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OPTIMIZED PARAMETRIC ANALYSIS TO 3D MODEL OF CUSTOMIZED HUMAN HEAD SCANNING USING THE HANDHELD 3D SCANNER

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Abstract: *Background:* The medical area has widespread utility of various scanning like Ultrasound, CT, X-rays, and MRI. These methods are considered helpful in contributing knowledge to the interior parts of the human body. Yet, there exists a deficiency in getting knowledge about the exterior body parts which can immediately obtain accepted responsibility through 3D Scanning technologies. A considerable number of analysis writings regarding various scanning methods and 3D scanning were analyzed to recognize the influence of them and the succeeding analysis.

Objective: Physicians and technologists utilize convenient scanning technologies within various sub-medical areas. This article endeavors to discover the expertly possible method of 3D scanning technologies in the therapy sector by improving the 3D scanning model of human head. This article will encourage physicians for the fittest approach upon the sufferer with tremendous information, least hazards, and maximizing advantages.

Materials and methods: In this research we have taken 10 experiments on 7 persons, and all the scanning are performed by using different-2 parameters and the 3D models were acquired with their quality ratings out of ten. All these experiments are done by using the handheld Sense 3D scanner. Finally this study achieved desired parameters of 3D scanning for human head.

Result: A customized 3D model is acquired by applying the variable parameters like distance of the object from scanner, angle of the scanner with the object, and rotational speed of body which we want to scan. Finally this study achieved optimization parameters of 3D scanning model of human head.

Conclusion: After applying different-2 parameters in this study, it is clear that optimization parameters to human head for 3D scanning were as follows: intensity of light =17.5, type of the surface which is to be scan, varying distance of the scanner to the object =15 to 3 inches, variation in angle of scanner =+/-45 degree, and the speed of rotation =120 minutes and hence finally the optimized parameters for 3D scanning to customized a 3D model of human head is obtained.

Keywords: 3D scanning, optimization parameters, customized 3D model.

1.0 Introduction

In this scientific age, every technology growing up with accelerated manner and time and money are the fundamental needs to be saved. The 3D scanning is also one such emerging technology. There are many types of scanners out of which the future of handheld 3D scanner appears very bright due to its cheap price and ability to scan an object quickly. The principal purpose of the 3D Scanner does transform a physical inorganic/organic commodity among a digital copy. The Scanning machine gathers data concerning the precise configuration as well as the volume of the existing body and registers the gathering digital information (**Haleem et al., 2020**). In the

current digital era, it is a fundamental necessity towards the digital production. 3D scanning plays an important role in various fields to generate a digital data of existing object within a few seconds without any harm to that object. This technology is not only fast, it gives the accurate shape as well as the size of the commodity with a precise value by 30µm (**Drury & Mooney, 2003**). The scanners are fittings with sensors and single/double camera, with the help of which capture a number of pictures of the physical organic/inorganic object among the determination. Acquired pictures are examined through a super-class workstation, at which the 3D scanner machine software accounts point data information during the apparent region to be scanned (**Gorthi & Rastogi, 2010; Ali et al., 2020; Javaid & Haleem, 2018**). The scanned points cloud data & knowhow is transformed into a software language which is known as the standard triangulate language (i.e., STL) form. The device scans the exterior surface, in order to indicative purposes, and the equivalent information can utilize for geometric compositions data (**Haleem et al., 2020**). In one hand, sequential scanning processes are very expensive and on the other hand, 3D scanning is cheaper as well as comfortable (**Bibb et al., 2010**). The 3D scanner can help the fast production of implants and excludes the hand-operated mapping method. In 3D scanners, digital data helps the design of suitable customized forms like implants, body shape gloves, anatomical, and prosthetics prints exterior form, reconstructing configuration, and color reliably (**Kumar et al., 2017; Javaid & Haleem, 2018**).

The 3D scanner device's fundamental principle is not different from the basic principle of a camera, in which several pictures should merge to build an elusive 3D design. To producing 3D designs, three fundamental technologies are employed, i. e. photogrammetry, hi-fi optics, and border projection. To inventing a 3D digital portfolio, it merges various pictures to build a design. For observing longitudinal variations in foundation morphology, the application of 3D scanning is beneficial; such long terms variations occur due to practice and nourishment or by participation through athletics.

2.0 Literature Review

This segment highlights the related work such as:

Initially the data acquisition process is completed after that if the objective of our work is required some geometrical conversion in desired design, then to achieve the surface redesign there will be a complex procedure passing through which the conversion mechanics dismissed.

DeCarlo et al., 1998, exercises an organic body of anthropometric facial analyses to form the inequality in face configurations. **Kähler et al., 2002**, parameterize the insufficient head scans with defacing a template mesh to adjust the scanned exterior and their method have the extra advantage that gaps in the scanned exterior are saturated with the geometry of the template exterior, generating an extra practical, perfect design. **Anguelov et al., 2005**, explains about the capturing of a high-resolution picture using only a singular look, the SCAPE design may be suitable for the discovered source material. They examined data to force the full 3D configuration, permitting them to visualize imaginary portions of the shape (outline achievement). **Peng & Sanchez, 2011**, explain that outlines only are insufficient for understanding human structure and posture from an individual picture and inject two modifications. Initial, they produce a height- and weight-constrained subspace of body structure modification to compel the difficulty. Next, and numerous importantly, they combine configurations from the shading suggestion within the physique configuration optimization. **Jing Tong et al., 2012**, developed a 3D configuration good from the physical object is a necessary duty for many utilization in computer graphics. Unluckily, despite for immobile pictures, there is no cheap system, to provide an excellent feature, high-resolution distance data in the actual period. **Volonghi et al., 2018** developed a 3D scanning methodology to create a customized hand because there is a mass customization required in the medical areas.

3.0 Objective of the study

Medical therapists sequentially scale the body's appearance and volume by hand or by using the particular tools to diagnose and determine therapy/health situation. Recently on one side, for designing 3D interior pictures of a sufferer body, Computed Tomography scanning, electro-magnetic X-radiations, Magnetic Resonance Imaging, and medical technique Ultrasound tools are generally applied. On the other side, the application of 3D scanning device appearance, these are reliable and helpful to utilization in respect of measure an individual's body framework, size, shape, skin surface area, and color precisely, a different therapy/health sector is developing, i.e. 3D Scanner device

has a tremendous ability to obtain 3D analysis without any direct physical touch. This study gives the optimized parameters to develop a 3D model for a customized human head using the 3D scanner.

4.0 Methodology

To develop a customized human head by using a cheap and same quality as that of the others, handheld sense 3D scanner. This study employ the different-2 parameters like type of light, the intensity of light, the distance of the scanner from the physical body, angle of rotation of the scanner between the scan, time per revolution of the physical body, and the image quality. 3D scanning of 7 person's head with 10 experiments has been performed to develop the customized human head. The effect of varied surfaces (like eyes, face, hair, etc.), distances, angles, intensities of light, etc. every parameter will be different. So with the change in the parameter, the scanning will also be changed. This experimental work/methodology acquire the 3D models with different qualities and after the 3D scanning, hence this study gives optimization parameters to 3D model of the human head.

5.0 Experimental Work

The complete process will be understood with the help of the table as shown:

Sr. No.	Intensity of light	Distance between scanner & human head (inch)	Angle of rotation of the scanner (degree)	Time per revolution of human body (sec.)	Image quality (rating)	3D Scanned model
1.	18.5	20	+/- 15	34	1/10	Figure 1.
2.	21.8	13	+/- 10	29	2/10	Figure 2.
3.	18.0	24	+/-20	32	3/10	Figure 3.
4.	20.0	17 to 5	+/- 18	115	4/10	Figure 4.
5.	22.9	15	+/- 5	59	5/10	Figure 5.
6.	30.0	12 to 9	+/- 16	79	6/10	Figure 6.
7.	20.7	15 to 5	+/- 30	160	7/10	Figure 7.
8.	18.5	17 to 4	+/- 34	145	8/10	Figure 8.
9.	17.6	15 to 4	+/- 37	122	9/10	Figure 9.
10.	17.5	15 to 3	+/- 45	120	10/10	Figure 10.

Figure: 1.

FIGURE: 2

FIGURE: 3

FIGURE: 4

FIGURE: 5

FIGURE: 6

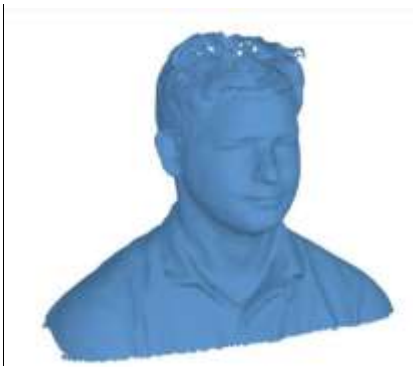

FIGURE: 7

Figure: 8

Figure: 9

Figure: 10

Figure: 11 Handheld 3D Scanner

6.0 Problems during 3D scanning and their remedies

Reflective surface: While scanning a gadget the vastly crucial matter is that it can't scan an extremely shining covering. The problem is also among visible bodies with transparent, shiny, dark, and dirt surfaces (**McBride et al., 2008**). The solution to this problem is a developer (white fog).

Obstacles: The scanner can't obtain the exterior, in which obstacles exist, i.e., valleys, seal, etc. The solution of these problems is to apply a special type of connection, to put the target at the essential angle hence the Scanning device can take these barriers.

Clouds data overlapping: Whenever, oversized things are to be scanned, clouds data obtained due to the surface overlapping. Thus it will create obstacles in data meshing. The medication is using a camera and the projector with high-resolution to take the exterior data.

Require a heavy processor: A huge database is needed to scan the large objects, which improves the scanning rate of an object. The PC processor in which the scanning software is operating occupies a powerful graphics card and RAM.

Hair gel and cap: A hairy face is very difficult to scan because the scanner can't get the data points, so hair gel and the hair cap to tie the hairs is the best solution to this problem.

Prevent movement: Scanning quality is affected even by the blinking and high breathing activities so we can say that the movement is inversely effect the desired 3D model.

7. Result

As we know that in the medical sector the interior surface of a human body is scanned with the help of electro-magnetic radiations (X-radiations), Computerized Tomography scanning, Magnetic Resonance Imaging technique, and Ultrasound, etc., in addition to the exterior of the body can be scan using the 3D scanner. But the main difference between these two scanning is that the interior scanner is not affected like the 3D scanner by the breathing, blinking, reflective surfaces, hairy surface, etc. so to scan an exterior of the human body, we need to keep in mind all these requirements. In this experimental work a number of parameters were applied to find out the optimized parameters for scanning a human head.

8. Conclusion

After examine a number of experiments, this study reached to the conclusion that because the every parameter have their distinct effect on 3D scanning, therefore if intensity of light =17.5, varying distance between scanner and the human head =15 to 3 inches, time per rotation of person =120 min, and the angle with which the scanner inclined to the person =+/-45 degree, then a customized human head can developed with a better quality and quickly.

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