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Study on the Digital Design of Macau Native Portuguese Women's Clothing in a Metacosmic Perspective

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Abstract: This paper studies the digital design of Macau native Portuguese women's costumes from the perspective of meta-universe. Firstly, it explains the current development of Macau native Portuguese women's costumes and the necessity of digital design, secondly, it analyzes the feasibility of the digital design of Macau native Portuguese women's costumes on this basis, and proposes the innovative application of digital technology in digital design of costumes, and finally, it concludes the application methodology of digital design of costumes in the meta-universe, with a view to effectively combining the costumes and modern digitalization to give them new vitality, and to contribute to the cultural inheritance, design and cultural and creative industries of Macau's costumes. Finally, it concludes the application method of clothing digitalization design in the meta-universe, in order to effectively combine Macau native Portuguese women's clothing with modern digitization and give it new vitality, so as to provide reference for the inheritance of Macau's clothing culture and the development of design and cultural and creative industries.

Keywords: Metacosmos; Digital Technology; Macau Native Portuguese Women's Clothing; Digitalized Design.

1. Introduction

1.1. Background of the Study

With the continuous maturity and application of technologies such as virtual reality and blockchain, Metaverse has gradually become an emerging financial, commercial and cultural platform. In this diversified virtual world, people can experience different lifestyles and cultural forms, including clothing, through virtual characters created by themselves.

At the same time, as a former Portuguese colony, Macau naturally has a rich Portuguese cultural heritage, including the native Portuguese culture, which has a distinctive clothing design that reflects the historical and cultural background of this group.

Therefore, digitizing and designing Macanese native Portuguese women's costumes will help to better display, transmit and protect Macau's cultural characteristics and historical heritage, and at the same time enrich the costume choices of virtual characters on the Metaverse platform, further promoting the development and application of Metaverse.

1.2. Purpose and Significance of the Study

Explore how to apply the innovation of digital technology in the design of Macau native Portuguese women's clothing under the perspective of the meta-universe in the digital era, in order to improve the design efficiency, strengthen the design innovation, and realize the digital display of clothing, so that more people can understand and appreciate the culture of Macau native Portuguese, and better inherit and protect the cultural heritage of Macau, and promote the transformation and upgrading of the clothing industry tomeet the needs of the market nowadays. At the same time, through the innovative development of digitalized design of costumes, it will enrich the diversity of the Yuan Universe platform and open new paths for the construction of Yuan Universe.

1.3. Research Methodology

Literature research method: Books and historical materials related to Macau native Portuguese women's costumes were searched through the university library and databases of various electronic resources, and literature related to Macau native Portuguese women's costumes were also searched and collected through libraries and museums in Macau region, and information and contents related to Macau native Portuguese women's costumes were summarized.

Case study method: Through collecting data, checking literature, and at the same time generalizing and analyzing the current cases and literature on the application of digital technology in the field of clothing design, analyzing and generalizing the different digital design methods, rationally analyzing the innovative exploration methods in the excellent cases, and combining the actual cases with themethod of digitally preserving the clothing of Macau's indigenous Portuguese women and summarizing the method of displaying and spreading them.

2. Literature Review

2.1. Current Status of Research on Digital Design of Clothing

2.1.1. Sub-section Headings

At present, there are fewer systematic works on the concept of "digitalized design of clothing" in China, butthere are scholars who have researched and published journals, so most of the references of the current state of research in this field are concentrated in thesis journals, and we found that there are 125 journals under the key words of "clothing" and "digitalization" through searching on the Internet, and the number of published articles is increasing year by year. Through the search of ZhiWang, we found thatthere are 125 journals under the keywords of "clothing" and "digitization", and the number of published papers is increasing year by year. In these published journals, thedigitalized design of costumes is mainly focused on three aspects, namely, digital protection

and inheritance of costumes and patterns, digital restoration, and digital innovation and display.

In the digital design of costumes, many literatures have mentioned the application of digital inheritance and protection of costumes and patterns, for example, Sun Zao, Zeng Hui, Jiang Miao pointed out in "The Special Role of Digital Images in the Inheritance and Protection of Intangible Cultural Heritage of Costumes" that digital images can better inherit and protect the intangible culture ofcostumes in the background of the new era; Han Fuyaopointed out in "Digital Inheritance and Development of National Costume Cultural Industry" the necessity of digital transformation and three ways of digital transformation, in order to achieve the goal of the national costume cultural industry.[1] Han Fuyao pointed out the necessity of digital transformation of national costume culture industry and the three ways of digital transformation in order to better inherit and develop national costume culture industry in "Digital Inheritance and Development of National Costume Culture Industry".[2] Chia Li and Shen Qiming pointed out in "Exploration of Digitalized Protection and Development of National Costume Resources - Taking the Construction of "Zhuang Costume Cultural Database" as an Example" that the management, research and utilization of national costume cultural resources should be strengthened with the help of new and high technology, for example, the construction of a cultural database of Zhuang costumes, and the establishment of a cultural database of Zhuang costumes. Building a Cultural Database of Zhuang Clothing[3] In the article, it is pointed out that the management, research and utilization of national costume cultural resources should be strengthened with the help of high-tech.

The application of digital restoration in the digital design of clothing is also very extensive, Guo Yuwei, Kong Wenwen in the "based on 3D virtual technology of the MingDynasty women's clothing digital restoration research" in theuse of digital virtual technology on the Ming Dynasty women's clothing existing cultural relics three-dimensional simulation and restoration; Tong Meng, Li Xuefei in the "Ming Dynasty official clothing structure research and digital restoration" pointed out the limitations of the clothingon display and two-dimensional picture data, using three-dimensional modeling to restore the Ming Dynastywomen's clothing.[4] Tong Meng and Li Xuefei in "Structure Research and Digital Recovery of Ming Dynasty Official Clothing" pointed out the limitations of the physical display of clothing and 2D photo data, and used 3D modeling to recover the structure and fabric of Ming Dynasty official clothing and display it.[5] Yao Tong and Huang Chuyi, in "Study on Digital Recovery and InnovativeDesign of Han Clothing Based on CLO 3D Platform", used digital technology to recover and digitally display the costume artifacts in the collection of Nanjing Museum.[6] Inthis paper, the digitalization technology was used to restore and digitally display the costume artifacts in the Nanjing Museum.

There is also a growing body of literature on digital innovation and display of costumes. Yu Lan, in "The Innovative Application of Digitalization of Dunhuang Algae Well Patterns in Costume Design," generalizes and analyzes the algae well patterns from the perspective of iconography and typology, and establishes a database for them by using digitalization technology.[7] Liang Hui'e and Li Donglei in "Reflections on the Display of Costume Fittings and Digitalization Construction of Museums in Jiangnan Region-Taking Headdresses in the Collection as an Example" put forward three principles of digitalization construction of museums from the perspectives of museum visitors and resource demanders with a view to better displayingmuseum exhibits by using digital technology.[8] Duanran and Liu Xiaogang in "The Application of Ethnic Minority Clothing Elements in Digital Costume Design" pointed out the feasibility and specific measures of applying ethnic minority clothing elements to digital costume design, and considered that such measures would help to improve the overall standard of costume design.[9] It is also believed thatthis measure will help to improve the overall standard of clothing design.

2.2. Research on the Current Status of Macau's Native Portuguese Women's Fashion

Searching for the keyword "Macau women" on the ZhiNan website, 41 journals were found, and the keyword "Macau costumes" was found in one journal. However, further screening of the above results revealed that there wasonly one journal under the keyword "Macau women's costumes". However, after further screening of the above results, it was found that there was only one journal underthe keyword "Macau women's clothing". In "An Analysis of the Characteristics of Native Portuguese Women's Clothing in Macau during the Ming and Qing Dynasties", Sun Shuyan conducted an in-depth exploration of the culture and characteristics of Macau Native Portuguese women's clothing in the Ming and Qing dynasties, and took Macau women's clothing as the basis for her research.[10] In her article, Sun Shuyan explored the culture and characteristics of Macau's native Portuguese women's costumes during the Ming and Qing Dynasties, and there are almost no articles on Macau's women's costumes.

Most of the literature on the Macau region studied by domestic scholars is based on anthropological and sociological perspectives, exploring the origins of the native Portuguese in Macau, their bloodline, social status, language, religion, family and marriage, etc., whereas there is less literature on the study and documentation of the costumes of Macau, although there are still a variety of books, newspapers and photographs preserved in the Macau museums and electronic websites that can be used to study the costumes of Macau women.

3. The Need for Digital Design of Women's Clothing for Native Portuguese in Macau

3.1. Macau's Native Portuguese Women's Clothing has been Neglected for a Long Time.

The native Portuguese of Macau are local residents born in Macau with Portuguese ancestry and have a long cultural and historical history of dress, which has an important place in the local community. However, in today's Macau society, the traditional dress of native Portuguese women has long been neglected. Despite the fact that Macau is a multicultural city, native Portuguese women's dress is rarely seen in public or in the media, and is not even recognized as part of the local cultural heritage, a phenomenon that has become more and more serious in the last few decades.

There are many reasons for this, including the influence of

western mainstream culture and contemporary fashion styles. In addition, due to the conflict and integration of cultures faced by the native Portuguese in Macau, their culture and costumes have gradually been influenced by other cultures and gradually lost their original characteristics. This situation has brought negative impacts on the local community, weakening the characteristics and attractiveness of Macau's diverse culture and affecting the development of Macau's tourism industry. At the same time, for the native Portuguese, the long-term neglect of their clothing culture will also cause them to lose their cultural self-confidence and sense of identity. Therefore, it is necessary to strengthen the protection, display and inheritance of the native Portuguese women's costumes in Macau, so as to give more cultural value and recognition to them.

3.2. A Relatively Homogenous Approach and Means of Development

Native Portuguese women's costumes have a long history in Macau, but the way and means of their development are relatively unitary. At present, the Macau government and all sectors of the society lack sufficient investment and support in the promotion of local culture and traditional costumes, thus limiting the development of native Portuguese women's costumes.

Traditional costumes require constant innovation in order to evolve and maintain their vitality. However, in recent years, there have been relatively few changes in the designs and styles of Macau's native Portuguese women's costumes, and there is a lack of innovation in costume design, so it is necessary to strengthen the cultivation of and support for native Portuguese women's costume designers in order to improve their design standards and creative abilities.

Coupled with the emergence of digital media and thearrival of the Internet era, there is a lack of digital publicity and promotion of Macau's native Portuguese women's costumes, and the government and all sectors of the society need to step up the publicity and promotion of native Portuguese women's costumes, in order to allow more people to understand and know about this cultural heritage. In order to preserve and develop the culture of native Portuguese women's clothing, the Macau government and allsectors of the society need to step up publicity and promotion, as well as to invest resources and support in order to promote its continuous development and evolution.

4. The Feasibility of Digital Design for Native Portuguese Women's Clothing in Macau

4.1. Unique Macanese Women's Clothing in Macau

Macau native Portuguese women's clothing is a kind of clothing with a historical and cultural background, characterized by the integration of Portuguese and Chinese traditional cultural elements, and the combination of the Chinese cultural elements has formed a unique style of clothing. In terms of color, the skirts of Macau native Portuguese women's clothing usually adopt bright colors, such as red, green and yellow, and are combined with various flowers, patterns and embroidery elements, showing a rich visual effect and respect for traditional culture. As for the choice of fabrics, Macau native Portuguese women'sclothing usually uses high-quality materials such as silk and cotton threads to ensure the comfort and beauty of the fabrics.[11] The choice of fabrics is usually made of high-quality silk and cotton threads to ensure comfort and beauty.

Figure 1. Unique and distinctive Macanese women's costumes

In addition, the design of Macau native Portuguese women's clothing emphasizes the integration of Chinese and Western design ideas. In terms of style and detail design, it often adopts traditional Chinese elements such as cross collar, guanzi and lotus petal sleeves, and at the same time, italso integrates western lace, embroidery and other handicraft techniques. This innovative design style allows for greater diversity and inclusiveness in the design of Macanese women's apparel.

Figure 2. Embroidery patterns on the clothing of native Portuguese women in Macau

Macau's native Portuguese women's clothing, which combines elements of Chinese and Portuguese cultures, is a unique cultural heritage that has formed its own distinctive style of clothing. In recent years, the unique Chinese national costume has attracted more consumers and designers through continuous cultural inheritance and innovation, and Macau native Portuguese women's costume can also attract more attention through design innovation while retaining its uniqueness.

4.2. Diversification of Digital Technology

With the continuous development and advancement of technology, digital technology has become more and more diversified. In today's digital age, designers can utilize a variety of digital tools and software to create more precise, efficient, and innovative designs.

3D modeling technology is one of the most popular and widely used digital tools. Through 3D modeling technology, designers can convert their ideas into concrete objects and realize rapid prototyping and testing of products, thus reducing production costs and time and improving product quality and accuracy. Virtual reality technology is also one of the digitalization technologies that have gained attention in recent years. Through virtual reality technology, designerscan

carry out more realistic and intuitive design and production, and allow consumers to interact with the designed products, so that consumers can better understand and experience the products.[12] The designers can make the design and production more realistic and intuitive through virtual reality technology.

Smart wearable devices and Internet of Things (IoT) technology are also manifestations of the continuous diversification of digitalization technologies. Through smart wearable devices, users can monitor their body data and increase their participation in designing products; while Internet of Things (IoT) technology can realize the digital integration of manufacturing, logistics and consumers, making the production and consumption segments smoother and more efficient.[13] The Internet of Things (IoT) technology enables digital integration of manufacturing, logistics and consumers, making the production and consumption processes smoother and more efficient.

Diversification of digital technology is very significant in today's era, a variety of diversified digital tools and software can improve the quality, efficiency and innovation of product design and production, more designers are beginning to actively adopt and innovate digital technology, to promote the continuous improvement and development ofproduct design and production technology.

5. The Innovative Application of Digital Technology in the Design of Native Portuguese Women's Clothing in Macau

5.1. Building a Digital Image Database for Apparel

Apparel digital image database is a specialized database for storing, managing and processing apparel-related digital images, which can be used in all aspects of apparel design, production, sales, etc. to improve the production efficiency, quality and accuracy of apparel and reduce production costs.[14] It can be used in all aspects of apparel design, production and sales to improve production efficiency, quality and accuracy and reduce production costs.

Macau's native Portuguese women's costumes are an important part of Macau's culture. Through the construction of a digital image database of costumes, it is possible to preserve and pass on the cultural elements of their costume design, materials and craftsmanship, and to promote exchanges and interactions among different cultures. At the same time, Macau's native Portuguese women's costumes have unique regional characteristics and ethnic customs. By building a digital image database of costumes, it can provide the tourism industry with more rich and colorful cultural resources, attracting more domestic and foreign tourists to visit Macau and promoting the development of the local economy.

Building a digital image database for apparel is a complex process that requires consideration of many factors. Before building the database, it is necessary to determine the objectives and requirements, including the type and quantity of images to be stored, the storage time limit, data formats and other aspects. In determining the demand, it is alsonecessary to take into account the actual use of the database to ensure the availability of the database. The collection and organization of image data, database design and development, testing and optimization, maintenance and updating, etc. need to be considered in order to construct an efficient, reliable and easy-to-maintain database system.[15] The database system is designed to be efficient, reliable and easy-to-maintain.

However, with the increasing demand for cultural products, the construction of a digital image database ofMacau's native Portuguese women's clothing will help to explore its application and development mode in the culturaland creative industries, and promote the development of cultural and creative industries while at the same time obtaining a better inheritance and protection.

5.2. Combined with the Internet Technology of the Dissemination Method

As one of the unique cultural heritages of Macau, Macau's native Portuguese women's costumes, the combination of Internet technology with the means of dissemination can bring new opportunities for its development. The Macau government can display and promote Macau native Portuguese women's costumes through digital channels such as online exhibitions and social media platforms, which can introduce the history, cultural background and design concepts of the costumes in detail and present them to others, as well as provide people with a more intuitive understanding of the costumes through multi-media.

Merchants can use data mining, intelligent recommendation and other technical means to provide consumers with a personalized shopping experience based on their preferences and needs. For example, by building models such as user profiles and consumer behavior analysis, they can provide customized services and product recommendations to customers, thus enhancing shopping satisfaction and conversion rates. Meanwhile, with the help of the e-commerce platform and logistics and distribution system, we can sell Macau native Portuguese women's apparel to all parts of the world. In this process, we need to carry out careful design and preparation in terms of product packaging, branding, and shipping arrangements to ensurethe quality of the products and the quality of the services. Finally, channels such as social media and online communities can be utilized to interact and communicate with consumers and collect customer feedback and opinions to continuously improve product quality and service standards.[16] We can also collect feedback and opinions from customers to continuously improve product quality and service standards.

The combination of Internet technology can promote the inheritance and development of Macau's native Portuguese women's apparel culture, and at the same time provide consumers with a more convenient and personalized shopping experience.

5.3. Introduction of Digital Technology for Apparel Production

Macanese women's clothing is a blend of traditional Portuguese and Chinese elements, with complex styles and detailing, as well as intricate embroidery and decorations, plus its matching accessories, including shawls, jackets and headdresses, etc., which are often time-consuming, labor-intensive and costly to produce, and are difficult to change in terms of style, color and detailing. It is also difficult to change the style, color and details of the garment during the production process.

The introduction of digital technology can bring more efficient, accurate and intelligent processes to the production

of Macau native Portuguese women's apparel. The use of 3D scanning system can accurately measure and record the style, size and material of the apparel; the use of CAD software for design and drawing can greatly improve the accuracy of the data and production efficiency; the use of intelligent production equipment, such as automatic cutting machines, CNC sewing machines, etc., can realize a fully automated and highly efficient production mode, reduce the cost of manpower and production cycle, and at the same time, improve the production efficiency and quality; the use of the Internet of Things and artificial intelligence and other technologies to establish a production management system, and at the same time, enhance production efficiency and quality. The use of the Internet of Things and artificial intelligence and other technologies, the establishment of production management system, can realize the intelligent monitoring of the production process, this system can be on the production progress, inventory, quality and other data real-time monitoring and analysis, so as to improve the accuracy and flexibility of the production plan, reduce the scrap rate and quality inspection costs; Finally, you can also use block chain technology to establish a supply chain traceability system, to achieve the raw materials and the whole process of production traceability. Finally, blockchain technology can be used to establish a supply chain traceability system to realize the full traceability of raw materials and production processes, to ensure product quality and safety, and to provide consumers with more product information and trust protection.[17] The supply chain is also a good way to provide consumers with more product information and trust protection.

Introducing digital technology for apparel production can improve the production efficiency and quality of Macau's native Portuguese women's apparel, and while reducing production costs and risks, it is also conducive to promoting the innovation and development of apparel design.

5.4. Apparel Display Using Digital Technology

The use of digital technology can provide a more diversified, intuitive and interactive way of displaying Macau's native Portuguese women's clothing. For example, by establishing a VR/AR display system and presenting the costumes in the digital exhibition hall through virtual reality and augmented reality technologies, this digitalized display not only meets people's demand for exotic experiences, but also provides more intuitive and detailed product information and cultural background introduction.[18] This digitalized display not only meets people's needs for foreign experience, but also provides more intuitive and detailed product information and cultural background. At the same time, a digital navigation system is established in the exhibition halls to provide people with personalized exhibition guidance and services. By setting up sensors and intelligent terminals in the exhibition halls, it is possible to track and navigate people's locations, analyze their personalized needs and historical behavioral data, and provide customized exhibition and service suggestions.[19]

The exhibition and service suggestions can be customized by analyzing their personalized needs and historical behavioral data.

Alternatively, multi-media display formats, such as LED screens, projection, etc., can be used to create digitalized display contents from the video of the fashion models' runway shows and present them with a combination of audio, text and graphics, etc. This format can make the displaymore vivid and infectious, bringing more audio-visual enjoyment to people and attracting people's attention and concern. Then, we can utilize social media and online communities to display and promote the apparel online. By posting apparel pictures and videos on social media platforms and interacting and communicating with people, we can guide them to the official website or e-commerce platform to make purchases.[20] The following are some of the key factors that can be considered to be the most important

The use of digital technology in the display of Macau's native Portuguese women's costumes helps to increase the effectiveness of the display, interactive participation, reach and sales conversion rate, which in turn promotes cultural heritage and innovation.

6. Digital Design of Macau Native Portuguese Women's Clothing in the Metaverse

6.1. Virtual Clothing Design based on CLO3D Software

CLO3D is a virtual clothing design software based on 3D simulation technology, which can realize the process of digital design, development and production of Macau native Portuguese women's clothing. With CLO3D, you can create 3D models of apparel. The software provides a variety of apparel templates and material libraries, which allow designers to create 3D models of apparel through quick assembly and editing.[21] The software provides a variety of apparel templates and material libraries. Meanwhile, CLO3D also provides physical simulation function, which can help designers to simulate the movement and deformation of the apparel in different situations, so as to better evaluate the actual effect of the apparel.

CLO3D can simulate the color and pattern of real clothes, even though Macanese women's clothes are rich in color and pattern, they can still be digitally designed by the software. The designers can also make personalized digital designs according to people's needs, freely selecting materials and designing patterns to realize personalized customization of clothing.

CLO3D can also generate virtual fitting models for clothing display. Designers can combine the 3D models of clothing with various virtual human body models, and then carry out accessories and scene settings, and finally get a highly realistic clothing display. This digital display allows people to understand the appearance of clothing and theeffect of human body wearing more intuitively.[22] This digital display allows people to understand more intuitively the appearance of clothing and the effect of human body wearing. The use of CLO3D software for the virtual design of Macau native Portuguese women's clothing can greatly increase the degree of digitization and production accuracy, and at the same time can also provide designers with more personalized creative space to promote cultural heritage and innovation.

Scholars Chen Qianqian and others used CLO3D software to replicate the Kazakh lined tab modeling.[23] Firstly, through the research on the form and structure of their clothing, they replicated the structural samples of the clothing; secondly, they constructed a virtual human body model according to the Kazakh men's body in the historical period

(as shown in Fig. 4); and then they used AI software to draw the simulated fabrics and patterns (as shown in Fig. 5), which were then imported to the corresponding plates in CLO3D software, and finally, they succeeded in constructing the Kazakh men's buckskin lined tabs virtual prototype clothing (as shown in Fig. 6).

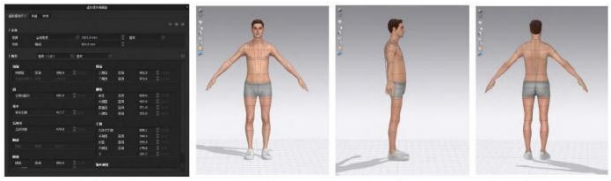

Figure 3. Virtual human body modeling based on the Kazakh male body in the historical period

Figure 4. Drawing simulated fabrics and patterns with AI software

Figure 5. Kazakh Men's Deerskin Lined Tab Virtual Sample Coat

6.2. VR/AR-based Virtual Dress Fitting

Macau native Portuguese women's clothing is often very inconvenient to put on and take off when trying on clothes because of its complicated style and many accessories, but the digitalized virtual trying on clothes through VR/AR technology can greatly reduce the difficulty of trying on clothes, and increase people's interest in them and their desire to buy them.

Before using VR/AR technology to realize digital virtual fitting, it is necessary to create a virtual fitting model based on 3D simulation technology, which needs to include the size, shape, material, texture and other information of the clothing, and this process can be completed through the CLO3D software. This process can be done by CLO3D software. After obtaining the virtual fitting model, we need to scan the user's body data to get the user's different body type and size parameters, and then personalize the fitting model.[24] Then, the fitting model can be personalized.

After entering the virtual fitting environment, users can select their favorite clothing styles and try them on the virtual fitting model. During the process, users can use gestures or controllers to interact with each other and change the size, position, or rotation angle of the model to get a more ideal fitting effect. After the virtual fitting, users can view the results and conduct comparative analysis, such as comparing the results of different colors and styles, and sharing and communicating the results with other users.[25] You can also share and communicate the results with other users.

For example, the Guilin Museum in Guangxi has designed a virtual fitting system, which is mainly used for three-dimensional display of ethnic costumes in the museum and provides opportunities for visitors to try on the costumes, so that they can choose the costumes they are interested in for virtual fitting to better understand the style, style, use and other relevant information about these costumes.[26] The museum also provides opportunities for visitors to try on the costumes they are interested in.

6.3. NFT Virtual Clothing

NFT Virtual Clothing refers to virtual collectibles created through blockchain and smart contract technology. They are often described as artifacts in digital form, and compared to traditional clothing, NFT Virtual Clothing is characterized by uniqueness, scarcity, and irreplaceability. In the NFT virtual apparel market, each piece of apparel is endowed with a unique certificate that can be used to indicate its ownership and verify its authenticity.[27] The NFT Virtual Apparel Marketplace.

NFT Virtual Clothing creators can be designers, illustrators, or anyone who enjoys art, fashion, and new technology. They can design, simulate, and render their designs using computer software, then turn those designs into real virtual clothing and sell them on the NFT Marketplace. Purchasers can pay with cryptocurrency and keep NFT virtual clothing in their virtual wallets, or display them in virtual world galleries or game scenes. NFT virtual clothing cannot be physically worn like traditional clothing, but can only be used as decorations for a virtual character or game character, displayed in a specific virtualenvironment.[28] They can only be used as decorations for virtual characters or game characters and displayed in specific virtual environments.

Because of the scarcity and uniqueness of NFT virtual clothing, which may increase in value over time, the purchase of NFT virtual clothing is gradually being considered as a collector's item investment. NFT virtual clothing is revolutionizing the fields of art, fashion and technology, and the future development of Macau nativePortuguese women's clothing in the meta-universe will inevitably be related to this, thus further broadening its digital development path.

7. Conclusion

With the development and popularization of the metaverse, it has become a challenge and an opportunity to digitally design Macanese native Portuguese women's clothing, exploring the points of convergence between traditional clothing and new technologies, integrating them into the metaverse, and forming a virtual clothing system with values and characteristics. In this process, a variety of new design methods and technological solutions are used to improve and innovate the materials, patterns, accessories,and displays of the costumes, with the aim of successfully inheriting and preserving the cultural elements and historicalbackground of Macanese women's costumes, while at the same time presenting a completely new look under the framework of the metaverse.

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