultural materials related to cultural and creative products. According to the principles and methods of graphic visual design, handle the relationship between visual symbols and regional cultural elements; think and design the form, composition, color extraction, etc. of each scene; and produce a set of graphic products as an identification map [17]

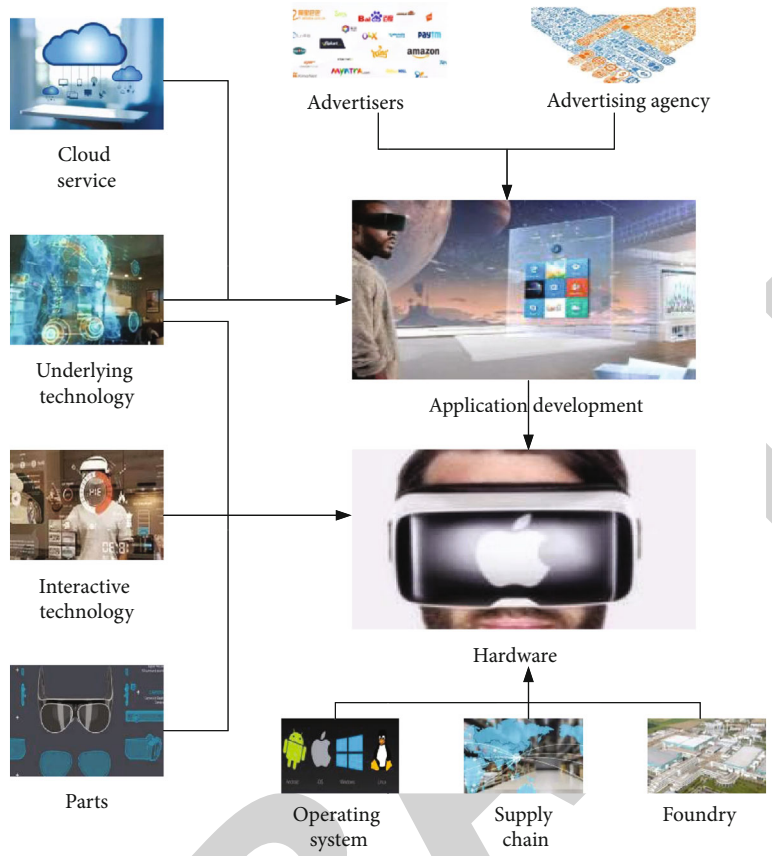

Figure 2: Map of China's augmented reality industry chain.

(2) The composition of dynamic graphics of new media images. The composition of dynamic graphics of images is the inheritance and development of the extraction of cultural elements based on the archetype of the landscape. Inheritance is the inheritance of design characteristic elements such as form, structure, and color. Development is the use of decomposition and transformation, replacement composition, breakup, and reconstruction in presentation to make the picture move, making the audience more willing to watch and understand. In application, it can have a wider communication space on the new media communication platform, so as to assist in the realization of the identifiability and communication of design objects, and have the ability to inherit and transmit cultural information [18]

(3) The augmented reality technology 3D model design framework, as the core output of the display design, is also a redesign based on the extraction of cultural elements from the landscape prototype. The final style of the 3D model is finalized through the attributes and compatibility of the plane static graphics, coupled with the simulation of the architectural prototype of the field research, and the output of the augmented reality software is used. Display experience through product postcards produced by plane vision, and achieve wide and effective product dissemination through various means such as new media platforms and new media products

2.2. Key Technologies of Augmented Reality Visual Search. The core technologies of augmented reality include visual search (also known as content-based image recognition), tracking registration, and rendering. The visual search technology, which is the entrance to augmented reality-related businesses, has also become one of the current research hotspots in academia and industry [19].

Mobile visual search technology refers to a retrieval technology that uses the camera on the mobile smart terminal side as an information capture device to obtain images or videos in real time as the query object to search for related information that users are interested in. The current mainstream mobile terminal visual search architecture is shown in Figure 3.

This kind of architecture, which is more commonly used in the industry, is limited by the computing power of current mobile terminals. Only image compression and result display are performed on mobile terminals. However, the more complex feature point extraction, descriptor generation, and image retrieval are carried out on the visual search server. Due to the large files uploaded to the server, most of the time of visual search is spent on data transmission. At the same time, the encoding and decoding of images also takes a lot of time, which greatly affects the user experience [20].

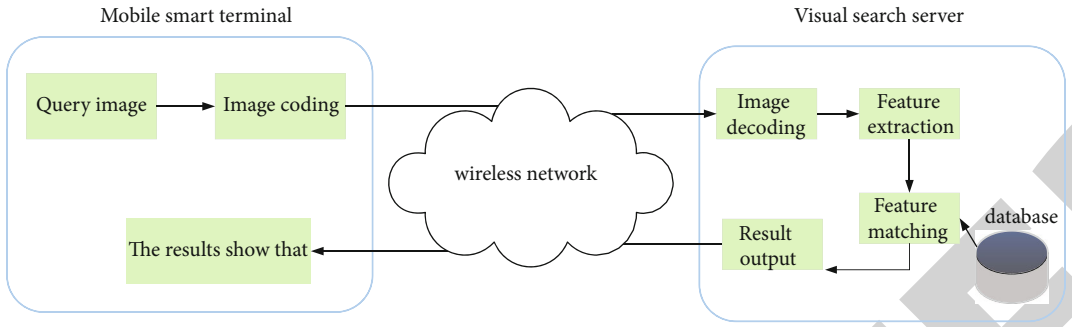

Figure 3: Terminal visual search architecture diagram.

2.2.1. Feature Extraction. In the process of extracting image features, in order to remove redundant information in the original features and improve the subsequent retrieval efficiency, the original local features (SIFT) are processed separately to obtain quantized local features and global features. At the same time, in order to reduce the time of geometric consistency verification for subsequent matching, we also coded the location information of the feature points [21].

2.2.2. Feature Point Selection. After the local feature points are extracted, the feature points are selected to remove the interference feature points, and the most important points are retained to improve the efficiency and accuracy of retrieval [22]. The algorithm is based on the statistical distribution of multiple inspection indicators of characteristic points. Define 5 attributes of feature points, namely:

$$c_n, \sigma_n, \theta_n, D_n, d_n, \tag{1}$$

Among them, Cn is a binary label of the feature point. If the feature point is a matching point, Cn = 1, otherwise Cn = 0. σ_n represents the scale of the feature point. θ_n represents the direction of the feature. D_n represents the peak value of the feature (that is, the DOG response when the SIFT feature is extracted). d_n represents the distance of the feature from the center of the image. $\sigma_n, \theta_n, D_n, d_n$ is the four evaluation attributes that determine the importance of feature points [23].

For any evaluation attribute y, the probability of an important point in an area S of the y branch is

$$P(c = 1 | y \in B) = \frac{P(y \in B \cap c = 1)}{P(y \in B)}. \tag{2}$$

Record whether each feature point in the training sample has a matching point, and assign the corresponding value to the binary label c. Defining a binary decision function kK, it can get

$$\hat{P}(y \in B \cap c = 1) = \frac{\sum_{n=1}^{N} k(y_n \in B) c_n}{N}. \tag{3}$$

After deforming, it can get

$$\hat{P}(y \in B) = \frac{\sum_{n=1}^{N} k(y_n \in B)}{N}. \tag{4}$$

Then, the above conditional probability can be written as

$$\hat{P}(c = 1 | y \in B) = \frac{\sum_{n=1}^{N} k(y_n \in B) c_n}{\sum_{n=1}^{N} k(y_n \in B)}. \tag{5}$$

That is,

$$\hat{P}(c = 1 | y \in B_k) = \frac{\sum_{n=1}^{N} k(y_n \in B_k) c_n}{\sum_{n=1}^{N} k(y_n \in B_k)}. \tag{6}$$

From this, we can get the probability of a matching point in the area where each attribute is located, and the probabilities of each attribute are multiplied to get the importance score r of the feature point, as shown below:

$$r = \hat{P}(c = 1 | \sigma \in S) \cdot \cdots \cdot \hat{P}(c = 1 | d \in D). \tag{7}$$

According to the importance score r in descending order, the top several points are selected for retrieval, and the remaining points are deleted. The selected features will be transmitted for further global feature generation and retrieval.

2.2.3. Local Feature Generation. When SIFT features are obtained, in order to obtain compact descriptors of different sizes and make the features more compact and scalable, further processing of SIFT is needed to generate local features and global features. The original local features used in the image visual search system are currently recognized as the best-performing SIFT features in the industry. It is a mature technology and will not be introduced in detail in this section. This section will mainly introduce the local feature quantification process. The quantified local features are mainly used for geometric verification in the retrieval process. The gradient histogram of a single sub-block of SIFT is shown in Figure 4.

We divide the 16 sub-blocks of SIFT into two sets of A and B and transform the gradient of each sub-block of SIFT as follows:

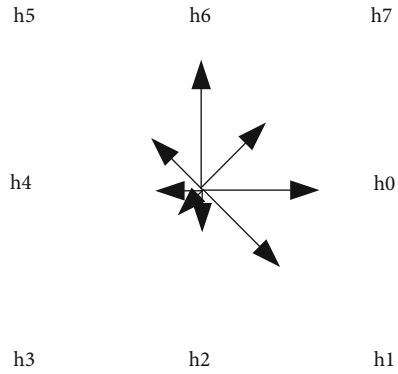

Figure 4: The description of each dimension number of the original SIFT descriptor.

SetA:

$$v_1 = (h_3 - h_7)/2, \tag{8}$$

$$v_2 = (h_0 - h_1)/2, \tag{9}$$

$$v_3 = (h_2 - h_3)/2, \tag{10}$$

$$v_4 = (h_4 - h_5)/2 \tag{11}$$

$$v_5 = (h_6 - h_7)/2, \tag{12}$$

$$v_6 = ((h_0 + h_4) - (h_2 + h_6))/4, \tag{13}$$

$$v_7 = ((h_0 + h_2 + h_4 + h_6) - (h_1 + h_3 + h_5 + h_7))/8 \tag{14}$$

SetB:

$$v_0 = (h_0 - h_4)/2, \tag{15}$$

$$v_1 = (h_1 - h_5)/2, \tag{16}$$

$$v_2 = (h_1 - h_2)/2 \tag{17}$$

$$v_3 = (h_3 - h_4)/2 \tag{18}$$

$$v_4 = (h_5 - h_6)/2 \tag{19}$$

$$v_5 = (h_7 - h_0)/2 \tag{20}$$

$$v_6 = ((h_1 + h_5) - (h_3 + h_7))/4 \tag{21}$$

$$v_7 = ((h_0 + h_1 + h_2 + h_3) - (h_4 + h_5 + h_6 + h_7))/8 \tag{22}$$

As shown in Figure 5, the transformed descriptor will be divided according to the original SIFT. Each block is an 8-dimensional vector. The first block h0 uses the SetA transformation scheme, the second block h1 uses the SetB transformation scheme, and so on.

According to relevant experimental experience, A and B adopt different conversion methods, respectively, for the subsequent feature quantification robustness and better recognition performance. In addition, among the 8 gradients of the SIFT descriptor, adjacent gradients, especially the gradients connected horizontally and vertically, often have a strong correlation. After the abovementioned transformation of the gradient, this correlation is still maintained.

A h_0	B h_1	A h_2	B h_3
B h_4	A h_5	B h_6	A h_7
A h_8	B h_9	A h_{10}	B h_{11}
B h_{12}	A h_{13}	B h_{14}	A h_{15}

Figure 5: Descriptor diagram after SIFT transformation.

Therefore, combined with the subsequent quantization to use the processing method shown above on the spatial adjacent histogram, the discrimination ability of the quantized local compact descriptor can be increased, and further, the descriptor becomes scalable and can be changed into different sizes.

2.2.4. Consistency Check. First, the quantized local features are used for feature matching, and the matching pair between the candidate image and the query image is obtained, and then the relative DISTRACT algorithm is used for geometric verification.

For any set of matching point pairs, x_n is the coordinates of the first image, and y_n is the coordinates of the second image. Defining its matching pair distance as follows:

$$Z_{ij} = \ln \frac{\left\| x_i - x_j \right\|}{\left\| y_i - y_j \right\|}. \tag{23}$$

Then, use the chi-square test to test with the corresponding chi-square probability distribution model to test whether it meets the null hypothesis or the opposite hypothesis. The corresponding probability distribution model expression is as follows:

$$f_Z(z\,;a) = 2\left(\frac{ae^z}{e^{2z} + a^2}\right)^2. \tag{24}$$

Using the above formula to construct the distance matrix between the matching points, calculate the eigenvalues and eigenvectors of the matrix, and use the following formula to estimate the number of matching pairs after the mismatch is eliminated.

$$m = 1 + \frac{\mu}{\sum_{\max} d(k)}. \tag{25}$$

Among them, μ is the main feature value, and $d(k)$ is the distance between the k-th matching pair.

In this way, the first m results with larger eigenvectors in the distance matrix are the correct matching pairs after eliminating mismatches. Letting r = first nearest neighbor/second nearest neighbor, and use the following formula to calculate the score:

$$\varpi(r) = \cos\left(\frac{\pi r}{2}\right) \tag{26}$$

Accumulate all the correct matching pairs of $\varpi(r)$, and use this value to reorder the candidate set images. According to the sorted result, the final search result can be obtained.

2.3. Supporting Technology of Augmented Reality

2.3.1. Components of Augmented Reality. From the composition of mobile augmented reality, mobile computing platform, tracking and registration method, display and interaction technology, wireless network technology, and data storage and access technology are its five supporting technologies.

2.3.2. Tracking and Registration Method. Tracking and registration technology is the key to mobile augmented reality systems. The quality of tracking and registration technology directly determines whether virtual information can be accurately superimposed on the real physical environment. Currently, there are three main types of tracking and registration methods commonly used (the tracking and registration method based on hardware tracker, the tracking and registration method based on machine vision, and the tracking and registration method based on wireless network).

2.3.3. Display and Interactive Technology. The visual channel is the most important information interface between humans and the external environment. Nearly 80% of the information that humans obtain from the outside world is obtained through the eyes. Therefore, display technology appears to be particularly important in augmented reality systems and is one of the key technologies of augmented reality. (At present, there are three main display technologies in common use: helmet-mounted display technology, handheld display technology, and space display technology.)

The interaction technology in augmented reality is closely related to display technology and tracking registration technology. The commonly used interaction technologies are mainly divided into three categories: interaction technology based on hardware devices, interaction technology based on pattern recognition, and interaction technology based on software interface.

(1) Interactive technology based on hardware equipment. The hardware-based interaction technology mainly relies on some hardware devices (such as keyboard, mouse, and data gloves) to realize the interaction between the user and the virtual scene

(2) Interactive technology based on pattern recognition. Pattern recognition technology is the basic technology of artificial intelligence. It is a technology to classify and describe images or various physical objects. It has a wide range of applications in machine vision. (It involves the recognition of graphics, images, and text, as well as the measurement, classification, and description of tangible objects.) The commonly used pattern recognition technologies for augmented reality mainly include speech recognition, text recognition, and facial expression recognition

(3) Interactive technology based on software interface (commonly used interactive tools are menus, special tools and special marks, etc.). Man-machine interface (also known as user interface or user interface) is the medium for interaction and information exchange between the system and the user. Its main function is to realize the conversion between the internal form of information and the form acceptable to human beings

2.3.4. Wireless Network Technology. The wireless communication network has the characteristics of low delay, reliable mobility, and sufficient data transmission rate, and the wireless communication technology is applied to the mobile augmented reality system (it can greatly improve the performance of mobile augmented reality and broaden the application scope of mobile augmented reality). Using the wireless communication network, the mobile augmented reality system can communicate with the confidence center and the Internet, obtain the required information, and collaborate with other users.

2.3.5. Data Storage and Access Technology. If the mobile augmented reality system needs to provide information related to the current personal roaming environment, it needs to obtain information related to the current person's environment, and these data must conform to the current context of the person's current environment. Through database, middleware, and context-based service technology, it can solve the problems of data and service discovery, management, and access.

2.3.6. Application Areas of Augmented Reality. The application field of augmented reality technology is very wide. In recent years, with the rapid development of mobile positioning, wireless communication networks, the Internet, mobile computing, and other technologies, augmented reality technology has been applied more and more in the fields of navigation, tourism and culture, entertainment and education, commerce, and military, as shown in Figure 6.

2.3.7. Computing Platform. The choice of mobile computing platform should consider the following factors: platform computing power, appearance and ruggedness, power consumption, multimedia and graphics processing capabilities, availability of extensions and interfaces, availability of memory and storage space, component upgrades, operating system and software development environment, technical support, and prices provided.

3. Cultural and Creative Product Display Survey Experiment

3.1. Selection of Rendering Engine. In the augmented reality system, the enhanced content includes images, text, sound, 3D models, and videos. This article gives some suggestions for the enhanced content from the perspective of rendering efficiency based on development experience, as shown in Table 1 and Table 2.

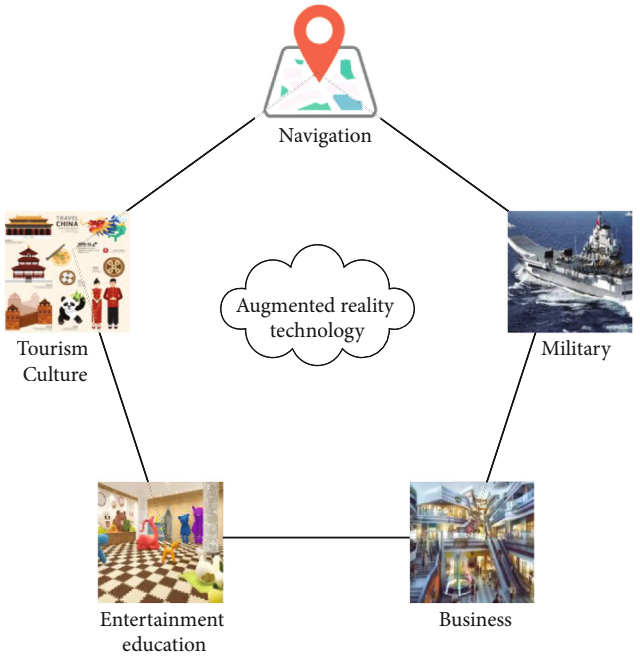

Figure 6: Application areas of augmented reality technology

Table 1: Comparison of image formats supported by Irrlicht and OGRE.

Image format	Irrlicht	OGRE
.PSD	X	X
.JPG	X	X
.PNG	X	X
.TGA	X	X
.BMP	X	X
.GIF	—	—
.PCX	X	—
.DDS	—	X

X in the table indicates that the project is supported or owned, and — indicates that the project is not supported or owned.

As can be seen from the above table, the rendering content types supported by the two engines are basically the same, which can meet the system requirements of mobile augmented reality. However, the ZLIB certificate owned by Irrlicht means that it has the greatest degree of freedom and can be used arbitrarily in commercial and non-commercial products, even if the use of Irrlicht is not mentioned, and the OGRE certificate type is LGPL, which requires the source code of the engine to be released together with the product code. This has resulted in especially developed applications that usually take up a large space and do not meet the requirements of lightweight systems.

3.2. Questionnaire Survey. In order to be able to conduct a survey of the user's experience during the experiment, a questionnaire survey experiment was designed to investigate the user's expectations and user experience during the use of augmented reality technology and then analyze the use of augmented reality technology through user feedback.

Table 2: Comparison of 3D file formats supported by Irrlicht and OGRE.

3D file format	Crystal space	Irrlicht	OGRE
.3DS	X	X	—
.B3D	—	X	—
.OBJ	X	X	—
.CSM	—	X	—
.DAE	—	X	—
.DMF	—	X	—
.OCT	—	X	—
.X	—	X	—
.MS3D	—	X	—
.MY3D	—	X	—
.LMTS	—	X	—
.BSP	—	X	—
.MD2	X	X	—
.MDL	X	—	—
.ASE	X	—	—
.POV	X	—	—
OGRE format	—	X	X

X in the table indicates that the project is supported or owned, and — indicates that the project is not supported or owned.

Table 3: Usage of augmented reality.

Usage	Male	Female	Total
Use frequently	4	1	5
Occasionally use	15	3	18
Will be used	12	7	19
Never use	31	11	42

First, before conducting the questionnaire, give a conceptual brief introduction to augmented reality technology, design some questions related to augmented reality, conduct a general background investigation on the questionnaire survey personnel, collect the statistics of the survey results, and screen and analyze them. The questions raised during our investigation should mainly focus on issues related to augmented reality technology. A total of 100 questionnaires were distributed in this survey, of which 84 were valid questionnaires, with 62 males and 22 females. The age range was 18-50 years old, and people over 80 had a bachelor's degree.

The results of the survey on the use of augmented reality are shown in Table 3.

The survey results of the usage scenarios of augmented reality technology are shown in Table 4.

The results of the survey of interest in augmented reality technology are shown in Table 5.

We can see from the above three tables that Table 3 reflects the use of mobile augmented reality, where the proportion of people who use it frequently is very small, and the vast majority of people are still not using augmented reality

Table 4: Use scenarios of augmented reality technology.

Scenes to be used	Male	Female	Total
Information browsing	27	13	40
Navigation	18	6	24
Museum	13	2	15
Other	4	1	5

Table 5: Interest in augmented reality technology.

Interest	Male	Female	Total
None	2	1	3
Low	7	3	10
Middle	16	2	18
High	14	3	17
Very high	23	13	36

technology. Table 4 reflects the use of mobile augmented reality in various fields. It can be seen from the table that the commonly used fields of mobile augmented reality are information browsing and navigation and there are many other fields of mobile augmented reality use. Table 5 reflects the user's interest in using mobile augmented reality. From the table, it can be seen that users are very interested in using mobile augmented reality.

4. Augmented Reality Effect

4.1. Interactive Experience Analysis. The development of modern interactive technology can solve the practical problems of cultural content such as "invisible, intangible, and inexperienced." In the experience process, the relative movement of the tracking object in the camera and the real environment (such as the change of the scene image of the real scene and the change of the angle rotation through the camera) is used to obtain the change of the position and orientation of the experiencer and the real environment. According to the changes of these perspectives, the distance and orientation of virtual objects superimposed in the real scene will change accordingly. This is one of the most basic interactive technologies in experience. In order to explore the changes in the user's sense of interaction during actual use, this article conducts a survey and analysis of the two kinds of augmented reality interaction before and after the improvement. The results of the analysis are shown in Figure 7.

From the above comparative analysis of the augmented reality interaction of the cultural and creative products before and after the improvement, we can see that before the improvement, the number of men who felt good in the sense of interaction was 51, while the number of women was 25; the number of people who felt good was good, where the number of men is 78 and the number of women is 41; the average number of men is 91, and the number of women is 66; and the number of men with a poor sense of interaction is 114, while the number of women is 84. Generally speaking, the feeling of augmented reality interaction before the improvement has been maintained at a relatively poor level, regardless of gender. On the other hand, after the improvement, the number of men who feel that the sense of interaction is excellent is 157, while the number of women is 70; the number of men who feel good is 81, while the number of women is 47; the number of men who feel average is 46, while the number of women is 38; and the number of men who have a poor sense of interaction is 50, while the number of women is 61. Generally speaking, after the improvement, the feeling of augmented reality interaction is basically maintained at a good or excellent level. Therefore, we can conclude that after the improvement, the experience of dynamic display interaction of cultural and creative products is very good.

4.2. Dynamic Display Design of Cultural and Creative Products. In order to conduct a research on the dynamic display scheme of cultural and creative products, this section explores the impact of augmented reality technology on product evaluation and purchase intention while emphasizing the attributes and characteristics of different historical cultural and creative products. At the same time, in order to eliminate the influence of the degree of familiarity and preference of augmented reality technology on the experimental results, we also asked the subjects to answer their own familiarity and attitude towards augmented reality technology. Finally, the subjects were asked to answer the items related to demographic variables. First of all, in order to explore the question of whether it is better to display the creative attributes of cultural and creative products through augmented reality technology or to display their historical attributes during the display of cultural and creative products, we will investigate them in five different categories. The site conducts statistics on its results, and the results are shown in Figure 8.

From the above figure, we can see from the comparison of the two different attributes of cultural and creative that emphasized the creative attributes of the product: the number of consumers rated as good in the first venue is 147, the number of consumers rated as ordinary is 103, and the number of consumers rated as bad is 50; in the second venue, the number of consumers rated as good was 124, the number of consumers rated as ordinary was 114, and the number of consumers rated as bad was 62; in the third venue, the number of consumers rated as good is 139, the number of consumers rated as ordinary is 89, and the number of consumers rated as bad is 72; the number of consumers rated as good in the fourth venue is 155, the number of consumers rated as average is 94, and the number of consumers rated as bad is 51; in venue 5, the number of consumers rated as good was 133, the number of consumers rated as average was 77, and the number of consumers rated as bad was 90; it can be seen that in the display of cultural and creative products, consumers who emphasize creativity are rated as good or mostly.

In contrast, among the evaluations obtained by emphasizing historical attributes, the number of consumers rated as good in the first venue is 84, the number of consumers rated as ordinary is 91, and the number of consumers rated as bad is 125; the number of consumers rated as good in the second venue is 69, the number of consumers rated as normal is

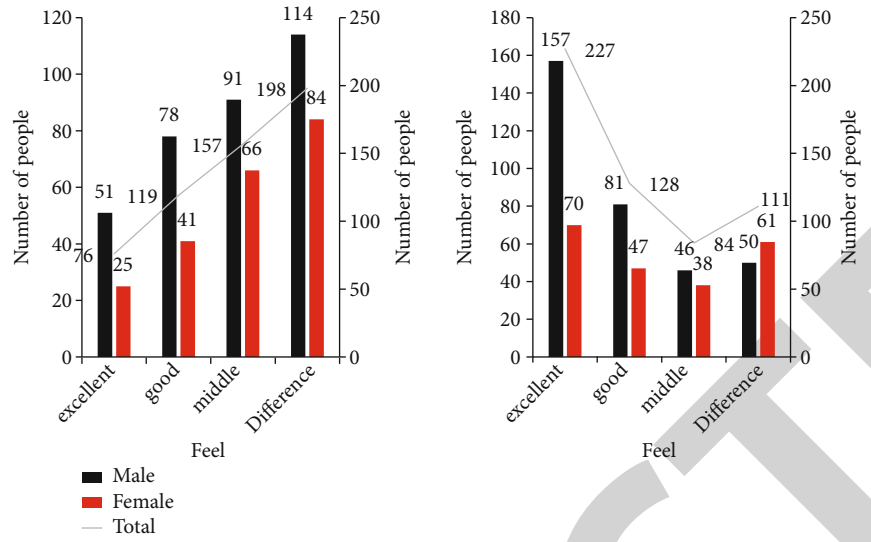

Figure 7: Comparison of the sense of interaction between cultural and creative products before and after the improvement.

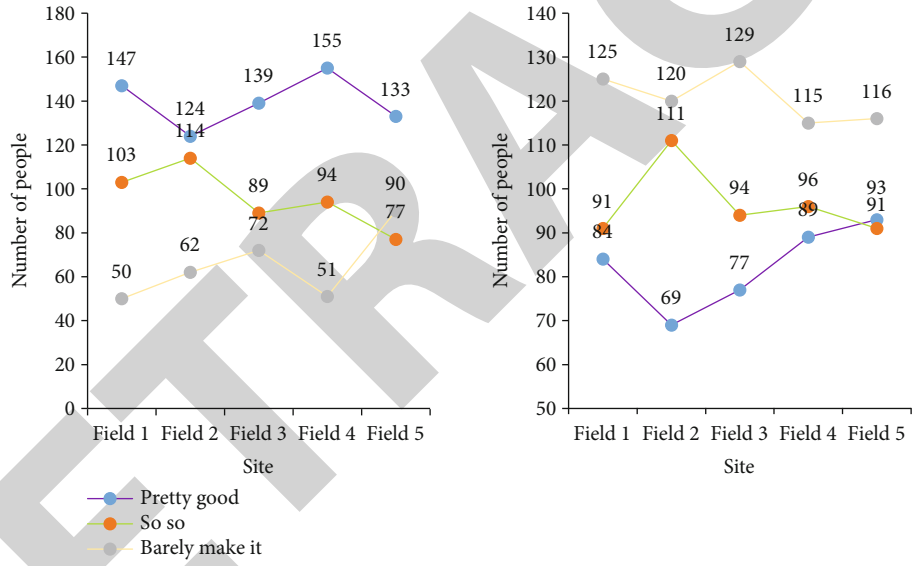

Figure 8: Comparison of consumer evaluation of cultural and creative products emphasizing the creative and historical attributes of products.

111, and the number of consumers rated as bad is 120; in the third venue, the number of consumers rated as good was 77, the number of consumers rated as average was 94, and the number of consumers rated as bad was 129; the number of consumers rated as good in the fourth venue is 89, the number of consumers rated as ordinary is 96, and the number of consumers rated as bad is 115; the number of consumers rated as good in venue 5 is 93, the number of consumers rated as average is 91, and the number of consumers rated as bad is 116; it can be seen that the evaluation of historical attributes in the display process is generally not high. The main reason is that consumers nowadays are more interested in curiosity and historical attributes may be a bit too boring for them. At the same time, in order to investigate the influence of augmented reality technology that emphasizes two different attributes on consumers' purchase intention, this article also investigates the purchase intention of the same people at five venues. The results are shown in Figure 9.

Through the statistical survey of the above consumers' purchasing intentions, it can be concluded that among the consumers who emphasize the creative attributes, the number of customers with strong purchasing intentions in venue 1 is 69, the number of customers with general purchasing intentions is 87, and the number of customers without purchasing intentions is 144; in the second venue, the number of customers with strong purchase intention is 84, the number of customers with general purchase intention is 91, and the number of customers without purchase intention is 125; the number of customers with strong purchasing

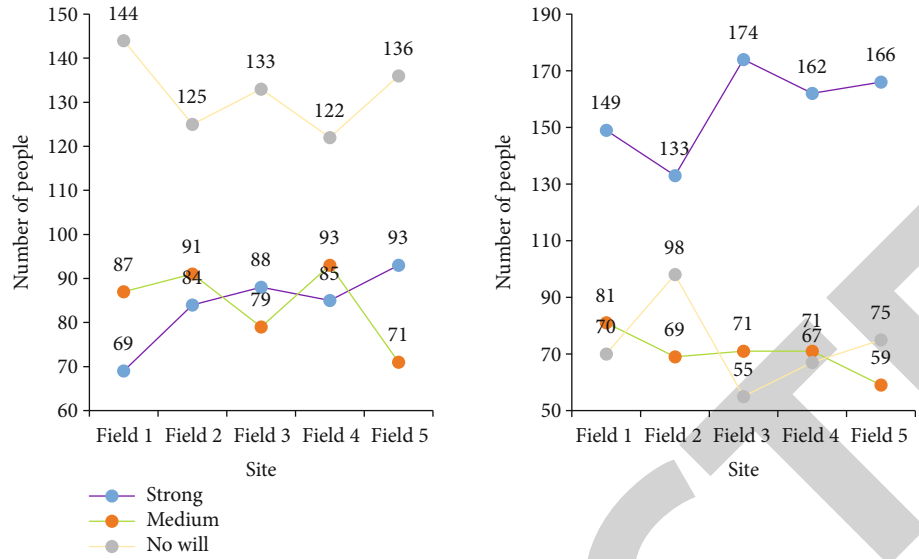

Figure 9: The impact of augmented reality technology and attribute emphasis strategy on product purchase intention.

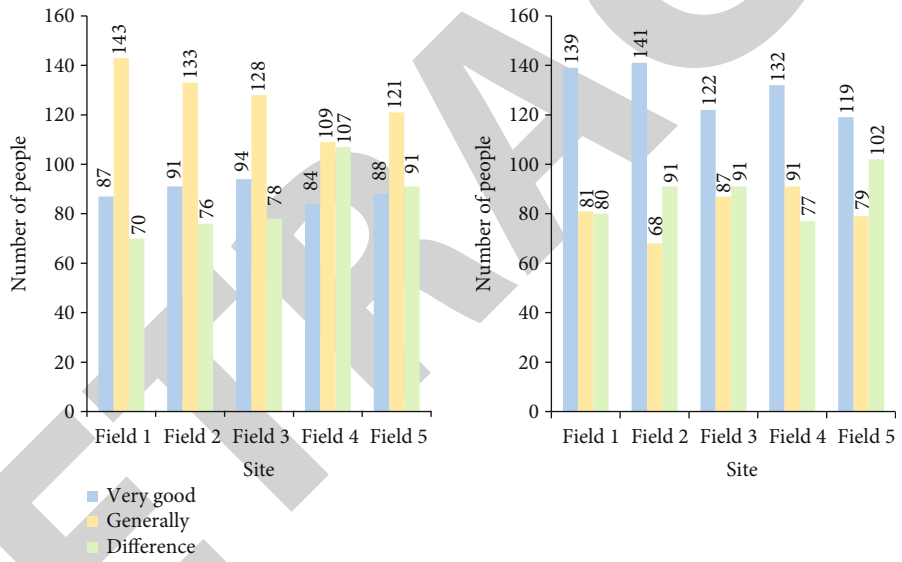

Figure 10: The impact of whether augmented reality technology is adopted on consumers' purchase intention.

intentions in the third venue is 88, the number of customers with general purchasing intentions is 79, and the number of customers without purchasing intentions is 133; the number of customers with strong purchasing intentions in the fourth venue is 85, the number of customers with general purchasing intentions is 93, and the number of customers without purchasing intentions is 122; in venue 5, the number of customers with strong purchasing intentions is 93, the number of customers with general purchasing intentions is 71, and the number of customers without purchasing intentions is 136; it can be seen that although customers are more interested in creative attributes during the display process, they are just waiting and watching with a curious mentality, and the willingness to buy is generally not strong.

In the display of cultural and creative products that emphasize historical attributes, the number of customers with strong purchasing intentions in the first venue is 149, the number of customers with general purchasing intentions is 81, and the number of customers without purchasing intentions is 70; in the second venue, the number of customers with strong purchasing intention is 133, the number of customers with general purchasing intention is 69, and the number of customers without purchasing intention is 98; the number of customers with strong purchasing intentions in the third venue is 174, the number of customers with general purchasing intentions is 71, and the number of customers without purchasing intentions is 55; the number of customers with strong purchasing intentions in the fourth venue is 162, the number of customers with average purchasing intentions is 71, and the number of customers without purchasing intentions is 67; in venue 5, the number of customers with strong purchasing intentions is 166, the

number of customers with general purchasing intentions is 59, and the number of customers without purchasing intentions is 75; different from the emphasis on creative attributes, in pavilions that emphasize historical attributes, the willingness to buy is still relatively strong, and consumers are willing to pay for the historical attributes of cultural and creative products.

4.3. The Impact of Augmented Reality Technology on Cultural and Creative Products. The above analysis conducted a detailed comparative analysis of consumers' evaluations and purchase intentions under two different cultural and creative product attributes, and finally, in the process of displaying cultural and creative products, consumers are more willing to pay for the historical attributes of cultural and creative products. Therefore, in this section, in order to explore the impact of augmented reality technology on their purchase intentions, five cultural and creative product historical attribute pavilions that use augmented reality technology and five cultural and creative product historical attribute pavilions that do not use augmented reality technology are designed. The result is shown in Figure 10.

It can be seen from the comparison of the purchase intention of consumers who use augmented reality technology and those who do not use the technology in the display of cultural and creative products with historical attributes in the above figure: When not in use, the number of people willing to buy at venue one is 87, and after using this technology, the number of people in venue one is 139; when not in use, the number of people willing to purchase venue two is 91, and after using this technology, the number of people who are willing to buy venue two is 141; when not in use, the number of people willing to buy venue three is 94, and after using this technology, the number of people in venue three is 122; when not in use, venue four is willing to purchase 84 people. After using this technology, venue four has 132 people; when not in use, venue five is willing to purchase 88 people, and after using this technology, venue five has 119 people.

It can be seen that the purchase intention of consumers has increased by 43% after the use of augmented reality technology. Consumers' experience after using augmented reality technology can be more intuitive, can promote the recognition of cultural and creative products, and can very effectively improve the dynamic display effect of cultural and creative products.

5. Conclusions

This article studies the dynamic display design of cultural and creative products. In order to better show its effect, digital augmented reality technology was added, and the technical principle of the technology was dismantled in detail, and it was understood and analyzed, and the key visual search technology was also detailed. The specific implementation process of digitization is also introduced in detail and improved so that the visual search technology can be more suitable for our research topics and for the dynamic display of cultural and creative products. Finally, experiments and analysis are designed to study the effect of its display, and the influence of the use of technology on consumers' feelings and consumption intentions is analyzed and compared, and the effect of augmented reality technology is fully guaranteed. Improvements in storytelling and resonating with audiences can be made through digital interaction technology. First, digital technology can easily provide virtual scenes (VR virtual reality), providing a realistic environment for narrative expression; secondly, the fusion of virtual images and real scenes can transform into "real" scenes that are higher than actual.

Data Availability

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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