Hindawi
Journal of Sensors
Volume 2024, Article ID 9873762, 1 page
https://doi.org/10.1155/2024/9873762

Retraction

Retracted: Research on the Application of Visual Sensing Technology in Art Education

Journal of Sensors

Received 23 January 2024; Accepted 23 January 2024; Published 24 January 2024

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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) Manipulated or compromised peer review

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.

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.

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[1] W. Mao and B. Zhang, "Research on the Application of Visual Sensing Technology in Art Education," *Journal of Sensors*, vol. 2021, Article ID 2406351, 10 pages, 2021.

Hindawi
Journal of Sensors
Volume 2021, Article ID 2406351, 10 pages
https://doi.org/10.1155/2021/2406351

Research Article

Research on the Application of Visual Sensing Technology in Art Education

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Received 2 September 2021; Revised 26 September 2021; Accepted 29 October 2021; Published 12 November 2021

Academic Editor: Haibin Lv

It is essential to have a new understanding of the development of visual sensing technology in digital image art at this stage, in order to make traditional art education have new professional ability teaching. Based on the current research results in related fields, a three-dimensional (3D) image visual communication system based on digital image automatic reconstruction is proposed with two schemes as the premise. In scheme 1, the hardware part is divided into two modules. The hardware used by the analysis of the 3D image layer module is the HUJ-23 3D image processor. The acquisition of a 3D image layer module uses the hardware of a realistic infrared camera. The software of the system consists of two parts: a 3D image computer expression module and a 3D image reconstruction module. A simulation platform is established. The test data of 3D image reconstruction accuracy and visual communication integrity of the designed system show that both of them show a good trend. In scheme 2, regarding digital image processing, the 3D image visual perception reconstruction is affected by the modeling conditions, and some images are incomplete and damaged. The depth camera and image processor that can be used in the visual communication technology are selected, and their internal parameters are modified to borrow them in the original system hardware. Gaussian filtering model combined with scale-invariant feature transform (SIFT) feature point extraction algorithm is adopted to select image feature points. Previous system reconstruction technology is used to upgrade the 3D digital image, and the feature point detection equation is adopted to detect the accuracy of the upgraded results. Based on the above hardware and software research, the 3D digital image system based on visual communication is successfully upgraded. The test platform is established, and the test samples are selected. Unlike the previous systems, the 3D image reconstruction accuracy of the designed visual communication system can be as high as 98%; the upgraded system has better image integrity and stronger performance than the previous systems and achieves higher visual sensing technology. In art education, it can provide a new content perspective for digital image art teaching.

1. Introduction

Mastering the basic theory of educational science and the current development trend is the basic professional ability of art education [1]. Visual sensing technology has been widely used with the development of sensing technology, electronic technology, and computer technology [2]. Art education should have a new learning perspective to recognize the development of visual sensing technology, so that digital image art can give them new thinking. First, it is known that the most common visual sensing products in life are cameras and mobile phones, followed by cameras in public places and traffic control. Compared with human vision, visual sensing technology has incomparable advantages, so it will be widely used in accurate quantitative perception, unsafe environment monitoring, and objects that are difficult to observe. On the other hand, three-dimensional (3D) image plays a great auxiliary role in visual sensing technology. Therefore, the 3D image has gradually become a common application in the digital image. With the development of the times and the continuous improvement of digital imaging technology, its usable ability has

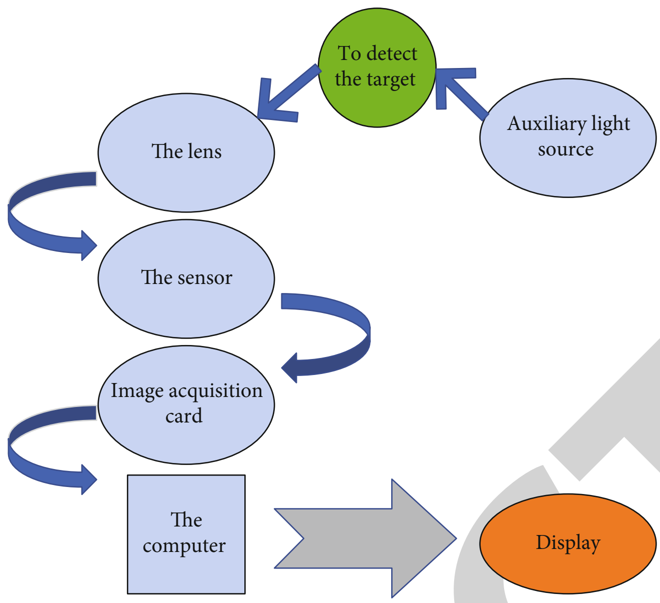

Figure 1: Image processing technology flow.

been gradually improved [3]. Therefore, upgrading the 3D image visual communication system to conduct research and analysis is more in line with the requirements of the real environment.

In recent years, many scholars have also made different degrees of exploration and achieved satisfactory research results [4]. At this stage, the most used is the 3D image visual communication system based on visual interaction technology. It uses 3D visual interaction technology to complete the visual communication of 3D images and realize the composition of the 3D image visual communication system. The 3D image visual communication system based on the idea of image blending is guided by the concept of image blending to complete the visual communication of 3D images, so that the 3D image visual communication system can be composed. Although the designed system can be used, it also has its shortcomings when collecting the first digital image, such as the interference of many uncertain factors [5].

Based on the above contents, two schemes are adopted to propose a 3D image visual communication system based on automatic reconstruction of digital image. After various tests, better system performance is achieved, and it has a great improvement in the accuracy of 3D image. Visual sensing can be far away from the detection target and collect a large amount of information and data. It not only optimizes people's working environment but also improves production efficiency. The cognition of new sensing technology, based on communication teaching in art education, gives the power of the times to students' professional ability. The research content can be used as a teaching reference [6], which is of great significance to promote art education.

2. Materials and Methods

2.1. System Research Based on HUJ-23 Processor. The image processing technology is a technology to analyze and process images to meet visual, psychological, and other requirements (Figure 1). Most images are stored in digital form, so image processing is mostly used to replace digital image processing. Scheme 1 is the design of a 3D image visual communication system with automatic upgrading of the digital image. Drawing on the previous research results, the design is to use the digital image automatic reconstruction technology to design a 3D image visual communication system based on digital image automatic reconstruction, which has a good system performance.

The hardware of the system is divided into two modules: processing 3D image layer module and collecting 3D image layer module [7]. The hardware of the system processing 3D image layer module is the HUJ-233D image processor. The acquisition of a 3D image layer module adopts a real infrared camera [8]. The software of the system consists of a 3D image computer expression module and a 3D image reconstruction module. The responsibility of the 3D image computer expression module is to computerize the 3D image through computer technology. The 3D image reconstruction module can use the digital image automatic reconstruction technology to complete the automatic reconstruction of the 3D image [9].

The hardware of a 3D image visual communication system based on digital image automatic reconstruction has two modules: processing 3D image layer module and collecting 3D image layer module. The hardware used to process the 3D image layer module is the HUJ-233D image processor. The 3D image processor has four CPUs (central processing unit), adopts Snapdragon processor, and has an excellent 3D data processing capability. The acquisition 3D image layer module adopts the realistic infrared camera as the hardware. Figure 2 displays the numerical details of the used realistic infrared camera.

The software of a 3D image visual communication system based on digital image automatic reconstruction

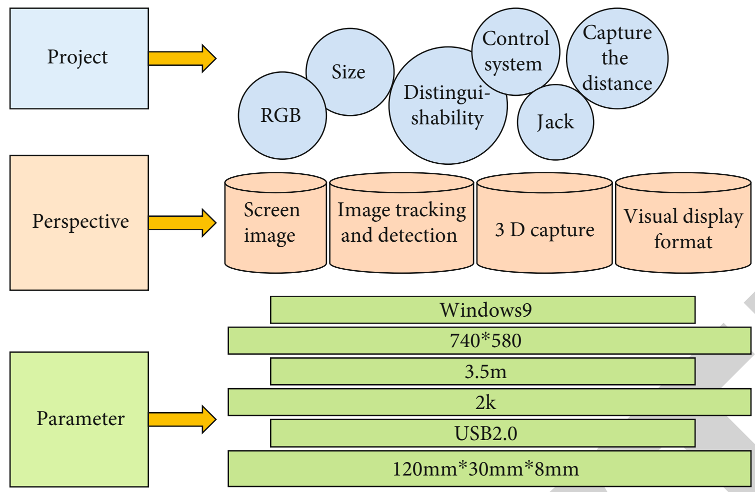

Figure 2: Parameters of the selected realistic infrared camera.

consists of a 3D image computer expression module and a 3D image reconstruction module [10]. The main function of the 3D image computer expression module is to use computer technology to computerize the 3D image. The first step is to decompose the 3D image into data blocks, including Ox4D4D, Ox3D3D, 0x4000, 0x4200, 0x4110, and 0x4120. Figure 3 is a detailed data summary of six data blocks.

The second step is to express the visual texture features of the 3D image through each data block, and the texture should be added in the expression process. After the texture acquisition is completed, the texture should be mapped, in which the focus will change, so the mapping size will change. The detailed point of texture mapping is to use the relationship between the coordinate system of the 3D image in the 3D model and the coordinate value in the texture coordinate system, so as to add the texture at the corresponding position in the 3D image in the 3D model. In the process of real processing, the following three situations will occur. The first is that there are many texture elements in the texture space, in which the minimum unit of two-dimensional texture corresponds to a 3D model pixel. The second is that each texture and texture element corresponds to a plurality of 3D model pixels. The third is that each texture and texture element corresponds to a 3D model pixel. The implementation of targeted treatment is particularly necessary for these three situations. The corresponding treatment countermeasures are as follows: implementation of compression filtration, implementation of amplification filtration, and no additional treatment. The texture is obtained by shooting, so coordinate conversion is a crucial difficulty. The texture shooting process and coordinate system are drawn in detail (Figures 4 and 5).

The coordinate axes and point coordinates in Figure 4 are listed in Figure 6. In the coordinate conversion process, Figure 6 is a detailed conversion process from a point in the coordinate system corresponding to the 3D image in 3D model to a point in the coordinate system corresponding to the camera.

$$N = A \times B \times C \times n. \tag{1}$$

In equation (1), n is the point in the coordinate system corresponding to the 3D image in the 3D model; N is the point in the coordinate system corresponding to the camera; B is the matrix corresponding to the coordinate rotation of the 3D image 3D model coordinate axial camera; A is the projection matrix; C is the matrix corresponding to the coordinate axis translation of the 3D image 3D model coordinate axis camera. In addition, the details of corresponding expressions of A, B, and C are as follows:

$$A = \begin{Bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & \frac{1}{f} & 0 \end{Bmatrix}, \tag{2}$$

$$B = \begin{Bmatrix} W_{11} & W_{12} & W_{13} & 0 \\ W_{21} & W_{22} & W_{23} & 0 \\ W_{31} & W_{32} & W_{33} & 0 \\ 0 & 0 & 0 & 1 \end{Bmatrix}. \tag{3}$$

Equation (3) is the conversion value corresponding to the coordinate axis rotation of the 3D image 3D model coordinate axis camera.

$$C = \begin{Bmatrix} 1 & 0 & 0 & -x_0 \\ 0 & 1 & 0 & -y_0 \\ 0 & 0 & 1 & -z_0 \\ 0 & 0 & 0 & 1 \end{Bmatrix}. \tag{4}$$

In (4), x_0, y_0, and z_0 are the quantities of the origin in the coordinate system corresponding to the camera in the 3D

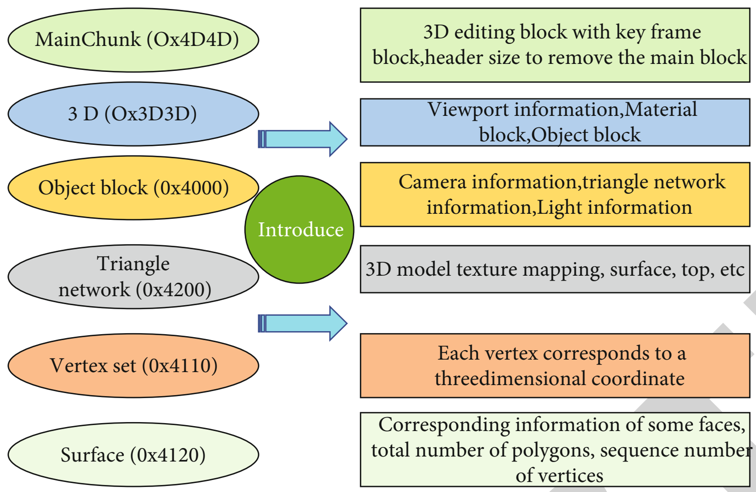

Figure 3: Details of data block.

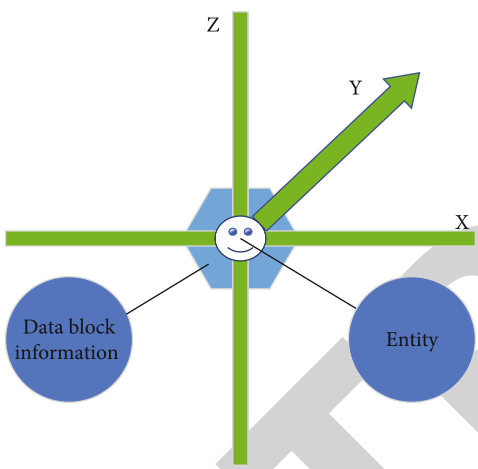

Figure 4: Schematic diagram of coordinate system.

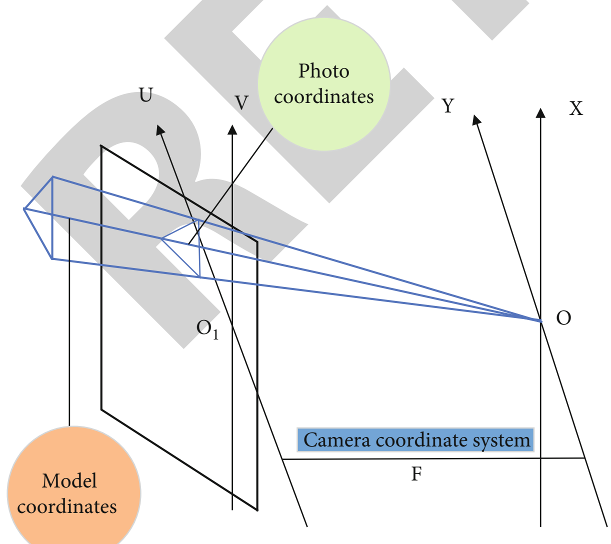

Figure 5: Texture shooting process.

image 3D model coordinate system. The expression of n is detailed as follows:

$$n = (x, y, z, 1)^T. \tag{5}$$

In (5), T is the coordinate system threshold. N can also be expressed by this equation:

$$N = (qX, qY, qZ, q)^T. \tag{6}$$

In (6), (qX, qY, qZ, q) represents the points in the coordinate system corresponding to the camera. Through the coordinate system diagram, the mapping relationship between the points in the coordinate system corresponding to the 3D image 3D model and the points in the coordinate system corresponding to the texture photo is expressed in detail as follows:

$$\begin{cases} X = U, \\ Y = V. \end{cases} \tag{7}$$

Then, the following equation is derived:

$$n' = \begin{bmatrix} qU \\ qV \\ q \end{bmatrix} = E \begin{bmatrix} qX \\ qY \\ qZ \\ q \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} qX \\ qY \\ qZ \\ q \end{bmatrix}. \tag{8}$$

In (8), E is the expression of the mapping matrix; $n^{'}$ is the point in the coordinate system corresponding to the texture photo. Therefore, the mapping relationship between the points in the coordinate system corresponding to the 3D image 3D model and the points in the coordinate system corresponding to the texture photo is detailed as follows:

$$n' = E \times A \times B \times C \times n. \tag{9}$$

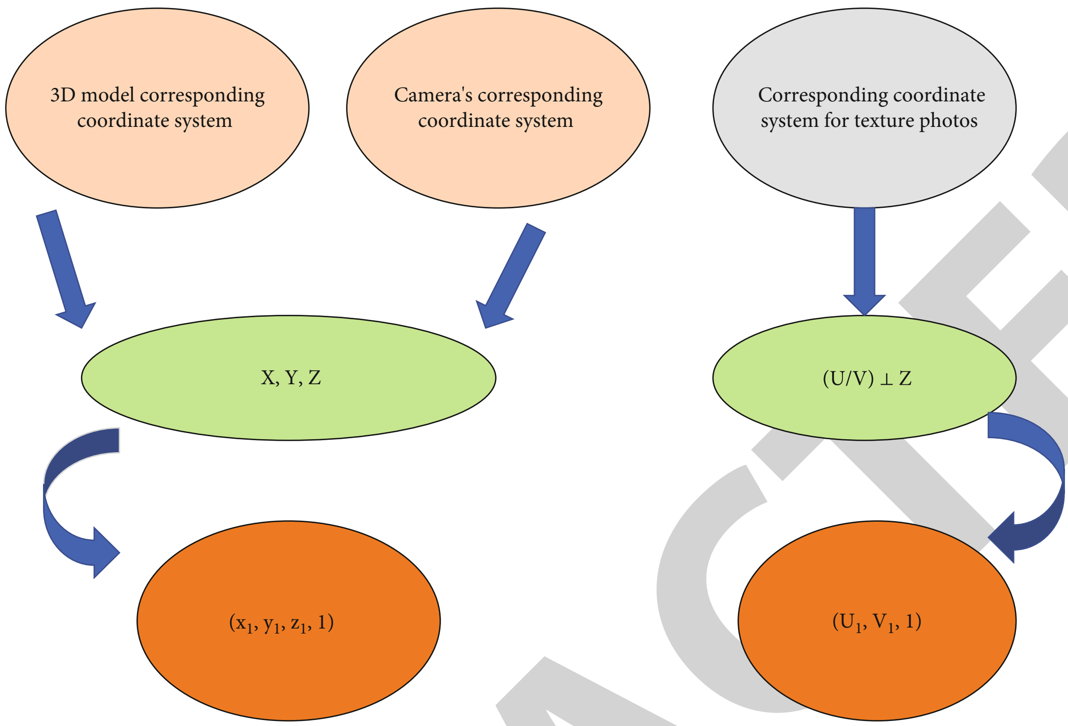

Figure 6: Coordinate axes and point coordinates of each coordinate.

The values of A, B, and C in the equation can be obtained by manually selecting the feature points.

2.2. System Research Based on Tower Processor. The level of digital imaging has been gradually improved with the advent of the digital age, and digital image has been widely used. In previous studies, some scholars have designed reconstruction systems for 3D digital images. The image will be distorted and incomplete in the application. A new 3D digital image reconstruction system is proposed based on the above phenomenon. The hardware of the system has been redesigned according to the characteristics of each link of digital image processing. The structure still includes three parts: image acquisition layer, image processing layer, and image reconstruction layer [11]. The initial data of 3D digital image reconstruction is the result of comparison and fusion of depth data and color data collected at the same time point. In the previous reconstruction system, the corresponding color camera is configured. The depth camera is adopted to obtain the depth data to ensure that the collected initial information can be adopted for visual communication technology [12]. An infrared realistic camera will be used in this design. Figures 7 and 8 are detailed images.

Figure 7: Infrared realistic camera.

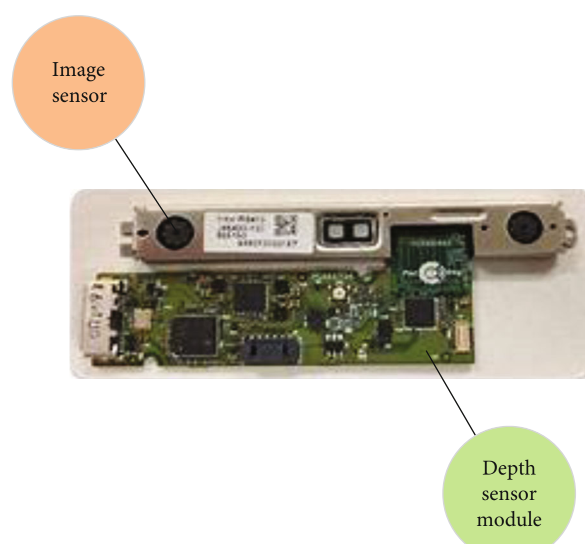

Figure 8: Realistic camera sensor.

The infrared realistic camera obtains the depth data of the image by using the principle of structured light and 3D ranging and converts the depth data into a depth image. Figure 8 is a realistic camera sensor.

It is difficult for depth images not to encounter the interference of object surface occlusion and material. The image information should be preprocessed after collection. Figure 2 still uses the parameter setting of the camera selected by the system of this scheme. It is the basis for camera selection, and the selected equipment is installed into the previous system. The collected image is input into the image data processing device. The image data processing equipment of the previous system cannot process the depth

Figure 9: Image processing equipment.

information, so a new processor is adopted (Figure 9). This design is to use the tower processor to process the image data. Table 1 displays the internal parameters of the processor. The above parameters are adopted to complete the internal settings of the equipment. It is connected with the depth camera to ensure that the data can be transmitted to the information processing equipment, so as to optimize the integrity of the data. The connected equipment is connected with the previous system, and the hardware equipment establishment in the design is completed.

The performance of the original system is optimized with the help of visual communication technology. The system software optimization design is completed to solve the problem of poor image integrity. 3D image reconstruction visual communication optimization system is designed.

The image data captured by the realistic camera is analyzed by using the image filtering technology, the pixel value of unprocessed pixels is estimated by using the Gaussian filtering model, and it and similar pixels are calculated by using the point cloud technology [13]. In the process of image filtering, the weighted value of pixels under a priori conditions is set, so as to make the image edge structure complete and effectively combine the characteristics of depth image to obtain the processed overall image. In the previous system, the processed image is directly modeled to complete 3D image reconstruction, and the reconstruction accuracy is not high enough. In this design, visual communication technology is applied to the image processing process, and various visual symbols are set in the processed image. Symbols are adopted to classify and store the processed images, special files are set, and the accuracy and speed of image processing during reconstruction are optimized. The image format should be focused on in the visual symbol setting to ensure that the symbol is used in the processed image, which is the prerequisite for feature point extraction.

The processed image is used, and feature points are extracted by SIFT feature point extraction technology. First, the 3D scale space is established to convolute the Gaussian function of different scale factors with the image to form a series of images with different scales and image pixels. If the scale space is set to $A(x, y, \partial)$, the original unprocessed

Table 1: Processing parameters of image equipment.

Content	Parameter
Raid card	5 GB cache
Operating system	Windows 8.0
Specification	4 U rack type
CPU	Xeon
Hard disk	2 T
CUP/RAM/RAM	3/ECC/8
Graphics card/GB	5

image is $B(x, y)$, and the Gaussian function is $C(x, y, \partial)$, there is

$$A(x, y, \partial) = B(x, y) \otimes C(x, y, \partial). \quad (10)$$

In (10), ∂ is the scale space factor. It is set to multiply, and each value has a corresponding image. These images are composed of a Gaussian pyramid for feature extraction. Its extreme point is set as the feature point of the image, which is reflected by the definition of DOG. Then, there is

$$D(x, y, \partial) = (C(x, y, n\partial) - C(x, y, \partial)) \otimes B(x, y). \quad (11)$$

In (11), n is the scale contraction factor. The extreme point is found in the result, which is the feature point of the image. The obtained feature points are matched, their consistency is calculated, and the key points of image reconstruction are obtained, so as to realize 3D digital image reconstruction.

Based on the feature points obtained above, the reconstruction of the 3D digital image is completed by using the previous system reconstruction technology. In the reconstruction, the image information after setting the visual symbol is adopted to ensure the integrity of the reconstruction. Figure 10 is a flow chart of 3D digital image reconstruction.

(1) The image is input to obtain the original image

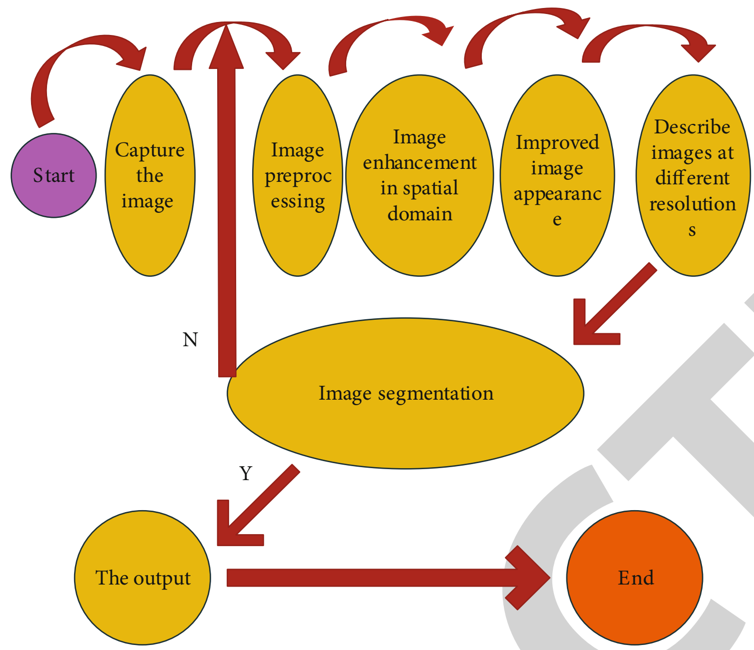

FIGURE 10: 3D digital image reconstruction process.

(2) The image is preprocessed to make the image easier to process and operate than the original image

(3) The missing part of the image spatial domain is supplemented to strengthen the spatial domain of the original image

(4) The appearance of the image is improved and optimized again based on step (3)

(5) Different resolutions are adopted to describe the image, and the optimal resolution is adaptive with the image [14]

(6) The image is segmented after resolution conversion

(7) A new image is output after image processing

After the 3D image is reconstructed through the above process, the reconstructed feature point set is set to u. S is the reconstructed 3D image vector, and the feature point of the original image is p. There is a point coincidence in the reconstructed image, and the coincidence part is not included in the accuracy calculation. The following equation can be obtained:

$$I(n) = \frac{[S(n) \times u + S(n) \times p]}{n}. \tag{12}$$

In (12), n is the 3D image section. The accuracy of the reconstructed 3D image is calculated by equation (12) [15]. After reconstruction, if the error of the 3D image does not exceed 0.1%, it is regarded as qualified. The above software is combined with hardware to complete the design of a 3D digital image reconstruction system based on visual communication.

3. Results

3.1. Performance Detection Based on HUJ-233D Processor. The simulation platform is adopted to test the 3D image reconstruction accuracy and visual communication integrity, so as to test the performance of the designed 3D image visual communication system based on digital image automatic reconstruction. In order to make the data of simulation experiment more diversified and persuasive, several existing 3D image visual communication systems are used as comparison test objects for a comparison test of four systems, which are 3D image visual communication systems based on visual interaction technology, image mixing concept, and virtual reality technology. The simulation platform used is based on a professional engine, 3D production equipment, and image editing tools, and the development language is the C++ programming language. The 3D image data in the multiarchitecture network transmission experiment can ensure the integrity and timeliness of the data. Among them, the selected editor is a highly integrated editor, which can improve the operation speed of a 3D image visual communication system [16].

3D image samples (A-J) are used in the experiment. Table 2 displays the detailed 3D image data of each group.

According to the 3D image reconstruction accuracy test results in Figure 11, first, the 3D image reconstruction accuracy of the designed 3D image visual communication system based on digital image automatic reconstruction, visual interaction technology, image mixing the concept, and virtual reality technology is tested [17]. Figure 11 presents the specific test results. Equation (12) displays the calculation of 3D image reconstruction accuracy. n represents the 3D image section; S represents the 3D image vector; u represents the 3D image feature point set; p represents the original feature point of the 3D image.

Table 2: 3D image data of each group.

Serial number	Size (mm*mm*mm)	Dpi	Texture/color scheme
A	51 * 43 * 73	172	Smooth/deep
B	101 * 173 * 171	320	Smooth/deep
C	34 * 74 * 24	365	Smooth/deep
D	53 * 34 * 71	265	Smooth/normal
E	124 * 365 * 141	233	Smooth/deep
F	54 * 33 * 75	355	Darker texture/deep
G	65 * 178 * 121	256	Darker texture/deep
H	72 * 33 * 52	234	Darker texture/deep
I	72 * 42 * 32	332	Smooth/normal
J	124 * 36 * 78	340	Smooth/deep

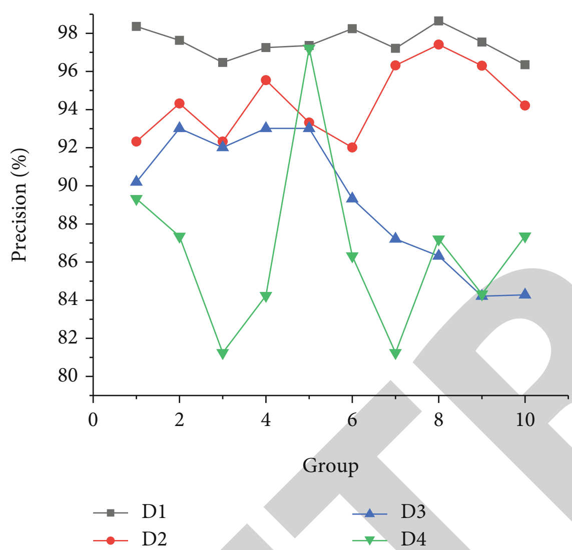

Figure 11: Test results of 3D image reconstruction accuracy (D1: designed visual communication system; D2: visual communication system based on visual interaction technology; D3: visual communication system under the concept of image mixing; D4: visual communication system under virtual reality technology).

The 3D image reconstruction accuracy test in Figure 11 shows that the 3D image reconstruction accuracy of the designed visual sensing system can be as high as more than 98%, which is much higher than the other three systems in the experimental comparison, and can well realize the complete 3D image visual sensing.

Then, the visual communication integrity of the designed 3D image visual communication system based on digital image automatic reconstruction and three comparative experimental systems is tested [18]. Figure 12 displays the test results in detail. It shows that the visual communication integrity of the designed 3D image visual communication system based on digital image automatic reconstruction is better than the three comparative experimental systems, realizing highly complete 3D image visual communication.

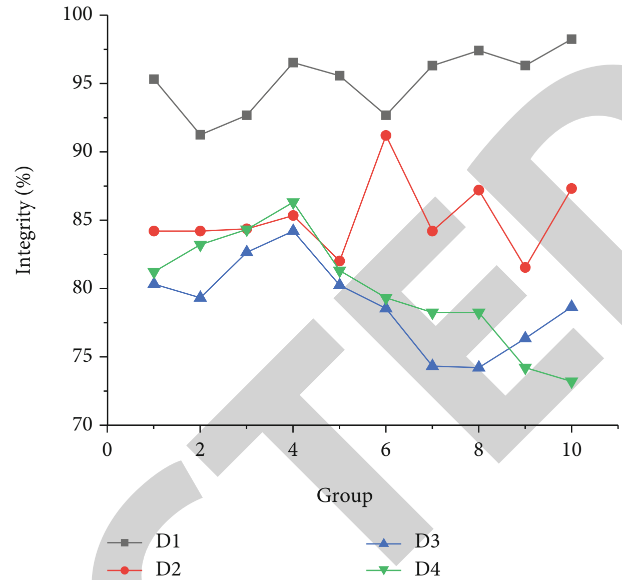

Figure 12: Visual communication test results (D1: designed visual communication system; D2: visual communication system based on visual interaction technology; D3: visual communication system under the concept of image mixing; D4: visual communication system under virtual reality technology).

Table 3: Sample reconstruction results.

Color/texture	Dpi	Size (mm * mm * mm)
Deep/smooth	159	45 * 50 * 60
Deep/smooth	325	99 * 110 * 20
Deep/smooth	359	22 * 45 * 50
Normal/darker texture	234	35 * 50 * 80
Normal/darker texture	223	30 * 170 * 10

3.2. Performance Detection Based on Tower Processor. The first detection method is adopted to implement the system detection, so as to prove the feasibility of the 3D digital image reconstruction system based on visual communication. The system performance test link is set to analyze its feasibility by comparing the reconstructed image integrity.

A 3D reconstruction platform is built according to the reconstruction results. Image editing tools, 3D production equipment, and professional engine are taken as the basis, and the development language is the C++ programming language. A multiarchitecture network is adopted to transmit image data to ensure its timeliness and integrity [19]. Highly integrated equipment is selected as the editor to improve the operation speed of reconstruction.

The platform mentioned in scheme 1 above is used to test the original system and the system designed. In this experiment, five groups of samples are set and reconstructed. Table 3 presents the reconstruction results obtained.

Figure 13 shows the test results.

Figure 13 displays that the integrity of the reconstructed 3D digital image by the designed system is obviously greater than that by the original system. The integrity is good, while

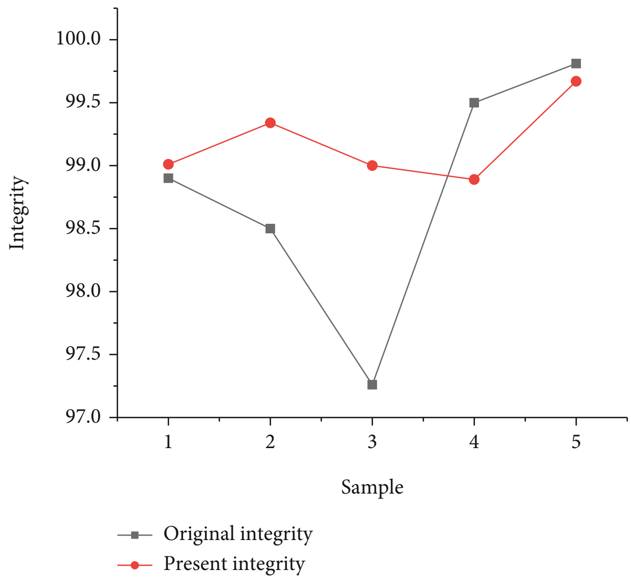

Figure 13: Comparison of test results.

the fluctuation of the original system is unstable [20]. The comparison shows that the texture and color matching of the previous system quite differ from the samples, and the reconstruction results of the designed system are consistent with the samples. It can be concluded that the performance and accuracy of a 3D digital image reconstruction system based on visual communication are better than the previous systems.

4. Conclusion

With the development of the times, art education puts forward new professional requirements in the face of the rapid development of visual sensing technology. Art education can have a new vision to explore in digital image art through this exploration. The designed 3D digital image reconstruction system based on visual communication improves the integrity of 3D digital image reconstruction results, and the reconstruction effect is much better than that of the original system. It reveals that using visual communication technology to set the corresponding visual symbols in the process of image reconstruction can improve the accuracy of reconstruction results. There will be various uncertain factors when the sensor collects the initial digital image. The design of this exploration is to apply digital image automatic reconstruction technology and adopt two schemes to propose a 3D image visual communication system based on digital image automatic reconstruction. After simulation experiments, the designed visual sensing system has good performance in accuracy and integrity and shows a relatively good system performance. Visual sensing can be far away from the detection target and collect massive information and data. It not only optimizes people's working environment but also improves production efficiency. In the design scheme, two schemes are used for the final design of the system, and finally, achieve the same goal by different ways. However, this is also a research deficiency. Finally, there is no more reference in the system, which needs to be improved.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

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