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The Design of Art Design System Based on Image Processing Technology

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Abstract: Nowadays, the design of digital image processing technology is developing in the direction of art and personalisation. In line with this development trend, it is necessary to combine computer art design to complete the art design system. The aim of this paper is to study the design of an art design system based on image processing technology. The interactivity of art and image processing technology are analysed, and a synthetic image display algorithm is proposed for application in the art design system. The system development tools and the architecture of the system are presented. We conduct environmental art design experiments, and the experiments yield good results.

1. Introduction

Image processing is a field of art that is both ancient and young. It is old because as early as the Stone Age, image carving with rock as the processing object has been produced, and this kind of stone carving is the prototype of image processing; it is young because with the increasing popularity of electronic computers, image processing is no longer carving in the traditional sense, but has become a new form of mechanical processing with digital images as the processing content and various materials as the processing object [1-2]. With the technology and the expansion of its research fields, image processing technology is gradually developing into an integrated field containing CAD, CAM and CAPP and other technologies, and the study of art design systems has become an important part of computer system research [3-4].

Virtual reality technology can visualise environmental art design, enhance the accuracy of the budget, strengthen the interaction between the two parties in the design process, facilitate the display of the landscape and change the traditional situation where environmental art design is

limited by the expression of thinking [5]. salma M takes the application of virtual reality technology in the construction of environmental art design systems as an entry point, explains the environmental art design system based on three-dimensional panoramic technology The characteristics of the three-dimensional panoramic technology in the construction of environmental art design system were analyzed[6]. Santosh Kumar Upadhyay, under the guidance of the concept of refinement management, established the refinement management system of the Art and Design Experimental Teaching Center, including the institutional system, safety system, procurement system, equipment system and open system. The centre adheres to the philosophy of people-oriented, excellence and pragmatism to achieve the normal and efficient development of the centre's work and provide quality services to improve the quality of art and design talents in the new era [7]. Javed Miya proposed an image processing method based on multi-feature fusion. The method is required to establish integrated features combining colour features and texture features, and classify pixel points by k-mean clustering, and then optimise 2D code images by morphology. Finally, the method was applied to laser marking of 2D codes on AL97 cast aluminium ingots and compared with the accepted method, the OTSU algorithm, and the experimental results showed that the method was effective [8]. It is therefore of relevance to study art design systems based on image processing techniques.

In this paper, we first review the theories and software development techniques involved in artistic interactivity, and elaborate on the functions, design methods and implementation processes of the subsystems. In this system, we mainly design and implement environmental art design cases, developing a friendly interactive interface building environment, a visual interaction subsystem and a powerful plug-in system.

2. Research on the Design of Art Design Systems Based on Image Processing Technology

2.1. Artistic Interactivity

Interaction refers to communication between people, which allows information to be transmitted more accurately and feedback to be obtained. In everyday life, people need to interact with other people and things around them. For example, when we are out and about, we first interact with people. This interaction is achieved through sensory stimulation [9-10]. When we are outside, the door sends a message to us about the barrier and people respond by opening the door. Interaction at this point is conversation. When we make use of a device, we are actually talking to it. In the process of watching television, we talk to the television, using sensing devices to transmit information to the television, and the television gets the information and the feedback action is channel change, which is interaction [10-11]. When using a telephone, we establish a dialogical interaction with the telephone through keystrokes. When driving a car, we use the steering wheel to interact with the car. The sensors, keys and steering wheels mentioned above are the interfaces through which we talk to the devices, which are the most common human-machine interfaces in our daily lives, and can also be called human-computer interaction. From a theoretical point of view, interaction represents the use of information control and feedback to build a user experience, which requires the realisation of corresponding functions, and the use of the realisation of functions to complete the relevant activities expected by the user [12-13].

Computers are in fact a class of devices that are much more comprehensive and complex than other devices, so the interaction between humans and such devices is much more complex to consider. This is especially true because the speed at which people pass information to each other is increasing due to the development of network technology, which makes interaction more frequent and requires specialised personnel to design and optimise. Human-computer interaction is in fact the science of research into the technologies that affect computers and people. The human-machine

interface represents the point at which the two are connected using some dialogue and information transfer, and is an important part of the system's composition. The continuous innovative development of computers will allow the development of interface technology and interfaces to be fuelled [14].

2.2. Image Processing Techniques

There are many methods in image processing for finding image edges (e.g. Sobel matrix), but using these methods would make the construction of the interpolation algorithm very complex. To simplify the construction of the algorithm, in this study the edge information of the image is obtained by binarising the interpolated region of the image. This edge finding method maintains the characteristics of the directional interpolation magnification algorithm, improves the efficiency of the algorithm, and also has good flexibility, i.e.:the threshold of the binarisation can be adjusted according to the image brightness distribution during the magnification operation to obtain a more accurate delineation of the image edges [15-16].

The interpolation operation of directional interpolation takes the method of template interpolation, and the template region size ~ is generally set to a 3×3 or 5×5 region or to a 9×9 template when the image magnification effect is more demanding. It should be noted that the setting of the region size is closely related to the selection of the interpolation method in the subsequent operation [17-18].

After the edges of the image have been obtained, there are various options for the interpolation calculation method for directional interpolation, such as nearest-neighbour interpolation, linear interpolation or the simplest arithmetic averaging method, but these interpolation algorithms must be linear. If a bilinear interpolation algorithm is chosen, there is a risk of destroying the image edge information that has been found. In the interpolation calculation, the information about the edges of the image determines whether the source pixels in the interpolated region are part of the interpolated available part.

3. Investigation and Research into the Design of an Art and Design System Based on Image Processing Technology

3.1. System Development Tools

This paper uses C+language, the best open source libraries. qt developed graphical user interface, OpenCV computer vision library, Ogre system for graphical representation, system scripting using Lua language. The system development tool Microsoft microsoftvisualstudio 2008 integrated development environment was selected, and the operating system was Windows 7. The system management process specifically refers to the management of user basic information and user authority settings. As shown in Figure 1, the system management settings greatly improve the security of image information, prevent illegal user intrusion, and effectively avoid data loss caused by user misoperation. The management process is more secure, normative and convenient.

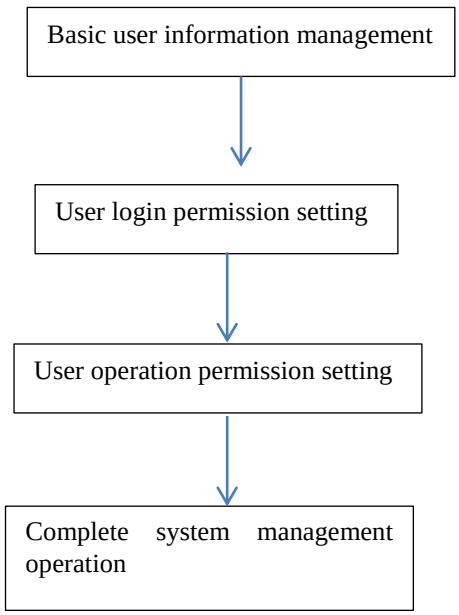

Figure 1. System management process reengineering business

3.2. Export of Scene

During visual programming, various types of graphics created by users in the scene can be classified into two categories: control and data flow. When saving the scene as a file, you only need to save the key attributes of the controls and data flow in the scene. The key attributes of controls in the scene are shown in Table 1.

Table 1. Control Description

name	codomain	explain
ID	[1，M]	The maximum value M is the number of controls in the current scene
type	Provder/Processor/Consume	Can only be one of three types
name	Name collection of all controls in the system	The name string can only consist of ASCII code
X coordinate	[0，W]	The maximum w is the width of the scene
Y coordinate	[0，H]	The maximum value H is the height of the scene

3.3. Synthetic Image Display Algorithm

(1) Masking synthesis algorithm

The mask data is another image layer generated according to the synthesis requirements and the image of this layer is represented by a binary image. When the mask synthesis method is used, the image synthesis algorithm can be represented as follows:

$$F = (F, \wedge M) \left| (F_2 \wedge \overline{M}) \right. \tag{1}$$

Where: F1 is the background image, F2 is the target image, M is the mask, F is the display image, and | represents the logical OR operation. When the mask data is 1, the corresponding position of the image becomes 0 when the mask data is 0.

(2) α Channel synthesis algorithm

α Channel data is the data between 0 and l, which represents the transparency of the target image in the composite image. The image compositing algorithm can be expressed as:

$$R_s = R_t \times \alpha + R_b \times (1-\alpha) \tag{2}$$

$$G_s = G_t \times \alpha + G_b \times (1-\alpha) \tag{3}$$

$$B_s = B_t \times \alpha + B_b \times (1-\alpha) \tag{4}$$

Rs, Gs, Bs are the displayed pixel colour values; Rb, Gb, Bb are the pixel colour values of the background image. If there is no transparency in the general composite image, masks are used; when transparency is used to add to the display, the α channel is used.

4. Analysis and Research on the Design of Art Design Systems Based on Image Processing Technology

4.1. Architecture of the System

In order to provide a simpler and faster development process for interactive media applications, this paper uses a node-based visual programming model as the core processing logic and Qt as the graphical interface library to develop an interactive media art and design system, which is named the Art Design System. The system aims to enable non-programming developers as well as programmers in unrelated fields to develop personalised interactive media art applications quickly and intuitively.

From a functional perspective the system can be divided into three parts: the user interface layer, the core layer and the application layer. The core layer is the most important part of the system, controlling the interaction and data execution logic of the system, including the visual interaction design subsystem and the node-based visual programming model; the application layer is an extension of the core layer, with all functional modules having application-oriented and domain-oriented The system contains four types of modules: I/O modules, mathematical modules, image and video processing modules and graphics modules, all of which are integrated into the system through a plug-in mechanism. The functional modules in the application layer enable control and access to external devices by encapsulating third-party libraries. The external devices involved in this paper are camera, mouse, microphone, Kinect, etc. The architecture of the system is shown in Figure 2.

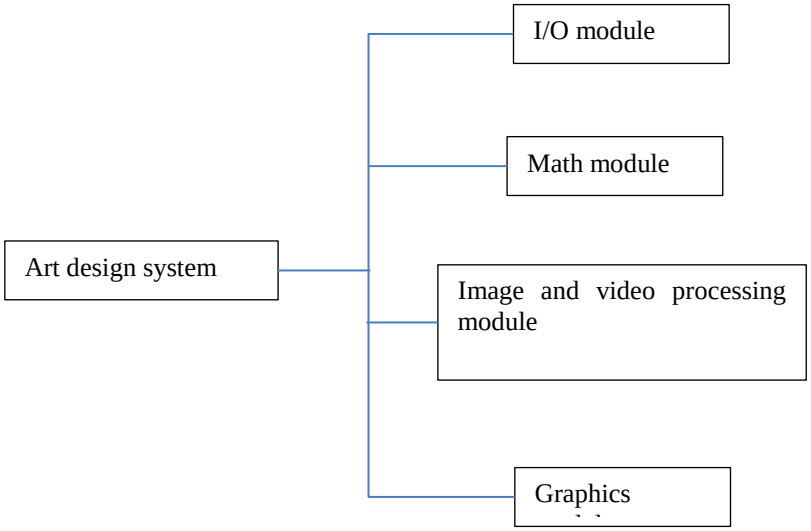

Figure 2. System architecture

4.2. Examples of System Applications

The harmonious development of man and nature is the primary condition for maintaining our human living environment, so it is necessary to plan the layout of the surrounding environment in any place of construction. Using the image synthesis system can combine different targets together to dynamically display the simulated environmental layout. The specific process is shown in Figure 3:

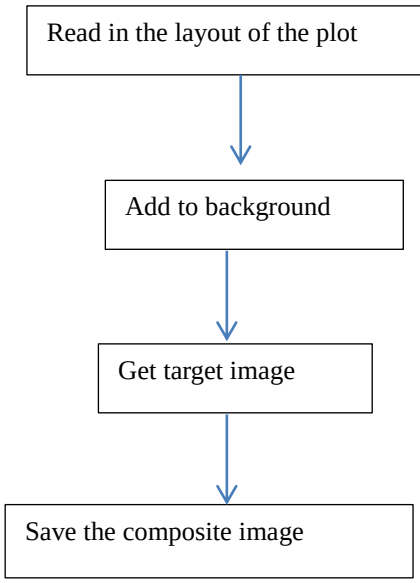

Figure 3. The specific process

Step 1: Read in the layout of the plot (background image), containing basic information such as

plot orientation and zoning.

Step 2: The second step is to read in the house and road images and add them to the background map and transform them accordingly.

Step 3: Add trees, flowers, hills and other targets to the background image as required. The target image is obtained from the landscape image segmentation, and converted to the target image, the effect is shown in Figure 4.

Step 4:Save the composite image.

Figure 4. Environmental design drawing

5. Conclusion

Computer development to date, although there are many excellent image processing programs, such software is either very limited, takes a long time to learn, or is a unique feature that prevents learning and creating work in a specific style. This paper uses image processing technology to build an artistic design system and apply it successfully to the creation of examples of environmental design. The system allows for easy creation of artworks for the public via a browser. However, the system completed in this paper still has some issues that need further research and improvement, such as the use of matching algorithms to improve the synthesis of images.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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