

## Research Article

# Embedded System Intelligent Platform Design Based on Digital Multimedia Artistic Design

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With the ever-changing times, technological progress, media transformation, and innovation, the soil for the growth of digital media art has been cultivated. The rapid development of the mobile Internet combines multimedia communications such as pictures, text, audio, video, and data, which greatly enriches people's life experience. Embedded systems have strong processing capabilities, small size, and convenient use. In recent years, they have become the mainstream of multimedia research. Therefore, this paper proposes a research on the design of an embedded system intelligent platform based on digital multimedia artistic design. This paper adopts the literature research method to study the development and evolution of digital multimedia and the characteristics and applications of embedded systems and other related theoretical research and design an embedded system intelligent platform based on the artistic design of digital multimedia, from software and hardware design and application. The platform design research is carried out in three aspects of the program, and the effect comparison of system's scheduling test, real-time test, peak signal-to-noise ratio test, and digital multimedia art design is analyzed. The experimental results show that when the pixel values are the same (both are 6), the signal-to-noise ratio of this method reaches 48.5, which is higher than the output value of other method platforms, and the system setting performance is better.

## 1. Introduction

With the rapid development of science and technology and the rapid expansion of commercial and cultural exchanges, the dissemination of information increasingly requires high-tech means. Digital multimedia is an emerging media concept with the functions of real-time information publishing and online advertising. It is mainly used in specific physical locations and specific time periods to broadcast advertising information to specific people. It has high commercial application prospects, and research value has now become a hot spot for research and development of high-tech enterprises at home and abroad.

The rapid development of the mobile Internet has changed people's lifestyles and has led human beings to enter a new information age. With the constant advancement of science and technology, digital media art design has changed the art design methods, concepts, and aesthetic values of people's lifestyles, working methods, working methods, and

living environment. As a product of digital media art, exploring the application of digital media art to screen design has a very important research value and significance.

Nurjanah developed the Aceh Disaster Digital Archive to make it easier for the community to obtain information about past disasters. It uses an open-source data platform that allows free access and is interactive and easy to use, which is essential for attracting the younger generation. Similar disasters can occur anywhere in the world. By collecting multimedia data from Aceh before and after the tsunami with another medium, they turned it into a visual form and linked it with social network services (SNSs) to promote relevant transmission of information and knowledge on the experience of the Aceh earthquake, and tsunami promotes sustainable disaster reduction. Information is the primary issue for disaster risk reduction, need for the transmission and dissemination of information, and generation after generation of sustainability. The 2004 Indian Ocean tsunami occurred in Aceh. The tsunami is estimated to have killed

more than 200,000 people. One of the important reasons is the information gap of past disasters. The purpose of his research is to promote the dissemination of information, but his experimental research has not achieved complete data transmission, nor can it guarantee the security of the data very well [1]. Dutt et al. faces highly dynamic operating behaviors and environmental conditions. Embedded systems must resolve many potential conflicting design constraints, such as flexibility, energy, heat, cost, performance, and safety. By adding intelligent elements, people hope that the resulting “smart” embedded system can run correctly and operate under expected constraints, despite the highly dynamic changes in applications and environments, as well as the underlying software/hardware platform. Since terms related to “smart” are loosely used in many software and hardware environments, they first proposed a classification of “auto-x” terms and used this classification to correlate the main “smart” software and hardware tasks. One of the main attributes of intelligent embedded systems is self-awareness, which enables embedded systems to monitor their own state and behavior, as well as the external environment, so as to intelligently adapt to the environment. However, the embedded system they studied has certain deficiencies in practical applications and needs more data support [2]. Joyce and Audsley with the development of nonvolatile memory technology and embedded hardware, large-scale high-speed persistent storage devices can now be practically applied to embedded systems. The traditional storage system model (including the implementation in the Linux kernel) assumes that the performance of the storage device is much lower than the speed of the CPU and system memory, thus encouraging a large amount of caching and buffering by directly accessing the storage hardware. However, in embedded systems, processing and memory resources are limited, and storage hardware can still run at full speed, causing this balance to change and leading to the observation of performance bottlenecks caused by the operating system rather than the speed of the storage device itself. In this article, they gave the performance and evaluation results of high-speed storage devices connected to Linux-based embedded systems, indicating that kernel’s standard file I/O operations are not suitable for this setting, and in some cases, “Direct I/O” may be preferable. By examining the results, you can determine where improvements can be made to reduce the CPU load and increase the maximum storage throughput. However, the performance of the research model he designed is not good enough [3].

The innovations of this article are as follows: (1) combine qualitative research with quantitative research and fully analyze research data; (2) combine theoretical research and empirical research, based on digital media and embedded system theory, in conjunction with artistic design for analysis and discussion.

## 2. Design Method of Embedded System Intelligent Platform Based on Digital Multimedia Artistic Design

*2.1. Digital Multimedia.* With the advent of the information society, the role of traditional media in information query,

advertising, and real-time information transmission is becoming more and more inadequate. The emergence and wide application of new media such as digital multimedia have just made up for the vacancy in this area [4]. Compared to traditional television, radio, newspapers, and other media, new media integrate multiple forms of media communication, clarify the boundaries between media, and have extensive interaction, extensive connectivity, and coherence. Contacts are frequent and direct, and the degree of relevance is enhanced. From the past one-to-multipoint communication state to multipoint-to-multipoint, everyone is both a mass communicator and an information producer [5].

The broad prospects of digital multimedia terminals in applications have also made them gradually become a hot spot for scientific and technical personnel and news. At the same time, the promotion of the industry has made the research of digital multimedia technology get the investment of many enterprises and scientific research institutions [6]. With the gradual deepening of research on digital multimedia technology, digital multimedia terminals are more and more easily accepted by people and gradually enter people’s daily life. In airports, stadiums, large shopping malls, and some business places, we can more or less see various applications of digital multimedia terminals [7, 8].

Digital multimedia terminals placed in public places such as airports, large shopping malls, stadiums, business offices, and large buildings are mainly responsible for advertising information release, business information query, venue information query, etc. [9]. Its specific purpose is the release of advertising information, venue information, and product discount information, followed by inquiries including real-time information such as weather, address, bus routes, and classified retrieval of product information, and some terminals with external equipment also have LED information, the publishing, free and pay phone, discount coupon printing, and other functions [10].

It can be seen that the research of digital multimedia is beneficial to the development of today’s society, and it is also in line with people’s needs for information dissemination and inquiry. In this context, according to the use of characteristics and requirements of digital multimedia, we have carried out a brand-new design of the software system of the digital media terminal and integrated the artistic design with the intelligent platform of the embedded system [11].

*2.2. Digital Media Art Design.* Digital media art is a media art developed based on digital technology. Digital technology uses computers as the basic tool, covering all contemporary art fields involved in technology, from film, photography, music synthesis, CD-ROM, and more [12]. The breakthroughs in capabilities brought about by digital technology give images unlimited flexibility. In the past, visual information was static. In this sense, the image is also fixed, although it can be edited in the movie or can be included in other images by montage [13]. Once transferred to a digital language, every element of the image can be modified by the computer. Images are information in the computer, and all information can be manipulated. Digital

media pioneer Peter Weibel said: “For the first time in history, images have become a dynamic system” [14].

In art, visual literacy is no longer limited to “objects.” It must accept the fluid, ever-changing field of experience that exists inside the computer and the new world that the computer will realize, namely, the interactive art world [15, 16]. It can be virtual reality, or it can be a complete dependence on cooperation with the “audience” who enters the process of completing the artwork. When the concept that the conceived artwork depends on the audience was still being formed, it was not known at the beginning that some artwork (such as interactive movies) at the end of the century would completely depend on the audience, not only to form an audience but also to join and give artistic content [17].

Multimedia digital art is an art form that includes fields that intersect with multiple industries. That is the connection between artistic creation and science and technology [18]. With the advancement of science and technology, new art forms have emerged from film, television, video to video art, multimedia art, and digital art. What influences the birth of new art is the advancement of science and technology [19]. Advances in science and technology have created new platforms and spaces for artists, greatly enriched the forms of artistic creation, and promoted the development of art. Digital media art is supported by new technologies that promote the creation and expansion of new art fields such as digital newspapers and digital movies [20]. 3D virtual space and mobile digital media have become a good way to open up new art fields. It is a digital media art that spreads across media and is equipped with special art forms and language models. It is gradually being understood and used by more and more people.

*2.3. Embedded System.* Embedded system (embedded system, ES) is the abbreviation of embedded computer system. The IEEE (Institute of Electrical and Electronic Engineers) defines it as “a device used to control, monitor or assist the operation of equipment, machinery or equipment” [21]. Most of the domestic definition of embedded system is as follows: a computer system that integrates operating system and software functions into the system [22]. The computer combines the software and information according to the requirements of the application. Generally speaking, a dedicated software/material system equipped with a microprocessor can be called an integrated system [23]. In terms of architecture, an embedded system generally consists of the following parts: processor, memory, input and output, and software. Figure 1 shows the overall structure of the embedded intelligent platform system.

The hardware part of the integrated system consists mainly of integrated processor/microprocessor, memory, peripheral components, graphics controller, and input/output ports. The processor/microprocessor is the key component [24]. Embedded systems mostly use EPROM, EEPROM or Flash Memory as storage media, instead of using large-capacity storage media like hard disks, because embedded devices generally require small storage space and are limited in size and power consumption. Therefore, chip memory is generally used [25].

Because of the particularity of the application, the embedded system has some different aspects compared with the general functions of the x86 architecture computers: (1) the design of the embedded system is generally customized according to specific needs. For example, the ARM series are mostly used in mobile phones, and PowerPC is used in network devices [26]. (2) When initially determining the design scheme of the embedded system, the two modules of hardware and software must be designed efficiently and harmoniously, so that the hardware meets the demand, while avoiding the waste of resources and maximizing the utilization of hardware resources. This design idea must be considered in product design and can effectively control the cost.

The development of computers has grown rapidly from mainframes to today’s desktop computers with powerful functions and small sizes. New products are coming out every day. Embedded smart devices are an outstanding product of the development of computer technology to the contemporary era, allowing people to enter the era of intelligent life. Intelligent control in the industrial field, smart home in family life, Internet of Things in public life, and multimedia applications that change traditional teaching all let people’s life quality be improved, so that people will have a comprehensive understanding of computers. Computers can not only calculate with scientific research, but embedded devices that complement them can also bring digital experience to people’s lives. Embedded systems involve all aspects of human life, such as industrial control, digital media, marine machinery, environmental monitoring, office automation, consumer electronic equipment, and home appliances, and have extremely broad application prospects.

From the perspective of the development of the electronics and computer markets, the demand for devices such as smart phones, tablet computers, and smart home appliances continues to increase, and emerging technologies such as 3D technology, human-computer interaction technology, and cloud technology based on such embedded devices are also emerging. The design of the embedded system scheme has a good application prospect, can be combined with the market, and can be easily commercialized. Because embedded processors are the core components of embedded systems, it is conceivable that having independent embedded processors and supporting expanded hardware must be the basis and prerequisite for the development of embedded systems with independent property rights. In terms of software, the operating system is the foundation and leader of the software industry, has a great influence on the development trend of the software industry, and is also the main source of benefits for the world software industry.

## 2.4. Image Fusion Technology

*2.4.1. Image Registration.* There are many image recording methods, including grayscale recording methods, domain transformation registration entry methods, and feature recording methods. The gray-scale image registration method does not need to do the corresponding preprocessing steps, and the principle is simple and easy to implement by hardware, and the disadvantage is that it requires a lot of calculations. This

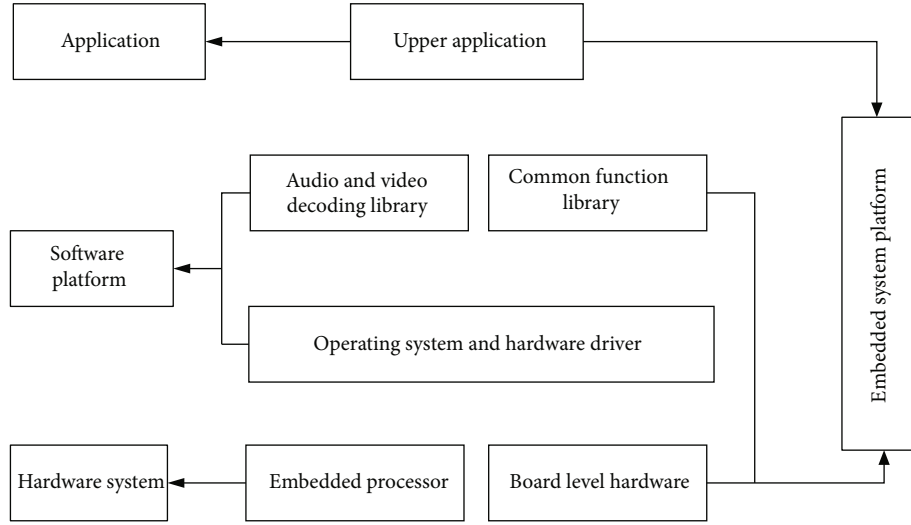


FIGURE 1: The overall structure of the embedded intelligent platform system.

TABLE 1: The main application of Zynq.

Application	Processing system	Programmable logic
Smart video	Operating system: system interface and control; analysis and control; function realization; graphics overlay; storage interface	Custom algorithm; connection function; encoding; video processing
Communication	Operating system: real-time processing; parameter update; storage interface	Crest factor suppression; digital distortion; connection function
Control system	Operating system; system interface and control; real-time processing; diagnosis; analysis; floating point; storage interface	Data acquisition; positioning calculation; system communication; man-machine interface and graphics; connection function
Bridging	Operating system; system interface and control, real-time processing, image analysis, car vector, storage interface, connection function	Data acquisition, positioning calculation, system communication, man-machine interface and graphics, connection function

TABLE 2: Real-time scheduling algorithm optimization.

Classification	Time driven	EDF	GRUB-PA	Resource scheduling algorithm based on proportional sharing
Software/hardware real time	Hard real time	Hard real time	Hard real time	Soft real time
Scheduling timing	Knowable	Dynamically determined	Dynamically determined	Dynamically determined
Priority	No	Dynamically determined	Dynamic or static	No
Time limit	Knowable	Knowable	Unknown	Known or unknown
Operation hours	Knowable	Knowable	Unknown	Known or unknown

method itself is more sensitive to image rotation and deformation, so it needs to be combined with other methods to be used in remote sensing images. The gray-scale image registration methods mainly include sequential similarity detection algorithm and cross-correlation algorithm.

Image-based gray-scale method is usually used for template registration. The commonly used templates are rectangular templates, which can translate images and have circular templates with good rotation effects. For motion

with only image translation, generally take a rectangular area in the reference image as a template and move this template in the current image to obtain the corresponding SAD (sum of absolute difference) value, and the minimum value is the registration position.

$$R_{\text{SAD}} = \frac{1}{n^2} \cdot \sum_{i,j=1}^n |h_{ij} - \tilde{h}_{ij}|, \quad (1)$$

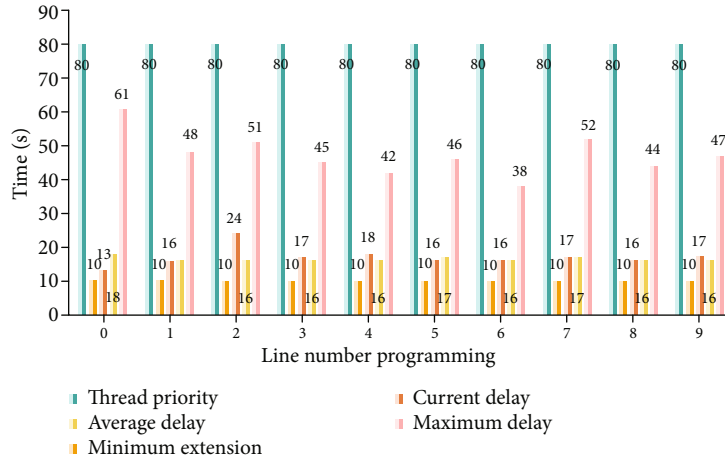


FIGURE 2: Real-time testing of hardware equipment change scenarios.

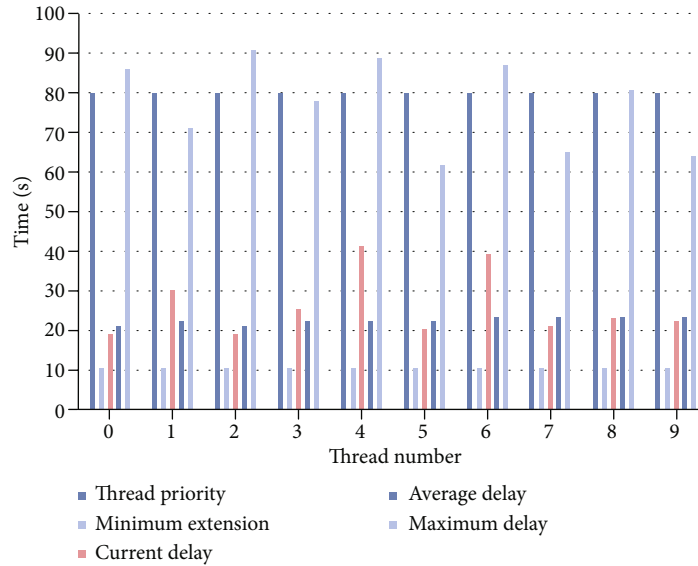


FIGURE 3: Large-flow packet network performance test.

where  $\tilde{h}_{ij}$  is the gray value corresponding to the reference image coordinate  $(i,j)$ ,  $h_{ij}$  is the gray value corresponding to the current image position, and  $R_{SAD}$  is SAD.

For a rotated image, you can take certain points as the center of the circular area according to different motion trends and convert it into a rectangular template after polar coordinate transformation; then, the rotation of the template in the airspace is equivalent to the polar coordinate cyclic translation of the rectangular template. From rectangular coordinates to polar coordinates,

$$\begin{cases} \rho = \sqrt{x^2 + y^2}, \\ \theta = \arctan x/y. \end{cases} \quad (2)$$

From polar coordinates to rectangular coordinates,

$$\begin{cases} x = \rho \cos \theta, \\ y = \rho \sin \theta. \end{cases} \quad (3)$$

Sequential Similarity Detection Algorithm (SSDA) was proposed by Barnea et al. It is the accumulation of the absolute value of the error. When the registration is not successful, its growth rate is large, and when it is about to reach the registration position, it increases cumulatively, becoming slower and slower. The final matching position can be determined by comparing the threshold  $T$  and the accumulated residual. The calculation method of the residual is shown

TABLE 3: Video input signal test.

Input video signal	Composite video signal PAL	Composite video signal NTSC	Component video signal 720P
Multimedia storage	Normal	Normal	Normal
Multimedia display	Slightly darker	Normal	Partial display
Multimedia playback	Normal	Normal	Normal
Multimedia transmission	Normal	Normal	Small amount of ghosting



FIGURE 4: Digital multimedia art design effect comparison.

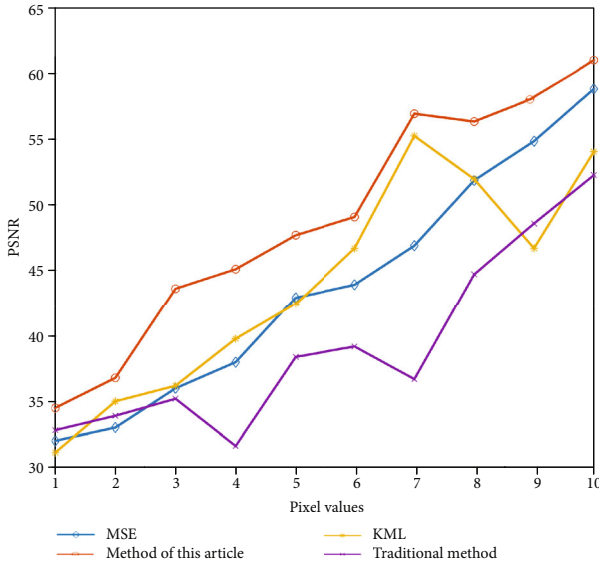


FIGURE 5: Peak signal-to-noise ratio comparison results.

in the formula

$$R(a, b) = \sum_x \sum_y |O_1(x, y) - g(O_2(x, y))|. \quad (4)$$

In the formula,  $O_1$  represents the reference image,  $O_2$  represents the image to be fused, and  $g$  represents the transformation model function.

This method is relatively easy and has high efficiency and fast processing speed. But this method is only based on the gray value of the image, and sometimes, the effect may not be particularly ideal. After that, combining sequen-

tial similarity detection and normalized product correlation, the feature similarities between images are obtained, and then, the optimal value is found randomly by the simulated annealing algorithm, and finally, the matching points are found for image registration.

The cross-correlation algorithm first determines the correlation coefficient between the template and the search window to determine the degree of correlation between the images. The largest correlation coefficient corresponds to the best position for registration, which is often used in template matching and recognition. The correlation coefficient  $CC$  of images  $A$  and  $B$  can be calculated by the following formula:

$$VV(S, N) = \frac{\sum_{ij} (S_{ij} - \bar{S})(N_{ij} - \bar{N})}{\sqrt{(\sum_{ij} (S_{ij} - \bar{S})^2)(\sum_{ij} (N_{ij} - \bar{N})^2)}}. \quad (5)$$

In the formula,  $\bar{S}$  and  $\bar{N}$  represent the average gray value of the image.

This paper introduces mutual information into the field of image registration to solve the problem of medical image registration. The larger the amount of information obtained by this method from the image to be fused, the better the fusion effect. First, calculate the probability density function model of the image to be fused and the image after fusion to compare the statistical dependence of the image. Its calculation formula is

$$MU(S, N) = R(S) + R(N) - R(S, N). \quad (6)$$

Among them,  $R(S)$  and  $R(N)$  are the entropy of image  $S$  and image  $N$ , and  $R(S, N)$  is the joint entropy of image  $S$  and  $N$ .

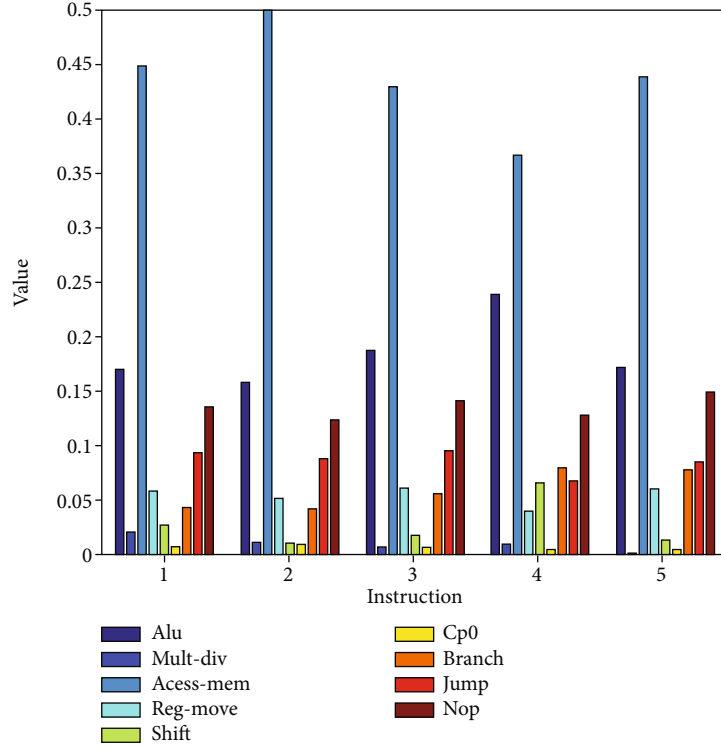


FIGURE 6: Instruction analysis of test program dynamic link.

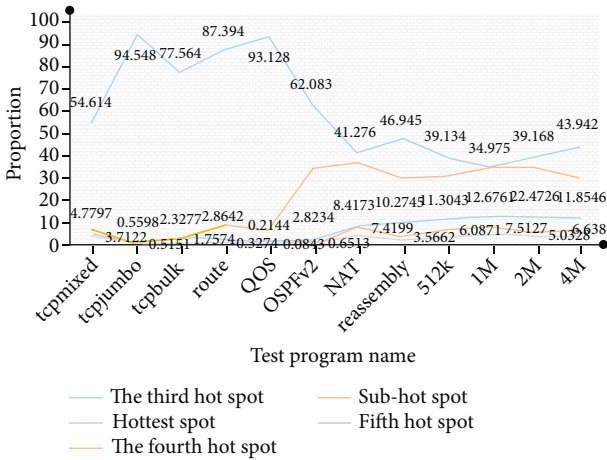


FIGURE 7: Distribution of hot spots of embedded system testing art design software.

**2.4.2. Image Registration Method Based on Transform Domain.** The Fourier method is a typical method based on sector conversion. After Fourier transform, the image will be converted from a spatial field to a frequency field. According to the transformation relationship between the area and the frequency domain, the spatial correlation function is transformed into a complex number function and fused in the frequency field. Assume that there is a translation error  $(a, b)$  in the two images  $P_1$  and  $P_2$ , that is,

$$P_1(x, y) = P_2(x - a, y - b). \quad (7)$$

Transform to frequency domain space as:

$$G_2(\xi_x, \xi_y) = \exp^{-j(a\xi_x, b\xi_y)} G_1(\xi_x, \xi_y). \quad (8)$$

The many properties of the Fourier transform make it possible to transfer various transformations of the image to the Fourier transform domain for operation during image registration. It can not only resist certain noises but also has formed a corresponding mature algorithm for hardware implementation.

**2.4.3. Image Fusion Based on Feature Points.** Registration based on feature points can overcome the shortcomings of using gray-scale information registration, but there are still spatial deformations and gray-scale differences in the process of feature image registration. The registration accuracy is not high. Therefore, it is necessary to select scale changes, angle differences, etc. The invariant feature points are registered to obtain a stable registration effect.

If  $Des_{ai}$  and  $Des_{bi}$  are the descriptor vectors of any two points  $(a)$  and  $(b)$  on the two images to be fused, then the distance between  $(a)$  and  $(b)$  is:

$$F(Q_a, Q_b) = \sqrt{\sum_{i=1}^n (Des_{ai} - Des_{bi})^2}. \quad (9)$$

Feature point image fusion: the original image information is the most authentic data source in image fusion. Pixel-level fusion does not require multiple preprocessing steps on the image before image fusion, and the reflected

data is more authentic. The linear transition of the overlapping area can eliminate the gap in the overlapping part of the image, and the transition is very smooth. The principle is as follows: if the width of the overlapping part of the two images is  $L$ , assuming the transition factor  $\tau(0 \leq \tau \leq 1)$ , the maximum and minimum coordinate values of the region in the XOY axis coordinate system. They are  $x_{\max}$ ,  $x_{\min}$  and  $y_{\max}$ ,  $y_{\min}$ , respectively, so we can calculate the transition factor by the following formula:

$$\tau = (y_{\max} - y_{\min}) / (x_{\max} - x_{\min}). \quad (10)$$

Then, the pixel gray value of the merged image is as follows:

$$G(x, y) = \tau(x, y)g_a(x, y) + (1 - \tau)(x, y)g_b(x, y). \quad (11)$$

Among them,  $gb(x, y)$  is the gray value of the source image  $a$  and  $b$  at the point  $(x, y)$ .

This method enables the smooth transition of the overlapping area of the fused image, displays it without stitching, and obtains a fused image without stitching.

*2.5. Optimized Fusion Algorithm Based on Feature Descriptor Similarity and Spatial Structure.* Spatial continuity: the similarity of the spatial structure between two images is described based on the LE algorithm. Taking the reference image as an example,  $fi$  and  $fk$  are both a feature point in the reference image  $F$ , and the element in the weight matrix  $W$  indicates the closeness of the feature point  $fi$  and  $fk$ . If it is the  $k$  nearest neighbor, then  $\psi_{ik} > 0$ ; otherwise,  $\psi_{ik} = 0$ .

$$\psi_{ik} = \exp\left(\frac{-t_{ik}^2}{2\sigma_1^2}\right). \quad (12)$$

Then, the local structure restriction can be described as follows:

$$T_{ij} = \sum_k \left\| \tilde{d}_j(g_i) - g_k \right\|^2 \psi_{ik}, (i \neq k). \quad (13)$$

Based on this spatial continuity is defined as follows:

$$F_{ij}^G = \left\| \tilde{d}_j - g_i \right\|^2 + \sum_k \left\| \tilde{d}_j(g_i) - g_k \right\|^2 \psi_{ik} = \sum_k \left\| \tilde{d}_j(g_i) - g_k \right\|^2 \psi_{ik}. \quad (14)$$

After that, we will introduce a Gaussian kernel for smoothing, and the optimization is as follows:

$$F_{ij}^G = \sum_k \exp\left(\frac{-\left\| \tilde{d}_j(f_i) - f_k \right\|^2}{2\sigma_1^2}\right) \psi_{ik}. \quad (15)$$

In the same way, the spatial continuity of the image to be fused can be obtained according to the local structural char-

acteristics of the image:

$$F_{ij}^D = \sum_k \exp\left(\frac{-\left\| \tilde{g}_i(d_j) - d_k \right\|^2}{2\sigma_2^2}\right) v_{jk}. \quad (16)$$

### 3. Embedded System Intelligent Platform Design Based on Digital Multimedia Artistic Design

The built-in intelligent digital media platform based on this document consists of three main components: hardware system, software platform, and application software. The software platform mainly includes common interfaces and function libraries, such as boot loader, operating system, and all basic hardware and extensive hardware drivers. The two parts of the hardware system and the software platform constitute the embedded system platform, laying the foundations for the development of the ultimate application software and the implementation of the entire intelligent platform of the embedded system.

*3.1. Hardware Design.* The hardware system in this article mainly adopts the Xilinx-Zynq series chips introduced by Xilinx, industry's first scalable platform source. Its main purpose is to improve the processing capacity and working performance of the chip as the main purpose, to meet the requirements of complex embedded systems for high performance, low power consumption and multicore processing capabilities, and the main application scenarios, such as embedded voice processing systems, video image processing, video surveillance, digital media, and other embedded application environments. For this time, the development board is mainly used in the embedded wireless communication processing system, and real-time wireless communication is required. This makes a single ARM-, DSP-, or FPGA-based embedded wireless communication processing solution unable to meet the requirements of practical applications. If a multichip combination scheme is adopted, the difficulty of development and system stability issues also make it difficult to implement this scheme. Because of the above reasons, the Zynq series development boards of Xilinx Company are used this time.

The architecture used by the Zynq platform is the ARM+FPGA architecture, which is the first device in the industry that tightly integrates the standard ARM Cortex-A9 dual-core processor and 28nm programmable logic on a single chip. This kind of architecture can not only complete the flexibility and scalability of FPGA, but also possess the functions of ASIC and the characteristics of low power consumption.

Compared with the traditional SOC development technology, the advantages of the Zynq platform are (1) high-value application architecture centered on the processor; (2) flexible and avant-garde technology; (3) expandable platform; (4) lower the cost of the bill of materials (BOM) is calculated. The main applications of Zynq are shown in Table 1.



**3.2. Software Design.** There is a heterogeneous multicore processor on the Zynq chip, which integrates ARM Coetex-A9 and high-performance FPGA on a single chip, and has the ability to program software and hardware at the same time. Only by jointly developing the software and hardware can the performance of the Zynq platform be brought into play. The coordinated development of software and hardware makes it more flexible in design. At the same time, the software and hardware cooperative development methods can optimize its software and hardware parts at different stages of development, making it more optimized.

Although the heterogeneous multicore system can better meet people's needs, its shortcomings such as long development cycle and poor performance stability make developers discouraged. However, Xilinx provides Zynq users with a powerful Vivado design suite, which has rekindled hope for multicore systems. This tool with the latest synthesis and place-and-route algorithms can shorten running time and improve development efficiency.

**3.3. System Design.** This article is mainly based on the embedded wireless communication system designed on the Xilinx Zynq platform. It is aimed at providing an ideal embedded communication processing with small size, good stability, fast processing speed, complete functions, and strong scalability for high-level applications of wireless communication. Zynq platform contains ARM processor, and the realization of wireless communication base station mainly relies on ARM processor. Because the ARM end has already supported the USB interface, the USB extension part can be used to realize that will reduce the difficulty of system development, and the plug-and-play feature of USB facilitates the hardware connection of the system.

According to the software aspect of the system, this time, it is aimed at the real-time optimization after Linux transplantation, so that the whole system can realize real-time wireless communication under the control of ARM. The platform software is based on the Linux kernel and completes character device files in the kernel space. The device driver provides call interfaces such as open, release, read, write, poll, and map.

#### **4. Design Analysis of Embedded System Intelligent Platform Based on Digital Multimedia Artistic Design**

The real-time scheduling algorithms of hard real-time and soft real-time are shown in Table 2. Hard real-time scheduling algorithms cannot be applied in any scenario. Sometimes, real-time scheduling algorithms cannot be used in some soft real-time environments. Therefore, resource scheduling algorithms based on proportional sharing can be used to solve such usage scenarios. The main principle of this algorithm is based on the corresponding weight and the task of operating time proportional to the weight. There are constant data streams in the system. For example, multimedia applications and other applications are most commonly used in scheduling algorithms based on proportional sharing. Because there is no such thing as pro-

portional priority, the CPU is shared according to the weight assigned by the task, but if the system is overloaded, then all tasks will operate slowly according to the corresponding weight. Therefore, in this case, in order to enable the more important processes in the system to be executed in time, it is necessary to adopt a method of dynamically adjusting the weight of the process to solve such problems.

It can be seen from Figure 2 that the real-time test after the hardware device changes are compared with the real-time test without additional operation of the system, and the average delay time and the maximum delay time are not significantly changed. Explain that the modified Linux kernel, real-time plugging, and unplugging of USB emulated external hardware devices change scenarios, the real-time performance of the embedded operating system based on the Xilinx Zynq platform is optimized.

As shown in Figure 3, compared with the real-time test without additional operations on the system, the average delay time and the maximum delay time are slightly increased, but they are still controlled within 100  $\mu$ s. It shows that although there is a large traffic packet that has caused changes in the network environment, the real-time performance is still controlled within a certain range, and the real-time performance has been improved.

Table 3 uses NTSC standard composite video signal input, PAL standard composite video signal input, and component video signal input in turn. It is found that the system can collect images normally, and other modules are basically operating normally.

Figure 4 This picture is borrowed from Baidu Gallery: <https://wenku.baidu.com/view>. It is a comparative display of digital multimedia art design effects. From this, we can clearly see the image. (a) The multimedia input to the digital image is more noisy, and the artistic design is vulnerable to greater interference and distortion, which reduces the design. Use the artistic design platform designed in this article to tackle custom design effects, improve design quality, and improve design performance. The effect diagram is shown in (b). In order to quantify the effectiveness of the plan, the maximum signal-to-noise ratio (PSNR) of the output design is used as a test indicator, and the result of comparing the signal-to-noise ratio and the peak signal-to-noise ratio is used. The noise of various design schemes is shown in Figure 5.

It can be seen from Figure 5 that the peak signal-to-noise ratio of the system intelligent platform designed in this paper is higher than other methods, indicating that the quality of the platform system designed in this paper is higher.

Figure 6 is the statistical analysis result of the program dynamically linked to the executable key library function. In the experiment, the awk filter and Sed tool were used in Linux, and a series of solutions were used to assemble and analyze the command, measure the number of commands, develop the proportion of these commands, and form an analysis tool. According to actual analysis needs, clarify the classification of statistical commands (memory access commands, general ALU commands, general ALU commands, etc.), fixed decimal point multiplication and division, mobile quasistandard multiplication and division, SIMD and CP0

control commands, etc. convenient modification and analysis. The analysis of program actions provides the basis. In order to verify the correctness and effectiveness of the comprehensive analysis tools, a series of automated test solutions as EEMBC AA were selected for analysis (report).

Figure 7 shows that the overall hot spots of network programs are relatively scattered, especially the IP packet verification, NAT, and IP report reorganization programs are more evenly dispersed. TCP will produce different results when processing different datasets, and the more chaotic the hotspot distribution of data packets. It is also more uniform, and in the TCP-mixed test, the sum of the top five program hotspots is only 74%.

## 5. Conclusion

This paper mainly studies the design of the embedded system intelligent platform based on the artistic design of digital multimedia. With the aid of digital multimedia, the embedded system intelligent platform of artistic design is constructed, and the real-time performance, network popular performance, and scheduling performance of the system platform are analyzed, as well as image processing performance and other aspects. The embedded system intelligent platform designed in this paper has good results, and the design quality and design efficiency are both high. The innovation of this article lies in the integration of embedded systems on the basis of the previous digital multimedia, which enriches the form of artistic design and improves the effect of artistic design. The disadvantage of this article is that the application of the system platform is not extensive enough, and its applicability remains to be studied. We hope that the research in this article can provide value and theoretical basis for the field of digital multimedia and art design.

## Data Availability

No data were used to support this study.

## Conflicts of Interest

The authors state that this article has no conflict of interest.

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