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Retraction

Retracted: Research on Application of 3D Simulation Technology in Industrial Product Design Technology

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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) Peer-review manipulation

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] C. Huang and D. Shi, "Research on Application of 3D Simulation Technology in Industrial Product Design Technology," *Advances in Multimedia*, vol. 2022, Article ID 3581886, 9 pages, 2022.

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Research Article

Research on Application of 3D Simulation Technology in Industrial Product Design Technology

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In order to study the driving effect of industrial product design, a method based on the application of 3D simulation technology in industrial product design technology was proposed. This method introduces the information about the change in industrial product design in industrial enterprises and analyzes the application of 3D simulation technology in industrial product design by taking DIALux, industrial robot, and resource information search system as examples. The results show that the application of 3D simulation system needs to be combined with industrial software, and the development of industrial software business mainly based on 3D simulation technology is emphasized so that the business revenue of enterprises increases from 709 million yuan in 2029 to 1.385 billion yuan in 2021, with a compound growth rate of 25.01%, which has achieved good economic benefits. 3D simulation technology plays an important role in promoting the development of industrial product design technology. It is necessary to actively promote the integration between 3D simulation technology and industrial software.

1. Introduction

3D simulation technology refers to a modern professional technology that uses model theory and some relevant information to realize 3D simulation with the computer as an auxiliary tool. With the gradual progress of 3D simulation technology, it has been widely used in scientific research of all walks of life, and it has begun to become an important evaluation index at the technical level of the national computer field and has gradually become a core technology closely related to national security to a large extent. People can discriminate things more objectively by using 3D simulation technology, which is no longer limited by theoretical research and trial experiments. Muhisim, Protel, and Proteu are often used in electronic product 3D simulation technology. In particular, the use of Proteu is inseparable from the development of electronic products [1].

The basic principle of 3D simulation technology is to turn the real controller into an algorithm in the 3D simulation scene and complete the test and verification of the algorithm by combining sensor 3D simulation technology. NVIDIA explained a 3D simulation test based on end-to-end deep learning in detail in its paper on autonomous driving. The key technologies of automatic driving are environmental awareness and vehicle control. Environmental awareness technology is the basis of the driving of autonomous vehicles, and vehicle control technology is the core of the driving of autonomous vehicles, including decision-making planning and control execution. These two technologies complement each other and constitute the key technology of autonomous vehicles. Figure 1 shows the control architecture of an autonomous vehicle [2].

Whether it is environment awareness technology or vehicle control technology, autonomous driving requires a lot of algorithm support, and algorithm development is an iterative process. Under the condition of the immature algorithm, in order to cooperate with the function and performance development of autonomous vehicles, it is necessary to follow the development process from pure model 3D simulation to semiphysical 3D simulation, to

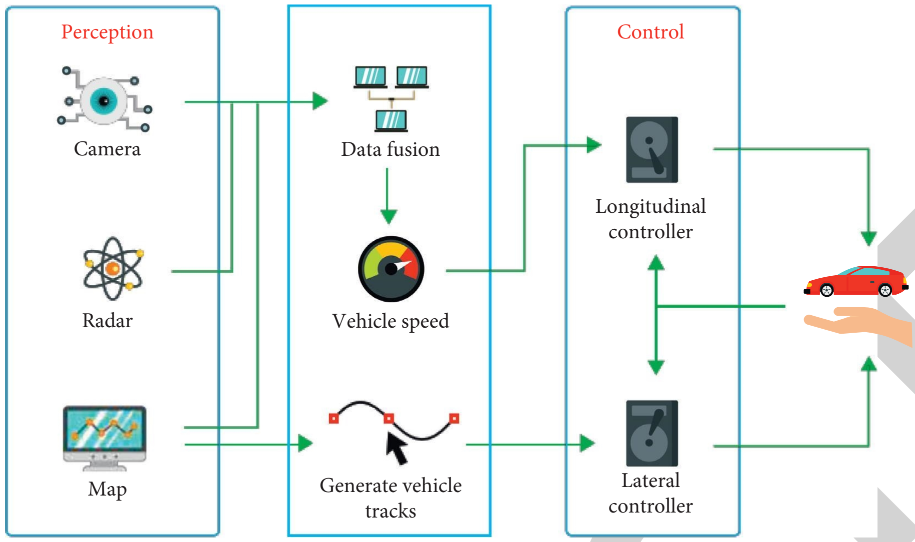

Figure 1: Autonomous vehicle control architecture.

closed site and road test, and finally to open site and road test [3].

The application of 3D simulation technology to the design of industrial products should always be based on the principle of 3D simulation [4] so that the role of 3D simulation technology can be better. Figure 2 is a schematic diagram of 3D simulation technology applied to electrical components and industrial products.

Industrial product design includes not only structure and function optimization design but also aesthetic design. Modeling design is an important part of industrial product design. At present, China's industrial products are heavy on structure and light on design. The product of the same quality falls under modeling limitation [5] and lacks competitive power internationally. Using VR technology to simulate the virtual environment, this process is completed by the computer and related software. The simulated 3D environment is not much different from the real environment. With the help of sensing devices, users can interact with virtual environments. This technology is used in the industrial field to build virtual parts models before production [6]. Virtual reality technology is mainly used in the field of computer 3D simulation, which integrates various information about products and realizes the dynamic design of products in 3D view. In the 1980s, China gradually focused its research on VR technology. The research content mainly includes virtual design, 3D simulation of the hot working process, and so on. At present, this technology can realize the 3D simulation of parts' working processes. At present, China is still deeply exploring VR technology [7].

2. Literature Review

At present, the industrial industry has formed a consensus on the definition of industrial big data. A brief summary of industrial big data is the general term for all data, technologies, and applications throughout the whole life cycle of products such as production and sales in the manufacturing field. It takes product data as a key element, expands people's understanding of traditional industrial data, and also covers related technologies and applications [8]. As one of the key technologies of intelligent manufacturing, industrial big data technology plays an important role in promoting the two-way connectivity between the virtual information world and the physical world, so as to promote the manufacturing industry to leapfrog from the traditional production processing type to the modern manufacturing service type [9]. The application of industrial big data refers to the use of big data-related methods and tools to predict, diagnose, and control the entire industrial products and industrial systems in industrial production, management, and design.

Many enterprises have realized the rich value behind industrial big data. For example, when Japan implemented its air compressor upgrade plan, it introduced the data-driven modeling method related to the intelligent maintenance system from the United States. By collecting the classification monitoring parameters of the air compressor in the rapids and nonrapids and using principal component analysis and support vector machine to establish the classification model, the boundary of the optimal rapids curve was found. At present, there are many kinds of discrete event 3D simulation software in the market [10]. These commercial software has been successfully applied in aerospace, shipbuilding, automobile, and other specific industries in western developed countries. Among them, the relevant aviation manufacturing companies in this area of research and application results are particularly eye-catching. Compared with the application of 3D printing technology in China's aviation industry, there is a certain gap in research and application in this area [11].

3. Methods

The application of this technology in the design process of real objects has the following advantages: it makes the design more intuitive. Designers can use this technology to achieve

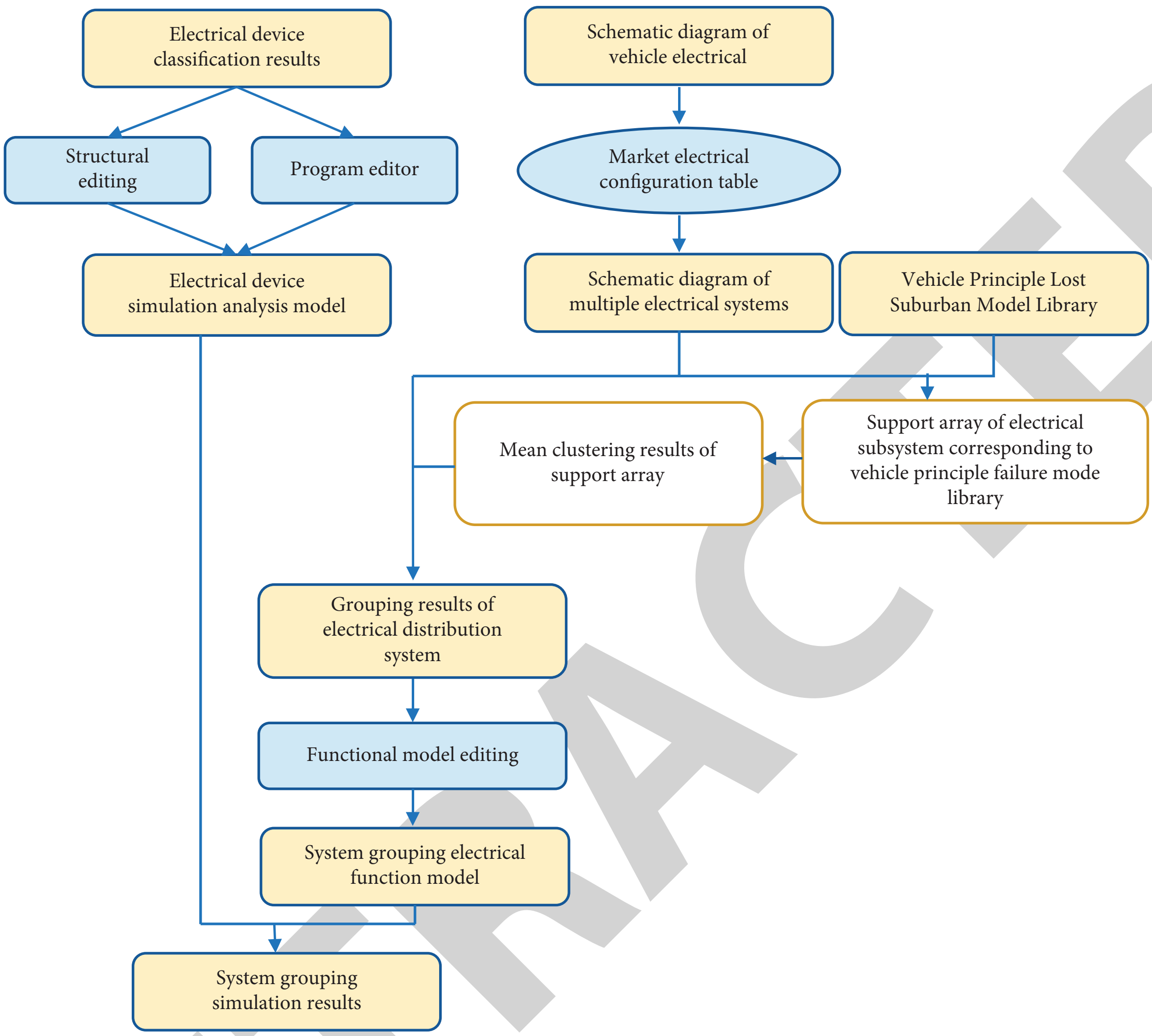

Figure 2: 3D simulation analysis and flow of fast wire harness principle.

human-computer interaction. Given full play to their imagination, the design of the product modeling will be more beautiful. Shorten the design time. In traditional industrial production, samples according to the design drawings need to be produced firstly and then optimize the design after testing the sample quality. However, the emergence of VR technology eliminates the step of sample production. All testing and optimization processes can be completed in a virtual environment. The product cycle from design to finished product is greatly shortened and more beautifully shaped. The realization of 3D simulation technology has no need to make a physical model. All the modeling optimization designs can be completed in the three-dimensional 3D simulation environment, and the aesthetic degree of industrial products will be improved accordingly [12].

The application of 3D simulation technology in the design of industrial products mainly includes the preliminary construction of the sketch, completing the assembly modeling, completing the dynamic demonstration of the model, and adjusting the model color [12]. The design of industrial products includes three parts: conceptual design, product modeling design, and product structure engineering analysis. In the conceptual design stage, the design team considers product function, quality, efficiency, user requirements, and manufacturing process. Innovative solutions are put forward so that the product at the beginning of design not only shows functional superiority but is also easy to manufacture and has low production cost so that the comprehensive competitiveness of the product can be enhanced. Many companies in developed countries see design as a popular strategic tool [13]. In the product modeling design stage, the designer uses the CAD system of three-dimensional graphics function to complete. The shape state of the designed products can be simulated on the computer. The creative scheme of the products can achieve three-dimensional design through rapid three-dimensional modeling and rendering and can be adjusted at any time in the shape feeling, shape adjustment, color, and other aspects. In the analysis stage of product structure engineering, CAE technology and finite element technology need to be applied, with the help of engineering analysis software to further adjust the product design scheme [14].

With the help of computer powerful computing power, designers can quickly calculate the lighting design scheme but also realize the 3D simulation of the lighting effect of the scene through the line of rendering output with a certain "photorealistic" image. The foundation of lighting energy saving is based on the premise of achieving the corresponding lighting effect, rather than just energy consumption. Here involves the illumination calculation of the illumination of the environment space in the early stage of lighting design. Table 1 presents the energy-saving requirements in the code for architectural lighting design [15].

At present, most environmental art designs lack professional lighting design at the initial stage, and the lighting effect design and expression in the design scheme only rely on the effect drawing to express. The advantage of rendering is that it is intuitive and fast. However, the choice of lamps and lighting effects is only based on the subjective thinking and previous design experience of the designer, which is often different from the final actual effect.

DIALux is an optical 3D simulation software with strong professionalism, high efficiency, and versatility. It has basic modeling functions and can assist its own modeling by importing external models. The lamp data is customized for each lamp manufacturer. The 3D simulation data is accurate and open and can be imported into IES format files of most lamp manufacturers. The final output of the project is in PDF format [16]. You can customize a large number of chart data such as lamp list, calculation point list, working surface list, grayscale/color illuminance chart, point illuminance chart, lamp data, furniture configuration chart, and so on. DIALux is widely used, almost all lighting design places can be completed through DIALux. Because of DIALux's friendly Chinese culture interface and good interaction design, designers can quickly get used to the software and complete the design.

Illumination 3D simulation calculation elements are drawn in Dialux. Since the current version of DIALux only supports the drawing of rectangular and polygonal computing elements and cannot directly draw the fan-shaped computing elements required by the experiment, the author changed a new way to determine the computing elements. Firstly, fan shapes with a central angle of 120°, the thickness of 1 mm, and radius of 300 mm and 500 mm were cut through Boolean operation in the DIALux drawing module. Then, fan shapes with radius of 300 mm and 500 mm were further cut, and the cut areas were placed on the table, located on the desktop perpendicular to the edge of the desktop side. Select two areas in the computing element module and name them "300 mm computing element" and "500 mm computing element," and then the drawing of the computing element required by the experiment can be completed. Table 2 shows the illumination information data of the two computing elements.

As can be seen from the data in the table, with the increase of the luminescence point height from the desktop, the overall trend of the illuminance value (Ave) of the two computing elements decreases, and the illuminance uniformity (Max/Min) also decreases [17]. When the luminous point of the light source rises to 300 mm from the desktop, the illuminance uniformity of the 300 mm computing element is 1.98, which begins to meet the Grade *A* illuminance standard. At this time, the illuminance value and illuminance uniformity of the 500 mm computing element also meet the Grade *A* illuminance standard. Therefore, the lower limit of the height range of the luminous point of the temporary light source is 300 mm. When the luminous point of the light source rises to 600 mm from the desktop, the illuminance value of the 300 mm computing element is 230*lx*, lower than the *lX* of class *A* illuminance standard. And, as the luminous point of the light source continues to rise, the illuminance value of the 300 mm computing element will continue to decrease. Therefore, the upper limit of the luminous point height range of the temporary light source is 500 mm.

Table 1: Energy-saving requirements in the code for architectural lighting design.

A room or place	Illumination power density (W/m^2)		Corresponding illuminance value (1*x*)
	Current value	Target	
General office	11	9	300
Fancy offices, design rooms	18	15	500
The meeting room	11	9	300
Business hall	13	11	300
Room for filing, copying, distribution	11	9	300
Archives room	8	7	200

Since each calculation point cannot be directly located in DIALux, the specific coordinates of each calculation point need to be determined first. In this study, first of all, in Auto CAD, draw out the study contour plan, and according to the calculation range and mark the calculation point, you can draw out the calculation point in Auto CAD and obtain the coordinate value of each calculation point. By inputting the coordinate value above, the light source can be placed in the calculated position in DIALux. Then, by changing the height value of the light source's luminous point, the illumination information of the working face within the range of 210 mm~560 mm of the luminous point height of the light source can be calculated [18], and the suitable height range of the luminous point of the light source at each position point can be further calculated. Place the luminous point of the light source on the *R*1 coordinate point of 105° and calculate the illumination information of the working surface when the luminous point of the light source is 210 mm, 300 mm, 400 mm, 500 mm, and 560 mm from the desktop, as shown in Table 3.

In addition to the application of 3D simulation technology to the design of industrial lighting products, 3D simulation technology can also be applied to the design of an image tracking system. Taking target tracking hardware-in-the-loop 3D simulation system as an example, target detection and tracking is a frontier technology, involving image processing, kinematics, mechanics, control theory, and so on. It has been widely used in both military and civil

Table 2: Illumination information data of two computing elements.

Height from the table (mm)	300 mm computing element				500 mm computing element			
	Ave (*lx*)	Min (*lx*)	Max (*lx*)	Max/min	Ave (*lx*)	Min (*lx*)	Max (*lx*)	Max/min
100	997	364	3,311	9.10	180	107	325	3.04
200	744	430	1,377	3.20	237	152	387	2.55
300	540	388	769	1.98	247	168	361	2.15
400	395	318	490	1.54	231	172	309	1.80
500	296	254	339	1.33	205	159	257	1.62
600	230	203	251	1.24	177	145	211	1.46

Table 3: Illumination information of working face.

Position coordinates	According to desktop height	Ave (*lx*)	Min (*lx*)	Max (*lx*)	Max/min
	210	373	176	723	4.11
	300	335	189	544	2.88
105° *R*1	400	284	189	405	2.14
	500	236	180	304	1.69
	560	210	169	258	1.53

fields, especially in the field of visual aircraft requiring automatic intelligent tracking capability and fast response.

The system is based on automatic matching and manual searching. On the premise of locking the moving object successfully, the target position coordinates are obtained, and the control identification code is preset according to the angle difference and distance information of the target deviating from the center of the field of view, which is fed back to the motor servo system by RS232 serial protocol. When the effective identification code is received, the servo motor controls the one-dimensional rotating platform to adjust the camera (the angle range of horizontal rotation is −600~+600) to rotate in the specified direction so that the target returns to the center of the field of view. If the temporary occlusion occurs, the tracking system can continue to move the tracking wave gate through the budget algorithm until the target is locked again. Figure 3 is the schematic diagram of the system structure.

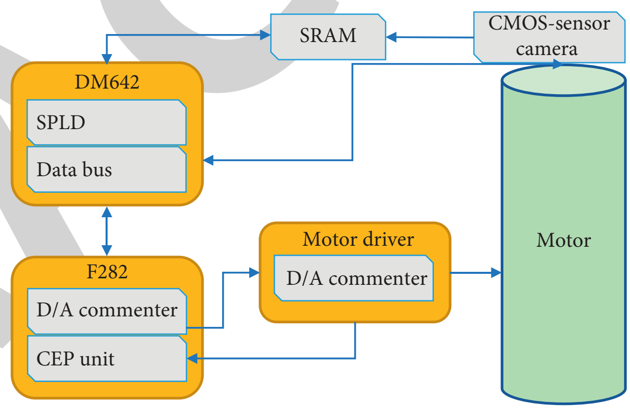

Figure 3: Schematic diagram of system structure.

The industrial robot application system is the sublimation of industrial robot research. It refers to the integrated application of industrial robots in different working conditions. The industrial robot application system is a set of electromechanical integration devices, which is very suitable for teaching [19]. It integrates mechanical manufacturing, computer programming, electronics and electricity, artificial intelligence, sensing technology, and other disciplines and technologies so that students can learn relevant knowledge at multiple levels and from multiple perspectives. The programmable controller is the control center of the whole system, through the electrical system to connect PLC and other devices, to achieve communication, so as to achieve various applications of industrial robots. Figure 4 shows the system composition of an industrial robot.

A set of industrial robot application system virtual 3D simulation platforms is set up, through the choice of the platform development tools to complete the virtual scene design, including model format processing, model data conversion, and light source design [20]. At the same time, choosing a proper collision detection method can reduce the interference between objects and enhance the authenticity of the virtual scene. UGUI-friendly visual components are used to complete the user interface design, and the screen adaptation technology is explored in depth for different terminal displays. The design of control interface functions is studied from six aspects: manual roaming of virtual scene, automatic roaming of virtual scene, text prompt, test function, animation 3D simulation of virtual industrial robot, and scene jump.

In the process design of the industrial robot application system, the whole system is initialized first, and then the task is released through the touch screen to realize the robot palletizing, grinding, vision, assembly, and storage five applications. Among them, palletizing is a very important operation unit. The robot rotates to the initial position of the palletizing and installs the suction cups. The robot moves to the reservoir area, grabs the trapezoidal materials from the reservoir area (eight pieces of trapezoidal materials are placed at each time, and the materials can be placed randomly), and places them in the positive and negative detection areas. After judging by the sensor, the robot grabs the materials again and puts the materials into the left and right sorting areas, respectively, according to the judgment results [21]. After eight judgments,

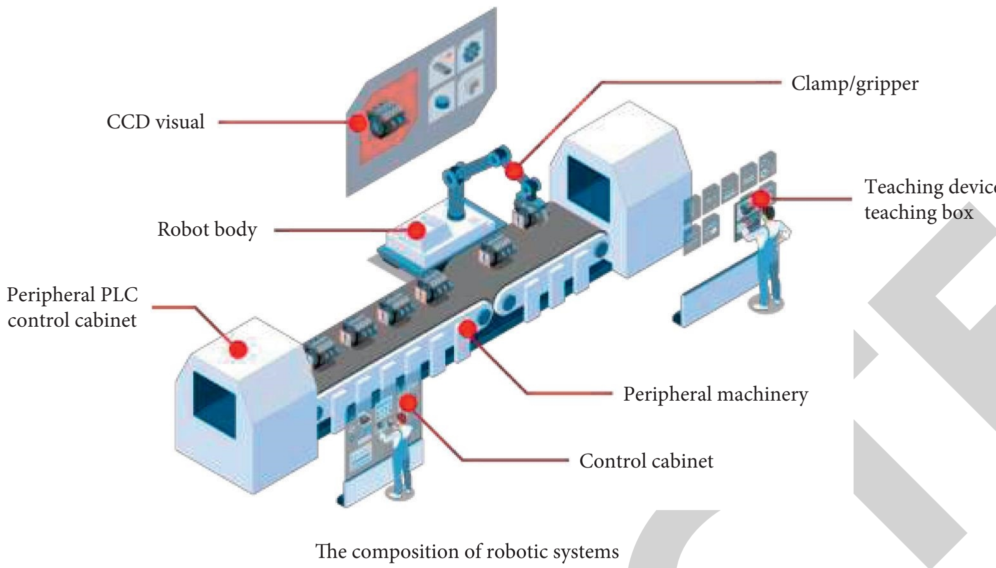

Figure 4: System composition of an industrial robot.

the robot placed the suction cups in situ and returned to the initial position of stacking, as shown in Figure 5.

Before searching and integrating multiregional resource information for industrial product design, the principle of multiregional resource information system of industrial product design should be analyzed. When the traditional resource information search and integration method is used to search and integrate the multiregional resource information of industrial product design, firstly, the clustering prototype and the total number of the resource information are determined, and the distance between the sample and the prototype is calculated. According to the calculation results, the optimal clustering results are obtained through the objective function to complete the search and integration of resource information [22]. Let X represent the data set of multiregional resource information of industrial product design, and there are n samples in the X data set. The expression of X is as follows:

$$X = \{X_1, X_2, X_3, \ldots, X_n\}. \tag{1}$$

Let X_i represent m attribute values of the i-th industrial product resource information sample, and the expression of X_i is as follows:

$$X_i = \left\{X_{i1}, \ldots, X_{ip}, X_{i(p-1)}, \ldots, X_{im}\right\}, \tag{2}$$

where subscripts from 1 to P represent numeric data attributes, while subscripts from $P+1$ to m represent typed data attributes. Let k represent the cluster number of multiregional resource information data set of initial industrial product design, $V = \{V_1, V_2, \ldots, V_k\}$ represent the set of modules corresponding to the initial data set, and $C_i = \{C_{i1}, C_{i2}, \ldots, C_{ik}\}$ represent the clustering set of multiregional resource information of industrial product design in the clustering process. The k-prototypes algorithm was used to integrate the resource information of industrial product design in multiple regions, and the total number of resource information categories K of industrial product design in multiple regions was determined. K initial cluster prototypes of industrial product design resource information were selected for each category. The distance d between prototypes Vl and sample X_i was calculated by the following formula:

$$d(xi, vi) = \delta\ d1(xi.vi) + \gamma\ d2(xi, vi), \tag{3}$$

where γ represents the weight value of the classification attribute of industrial product resource information and δ represents the dissimilarity degree of the classification attribute of industrial product resource information.

The clustering prototype of each class of multiregional resource information of industrial product design is recalculated. Let V represent the pattern of multiregional resource information sample data set of industrial product design so that the value of $D(X, V)$ is the minimum, and $D(X, V)$ represents the total distance between all resource information samples and the corresponding set module. The calculation formula is as follows:

$$D(X, V) = \sum\left[\delta d_1(x_i, vi) + \gamma d_2(x_i, v_i)\right]. \tag{4}$$

For the model of the industrial product design resource information with numerical attributes, the mean value of numerical attributes in the cluster sample is selected. For the module of industrial product design resource information with classification attributes, the value with the highest probability of occurrence of each classification attribute in the cluster sample is selected, as follows:

$$\frac{C_{vlj}}{n \geq C_{clj}/n}. \tag{5}$$

According to the above steps, the principle of multiregional resource information system for industrial product design can be obtained, which can be used to complete multiregional resource information search and integration.

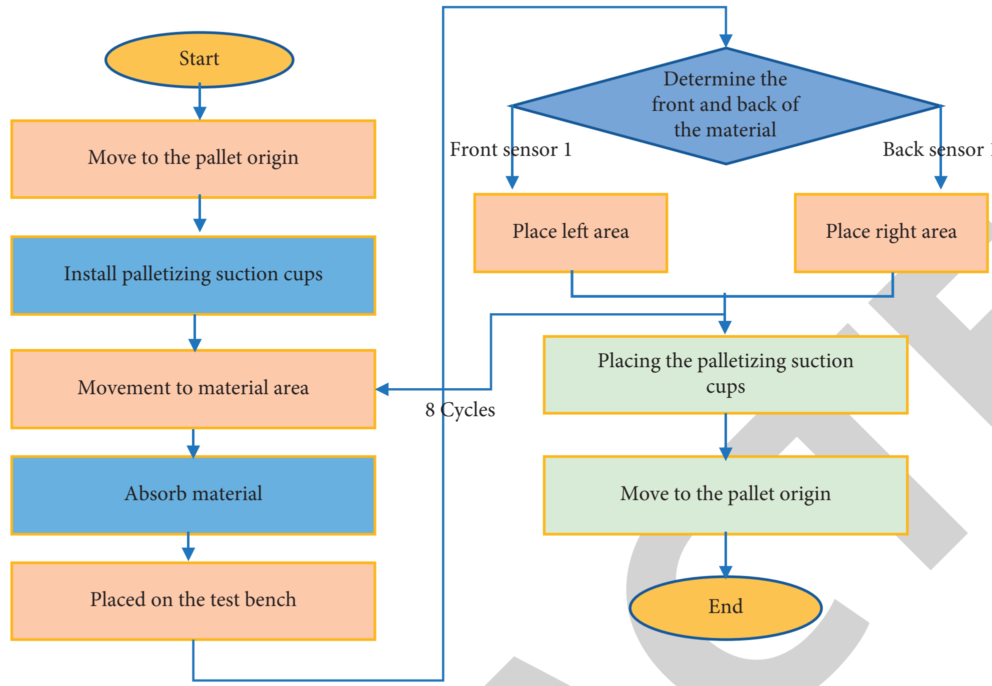

FIGURE 5: Palletizing process.

The intraclass dispersion function and interclass aggregation function are introduced into the weight calculation formula of TF-IDF. By calculating the maximum value of the product of feature words in the intraclass dispersion and interclass aggregation of the multiregional resource information text set of industrial product design, the interclass distribution and intraclass distribution of feature words in the multiregional resource information text set of industrial product design were evaluated. It provides a basis for searching and integrating multiregional resource information on industrial product design. The clustering degree between categories represents the distribution of feature words among various categories in the multiregional resource information set of industrial product design. If a feature word frequently appears in a category and rarely appears in other categories in the resource information set, it indicates that the feature word has a strong ability to distinguish categories. Let the clustering degree between classes be represented by CD, and the calculation formula of CD is as follows:

$$C\,D = \frac{\mathrm{d}f_i(w)}{\sum \mathrm{d}f_i(w)}. \tag{6}$$

The larger the value of the CD is, the more concentrated the feature W appears in the class.

In order to improve the efficiency of multiregional resource information dissemination in industrial product design, it is necessary to integrate the multiregional resource information in industrial product design. The current resource information integration methods have the problems of slow convergence speed and low precision of clustering results. A search and integration method for multiregional resource information of industrial product design is proposed, which solves the problems existing in the current method, improves and optimizes it, and lays a foundation for efficient dissemination of multiregional resource information of industrial product design.

4. Result

With the rapid development of China's social economy, science and technology are also making gradual progress. China's 3D simulation technology has also been applied to the corresponding electronic products, and the application range is relatively large. Besides, the application of 3D simulation technology to promote the level of China's electronic technology has risen a great step. Nowadays, the product structure of the world is increasingly diversified and personalized, and the short cycle, low cost, high quality, and flexible market response ability have become the focus of competition [23]. The development of modern industrial technology shows that product innovation is based on knowledge and information innovation design. Virtual 3D simulation technology is adapted to the development trend of product development and rapid development.

Highly developed science and technology and outstanding industrial design representing the trend of the new century will play an important role in economic competition. Virtual 3D simulation technology changes the traditional design method in many aspects. On the one hand, it provides new means of artistic expression for product creation. On the other hand, it uses computer technology as the core of modern high technology, in the product design process for designers to provide real-time, interactive, dynamic, active, and completely different from the previous design way. Virtual 3D simulation technology has greatly

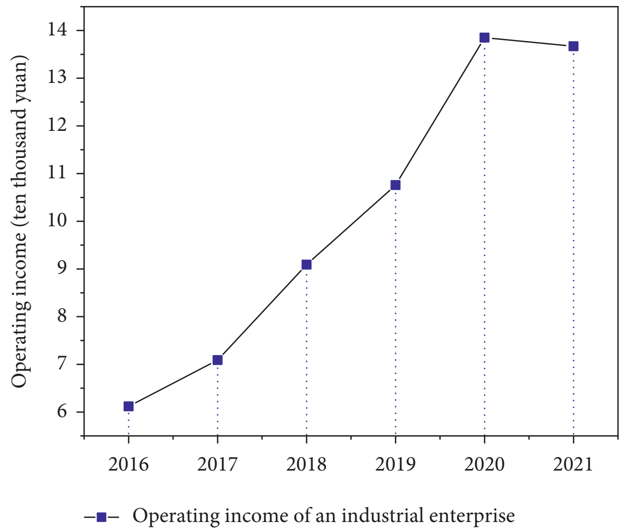

Figure 6: Operating income of an industrial enterprise (100 million yuan).

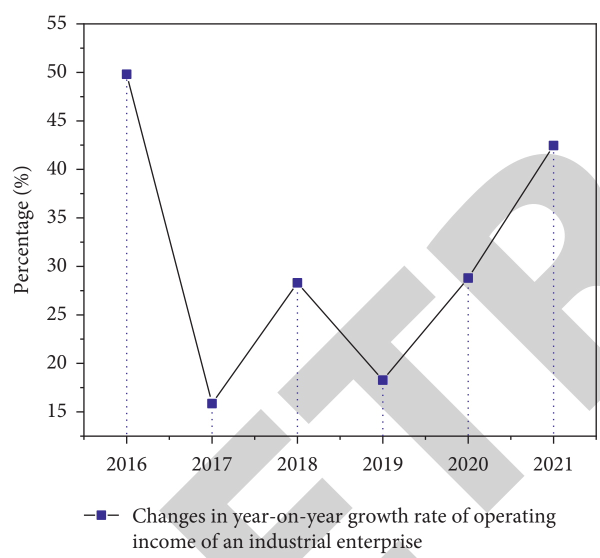

Figure 7: Change of year-on-year growth rate of operating income of an industrial enterprise.

improved the depth, breadth, and speed of information interaction among designers, manufacturers, and users, which is in line with the development trend of modern design technology.

The application of 3D simulation technology to the development of industrial enterprises is the most important combination of 3D simulation technology and industrial software. An industrial enterprise provides secondary development based on Oracle, SAP, and other mature software modules but also provides technology in Taiwan, big data, and other related self-developed products. Intelligent manufacturing and industrial Internet field product solutions. It can provide 3D simulation system software products based on 3D simulation technology for some manufacturing enterprises and has obtained ideal economic benefits in recent years.

As can be seen from Figures 6 and 7, the operating income of this industrial enterprise has achieved rapid growth, and its profitability has also significantly improved. From 2017 to 2020, the company's operating revenue increased from 709 million yuan to 1.385 billion yuan, with a compound growth rate of 25.01%, and its net profit increased from 101 million yuan to 176 million yuan, with a compound growth rate of 20.34%. In the first three quarters of 2021, the company achieved a revenue of 1.367 billion yuan, up 42.46% year on year, and a net profit of 132 million yuan, up 20.76% year on year. According to the company's performance express, in 2021, the company achieved an operating revenue of 1.934 billion yuan, an increase of 39.57% over the same period last year, and returned to the parent company's net profit of 228 million yuan, an increase of 29.69% over the same period last year. In general, the company's performance growth is basically in line with market expectations.

5. Conclusion

3D simulation technology is very convenient in the process of design and development and can quickly realize the debugging and design of electronic products. In the process of the gradual improvement of science and technology, rapid and efficient design and research and development of electronic products have been achieved, making the development of electronic products continuously refined. The progress of 3D simulation technology promotes the development of electronic products, and more and better electronic products will be developed in the future social development, making further contributions to the development of Intelligence in China. Economic globalization, communication network, and design virtualization are the future life style of mankind in the new century. With the rapid development of computer software and hardware technology, virtual 3D simulation technology has provided a powerful tool for today's industrial designers as a cutting-edge application of computers. The rapid development of computer 3D simulation technology not only means a change in design means but also changes the way of thinking about industrial design. It has promoted a series of profound, comprehensive, and far-reaching changes in the manufacturing industry from product design to manufacturing to technology management. Product scheme design usually cannot be carried out by pure mathematical calculus, nor can it be described completely by a mathematical model but needs to be described formally according to product characteristics. With the help of the knowledge and experience of design experts, the virtual 3D simulation technology has gone through a long process from its germination to today's maturity. Virtual 3D simulation technology has greatly changed people's way of thinking in a sense. Although the previous forms of product expression have a gorgeous appearance, they lack systematic understanding of product space and human-machine interaction. Virtual 3D simulation technology not only can improve the authenticity and interaction of product display but also can assist product development and design in reverse.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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