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3D human body scanning devices have been commercialized on the market

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ABSTRACT: *3D human body scanning devices have made many advances and are very useful in the garment industry. Scanning systems are increasingly efficient, powerful, faster, and less expensive. This article mentions some commercialized 3D human body scanning devices on the market today. Commercialized devices are searched based on two key phrases to use for searching titles and abstracts in the database. Analyze and synthesize the information from which to obtain the characteristics, specifications, and applications of 3D human body scanning devices. Depending on the purpose, choose a suitable and effective 3D human body scanning device.*

Key words: *3D body scanner, 3D body scanner service*

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I. INTRODUCTION

In the fashion industry, medical, sports, and scientific research, accurately capturing human body data becomes increasingly important. 3D body scanners enable the collection of detailed, high-precision geometric data, facilitating the creation of comprehensive digital maps of body size, proportion, and structure. The applications of this technology are diverse: in the apparel industry, it supports the design of well-fitting, personalized clothing for each customer; in medicine and rehabilitation, it tracks anatomical changes, supporting the assessment of treatment progress; in sports, it assesses posture, optimizing training techniques; and in behavioral and ergonomics research, 3D data helps analyze the interaction between humans and the environment. As a result, 3D human body measurement devices not only improve the quality of products and services but also contribute to improving health, work performance, and personalized experiences for users.

In the garment industry and fashion design, to obtain three-dimensional data and digitize the human body, a scanning device suitable for this purpose is required. Since its inception, systems serving the digitization of the human body have been increasingly improved, representing human activities as real, and scanning systems are becoming more efficient, powerful, faster, and less expensive. Currently, there are many types of three-dimensional scanning devices on the market, depending on the needs of use, choose the device suitable for the scanning object, with a reasonable price, high accuracy, fast scanning speed...

II. RESEARCH METHODOLOG

The method of analyzing and synthesizing information is used to overview the 3D body scanning devices that are commercialized in the market. The important databases searched are Google and Internet Explorer. The commercialized devices are searched based on two key phrases to use for searching the title, abstract in the above database. The first phrase is a *3D body scanner*, the second phrase is a *3D body scanner service*. The articles, information are classified according to the research question for review.

III. RESULTS AND DISCUSSION

3D scanning technology is increasingly developing and widely applied in many fields, especially in medicine, fashion, sports, and entertainment. 3D scanning of the human body is a technique that uses special devices to collect 3D data about the shape and size of the human body. This data is then used to create an accurate 3D model of the body, opening up many interesting and useful applications. On the market, 3D scanning devices for the human body have been commercialized, including:

1. HoloScan Aturos full body 3D scanner

Figure 1. HoloScan Aturos full body 3D scanner [1]

The HoloScan Aturos full-body 3D scanner is a 3D scanning device for creating a digital model of a person's entire body. The device uses sensors and scanners to collect information about the shape and size of the body, then creates a realistic 3D digital model. Some applications of the HoloScan Aturos full body 3D scanner in many fields today include:

Fashion: In the fashion industry, creating a 3D model of the body can help design clothes or accessories that fit and suit the user.

Medical: Creating a 3D model of the human body can be used in the medical field to create an exact replica of a part of the body, helping in creating personalized medical objects, such as loading the exact size for stabilization or designing suitable medical instruments. Entertainment: Applications in the entertainment industry, including creating characters in video games or movies based on 3D models of the body.

Sports and fitness: Used to track changes in the body and size of athletes or gym-goers to analyze and improve performance.

Features of the HoloScan Aturos full body 3D scanner:

The elliptical layout of the scanner works better when scanning people in the A-position, so the scanner can perfectly scan many objects within the frame. High resolution: The HoloScan Aturos full body 3D scanner is designed to provide higher resolution raw models with 12 million pixels and a pixel size of 1.4µm x 1.4µm. Easy to use and easy to move: The scanner can easily capture and produce 3D models quickly. The scanner is highly portable and easy to use, so it is convenient to arrange in a convenient place for work.

The scanner integrates various technologies such as laser scanning, photogrammetry, or structured light to collect information about the body and create an accurate digital model. Instant capture: Scanning is completed in 1 second, making it a great tool for projects and events that require scanning large objects. Ease of use: The scanner's software is easy to use and is regularly updated based on real-world user experiences from countries around the world. Scan any large object, scan any color, because the scanner is integrated with structured light, which makes it possible to scan difficult shapes and surfaces such as black or plain clothing. High portability: The scanner can be assembled and set up quickly and easily in less than 5 minutes by one person. Space saving: The scanner is small (only 250cm) and can be stored in 12 cases. The machine is light to transport and can be assembled in a small space, making it more flexible and mobile.

Open design: The scanner has unlimited possibilities for comfortable communication, natural interaction, and invites its customers to be shouted at quickly.

Integrated lighting system: The LED stripes integrated on the modern Flexible Scanner achieve a high CRI value of at least 95. They ensure natural color fidelity and excellent illumination over the entire lamp body. Smart color calibration mode: The color accuracy of the avatar is very important for 3D color applications. To ensure color accuracy.

Expandable: Technically, it is possible to change the number of columns, the height or diameter of the system, and other aspects to customize according to the needs.

Some technical parameters of the HoloScan Aturos full body 3D scanner:

Standard image matrix of 12 and 15 poles, 72 cameras and 90 cameras respectively, diameter of 2.5m and 2.68m. Matrix photo module: Brand - Sony, Sensor type - Color CMOS, Pixels - 12 million pixels, Photosensitive size - 1/12" large photosensitive, Pixel size - 1.4µm x 1.4µm, Module quantity - 72 sets or 90 sets. Total data collected. Pattern image group 1.08 billion pixels. Lighting system LED flashing light strip, high CRI 97%. Input lighting power is 220V - Output is 0- 30V. Other power supplies are 110V-220V, and the output is 0-

12V. Multi-camera control software. Can control all shutter, aperture, 15,0, and other core parameters of the camera at the same time and monitor the camera status. Transmission system. Router 1 piece, Switch 15 pieces, 14-port network card. Shielded network cable type 66. The total diameter of the set is 2.60m, the total height is 2.15m, 15 customized aluminum profile columns [1]. Requires a suitable configuration Laptop PC. 24-inch screen, CPU core 15 or higher, 16GB RAM, 1 TB hard drive.

2. 3D full-body scanner rotates 360 degrees with integrated 3DWOW software

Figure 2. 3D full-body scanner rotates 360 degrees with integrated 3DWOW software [2]

A 360-degree rotating full-body 3D scanner integrated with 3DWOW software is an advanced solution for creating accurate and fast 3D models. With the ability to scan the entire body within seconds, this device provides a smooth and efficient 3D scanning experience. This is also a 360-degree rotating 3D scanning and shooting solution with completely new technology, with 3DWOW software.

Some outstanding features of the 360-degree rotating full-body 3D scanner integrated with 3DWOW software: 360° full-body scanning: The device uses an automatic rotation mechanism, allowing the entire body or object to be scanned quickly and accurately. Integrated with 6-core technology including: 360 Scan, 6 high-resolution cameras with 1200W capacity, perfect 1:1 ratio copying, super fast scanning in just 15 seconds, cloud storage, Al model structure. Integrated 3DWOW software: The included software supports scanning, data processing, creating detailed 3D models, and easily exporting to popular formats. High accuracy: With a modern camera and sensor system, the machine ensures high accuracy in collecting geometric and color data. User-friendly. The software interface is intuitive, easy to use, and suitable for both beginners and experts.

Stable data collection – fast modeling: 360-degree rotating full-body 3D scanner table with integrated 3DWOW software. Advanced sensor technology and precise data collection algorithms are used to ensure stable and accurate scanning. The machine is equipped with a powerful processor and optimal data processing algorithms, helping to create models quickly and efficiently, improving productivity and output quality.

Figure 3. Column collection table [2]

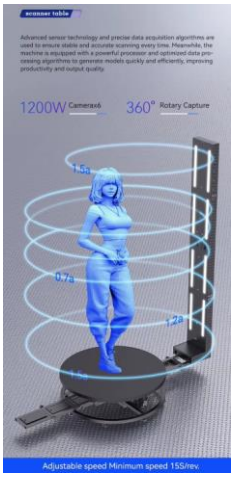

Figure 4. Adjust the rotation speed of the turntable [2]

A 360-degree rotating full-body 3D scanner integrated with 3DWOW software is equipped with a high-brightness lighting panel and integrated with six 4K HD cameras, with extremely high precision of 1/1000 and

the ability to collect up to 2 million individual body point cloud points. 360° Rotary Table: The new technology rotary table design allows the Scanner to start and stop automatically, operate smoothly and quietly, and choose 3 different rotation speeds. Software-controlled devices: Simple operation, with just one button, and convenient Bluetooth connection. In particular, the smart Scanner system helps convert real subject images/videos into 3D models quickly and accurately. Foldable Photo Scanning Table - Compact and Easy to Carry. The design of the highly portable Scanner includes a 1000mm diameter rotary table and a foldable scanning column. The 1000mm turntable provides a wide scanning range, making it easy to scan large objects or capture large groups of people. In addition, the folding design of the scanning column can be easily stored, saving space and ensuring the safety of the device, bringing convenience and flexibility to users, whether used in the studio or outdoors. Total weight: 50 kg, Turntable diameter: 1000 mm.

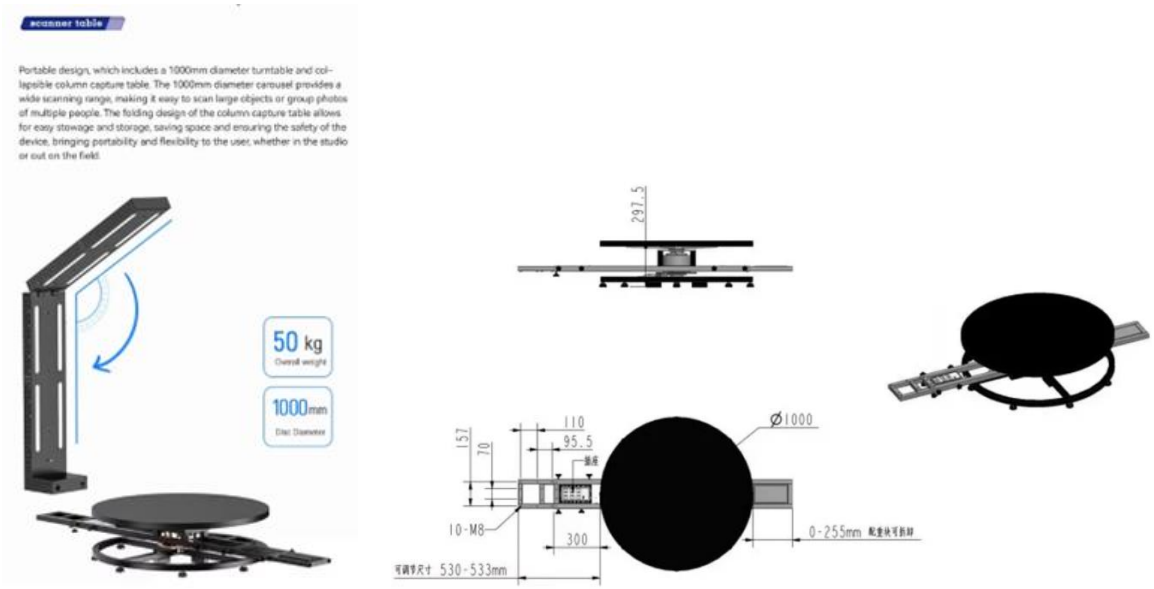

Figure 5. Turntable design [2]

Some technical parameters of the 360-degree rotating fullbody 3D scanner integrated with 3DWOW software: Rotation mechanism: Automatic, 360 degrees; Included software: 3DWOW; Export format: OBJ; Connection: USB 3.0, Wi-Fi; Compatible operating systems: Windows, macOS; Turntable diameter: 100cm; Number of cameras: 6; Weight: 50kg; Scanning effect: Color support; Power supply: 220V/4A.

3. Artec 3D Body Scanner Artec Shapify Booth

Figure 6. Artec 3D Body Scanner Artec Shapify Booth [3]

The Artec Shapify Booth Body Scanner is a one-click 3D body scanner based on Artec's high-precision 3D technology with proprietary automated 3D modeling software used to capture the human body shape with high precision. One-click body scan in 12 seconds with automated data post-processing. Scan a person or even a

couple in 12 seconds. See a detailed preview of the 3D model in just 5 minutes. Ready to print the model in 15 minutes

Key features: At the core of Shapify technology are four wide-angle high-resolution 3D scanners and the booth's automated post-processing software. The scanner creates a circle around a person to capture their body shape from every angle. Obtaining accurate body measurements makes it possible to reproduce even the smallest details from the person's posture to the folds in their clothing. Scans captured in the booth are then automatically aligned, merged, and turned into a digital 3D replica, ready for 3D printing. The full-color 3D portrait, or figure, can be used in a variety of applications, from creating a timeless keepsake – a 3D printed statue, to collecting body measurement data, opening up new opportunities for technological advancements in areas such as medicine, diet, and fashion.

Applications: Artec Shapify Booth is used for 3D portraits, body measurements, and personal avatar creation.

4. Fully automatic 3D human body scanner

Figure 7. Fully automatic 3D human body scanner [4]

Basic information. 3D vertical scanner; Range: 400*2000mm; Color data: 640*480(VGA); X/y accuracy: 0.6mm @500mm:0.9mm @1200mm:2mm; Depth accuracy: 0.05cm @500mm:0.1cm @1200mm:0.5cm; Color frame rate: 30fps; Data format: 16bit; Output: 30w; Weight: 25kg; Dimensions: 400*400*2100mm; USB cable: USB 2.0/3.0; File format: FPLY OBJ STL VRML, Can save as common formats for CNC

Advantages:

Fully automatic: Simple operation, intelligent software, idiot-like operation, scientific effect, no need for professional and technical personnel to evaluate this choice.

High precision scanning: Accurate scanning details, data will not be lost, three-dimensional data is more accurate than the human body collection, effectively improving the success rate of scanning.

High stability: The machine is stable and will not shake, the scanning probe is moving up and down, the human body rotates 360 degrees to get a full range of data acquisition, different from the handheld scanner, easy to shake and easy to losing data.

Fast speed: Scanning the entire body vertically only needs 2-4 minutes, 5 times faster than other handheld scanners or ordinary scanners.

Higher accuracy of color representation: High resolution, color reduction is correct, good performance on details.

Less downtime: The machine is stable and the software is automatically repaired, and the machining data is complete, so the downtime is less and the efficiency is improved.

Technical:

Technical principle: Shaper3D body scanner is based on infrared video imaging, optical sensors to accurately collect human full color data, to restore the real details, no radiation, no harm to the human body. Use principle: Move the lens up and down and rotate the machine base 360 degrees to collect human data with a full range without a dead angle. Easy to operate and easy to scan.

Applications: 3D Studio, fashion, wedding photography studio, schools, educational institutions, medical rehabilitation assistance, three-dimensional film, animation, games, etc.

5. 3D Printing Van Loc

There are many different methods of 3D scanning of the human body, but the most common is using structured light technology. In this method, the scanner will project a series of light stripes onto the human body

and record the reflected images of these stripes. Based on the collected data, the computer will create a 3D model of the body.

Figure 8. Handheld scanner [5]

Applications of 3D scanning of the human body:

Making statues: 3D scanning is used to create 3D models and transfer them to other materials, such as bronze portrait statues etc.

Medical: 3D scanning is used to create 3D models of body parts, helping doctors diagnose diseases, plan surgeries, and monitor treatment. For example, 3D scanning can be used to create 3D models of broken bones, helping surgeons determine the exact location of the fracture and plan effective surgery.

Fashion: 3D scanning is used to create clothing and accessories that are tailored to each individual. This helps reduce fabric waste and creates products that fit perfectly to the wearer's body.

Sports: 3D scanning is used to analyze athletes' movements, helping them improve their technique and enhance their performance. For example, 3D scanning can be used to analyze a golfer's swing motion, helping them identify flaws in their technique and adjust their stance to hit the ball more accurately. Entertainment: 3D scanning is used to create 3D characters in movies, video games, and virtual reality applications. This helps create more lifelike and realistic characters, giving viewers a more enjoyable experience.

Benefits of 3D scanning of the human body:

High accuracy: 3D scanning can create accurate 3D models with high accuracy, helping to collect detailed data on the shape and size of the human body.

Fast speed: 3D scanning can collect data quickly, in just a few minutes, saving time and costs.

Ease of use: Modern 3D scanners are easy to use, do not require much professional skills.

Easy data storage: 3D scan data can be stored in digital form, easy to access and share.

Some notes when scanning the human body in 3D:

Choosing the right 3D scanner: The 3D scanner needs to have the accuracy and resolution suitable for the needs of use.

Preparing the human body before scanning: Jewelry and decorations need to be removed, and the body must be kept still during the scanning process.

Data security: 3D scan data needs to be carefully secured to avoid personal information leakage.

3D scanning of the human body is an advanced technology that brings many benefits to many different fields. With the ability to provide accurate and detailed data, 3D scanning helps improve efficiency and work quality while creating products and services that meet the personalized needs of users.

IV. CONCLUSION

Three-dimensional scanning has some advantages, including being fast and highly accurate. Using three-dimensional scanning, no specialized knowledge is required to obtain measurements. What makes three-dimensional scanning so popular is its non-contact method, which increases accuracy and shortens data collection time, reducing human resource costs and time.

Three-dimensional body scanning technology has made many advances and is very useful in the garment industry, however, in order to obtain accurate scanning data, the scanner needs to meet some practical

requirements when scanning such as displacement, breathing, the eyes of the person being scanned; comfort during scanning: posture when scanning, time and environment of scanning; scanning technology must be safe for the eyes; protection of personal data; psychological issues, data display, cost and identification of hidden areas (armpits, chin ...).

Despite the shortcomings of each human body 3D scanning system, their data accuracy is sufficient that 3D scanning devices can be considered suitable for collecting anthropometric data for clothing design.

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