

# Research on Digital Media Art Design System Based on Virtual Reality Technology

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**Abstract.** Virtual reality technology is increasingly widely used in the field of digital media art design, providing a new creative space for designers. Based on this, this paper proposes a new digital media art design system, which is divided into two main parts, hardware module and software module, forming an organic whole, providing designers with efficient and accurate design tools. In this paper, the proposed digital media art design system has significant advantages over traditional design methods. Through simulation experiments, the system is outstanding in operation speed and accuracy. When processing large-scale data, the system can quickly generate high-quality design solutions to meet the needs of designers. At the same time, due to its high accuracy rate, the system can effectively reduce the time cost of designers in the process of modifying the scheme, and improve the design quality.

**Keywords:** Virtual Reality technology; Digital media art design system; Hardware module; Software module

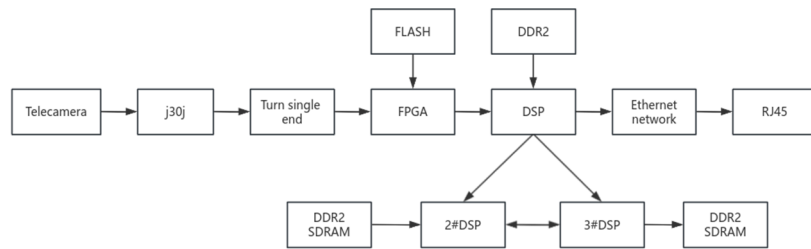
## 1 Introduction

The rapid growth of economy makes people gradually put forward higher requirements for the surrounding living environment [1]. In order to meet people's living needs, the art and design industry has gradually, on the basis of traditional design methods, with the help of big data, cloud computing and other advanced technologies, developed a variety of digital media art and design systems. Through an in-depth analysis of the public needs, these systems can automatically design relevant art solutions to make the works more in line with the needs of modern society [2]. However, through the in-depth analysis of the existing digital media art design system, it is found that there are defects such as weak visual expression ability, which leads to the system can not be really applied to practice, which causes some obstacles to the artistic creation work. In order to improve the overall effectiveness of the system, virtual reality (VR) technology serves as a solution to improve the existing system. Therefore, this study is committed to study the system of digital media art creation based on virtual reality, to provide strong support for improving the effect and quality of art creation [3].

## 2 Hardware structure design

### 2.1 System design

Virtual reality (VR) technology is transmitted to the terminal equipment through computer simulation to build a three-dimensional virtual world for users, so that users can listen, observe and touch, and achieve the feeling of immersive [4-5]. Integrating VR technology can improve the art design effect of digital media, build the stereo visual effect, and increase the artistic expression force [6]. This paper designs a digital media art design system with VR technology as the core, including 3D modeling technology, sensing and display technology, etc. The core processor adopts TMS320C6657 chip, and the circuit design is optimized for the different functions of each component. The software system selects the MapInfo platform, and the overall structure is shown in Figure 1.



**Figure 1.** Structure diagram of the digital media art design system based on VR technology.

### 2.2 Hardware design

In the original system, DDRS controller is used. Through the analysis and research of the controller, it can be found that it can only support the operation of DDRE-1333 series processor, so the system is designed as one of the data processing components [7-8]. On this basis, the TMS320C6657 processor with better performance is also configured to process the data through dual core, so as to improve the data processing speed of the system, give the system stronger artistic design ability, and provide support for digital media art design. Due to the difference between input and export ports, the processor, memory and bus interfaces should be optimized.

**Table 1.** The energy consumption table of each circuit in the system

Number	Circuit name	Voltage (V)	Current (A)	Power dissipation (W)
1	DSP circuit	1.26	4.6	5.62
2	FPGA circuit	2.3	0.6	0.5
3	DSP circuit	1.6	0.2	2.45
4	SRIO circuit	1.5	0.8	0.54
5	DDR2 circuit	1.3	0.5	0.85

6	EMAC circuit	1.2	1.6	2.8
7	Clock circuit	3.3	0.6	1.62
8	Aggregate	—	—	14.38

In terms of the power supply circuit, the current and voltage modes are used, in which the system provides sufficient energy. There are multiple system circuits in the whole system, whose functions are completely different, such as DSP circuit, FPGA circuit, SRIO circuit, etc. When the system is running, the power supply shall be transmitted to the system to meet the power consumption of all circuits running simultaneously. Through experimental studies of each circuit, the results are shown in Table 1. As can be seen in this table, when the system runs, the total power consumption is 14.38W. In order to ensure that the whole system is more secure and stable, we need to set a certain margin. At the same time, the current ripple and noise are relatively small, within the range of relevant provisions.

To meet the conditions, we need to determine the optimal power consumption of the system, and the excessive power consumption increases the design difficulty and wastes energy. Choose the AC-DC circuit to improve the design efficiency. The power module adopts MUA30220S05 with high conversion rate about 75%, error  $\pm 1\%$  and low noise 50 mV. Connect the 220V AC system and install the TNR15G241K resistance protection power supply. The precision conversion voltage is about 6V, which is higher than the 5V required for DPS circuit operation, driving it to run smoothly. See Figure 2. The entire memory module consists of four layers:

- The upper layer is the SRAM in the film, with the slowest speed, but a high capacity;
- The second layer is the off-chip DRAM, which is slightly higher than the top layer in terms of storage rate, and the capacity is larger;
- The third layer is Flash memory, which is the slowest rate and the highest capacity part in the whole module;
- The lowest level is Web distributed storage, or remote storage, which is used to store remote data information.

In the SRAM inside the module, it includes Cache function, and in the DRAM outside the module, it has BlockRAM function. For Flash memory, it has the function of program guidance, and after the sensor collects the real image data, it delivers it to the upper machine storage module.

## 2.3 Software design

This system mainly relies on the software. According to the functional requirements of each hardware device, we wrote the corresponding control program. These programs are the basis for building modules that enable them to integrate seamlessly with the entire system structure, thus ensuring the proper operation of the system. When making the plug-in design, the main content includes the following aspects.

### 2.3.1 Image plugin.

For the drawing of the various virtual images. The plug-in was developed using the MapInfo platform, including the specific OpenCV library function, to draw virtual images. The

implementation principle of the plug-in is: image import control for image related files, specifically ImageLoader(); image processing control for data input and export data according to the analysis results, specifically for various callback functions; image transformation. The CVThresholdType() class is used to transmit data to the system, and the corresponding algorithm is adopted according to the requirements of the processing content.

### 2.3.2 Video plugin.

It can be divided into three categories, acquiring video and converted to 3D virtual images. When running, the camera collects the data and processes the video plug-in. As shown in Figure 3, VR can comprehensively retrieve images, and then store video sources to build CvCapture objects. Before the end, the frame data is extracted repeatedly until the iterations reach the standard.

### 2.3.3 Sound plugin.

During sound data collection, it is mainly implemented by BASS. This function works on: in the sound part, the BassLoader control as the main tool to transmit the sound to the system and the input parameters as the main path to collect the audio data in the information; the export parameters are used as the handle to display the normalized floating point number. In the math part, class WebcamProvider() is used as the main dysmenorrhea to transmit frame data to the camera, and on this basis, the Smooth control and the CvContourExtractor control as the main tools.

In order to prevent system export error report, the error report interface is shown in Figure 4. In case of a failure, we will take the following steps: If the user operation error occurs, the system will pop up a prompt window to remind the user to stop the current error operation. In order to feedback the running status in real time, we adopted a mode-free dialog to collect the errors that occurred during the operation. When a fault occurs during simulation, the system will generate fault information; if everything is normal, the system will continue to operate; if there is an error information, the system will enter shutdown mode; if the operation of fault report is ongoing, the system will automatically enter the operation state.

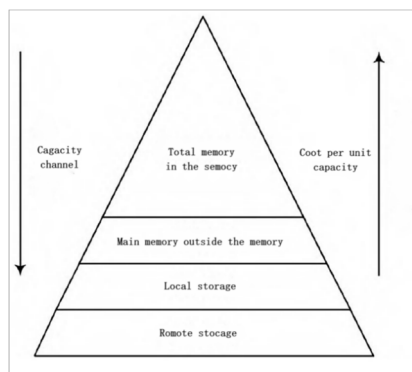


Figure 2. Memory structure diagram.

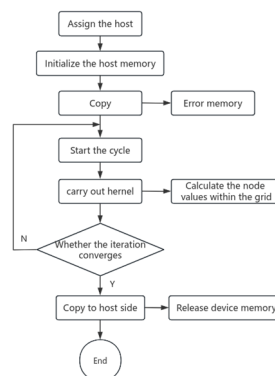
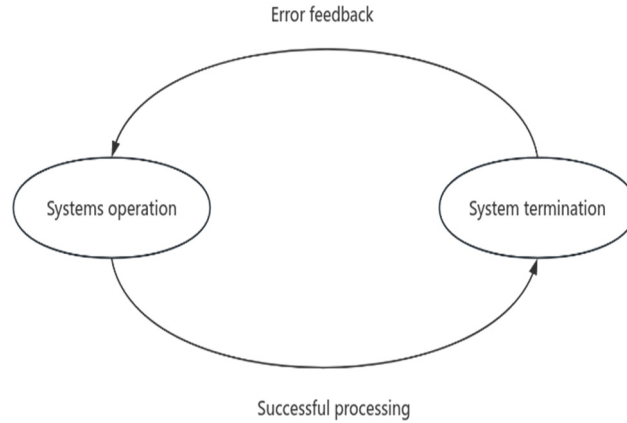


Figure 3. A Schematic diagram of the video plugin operation.



**Figure 4.** System running in a finite state structure.

### 3 Simulation experiment

#### 3.1 Experimental environment

In order to make the experiment illustrative, the numerical comparison is used to compare the traditional digital media art design system with the present system. In the experiment, a variety of measuring instruments were used to obtain rich experimental data, which provides a reference basis for the subsequent work. The core of the digital media art design system based on virtual reality technology is the TMS320C6657 processor. The processor is mainly responsible for receiving the image data and summarizing the calculation results. When the DSP controller receives the image, the image will be transmitted to 2# DSP and 3# DSP, and after splitting, the image data will be uploaded to the corresponding position. According to the above construction test environment, continuously send 10 or 10 image data with the image plugin, and upload the test results to the system through the data interface.

**Table 2.** Simulation test results table.

Test case	Extent (b)	Routine design system quantity run time test (ms) results	Results of the system run-time test (ms) designed in this paper
TC1	512*300	813.154 True	11.444 True
TC2	512*300	22.254 True	1.473 True
TC3	512*300	68.485 True	7.121 True
TC4	512*300	1010.142 True	9.154 True
TC5	512*300	23.154 False	1.154 True
TC6	512*300	55.513 True	4.154 True
TC7	512*300	611.154 False	10.154 True
TC8	512*300	410.431 True	9.451 True
TC9	512*300	67.154 False	6.154 True
TC10	512*300	23.514 True	1.154 True

### 3.2 Experimental results and analysis

The experimental test system takes the time to calculate the digital media art design during the debugging process. The test results are shown in Table 2. It can be seen from the test results that the system takes less time to run, the target detection task is correct, can be completed stably, and meet the high performance requirements of the system. Using the traditional digital media art design system to detect targets, three errors take longer.

## 4 Conclusion

Various input objects are the starting point of the digital media art creation platform, but also an important part of the system. In terms of hardware design, in order to effectively improve the visual performance ability of the system to match the key information points, the dual-core TMS320C6657 and DDR 31333 series processors are used to analyze the data files. Software and hardware combine to complete the design of digital media art design system based on virtual reality technology. In the experiment part, in order to ensure the practicability of the built system, the comparative experiment is adopted to verify that the proposed system runs for a shorter time and is more in line with the design requirements.

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