"I admit that I have read this report and I found that it is suffice from the aspect of scope and quality to pass Bachelor Degree of Mechanical Engineering
(Design and Innovation)

Signature : .....

Supervisor Name: MR. HAMBALI BIN BOEJANG

Date : 8 MAY 2007

ASSESSMENT OF FUSE DEPOSITION MODELING (FDM) MACHINE AND 3D MODELING MACHINE

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A thesis is fulfillment of the requirement for the award of the Bachelor Degree of Mechanical Engineering (Design & Innovation)

Faculty of Mechanical Engineering
Universiti Teknikal Malaysia Melaka

APRIL 2007

DECLARATION

"I hereby declare that this thesis entitled **"Assessment of Fuse Deposition Modeling (FDM) Machine and 3D Modeling Machine"** is the result of my own research except as cited in the references"

Signature: .....

Author : MOHD JEFRI BIN AMIR

Date : 8 MAY 2007

DEDICATION

THIS TASK IS DEDICATED TO ALL MY FAMILY ESPECIALLY MY PARENT, BROTHER AND SISTER. YOU ALL VERY IMPORTANT IN MY LIFE.

ALSO TO MY PROJECT SUPERVISOR, ALL LECTURES, TECHNICIAN AND ALL MY FRIENDS ESPECIALLY COURSE MATE. THIS PROJECT WILLS SUCCESS BECAUSE OF YOR SUPPORT.

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Lastly, I would like to apologize for my wrong-doing and mistakes during this PSM period. I hope all the knowledge and experience that I gathered in this PSM can help me in my career in the future.

Thanks.

ABSTRAK

Kemajuan dalam 'Rapid prototyping, teknologi pada masa ini telah banyak meningkatkan keperluan yang tinggi untuk kualiti yang lebih baik, ketahanan dan pembuatan, 'Rapid Prototyping' teknologi adalah salah satu proses pilihan di mana diguna pakai di dalam menghasilkan model prototype dalam industri pada masa kini. Proses ini berpotensi sebagai pilihan di dalam menghasilkan model prototype sebelum menhhasilkan produk yang sebenar. Laporan ini telah menerangkan pengenai penilaian bagi mesin 'FDM' dan mesin '3D Modeling'. Penilaian bagi kedua-dua mesin ini adalah melibatkan perbandingan ketepatan mesin menghasilkan sesuatu produk, jangkamasa mesin menghasilkan produk dan melihat permukaan hasil kerja setelah siap dibuat. Report ini juga ada menerangkan mengenai proses dan teknik dalam 'rapid prototyping' di mana merangkumi mesin Steriolithograpi, 3D printing, FDM dan 3D modeling. Laporan ini juga menerangkan mengenai cara-cara penilaian dibuat keatas kedua-dua mesin, analisis dan mengeluarkan keputusan untuk membuat perbandingan.

ABSTRACT

Development in Rapid Prototyping Technology is increasing due to high requirement for better quality, durability and manufacturability. Rapid prototyping technology is one of the alternative processes that have received considerable attention from industry recently. In industry, the process is potential to be as an option to developed prototyping model before produced a real product. This report overviews the state of the Assessment of the FDM machine with the 3D modeling Machine. The assessment both of the machines provided the comparison of build time, surface finish and accuracy of the machine. This report also has briefly about the rapid prototyping process and techniques providing the Steriolithograpy machine, 3d printing, FDM machine and 3D modeling machine. This report also explains about the experimental work for assessment of Rapid prototyping machine, analysis and carries out the result for comparison.

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GLOSSARY

SYMBOL	DEFINATION
RP	Rapid prototyping
3D	Tree Dimensional
CAD	Computer Aided Design
STL	Standard Triangulation Language
FDM	Fused Deposition Modeling
IGES	Initial Graphics Exchange Specification
CMM	Coordinate Measurement Machine
CAM	Computer-aided manufacturing
NC	Numerically Controlled
CNC	Computer Numerical Control
CAD	Computer Aided Design
DNC	Direct Numerical Control

APPENDIX

CHAPTER 1

PROJECT INTRODUCTION

1.1 Project Background

'Projek Sarjana Muda' (PSM) is a compulsory for all student of UTeM in order to obtain a degree in the engineering field. From the PSM, every student will apply their subject learned from the classes into the final project. There are many applications that have to do such as theoretical, experimental, analysis, design and so on.

These final projects will an overview the comparison of rapid prototyping machine. There are two type of rapid prototyping such as Feed Deposition Machine (FDM) and 3D Modeling Machine. This project start from design test model prototyping, fabricate the prototype using the machine and make the analysis using the CMM machine and Portable Surface Roughness Tester. The analyses are including the dimensional accuracy, built time model and visual the surface finish.

This project chosen because a new technologies in rapid prototyping is being used in just about all industrial sectors, although there are probably more applications in the automotive industry than any other[10]. It's faster, coast less, and quality is improved. Typically, these saving vary between 40% and 80 % for both cost and time, and in the same case go even higher. In most companies 10% cost or time

saving on a major development program would be considered excellent. A 20% time or cost saving is considered outstanding. A 30% Cost or time saving would be considered phenomenal. But a 50 % time or cost saving is a paradigm shift that can over whelm competition [4]. Rapid Prototyping (RP) techniques also are methods that allow to quickly producing physical prototypes with the important benefit to reduce the time to market.

So, the comparison both of the machine will give more knowledge in the rapid prototyping process. In this case, the advantages and disadvantages will show at the final result and thinking about the improvement of the machine. May be there are a lot of method can be used to produce a more quality of the product.

1.2 Project Main Objective.

1.2.1 Aim

The aim of this report is to provide an assessment of Fuse Deposition Modeling Machine (FDM) and 3D Modeling Machine. This is a newly purchased Rapid prototyping (RP) facility in prototype laboratory at UTeM.

1.2.2 Objective

The objectives of the report are clarifying the stages involved in assessment of rapid prototyping machine. There are including two type of rapid prototyping machine such as Fuse Deposition Machine (additive process) and 3D Modeling Machine (subtractive process). The objectives are following :

- To do literature search
- To design test model
- To manufacture the test model via RP technique and CNC
- To measure the built time
- To measure the accuracy
- To visualize the surface finish
- To carry out comparative analysis (advantages and disadvantages, application etc.)

1.3 Scope of Project

The main project of scope is to assess a newly purchased RP facility in prototyping laboratory at faculty of mechanical engineering in UTeM, This project is to compare two different processes such as additive and subtractive process which produce a better prototype.

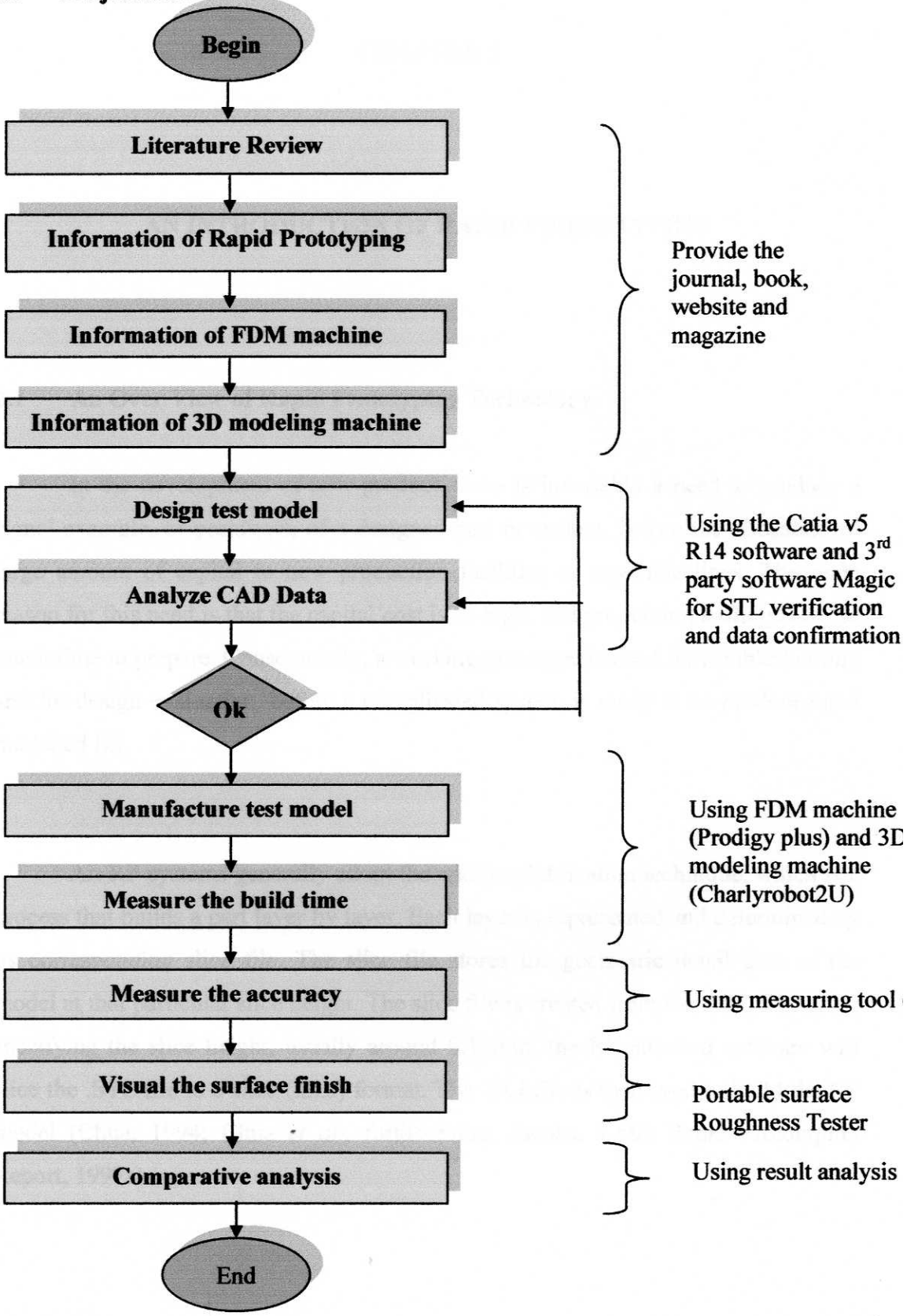
1.4 Problem Statement

Many students did not no about the capability of this rapid prototyping machine in producing prototypes especially based on its prototype accuracy, built time, and the surface finished. This is because the machine is new to UTeM and not many students know how to use it to its full potential.

1.5 Problem Solving

To make a detail analysis on both of these RP methods of FDM and 3D modeling machine at FKM's prototype laboratory to see its potentials a test model was built in order to compare its performance in terms of surface finish, accuracy and built time in producing prototypes.

1.6 Project Flow Chart



CHAPTER 2

AN INTRODUCTION OF RAPID PROTOTYPING

2.1 An Over View of Rapid Prototyping Technology

In the development of new product, there is invariably a need to produce a signal example, or prototype, of a designed part or system, before the allocation of large amount of capital to new production facilities or assemble lines. The main reason for this need is that the capital cost is so high, and production tooling takes so much time to prepare. Consequently, a working prototype is need for troubleshooting and for design evaluation, before a complicated system is ready to be produced and marketed [2].

All RP systems generally adopt the additive fabrication technique, which is a process that builds a part layer by layer. Each layer is represented and determined by its corresponding slice file. The slice file stores the geometric detail data of the model at that particular slice height. The slice file is created from the .STL file. After specifying the slice height, usually around 0.15mm, the RP attached software will slice the .STL file to a slice (.SLI) format. The .SLI file is then used to build the RP model (Chua, 1994; Chua *et al.*, forthcoming; Jacobs, 1992; Rapid Prototyping Report, 1997a).