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COMPREHENSIVE STUDY ON 3D SCANNER METHOD TO CONVERT CLOUD DATA TO SURFACE MODELING

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BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY (AUTOMOTIVE TECHNOLOGY)

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Faculty of Mechanical and Manufacturing Engineering Technology

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This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours.

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DECLARATION

I hereby, declare this report entitled “Comprehensive Study On 3D Scanner Method to Convert Cloud Data to Surface Modelling,” is the result of my own study, with the exception of the references given. The Choose an item. has not been approved for any degree and is not being considered for any other degree at the same time.

Signature : 

Name : Nurulain Nabilah Binti Azman

Date : 17 JANUARY 2022

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours. The member of the supervisory is as follow:

Signature : .....

Supervisor Name : Mohammad Rafi Bin Omar

Date : 17 JANUARY 2022

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DEDICATION

Alhamdulilah, thanks be to Allah for providing me with the strength, direction, and knowledge I needed to finish my study. I dedicate my thesis to my loving parents for their unwavering moral support, as well as Fauzi bin Paijan and Hafizah binti Abu Bakar for meeting all of my needs while compiling this thesis from start to finish. Finally, many thanks to my supervisor, Mr Mohammad Rafi Bin Omar, for his help and advice in finishing my thesis.

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ABSTRACT

A 3D scanner is a device that collects real-life data about the form and appearance of an object or environment to the collected data can be used to generate three-dimensional computer models. Following that, a common issue discovered through this research is that 3D scanning is a promising option, but it is unclear how these new technologies compare to traditional ways. An experimental study is being conducted to investigate the conversion of data point clouds from a 3D scanner to CAD data with a variety of shapes, such as simple geometrical shapes, and complex shapes. The objective of this experiment is to compare a few different software designs to optimum method duration time for conversion cloud data. The T-Scan Lv system is utilised as a laser scanning during the 3D scanning procedure. Three trials of each model sample shape are use in this experiment method. The software is used to modify the point cloud data to surface modelling is PolyWorks and Catia. The result collected based on the scanning duration, editing cloud data duration and mean of standard deviation in percentage. From the overall result, the most accuracy software are used to editing cloud data to surface modelling is complex shape for PolyWorks software where the mean of standard deviation is 96.78% while for Catia software is square shape which is the mean of standard deviation is 96.14%. Finally, every method of modifying cloud data utilising the greatest software has been studied.

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ABSTRAK

Pengimbas 3D ialah peranti yang mengumpul data kehidupan sebenar tentang bentuk dan rupa objek atau persekitaran kepada data yang dikumpul boleh digunakan untuk menjana model komputer tiga dimensi. Berikutan itu, isu biasa yang ditemui melalui penyelidikan ini ialah pengimbasan 3D merupakan pilihan yang menjanjikan, tetapi tidak jelas bagaimana teknologi baharu ini dibandingkan dengan cara tradisional. Kajian eksperimen sedang dijalankan untuk menyiasat penukaran *point cloud* data daripada pengimbas 3D kepada data CAD dengan pelbagai bentuk, seperti bentuk geometri mudah dan bentuk kompleks. Objektif percubaan ini adalah untuk membandingkan beberapa reka bentuk perisian yang berbeza dengan masa tempoh kaedah optimum untuk penukaran data awan. Sistem T-Scan Lv digunakan sebagai pengimbasan laser semasa prosedur pengimbasan 3D. Tiga percubaan bagi setiap bentuk sampel model digunakan dalam kaedah eksperimen ini. Perisian yang digunakan untuk mengubah suai data *point cloud* kepada pemodelan permukaan ialah PolyWorks dan Catia. Hasil yang dikumpul berdasarkan tempoh pengimbasan, pengeditan tempoh *cloud data* dan purata sisihan piawai dalam peratusan. Daripada hasil keseluruhan, perisian ketepatan yang paling banyak digunakan untuk menyunting *cloud data* ke pemodelan permukaan ialah bentuk kompleks bagi perisian PolyWorks di mana min sisihan piawai ialah 96.78% manakala bagi perisian Catia adalah bentuk segi empat sama iaitu min sisihan piawai ialah 96.14%. Akhir sekali, setiap kaedah mengubah suai *cloud data* menggunakan perisian terhebat telah dikaji.

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Thanks a million, to my delightful family for supporting me. I cannot find the right term for your support and trust in our capacity to succeed my appreciation. I would want to thank all my friends for their advice and support. I appreciate the support you have provided to complete the thesis for your thoughts and information. Finally, I would want to thank everyone engaged in my project, either directly or not. Your compassion I'm sure not to forget, and only Allah can repay all of you. Thank you very much.

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CHAPTER 1

INTRODUCTION

An overview of the 3D scanning method and data cloud countermeasure analysis will be provided for this chapter. The study will also discuss the fundamental idea, problem statement, objective, and goal. The structure of the report is described below.

1.1 Overview

Technologies integrates engineering and production technology for machinery production in industrial technology. Technology also facilitates and facilitates the industrial process. With the development of modern technology, technology has evolved drastically. Many burdens have been raised in human life with modern technologies. Today, several sophisticated technologies are employed in the manufacturing sector. 3D scanner, SLS, 3D printing and other technology for example.

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A new way of assessing the surface of complicated objects or objects is by using 3D scanning technology. The 3D scanner generates an object's surface data "point cloud." In other words, a 3D scanner can capture the exact size and shape of physical objects as a 3D digital representation in the computer world. 3D scanning can measure objects in fine detail and record free-form forms such that highly accurate point clouds are quickly generated. 3D

laser scanning is ideal for measuring and inspecting curved surfaces and complicated geometries that require a large quantity of data to be precise and insufficient in traditional measurement methods or a touch probe application.

3D scanning technology can relate to the reverse engineering process for product innovation design and 3D printing technology. This technology can be used to combining 3D scanning and reverse engineering technology. application of 3D scanning in RE process involves three main steps: (1) scanning, (2) point processing, and (3) application specific geometric model development. By reverse engineering, data are obtained, 3D scan technologies are used to produce a point cloud of surface object data. Point clouds are produced with 3D scanners or a photogrammetric program. That software measures many points on the outside surfaces. Point clouds are usually generated by 3D scanners or software that measure many points on the exterior surfaces of things surrounding them. From the output point cloud data many purposes are used including to create 3D CAD model or convert the point cloud data to engineering design software such as PolyWorks and CATIA.

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The design is generally carried out by the CAD software designer, with a long cycle time and low efficiency that cannot match the demand of the market. Three-dimensional printing technologies can cut the production test cycle of new items and based on existing technologies, reverse engineering can copy and rebuild products and so shorten the design cycle. On this fundamental level, the study here proposes using a 3D scanning method to compare which one method of software, like CATIA and PolyWorks, easy to use to redesign the shape and compare the amount of time necessary to redesign the software. In this project, which is complex in form and geometry, there are two concept forms we chose. The outcome

will be that the point nude will be converted into CAD software and that the object will be reshaped using CATIA or PolyWorks.

1.2 Problem Statement

In today's heavily competitive global market, manufacturers always seek new ways of reducing the time required to sell a new product. Rapid product developments (RPD) mean innovative technologies and processes that support manufacturers and designers to satisfy the requirements of shorter product development times. This means rapid product development. However, fewer studies have been carried out on the use of a 3D scanner to scan the geometric forms and complex forms of the data in a cloud.

Point cloud object classification, which is a classical and critical problem in computer graphics and computer vision fields, aims to identify the categories of different point cloud objects (Deng, 2022).

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Surface modelling technology, which is an intrinsically challenging procedure in which each face or form is built from splines and unique sketches and geometry sets, is historically used to construct sophisticated objects. If smooth transitions between faces are required, each surface must work independently, as well as the transition (whether tangency or continuous curvature) (*DEVELOP3D*,2012).

Following that, a common issue discovered through this research is that 3D scanning is a promising option, but it is unclear how these new technologies compare to traditional ways. To fulfil this duty, early scanners used lights, cameras, and projectors (Farhan, 2021).

1.3 Objective

The main aim of this project to Comprehensive study on 3D Scanner Method to convert Cloud Data to Surface Modelling are:

a) To study the method conversion data point cloud data from 3D scanner to CAD data.

b) To scan cloud data and analyse geometry shape and complex shape by using 3D scanner.

c) To analyse for further investigations between a few designs software and compare the optimum method duration time for conversion cloud data.

1.4 Scope

The implantation of "Convert Cloud Data from 3D scanner by reverse engineering method" project converging into:

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a) Develop of a 3D scanner component with complex internal features is 3D scanned and the point cloud is optimized before different surface modelling techniques are tested.

b) Application of 3D scanner type T-TRACK LV to scan geometry and complex shape and collect the cloud data.

c) Application of CATIA and PolyWorks software in design and choose the best method duration time for conversion cloud data.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss on the 3D scanner with reverse engineering to collect data from points. The general 3D scan overview, reverse engineering used, software development, comparative data also are shown to obtain the results set out in the research objectives. Figure 2.1 depicts the progression of the literary evaluation.

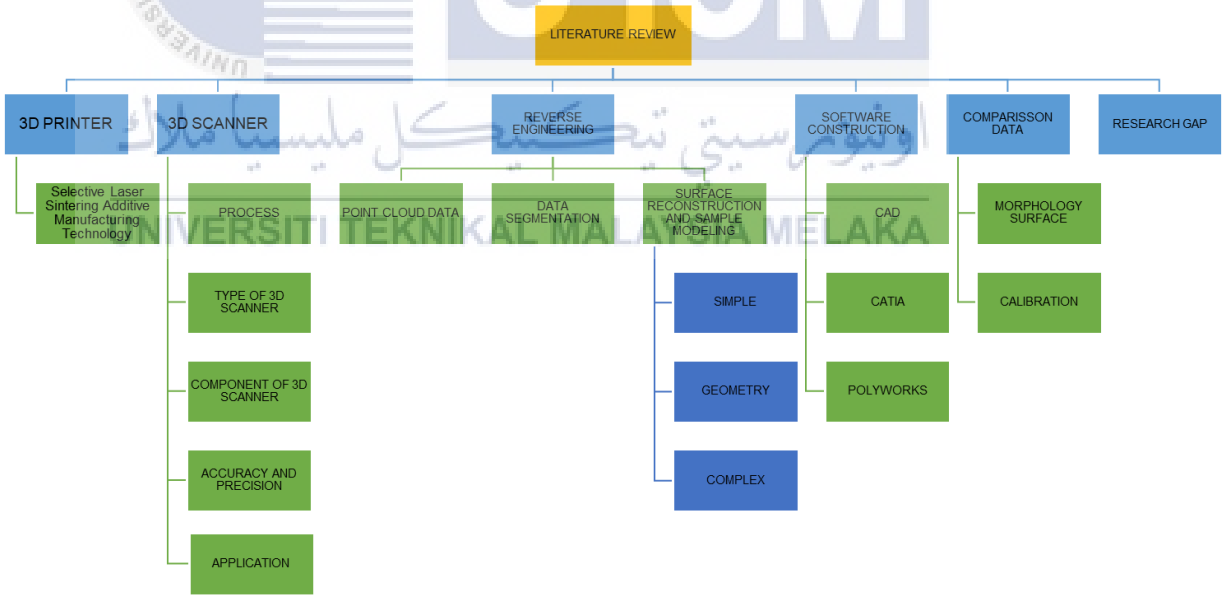

Figure 2. 1 Flow Chart of Literature review

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2.2 General Overview of 3D Printer

Selective Laser Sintering Additive Manufacturing Technology (SLS) method. Selective Laser Sintering is an additive method that facilitates the manufacture of 3D things by melting a powdered material layer by layer using a laser SLS uses a CO2 laser as the heat source to fuse the powders under pressure -free conditions (Yan., 2019). SLS technology is one of the most promising advances in 3D printing due to the high complexity of parts it can form short manufacturing cycle, low cost, and wide range of materials it is compatible with. SLS production casting moulds, sand moulds (core), injection moulds with conformal cooling channels, and fast prototyping of ceramic and plastic functional components are typical examples of SLS technology. It is already widely utilised in aviation, aerospace, medicine, equipment, and a variety of other sectors ('Selective Laser Sintering Additive Manufacturing Technology', 2021). The proses of Selective Laser Sintering Process Excessive power beam laser is used to induce fusion of the powdered raw powder.

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Currently, many 3D printed products have been produced; however, there is a gap between the physical qualities and surface morphology of the printed object. These methods have become more efficient, less expensive, more cost-effective, sophisticated, and higher in resolution and quality. Selective Laser Sintering is used to create objects with no supports; the design options are nearly infinite. During selective laser sintering, the particle coalescence of a powdered aggregate by diffusion is accomplished by firing at an elevated temperature and, in the other hand, during selective laser melting, the powder is transformed from solid phase into a liquid upon heating.

2.2.1 Proses

There are a few processes are involved in 3D printer process which is from the printing process until the post processing. Figure 2.2 show the Schematic of the selective laser sintering process.

1) **Printing:** The powder is applied in a thin layer on a platform within the build chamber. The printer preheats the powder to a temperature just below the raw material's melting point, making it simpler for the laser to raise the temperature of portions of the powder bed as it traces the model to solidify a component. The laser scans a cross-section of the 3D model, heating the powder to just below or just at the material's melting point. This mechanically fuses the particles together to form a single solid component. The unfused powder acts as a support framework for the component during printing, eliminating the need for separate support structures. The platform is then lowered into the build chamber by one layer, generally between 50 and 200 microns, and the procedure is repeated for each layer until the pieces are complete.
2) **Cooling:** After printing, the build chamber should be allowed to cool slightly inside the print enclosure and then outside the printer to provide good mechanical qualities and to avoid warping in components.
3) **Post-processing:** removing the final pieces from the build chamber, separating them, and cleaning them of excess powder. The powder may be recycled, and the printed pieces can be further treated using media blasting or media tumbling.

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