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Research on the Application of Digital Human Production Based on Photoscan Realistic Head 3D Scanning and Unreal Engine MetaHuman Technology in the Metaverse

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Abstract

With the development of digital content software production technology and the technological progress of related hardware, the social status quo in the post-epidemic era, the popularization and application of 5G networks, the market and consumers' increasing demand for digital content products, artificial intelligence, virtual digital human, virtual Idols, virtual live, self-media content and metaverse-related content industries are all developing rapidly. Virtual idols, virtual digital human, etc. are not only accelerating innovation in production technology. The economic cost, technical difficulty and time requirements of production are also greatly reduced. With the arrival and development of the Metaverse, the author believes that the content industry with virtual digital humans as the core will continue to develop in the direction of refinement, specialization, facilitation and customization. In this article, we will analyze and study the production of virtual digital human based on Photoscan technology and Unreal Engine 5 Metahuman software, and discuss the application status and future development of related content.

Keywords: *Digital Human, Virtual Idol, Photoscan, 3D Scanning, MetaHuman, Metaverse.*

1. Introduction

With the advent of the self-media era and the 5G network era, the user needs of web3.0 and fragmented entertainment life have made the experience of virtual and interactive content and the experience of metaverse

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content a rigid need. The popularization and rapid development of production technology make virtual digital human products with interactive functions no longer expensive and difficult to produce. The virtual digital human, which originally required a lot of time, technical strength, and financial support, had cumbersome production steps. The combination of Photoscan technology and Unreal Engine 5 Metahuman software, as well as simple facial capture and motion capture related technologies make it possible to popularize and customize virtual digital humans. Simple, fast and efficient virtual digital human production can not only quickly occupy the market share in the current live broadcast content, but also the self-media industry, news media, education science and other industries can also improve the quality and breadth of the original content through related technologies and content. At the same time, at the moment when the metaverse is developing rapidly, a lot of attention is paid to the metaverse infrastructure that is limited to the objects to be interacted with, that is, the content of the metaverse itself, but many people ignore the virtual characters as the interactive subjects. Virtual characters that can be produced simply, quickly, at low cost and with special features can accelerate the development of customization of virtual characters, and quickly and effectively extend the economic activities that focus on users themselves in this universe to the metaverse. We think this is a very important content and development direction. In this article, we will analyze and study the production of virtual digital human based on Photoscan technology and Unreal Engine 5 Metahuman software, and discuss the application status and future development of related content. [1] The research process and content of this paper will be beneficial to the development of the metaverse industry, and explore how to use the Unreal Engine to quickly and conveniently create a virtual digital human with a certain precision and application range.

2. Photoscan 3D Scanning Technology

Existing 3D scanning technology methods

(1) CT-based 3D model building method

CT is computed tomography, also known as "computed tomography", referred to as CT. The technology relies on X-rays to irradiate the modeled object. Because different objects have different resistance to the emitted X-rays, the object can be reconstructed by three-dimensional technology. This model reconstruction method is efficient, intuitive and accurate, but the required scanning equipment is expensive and bulky, and it is not easy to scan the subject at the scene, which limits its use in large scene modeling.

(2) 3D model building method based on nuclear magnetic resonance

Magnetic resonance imaging technology relies on the characteristic parameters of spectral lines, such as the width, area, contour shape, and position of the spectral lines, to obtain the molecular structure and properties of substances. When an object placed in a magnetic field is irradiated with a corresponding electromagnetic wave, the arrangement direction of the hydrogen atoms can be changed, resulting in resonance. In view of the different electromagnetic wave signals emitted by different objects, analyzing the electromagnetic waves emitted by the object can obtain the type and location of the atomic nucleus of the object, according to which the three-dimensional image of the object can be depicted. Therefore, it is characterized by high accuracy and high resolution. However, due to the high cost, this method is generally not used for 3D modeling in large scenes.

(3) 3D model building method based on laser scanning

The laser scanning modeling method needs to rely on the three-dimensional laser scanner (3D scanner) to realize the collection of information data. The three-dimensional laser scanner obtains the distance, shape,

appearance and other information of the object, and analyzes and reconstructs the three-dimensional model of the object. High-speed laser scanning can obtain modeling data in a very short time, greatly shortening the 3D modeling time. However, optical technology is not suitable for processing high albedo objects such as specular or translucent surfaces, so laser scanning reconstruction is not suitable for high albedo surfaces. Therefore, the reconstruction of the scene that needs to be protected and the three-model of the large scene often cannot use the method of laser scanning.

(4) 3D model building method based on photos

The method based on photo modeling is to use a digital camera as an image information acquisition device, and use computer vision, computer graphics, image processing and other technologies to extract the three-dimensional spatial information and depth information of the subject from the two-dimensional image. Thereby, a three-dimensional model of the subject is reconstructed.

2.1 Photoscan Technology

(1) The technical advantages of photo modeling are reflected in:

(a) The shape, size and location of the subject are not restricted when shooting.

(b) The learning threshold is low, and beginners without modeling experience can also operate.

(c) Depending on the relevant software processing system, it is possible to choose fully automatic or semi-automatic modeling methods, and it can also process multiple 3D modeling projects in batches, which greatly reduces the workload of modelers.

(d) The requirements for hardware equipment are relatively low, and ordinary digital cameras and even mobile phones can be used as modeling input devices, and the modeling equipment only needs a high-performance workstation.

The above advantages are destined that photo modeling will become an important development direction in the field of 3D modeling in the future, which can be widely used in aerial remote sensing measurement, 3D landscape map production, 3D printing, archaeology, film and television production and other fields.

(2) Principles of photo modeling technology

The entity pictures captured by input devices such as cameras are two-dimensional images, and the three-dimensional modeling based on photos needs to analyze multiple two-dimensional photos obtained, and extract the three-dimensional information of the object from them. First of all, the camera must be calibrated, and the internal parameters of the camera, such as focal length, optical center coordinates, etc., are obtained from the obtained photos. The external parameters and the shooting direction and position information of the camera in the actual three-dimensional space.

(3) Photo modeling process

Image acquisition: refers to the digital image acquisition process of the modeling target, which is the starting point of photo modeling.

Image feature matching: This process includes the identification, extraction, analysis and matching of image features. Regarding feature extraction, it is the process of transforming the original sample features of high-dimensional space into low-dimensional space features to describe.

Camera calibration: This process is to obtain camera information. According to the parameter properties of calibration, camera calibration can be divided into internal calibration and external calibration. Internal

calibration refers to the camera's internal geometric optical parameters, such as focus, focal length, lens distortion, and entrance pupil; external calibration refers to the camera's spatial transformation parameters, such as position and rotation information.

Sparse point cloud: After the image is subjected to feature matching and camera calibration, the image of the sparse point cloud can be obtained, and the external calibration process of the camera is carried out simultaneously with this.

Spatial dense point cloud: After getting more detailed scene information, you can use this to perform multi-view stereo reconstruction. The number of photos taken, shooting quality, lighting conditions, the complexity of the subject itself, and the target material are all key factors that affect the quality of dense point clouds.

Meshing: There are many meshing algorithms, and the most used is the mesh model generated based on the triangular surface structure. After meshing, the obtained model should continue to be optimized. On the one hand, the holes are repaired. Because of the loss of some features of the modeling target, the obtained point cloud is sparse and of low quality, and some holes will be generated after meshing; On the one hand, the number of triangles obtained after meshing is huge, which is not practical, and the number of polygons needs to be reduced to improve efficiency.

Mesh topology optimization: After the mesh is repaired and simplified above, it is necessary to manually re-topologize the modeling target to optimize the structure of the polygons.

UV processing: The UV coordinate system is the texture mapping coordinate system of the polygonal model, and the 3D model establishes a one-to-one mapping relationship with the 2D image through UV coordinates. For any polygon model, the UV coordinate information can theoretically have countless solutions. These solutions will not affect the structure of the model itself, but will affect the
Affects the precision and rendering of the final texture map. The goal of UV processing is to establish a coordinate system that is flat and relaxed, easy to identify, scientific and reasonable in layout, and can effectively utilize UV space.

Texture optimization: The texture is the surface map of the 3D model. Generally speaking, the establishment of the texture is usually after the establishment of the UV coordinates, but for the 3D reconstruction technology based on the image, after the dense point cloud is generated, the texture information is mapped through the image space. can be obtained, but the UV coordinates have not been obtained at this time. The obtained texture information is a spatial texture information that can neither be edited nor mapped onto a flat image. Therefore, this texture needs to be optimized into a traditional texture map for use. [2]

2.2 RealityCapture Software

Photo modeling software can be divided into whole process modeling, partial process modeling and auxiliary modeling software.

The full-process modeling software can realize all the work from photo import to the initial generation of 3D surfaces, requiring only a small amount of manual participation, which is close to automation. At present, there are mainly software such as RealityCapture, Meshroom, 3DF Zephyr, 123DCatch, Smart3D, PhotoScan, and Pix4D.

Partial process software, this kind of software cannot complete all the three-dimensional modeling work independently, but can only complete part of the process, but each has its own good parts, such as VisualSFM, Meshlab, Sure and so on.

Auxiliary reconstruction software, such software comes from a wide range of sources, including software used in a comprehensive development environment, as well as software used in specific fields, such as Meshmixer, GeomagicStudio, CloudCom-pare, and Modo.

Based on the ease of use, stability, software cost, export function and export cost of the software, we choose to use RealityCapture for production.

2.3 Camera Array System Based on Photoscan and RealityCapture

Referring to the common photo scanning software at this stage, although a 3D model can be generated by using a single mobile phone or camera for shooting, there are great problems in the uncertainty of the production process and the accuracy of the generated 3D model. So referring to the case of related content production such as movies and games, we independently produced photo-scanning camera arrays for real people.

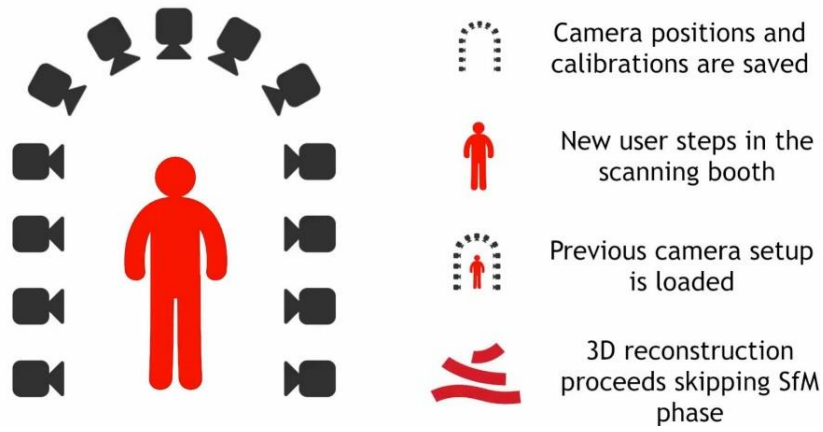

Figure 1. Common camera array layouts

Figure 2. Common camera arrays

Based on common camera array layouts and fabrication methods, we fabricated two different simple camera arrays for photoscan modeling.

Figure 3. First self-made camera array layout

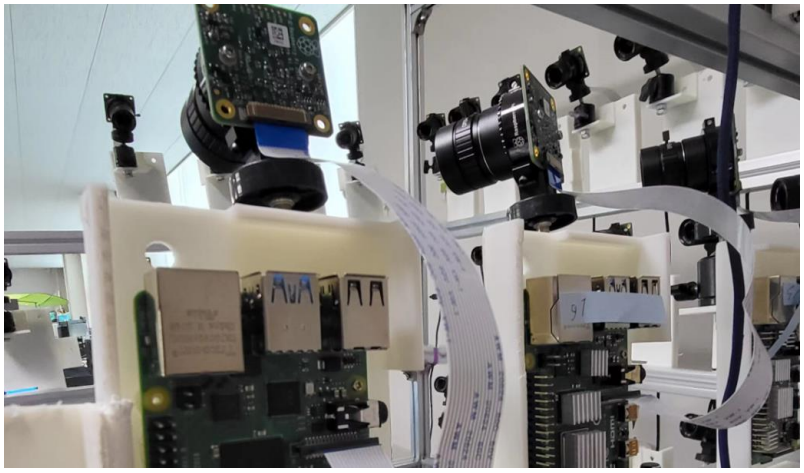

Figure 4. First self-made camera array detail

For the first camera array, we used a small camera lens, with a PCB board and related control chip modules, to establish a link in the local area network and control it. While using a square arrangement, metal is used as a large bracket, and a small fixed bracket is made using 3D modeling technology and 3D printing technology.

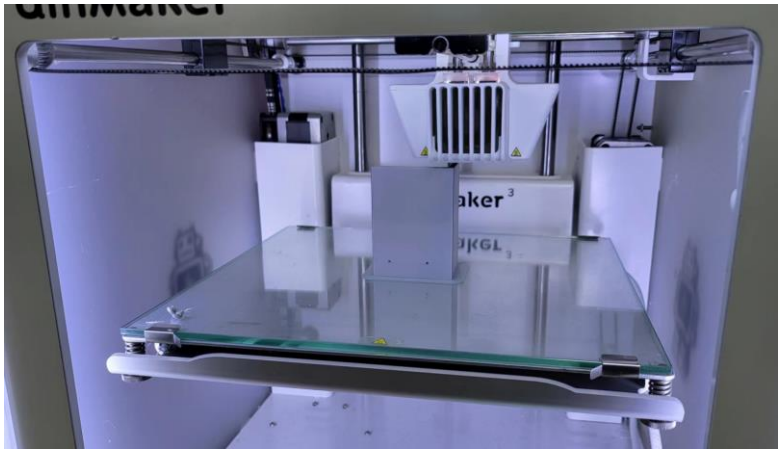

Figure 5. Using 3D printing technology to make a fixed bracket

In the early use test, due to the various problems in the use of the first camera array solution, we specialized the solution for the photo scanning of real people's avatars, and produced the second camera array.

Figure 6. Second self-made camera array

As shown in the figure, the second camera array adopts a spherical design, all brackets are fixed with metal, and a smaller miniature lens and control module are used. The problems of wireless LAN data transmission and related hardware circuits are optimized, making the second camera array more suitable for photo scanning and 3D model generation of people's avatars, busts and other content. In the next example we use the second camera array for production.

3. The production process of virtual digital human based on Unreal Engine 5 Metahuman and Photoscan technology

3.1 Head scan using camera array

Using the camera array to scan the model's head in 3D, first of all, we must try to ensure the model's skin texture, do not use oily or water-based cosmetics or skin care products, which will cause a lot of reflections on the skin and affect the shooting effect. Models should try not to use cosmetics. If the model's skin is oily, the reflection on the surface of the model's skin can be eliminated by appropriate use of powdered cosmetics, so as to ensure the shooting effect.

Second, the scan does not require the use of the model's own hair, so the model needs to wear items such as a swimming cap or hair cover, which also minimizes the appearance of reflections. Glasses are also not recommended for models due to reflections.

For the camera array we used, different models can be adjusted in height through other props to ensure that the model's head is in the appropriate shooting position within the camera array.

After configuring the lights and using wireless LAN for data transmission, we can use the camera array to shoot the model.

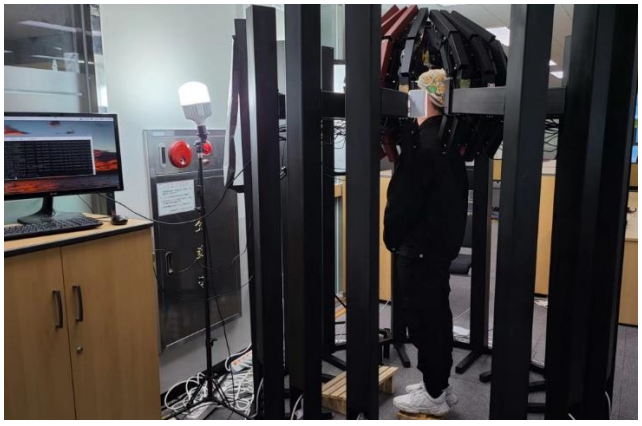

Figure 7. Model photo scan shooting site

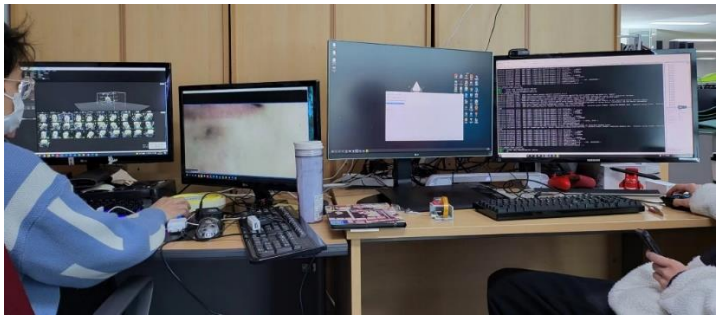

Figure 8. Photo data transfer and photo batch processing

The photos are transferred to the local area through the wifi local area network and saved, and the photos can be processed in batches through software such as Photoshop, such as eliminating reflections, highlights, and beautifying people. By processing the photos, the efficiency of subsequent 3D model generation and the fineness of the 3D model can be improved. [3]

3.2 3D model making based on Reality Capture software

We use Reality Capture to perform floating-point operations and 3D model generation from the images captured by the camera array. The 3D model can be made more refined by manually adjusting the camera positioning points. After obtaining the 3D model, we need to process the texture and UV, and save the texture and UV data in the file when exporting the model file.

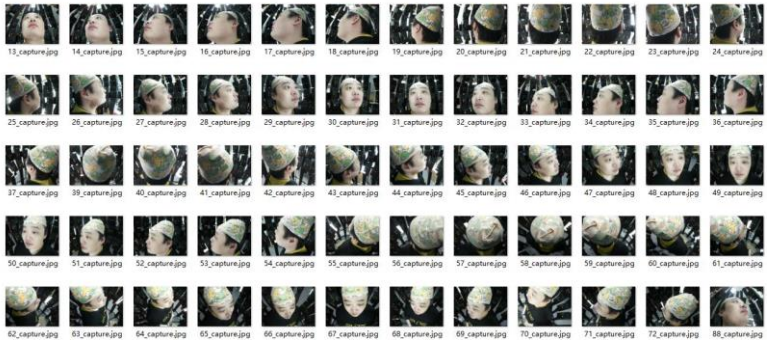

Figure 9. Image data obtained from photo scanning

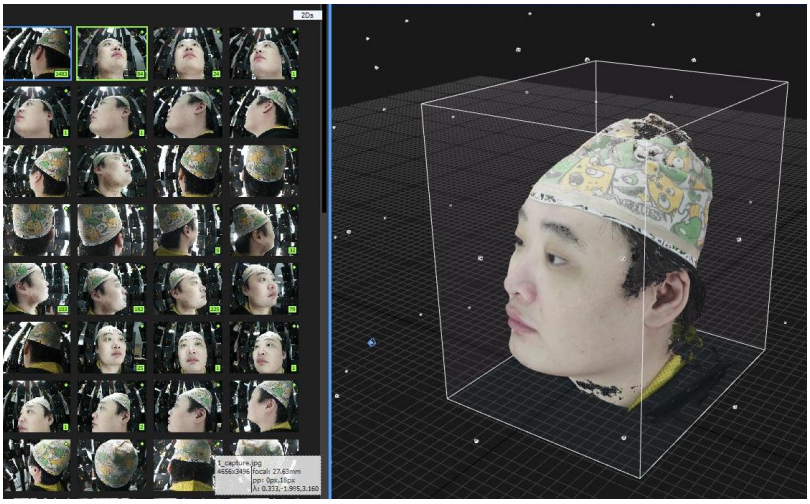

Figure 10. Generate 3D models with textures through floating point operations

After exporting the 3D model, we first imported the model into zbrush, retopologized the model, and appropriately reduced the number of faces of the model, which helped improve the efficiency of post-production, and properly corrected the protruding hat and hair. At the same time make the texture map of the skin and export the file. Import the re-exported file into MAYA again, manually modify the model and perform symmetry processing, and you can also mirror the UVs symmetrically.

3.3 Mesh to Metahuman Production

Through the previous steps, we obtained a simple 3D avatar model of a real person. Next, we imported the 3D model into the UE5 engine. Using the newly released Mesh to Metahuman function in June 2022, we can efficiently and easily complete the model in the UE5 engine. Face rigging, and make the model into the Metahuman model we need.

Figure 11. 3D model made by using Mesh to Metahuman

The 3D model of the avatar is manually positioned and automatically bound in the UE5 engine, the facial controller and skin weights are tested and modified, and then the obtained model is uploaded to the cloud server through the Bridge of the UE engine.

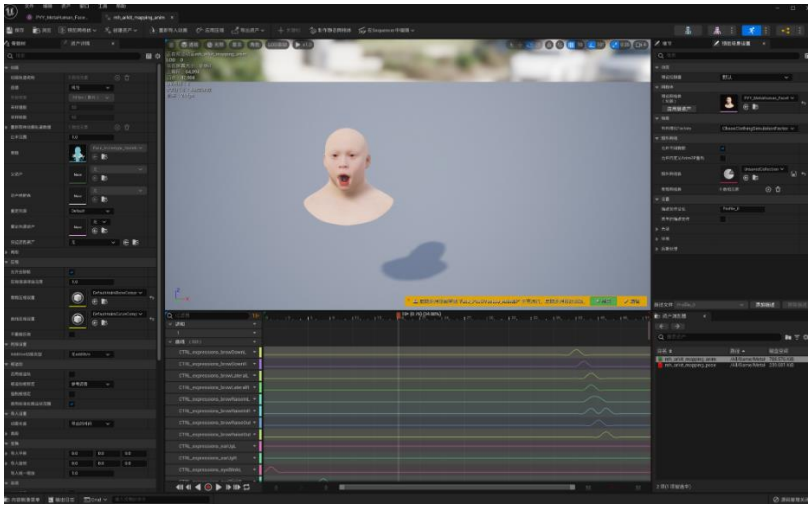

Figure 12. Corrections to skin weights and controllers in UE engine

3.4 Virtual digital human production based on metahuman creator

Through metahuman creator (MHC), we can read our 3D model from Bridge's cloud server. After importing the 3D model into MHC, we can customize the model's outline, skin, hair, body shape and clothing. After editing, we can get a complete virtual 3D character model with rigs for skeletal controllers. [4]

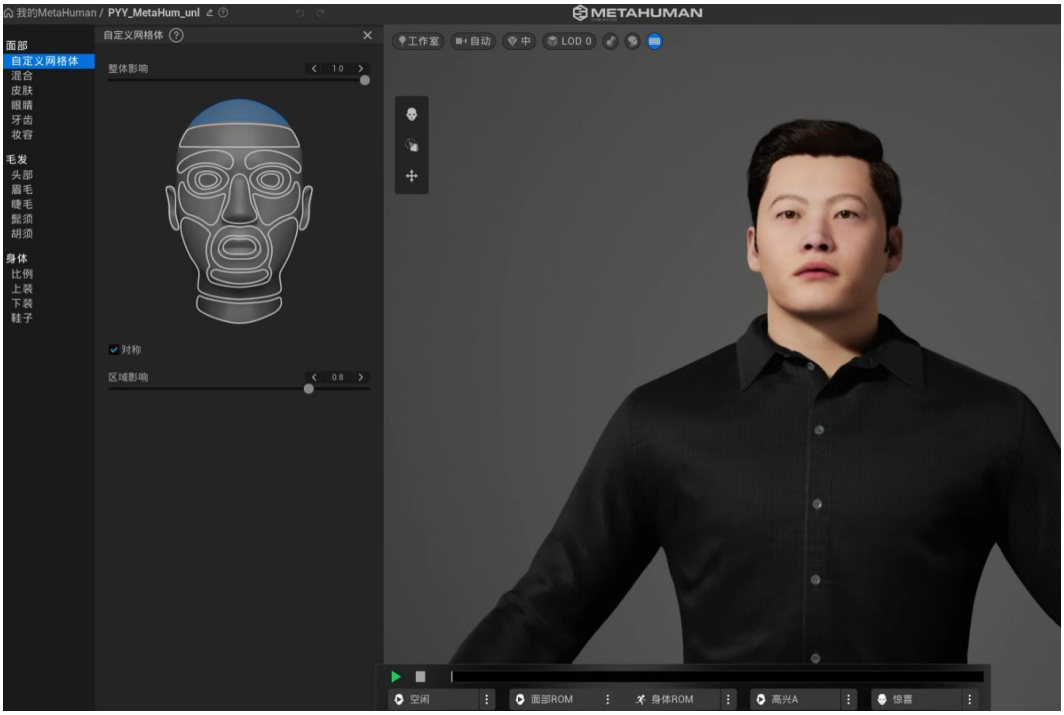

Figure 13. Detailed production of character head in MHC

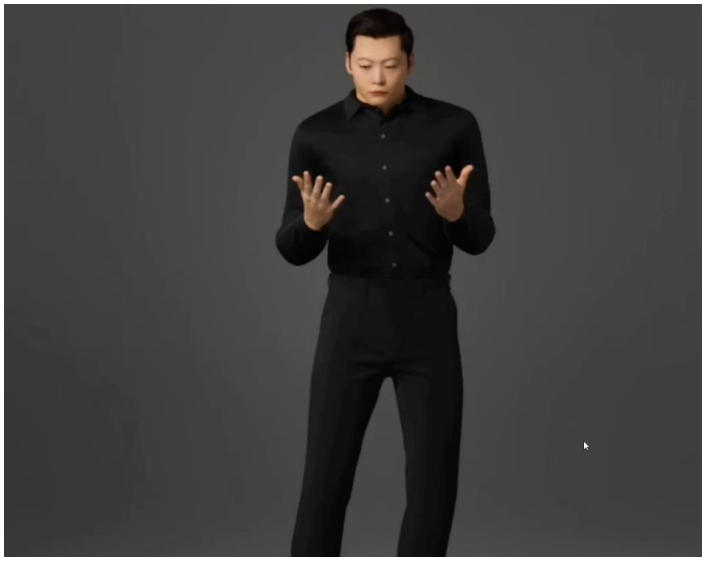

Figure 14. Detailed production of character body in MHC

After completing the refinement of the model in MHC, save the completed 3D model to Bridge's cloud server again. We can also edit and modify the 3D model in MHC at any time afterwards.

3.5 Import the virtual digital human model made in metahuman creator into UE5 for use

Load the edited model into the local UE5 engine through Bridge, and we can continue to adjust the model. After the 3D model is adjusted, we save the model in the local resource library for use.

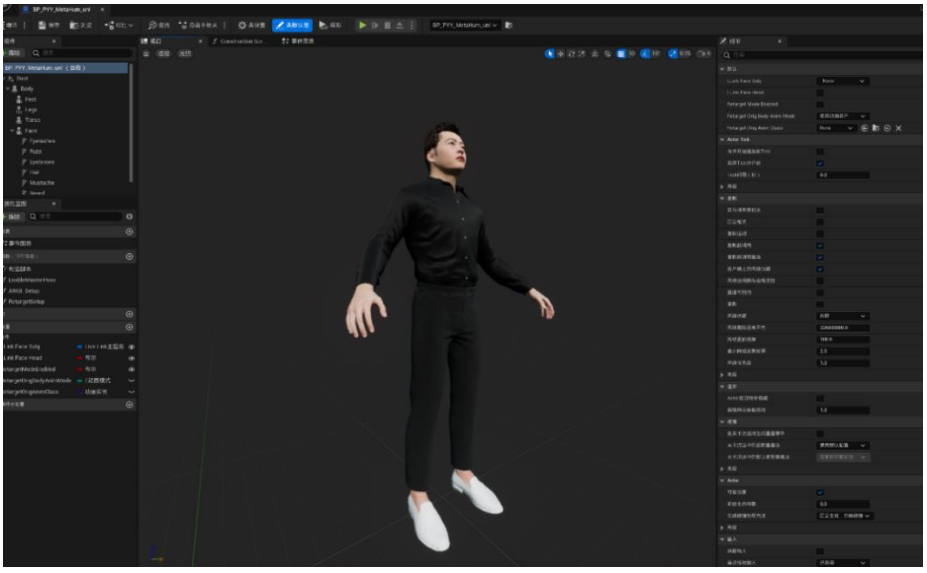

Figure 15. Import the virtual digital human model made in metahuman creator into UE5 for use

3.6 Use real-time facial capture in UE5 engine

During the research and production process, we tested the models for features such as real-time f acial capture and video recording. Open the locally saved 3D model in a new UE5 project, set up

the camera and edit the camera.

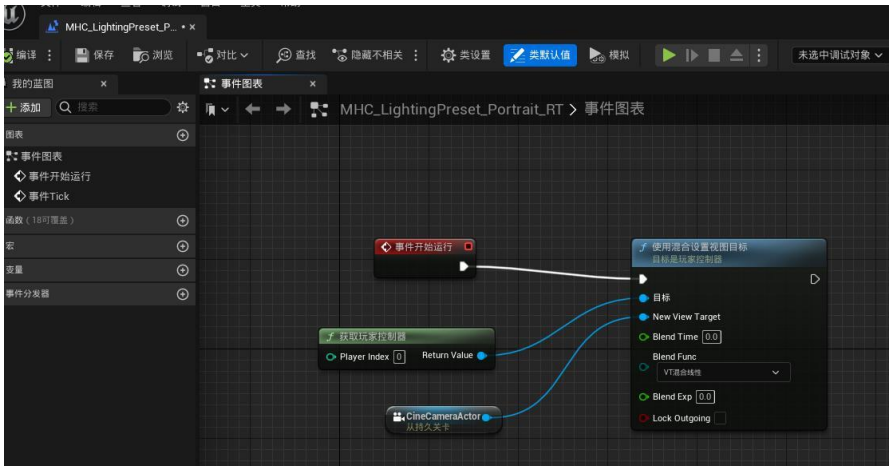

Figure 16. Setting up Camera Blueprints in UE Engine

Enable metahuman and plug-in functions such as LiveLink and arkit in the UE5 project, and set the background and lighting at the same time. Using IPHONE and wifi network, simple real-time fa ce capture function can be realized with the help of livelink function.

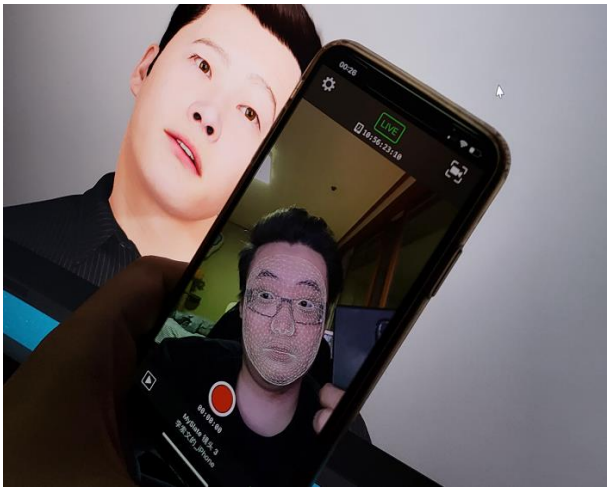

Figure 17. Live Face Capture Test

Similarly, without using arkit and iPhone, we can also use other plug-ins and mobile devices of Android system or common USB cameras to realize the function of real-time motion capture.

3.7 A variety of multimedia content can be produced based on UE5 engine

Based on the above production methods and content, we can use the UE5 engine to produce a v ariety of digital content. Perform 3D scans based on real people and obtain 3D models, so that the models can be used in video content, live broadcasts, digital animations and even movies, etc., all o f which will become simple and convenient.

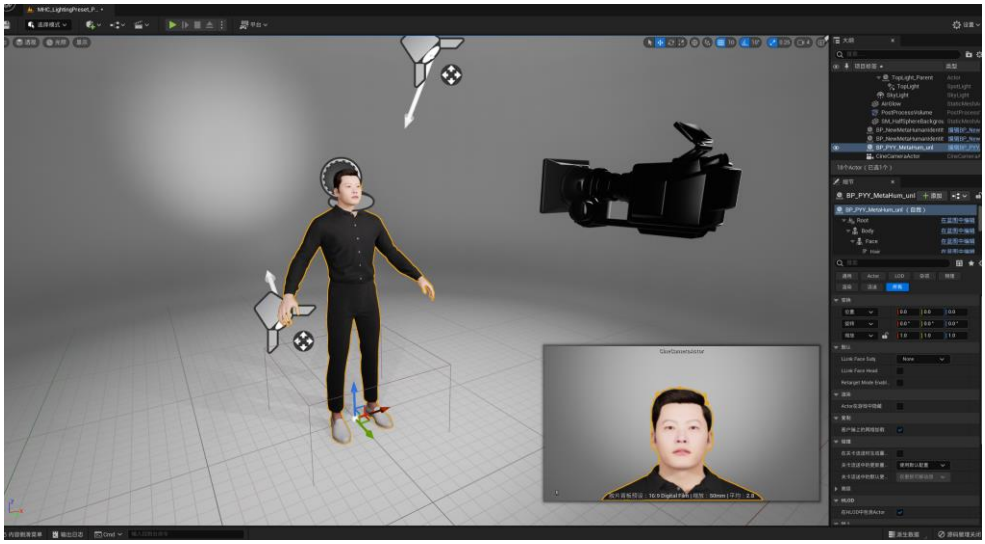

Figure 18. Virtual production in UE engine based on the virtual characters we made

As shown in the figure, we tested virtual production, real-time face capture, content video recording and real-time face capture live broadcast in the UE5 engine. The simple, fast and convenient way of digitizing, virtualizing, and putting the images of real people into 3D digital content will also have a rapid and positive impact on the digital media content industry. At the same time, virtual digital characters and user customization have become easier, with lower costs and lower barriers to entry, thereby improving the productivity and product quality of the self-media industry. [5]

4. Virtual Digital Humans and Metaverse

The concept of "digital human" can be traced back to McLuhan's "cyborg", which originated in Japanese animation in 1990, and is the realization of non-human images in virtual or real scenes through painting, animation, CG technology, etc. The domestic application of anatomy experiment teaching originally from the medical field, as a digital simulation of human physiology, has been proved to be beneficial to anatomy teaching. The digital human in the medical field refers to the digitization of the human body's organizational structure, physical function, and physiological function, which is equivalent to the "living map" of the human body. Some scholars further put forward the concept of "holographic digital human" to discuss the development of holographic digital human and its medical health service mode.

The "virtual digital human" in the metaverse is not a purely static physiological simulation, but an all-round simulation of human physiological and social properties using various new technologies. It is a social human with social functions. Before 2018, limited by technical bottlenecks and one-way output of content, most of the "virtual digital people" did not appear to be in a state of breaking the circle, and the barriers between the virtual and real worlds were insurmountable. In recent years, with the advancement of artificial intelligence, motion capture and other technologies, the interactive and social attributes of digital people have been continuously enhanced, and the boundary between virtual and real has gradually disappeared, attracting attention from all parties. According to the "Birth of the World's First "Digital Human" published in the 11th issue of "Science Enlightenment" in 2019, 78-year-old American writer Andrew Kaplan chose to become the first "digital human" on September 2, 2019. On April 23 of the same year, Shanghai Pudong Development Bank held a press conference on the concept of "Hello Future" digital human, and proposed the concept of "Digital Human" for the first time, and cooperated with Baidu and China Mobile to launch a digital human

cooperation plan. In February 2020, Martin Luther King Jr. appeared on the cover of Time for the sixth time as a digital human, marking the arrival of the era of digital human. As the metaverse continues to explode, digital humans, as the main body of the future virtual world, will usher in a golden period of industrial development. Virtual digital humans are gradually opening up new application prospects in all walks of life. Co-initiated by the Central Academy of Drama and Beijing Institute of Technology, with technical support from Tencent, funded by the “Outstanding Young Scientists in Beijing Universities” program, and supported by Mr. The 26-year-old Peking Opera master Mr. Mei Lanfang is the prototype and reproduces it. The application of "virtual digital human" in the brand avatar has shown commercial value.

4.1 Virtual digital human is an inevitable choice in the era of artificial intelligence

In the era of artificial intelligence, the media industry has been completely reconstructed and subverted. Big data and artificial intelligence technologies have entered every link of the media industry and completely reconstructed the media industry, from news content production, distribution, and dataization of news content to users. Portraits, interactions with users, and timely feedback have all been reconstructed, and virtual digital humans have played a prominent role in reducing content production costs, providing round-the-clock service, and producing massive short videos.

First, virtual digital people can greatly reduce the cost of news content production. The virtual digital human is an iterative innovation based on the previous news robots. In addition to the massive, fast and efficient advantages of news robots, it can cover a wide range of markets and greatly reduce labor costs and content production costs.

Second, the virtual digital human can serve around the clock and be used in multiple application scenarios. As a robot, the virtual digital human can not only work tirelessly 24 hours a day, but also serve multiple application scenarios at the same time, especially when the host of major emergencies is difficult to be present.

Third, virtual digital people can provide massive short video content to make up for the lack of short video content production capacity of traditional media. Massive and diversified content is a necessary condition for the transformation of the Internet, otherwise it will be difficult to attract a sufficient number of users. On the one hand, Internet platform media provides massive and diversified content through a large number of self-media on the platform, and on the other hand, uses artificial intelligence technology to produce a large number of short videos. However, traditional media is limited by various constraints such as talents, technology, and funds, and it is difficult to produce a large amount of short video content, while the virtual digital human based on artificial intelligence technology provides a possibility, which can provide a massive amount of Internet transformation for traditional media. The short video content made up for the content shortcomings of Internet media founded by traditional media.

4.2 The Necessity of Customized Digital Humans in the Future Metaverse

For the time being, the world’s capital and technical power dedicated to the construction of the metaverse is not limited to the layout of the basic structure and structure of the metaverse. To construct a complex virtual world, people and things are indispensable elements, and now a large amount of capital and technology are pouring into the basic "things" and "people" as idols and IP. Making the "human" in the metaverse as the opposite of the user is a compromise for the market and demand, and it is also a means of making profits quickly. However, the basic nature of the metaverse determines the breadth of future development. From a long-term and macro perspective See, being able to integrate every user into the metaverse and pass the user himself into a "human" in the metaverse is the long-term development model in the future.

In the real economic market, "people" refers to the consumer audience. In the link between people and goods,

it has the most diverse components and the greatest changes, and it is also the most elusive link for brand merchants to achieve market breakthroughs. In the metaverse world, "people" are equally important, and the "people" link has become a brand new value channel connecting real people groups and virtual world brand goods. It should not only carry the value of branded goods, but also serve as a metaverse projection of consumers' real-life needs.

Therefore, through simple, fast, and low-cost customized services, users can quickly enter the metaverse as a virtual digital human, which can not only promote the development of the virtual economy, but also bring users a deeper metaverse content experience. By customizing the virtual digital human, users can experience features, make features, and become features, so as to gain a sense of identity and presence in the metaverse, so as to promote users' consumption and production activities in the metaverse, making the metaverse. It has the same ability and possibility of healthy development and long-term development towards a virtual society.

4.3 The possibility of virtual digital humans developing in the metaverse

The virtual digital human has stronger visual effects, better immersive experience, and warmer emotional interaction. It can become a bridge between the real world and the virtual world. The virtual digital human industry is entering an accelerated period with the rapid development of the metaverse industry. [6]

At present, although the virtual digital human and its industry have begun to accelerate, in order to achieve large-scale commercialization, there are still problems such as high technical threshold, long cycle, high cost, and scarcity of talents. The virtual digital human is a collection of advanced technology with a high technical threshold. A truly intelligent and personalized virtual digital human needs a longer period of iterative innovation, especially to create a non-specific virtual digital human with high precision and high fidelity, which often requires millions or even tens of millions of dollars in capital investment. This is not something that the average small business or small media can afford. In addition, the shortage of talents in the virtual digital human industry is extremely obvious. Not only are software and hardware engineers in related fields extremely popular, but also related technical art talents (such as animators, 3D character riggers, special effects designers, etc.) Huge gap. [7]

At present, virtual digital people are mainly divided into virtual idols, virtual anchors, virtual employees, etc. Their main functions are media services, enterprise services and brand marketing services for the B-side. Especially in corporate brand marketing, virtual digital people (virtual idols) have huge potential and room for development, mainly in the field of live streaming. Specifically, on the one hand, based on the text co-creation model, KOL fans and virtual idols form a real community of interests, which is more helpful to capture fans' attention; on the other hand, it forms strong relationship links with fans and enhances virtual idols' cross-platform traction. And the ability to carry goods, greatly weaken the dependence of live broadcast and goods delivery on live broadcasters. In the future, the application of virtual idols in brand marketing can be further improved in the following two ways: one is fan co-creation + private domain marketing to strengthen brand awareness. Cross-border alliance with virtual idols to provide fans with a broad space for text production, the brand will gain a lot of exposure and UGC content, strengthen its cognition, popularity and favorability among the "Z era" audience, and pave the way for subsequent transformation; 2 It is a vertical anchor + e-commerce platform to stimulate consumption conversion. Virtual idols attract fans who gather together because of consistent interests on social platforms, and make them form fan communities. This model naturally has a trend of differentiation, so it is the best choice for virtual idols to deeply cultivate in the vertical field. [8][9]

5. Conclusion

Since 2021, the metaverse has risen rapidly, and the metaverse with deep immersion is the best landing

scene for virtual digital humans. From the perspective of in-depth experience, Roblox CEO David Baszucki attributed the main characteristics of the metaverse to eight aspects: identity, friend immersion, low latency, diversity, anywhere, economic system and civilization. Whether it is identity, friends, or immersion, virtual digital people have huge room for play. From the perspective of the development practice and landing scenarios of the metaverse, the metaverse will go through three stages of cloud games, digital twins, and virtual-real symbiosis in the future.

In the cloud gaming stage, for gamers, games are no longer purely entertainment behaviors, but have become an extension of the real world. Players like to express themselves and socialize in games. In particular, more and more players are willing to devote more time to participate in the virtual world, and play games, experience, socialize, create, entertain, and shop in the virtual world. Application. The virtual digital human will not only greatly improve the fidelity of various characters in the game, and significantly improve the user experience of gamers, but also provide each gamer with their own virtual idol, which can better socialize in the game. In the further digital twin stage, not only entities and processes in the industrial field can provide digital twins in the virtual space, but more individuals can also establish their own digital twins through virtual digital human technology. The application scenarios of virtual digital human will be further expanded. In the final form of the metaverse, the virtual-real symbiosis stage, every user in reality can create his own virtual digital person in the virtual world, and then can freely travel through different metaverses. Every individual in reality learns, works, invests, creates and consumes in the physical world through their real self, while their own virtual digital people create, play, experience, trade, invest, etc. in the virtual space. In the "virtual and real symbiosis" stage, real humans and their virtual digital people will form new social relationships and emotional connections, and build a new "human society" with virtual and real symbiosis. The real economy and the virtual economy have also co-evolved into a digital economy, becoming an economic form in a state of symbiosis between the virtual and the real. [10]

The virtual digital human and its industry have made significant progress, but subject to the constraints of technology, cost, application scenarios and other factors, it is still in the initial stage of development but in the acceleration period, and its future rapid development depends on technology, capital, policies, and commercial applications. The rapid expansion of the scene, and the key lies in the progress of the overall development of the metaverse.

The metaverse will be the true future of the Virtual Digital Human, and the Virtual Digital Human is also the cornerstone of the metaverse. Therefore, in the layout of the metaverse industry, the simplification, speed, standardization and customization of the virtual digital human production technology will definitely be the top priority of the metaverse related industries. 3D scanning and photo scanning technology are the technologies that are most in line with the production method of virtual digital human at this stage. With the needs of the market and users, scanning technology and virtual digital human production technology will also be rapidly popularized and applied and developed rapidly.

Using 3D scanning technology to make a virtual digital human can make the character model more precise and realistic, at the same time, it can reduce the production time and technical requirements of the virtual digital human, and provide users with more unique and original possibilities. At this stage, revolutionary technical improvements can be made to the character models of the self-media and virtual idol industries. From a long-term perspective, the virtual digital human made based on 3D scanning technology will become the cornerstone of the metaverse content application, introducing users to the metaverse content application quickly and conveniently in a simpler, faster and more realistic way. In the future application of the metaverse, it will play a certain positive role in the production and output of the basic content of the metaverse, and the economic and social activities in the metaverse.

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