Faculty of Mechanical and Manufacturing Engineering Technology

DESIGN AND DEVELOPMENT OF PLATFORM FOR LARGE OBJECT 3D PRINTER

Asnawi Bin Abdul Malek

Bachelor's Degree in Manufacturing Engineering Technology (Product Design) With Honors

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DESIGN AND DEVELOPMENT OF PLATFORM FOR LARGE OBJECT 3D PRINTER

ASNAWI BIN ABDUL MALEK

A thesis submitted
in fulfilment of the requirement for the Bachelor's Degree of Manufacturing Engineering Technology (Product Design) with honours

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DEDICATION

To my beloved parents

To my supervisor and co supervisor

To my fellow friend

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ABSTRACT

This project is a new study about the 3D printer. 3D printer is a process of making three-dimensional object from digital file. The reason of this project is doing because of every existing 3D printer have built up volume limited. The purpose of this project is to study the existing 3D printer and its parameter. Then improvise the 3D printer to able to print large object. The 3D printer that will be using is UP PLUS 2 3D printer. There are many changes need to be done to able to print large object such controller of the 3D printer and the platform. There are some researches have been done to study about the 3D printer and apply the knowledge to improve the 3D printer. During the study of the existing 3D printer, there is some problem have been identified and do some improvement to achieve the objective. The method that being use in the project is design development where one of the ways is by morphology chart to get an idea from the chart. Sketches is made from the idea and reverse engineering to obtain cad data. The result will be focusing on the changing the platform by fabricating the parts, make a new controller and test run the printer after done. Before run the printing, all axis is test it movement to it limit and return back to home position. It takes about two minutes to complete the drawing. From the result, all of the objectives have been achieved but there is a limitation. The first limitation is the long base tend to bend went the platform move to the other end due to no support and small area of holding at the frame. The second limitation is some of the wire cannot be connected to the controller because of different male and female connector.

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ABSTRAK

Projek ini adalah kajian baru mengenai pencetak 3D. Pencetak 3D adalah proses membuat objek tiga dimensi dari fail digital. Tujuan projek ini dilakukan kerana setiap pencetak 3D sedia ada mempunyai had jumlah membina sesuatu barang. Tujuan projek ini ialah mengkaji pencetak 3D sedia ada dan parameternya. Kemudian mengubahsuai pencetak 3D untuk mencetak objek besar. Pencetak 3D yang akan digunakan ialah pencetak 3D UP PLUS 2. Terdapat banyak perubahan yang perlu dilakukan untuk dapat mencetak objek besar seperti pengawal pencetak 3D dan platform. Terdapat beberapa kajian telah dilakukan untuk mengkaji pencetak 3D dan menggunakan pengetahuan untuk mengubahsuai pencetak 3D. Semasa kajian pencetak 3D sedia ada, terdapat beberapa masalah yang telah dikenalpasti dan melakukan perbaikan untuk mencapai matlamat. Kaedah yang digunakan dalam projek ini ialah pembangunan reka bentuk di mana salah satu cara adalah dengan carta morfologi untuk mendapatkan idea dari carta. Lakaran dibuat dari idea dan kejuruteraan terbalik untuk mendapatkan data cad. Hasilnya akan memberi tumpuan kepada perubahan platform dengan membuat bahagian-bahagian, membuat pengawal baru dan menguji pencetak selepas selesai. Sebelum menjalankan percetakan, semua paksi adalah menguji pergerakan untuk mengehadkan dan kembali ke kedudukan rumah. Ia mengambil masa kira-kira dua minit untuk melengkapkan lukisan. Dari hasilnya, semua objektif telah dicapai tetapi terdapat batasan. Batasan pertama adalah asas panjang cenderung membengkok memasuki platform bergerak ke hujung yang lain kerana tidak ada sokongan dan area pegangan kecil di bingkai. Batasan kedua adalah beberapa wayar yang tidak dapat disambungkan kepada pengawal kerana penyambung lelaki dan perempuan yang berbeza.

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CHAPTER 1

INTRODUCTION

1.1 Overview

In this chapter will tell about the introduce the method of this project. First, it introduces the general idea of background of the project and state the problem of the project that need to be solve. Second is to determine the objective of the project and the area of implementation of the project. lastly, it tells briefly about the probability of the outcoming result.

1.2 Background

3D printer is a process of making three-dimensional object from digital file. The 3D printed object is achieved by operating additive processes. The additive process create object by creating a layer of material until an object is created. 3D printing is not a subtractive manufacturing process where the material is being cut out or hollowing out a piece such as milling and lathe machine. 3d printing can produce a complex shape by using less material than traditional manufacturing methods.

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Figure 1.1 Creality CR 10S 3D printer

To make a 3D printer object, it started with a creation of 3D model in your computer. The design of the 3D model can be created by using a Computer Aided Design (CAD) software. Besides that, the 3D model can be obtained by using a 3D scanner. The 3D printed model that create by using a CAD result in reduce in reduce error can be corrected before the printing. Before printing the 3D modeling in the format of STL, the error must be checked. Most error occur in the STL file is holes, faces normal, self-intersection, noise shells and manifold error. The model that are 3D scanned have more error than the created 3D model using CAD software due to the reconstruction of the 3D scan part. Once the STL file complete, the file is sent to the post processing software such as slicer and Cura, to convert the model into series of thin layer and produce G-code file for the 3D printer to interpret. The G-code will be printed by the 3D printer.

There are many addictive process that are involving in the 3D printer. One of the process is by melt or soften the material to produce the layer. The fuse filament fabrication, known as fused deposition modelling (FDM), the part is made by extruding bead or stream of material that are harden to form a layer. The material such as thermoplastic, metal wire,

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or other material, is entering the through the extrusion nozzle head where the material is heating up and flow in and out of the nozzle. There are several types of FDM 3D printer. The first is cartesian FDM 3D printer. Cartesian 3D printer is the most common 3D printer that in the market. It is using the technology of three axis: X, Y and Z axis to determine the position and movement of the printer. The X and Y axis will move the 3D printer nozzle while the Z axis moving the bed up and down.

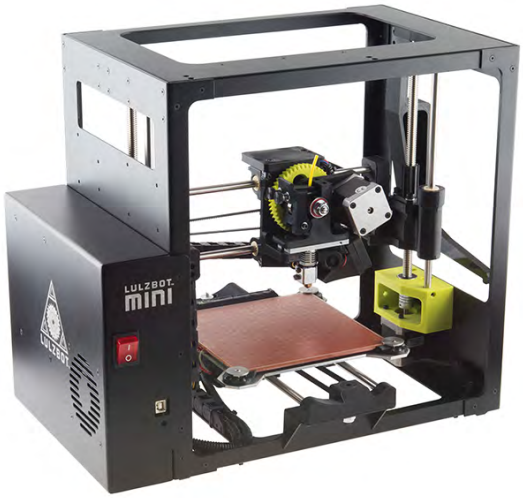

Figure 1.2 Cartesian 3D printer

The second method is delta FDM printer. Delta 3D printer is become more in 3D printer market. It is consisting of six axis movement. The delta 3D printer operation using cartesian coordinate. This design is to speed up the printing process but it reducing the accurate of the printer compare to the cartesian printer. The difference between the cartesian and delta are the movement of the machine. The cartesian can move each element in one direction but for delta, the printer head can move any direction but print tray stay still.

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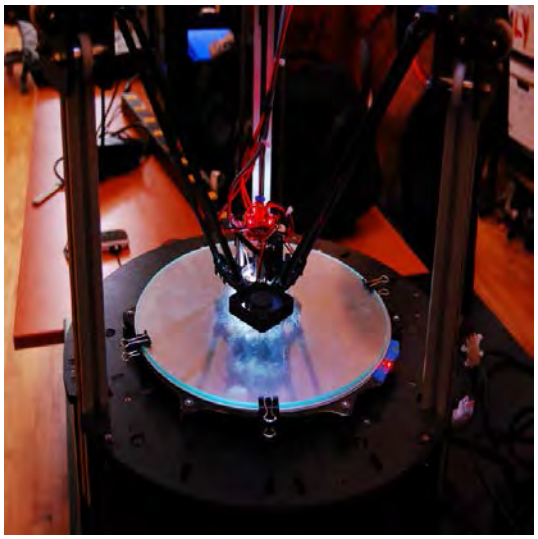

Figure 1.3 Delta 3D printer

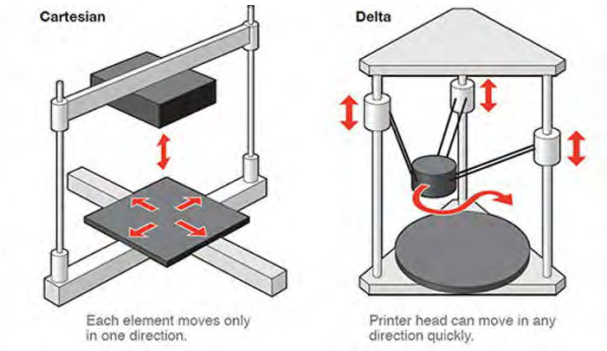

Figure 1.4 Comparison movement of cartesian and Delta 3D printer

Polar 3D printer is not determined by the X, Y, and Z coordinate, but by using a polar and length. It means that the plate will be rotate and some along with extruder that moving up and down. The polar only need two engines where the cartesian need three no make it move. The polar is using less space compare to other 3D printer.

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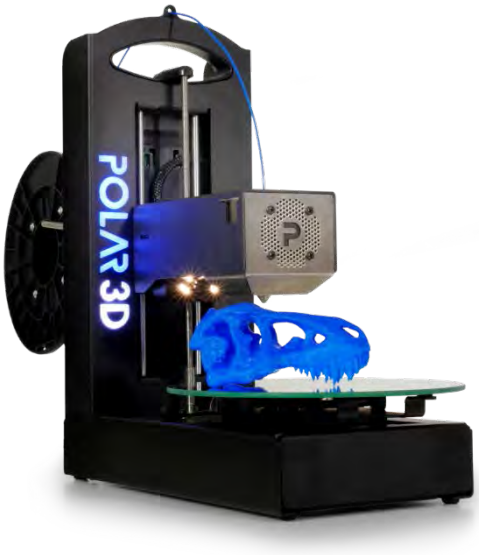

Figure 1.5 Polar 3D printer

The 3D printing has been used in the manufacturing, medical, industry and sociocultural where facilitate 3D printing become successful commercial technology. The first it is use to reduce the production time and cost in the making of prototyping of a part. On the years 2010, the addictive manufacturing expends in entering the production. The additive manufacturing of food is developed by squeezing out food, layer by layer until shape is produce. Variety type of food can be print such as chocolate, candy, and flat food like cracker and pizza.

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Figure 1.6 3D printed pancake

3D printer also is being using in the fashion where the designer tests the product such as 3D printing bikini, shoes, and dress. In the production Nike, it uses 3D printing to prototype and manufacturing the 2012 Vapor Laser Talon football shoe for the player of American football. 3D printing also become consume grade eyewear with custom fitting and styling.

1.3 Problem statement

The 3D printer is having limitation in size and cannot print large part base on the parameter use. The size of the part or product cannot exceed 140mmX140mmX130mm that the part able to be printed. To solve this problem, the platform of the 3D printer is improvising so that it is able to print large object.

1.4 Objective

The objective of the project is:

1. To study the existing 3D printer design and process parameter
2. To develop a competitive 3D printer but with a better built up volume

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3. To convert the 3D printer platform to enabling large part to be print

1.5 Scope

For this project, the design of 3D printer will be focusing on:

1. The design of the 3D printer will be based on the existing 3D printer that are in the market
2. The software that will be using in this project is CAD software for designing the part
3. The 3D printer part will be taken from the 3D printer that are available in UTeM

1.6 Expected result

From this project, the outcome of the project will be on the understanding on how 3D printer design and able to make an improvement on the existing 3D printer.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

After studying the literature, many works have been done that are related to the design and development of conveyor platform for large 3D printing. There are several methods have been done in collecting the data such as searching on the internet for journal, reading previous research, and collect pattern design that are related to the research

2.2 Rapid prototyping

Base on the article by (Wong & Hernandez, 2012), rapid prototyping is the first form of the creating layer by layer by three-dimensional object by using computer aided design (CAD). The figure 2.1 show step that are involving in the rapid prototyping:

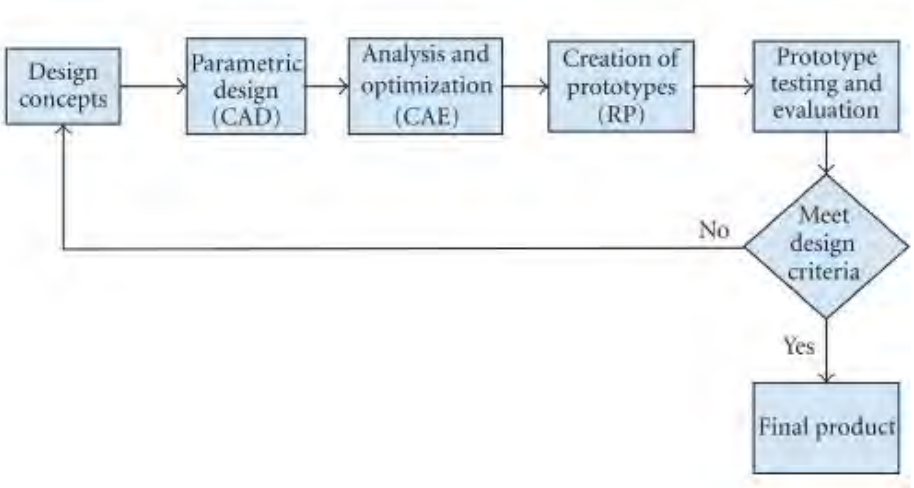

Figure 2.1 step of development of rapid prototyping (Wong & Hernandez, 2012)

Rapid prototyping is not just able to make a creating model but with the benefit of using plastic, it able to made an end product.

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