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Reverse Engineering, Additive Manufacturing, Point Cloud, Mesh, Reflectance

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RESOLUTION IN THE 3D MODELING OF OBJECTS FOR ADDITIVE MANUFACTURING AND REVERSE ENGINEERING – SHUTTER EFFECT

Abstract

This article presents a proportional relationship between Shutter and the value of the resolution scanning system that allows decision making for modeling 3D parts used in reverse engineering and additive manufacturing. As a first step, the object of interest is treated to dim excessive brightness, then the object is scanned (by point cloud or mesh) with the use of a Handyscan 700 scanner. The point cloud is processed with the Geomagic software Desing X to generate a CAD image and a ".stl" file for 3D printing.

1. INTRODUCTION

During the development of a new product, it is necessary to carry out a systematic analysis of the ideal manufacturing technique that will best adapt to the needs and budget of the customer (Akhmet & Fen, 2016; Ruan et al., 2016; Babel, Sawicki & Gasiorowski, 2021; Rojo, Bonilla & Masaquiza, 2018; Lan et al., 2018). The current demand for quality and low cost products has lead us into a new industrial revolution for manufacturing (Herrmann, 2002; Pedroza, 2018), where computer-aided design, CAD, software plays an important role in the design process. In the last three decades, the world has witnessed a digital transformation of every aspect of life and society. There exists a multitude of examples regarding this change: CAD, CAM, CAE systems, TDT, magnetic resonance, TAC, 3D ultrasound, etc (Bilal et al., 2020; Gonzalo, Sandra & Rodrigo, 2020). 3D scanning is among these techniques, which consists of capturing geometric information of a physical object by means of large capacity data acquisition tools such as laser scanners, optical digitizers, probes, contact arms, coordinate-measuring machines and computerized axial tomography scanners

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(Babel, Sawicki & Gasiorowski, 2021; Li, 2001). A 3D scanner can be defined as a device that analyses a real-world object or environment to collect data on its shape and possibly its appearance. The collected data can then be used to construct digital 3D models (Saorín et al., 2017; Montusiewicz, Czyz & Kayumov, 2015; Montusiewicz, Czyz & Kesik, 2015; Fines & Agah, 2008; Ojeda, Belete & Batista, 2014).

In this paper we establish a proportional relationship in the process of data acquisition, such that the data processing reduces the processing time during reverse engineering.

2. DEVELOPMENT

In this section, the process of digitization and CAD modeling of an object is presented.

2.1. 3D Digitization

The first step in reverse engineering consists in capturing the object's geometry. This is done by means of a Handyscan scanner shown in Fig. 1. More specifications of this scanner are given in Table 1.

Fig. 1. Handyscan 700 scanner

The following procedure was considered for the scanner's manipulation: 1. Hamdyscan 700 position. When scanning the object of interest, it is important to keep a distance of 12 in from the object. The scanner has poka-yoke LED that indicates the correct distance. The scan is done until a homogenous point cloud is obtained as seen in Fig 2.

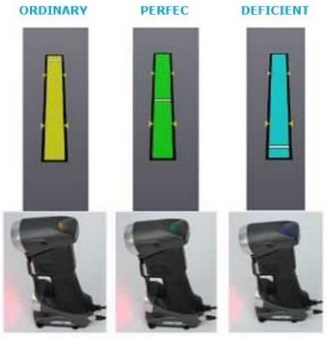

Fig. 2. Distance poka-yoke