UNIVERSITI TEKNIKAL MALAYSIA MELAKA

PRODUCT IMPROVEMENT OF CORNELL CFF-12P FAN BY DESIGN FOR ASSEMBLY METHOD (BOOTHROYD DEWHURST)

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's in Manufacturing Engineering Technology (Product Design)(Hons)

by

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2016

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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SESI PENGAJIAN: **2016/17 Semester 1**

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APPROVAL

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

……

(PN. NURUL AIN BINTI MAIDIN)

ABSTRAK

Kaedah mereka bentuk pemassangan adalah rangka kerja yang ditubuhkan yang digunakan untuk mencipta produk. Dengan melaksanakan kaedah mereka bentuk pemasangan dalam projek ini, rekabentuk analisis yang dijalankan untuk kipas Cornell CFF 12-P. Aspek-Aspek penting yang perlu di pertimbangkan adalah proses pemasangan, kesukaran pengendalian dan kesukaran pemasangan. Masalah yang terdapat pada kipas ini adalah terdapat banyak penggunaan skru pada pemasangan produk ini. Objektif projek ini adalah untuk mengurangkan bahagian produk pada masa yang sama mengekalkan fungsi kipas, untuk menganalisis perbandingan di antara kecekapan reka bentuk asal dan reka bentuk baru dan untuk optimumkan penyelesaian yang lebih baik daripada kipas yang sedia ada dipasaran berdasarkan garis panduan reka bentuk pemasangan. Berdasarkan kajian, terbukti masa pemasangan dapat dijimatkan dari 52.31 s kepada 15.8 s. Indeks reka bentuk pemasangan juga menunjukkan peningkatan dari 0.6 kepada 6.3. Kelebihan menggunakan kaedah reka bentuk pemasangan telah dibuktikan dalam reka bentuk baru kipas Cornell CFF-12P. kecekapan reka bentuk yang telah dikira secara manual juga menunjukkan peningkatan daripada 29% kepada 76%

ABSTRACT

Design for Assembly method is an established framework that is used to create a product. By implement DFA method in this project the design analysis is conducted for Cornell CFF-12P fan. The important aspects that need to be considered is assembly process, handling difficulties & insertion difficulties. The problem with this fan is a lot of fastener use to assemble the product. The objectives of this project is to reduce part while maintaining the function of fan, to analyse the comparison between the design efficiency original design and improved design and to provide optimised solution that better than existing fan in market based on DFA guidelines. Based on study, it is proven that the assembly time is save from 52.31 s to 15.8 s. the DFA index also show improvement from 0.6 to 6.3. The advantages of using DFA method has been proved in redesign the Cornell CFF-12P fan. The design efficiency that has been calculated manually also show increasing from 29% to 76%.

DEDICATION

To my beloved husband, son, parents and family thank you for being supportive and for the love.

ACKNOWLEDGEMENT

First and foremost I offer my sincerest gratitude to my adorable supervisor, Madam Nurul Ain Binti Maidin, who has being very supportive share knowledge and for being very patience. I attribute the level of my without her encouragement, this project would not have been completed or written. One simply could not wish for a friendlier supervisor

In my daily life 1 have been blessed with my beloved husband, Mr Mohammad Amirul bin Abdullah for helping and be by my side whenever I felt that I am not the best and not to forget my son, Muhammad Amir Mukhriz bin Mohammad Amirul for always make me wants to do my best.

My special thanks to my beloved parents Mr Sapardin bin Hj Kamaruddin and Mrs Faridah Hanum binti Isa for all the sacrifice.

Thanks you everybody for with me went through ups and downs together.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

DFMA	=	Design for Manufacturing and Assembly
DFA	=	Design for Assembly

CHAPTER 1

INTRODUCTION

These days, several of fan model are accessible with various brand and quality this made the component of the fan to appear as something else and unique depends on the designer and company intention to be focused. In any case, the manufacturing process is the essential things to be considered as it will influence the cost of the product itself. Thus, this project focused on analysing the design of a fan in order to diminish cost then enhance the manufacturing and assembly process with a new design of a fan after the analysis. This chapter fundamentally clarify how the project is being made starting from the background study, problem statement, objectives, scope, and organization of the project and lastly result expectations.

1.1 Background

Nowadays, there are a lot of process which all influence product cost, quality and productivity of system. This is because a lot of product is made up of fasteners and redundant features. Design for Manufacturing and Assembly (DFMA) method can ease the manufacture of the part will form a product and ease the assembly. It is to simplify product structure, to reduce manufacturing and assembly cost and to quantify improvements that eliminates waste or efficiency in a product design. The aim of this project is to improve the design and analyse of the efficiency and function of the product before and after redesign also prove it by prototype.

1.2 Problem Statement

Some of the fan uses a lot of fasteners and redundant features. As a solution, the part is reducing but function remains the same. Analysis need to be constructing to make a comparison between the original design efficiency and after redesign efficiency. Hence, to show the problem can be overcome, a prototype of a new design will be built. This is to show the product still functioning even reducing its part.

1.3 Objectives

(i) To reduce part while maintaining the function of fan.

(ii) To analyse the comparison between the design efficiency original design and improved design.

(iii) To provide optimised solution that better than existing fan in market based on DFA guidelines.

1.4 Work Scope

(i) Conduct survey toward 100 respondents to gain the information about assemble problem for this fan.

(ii) Improve the design (redesign) by using SolidWork.

(iii) Analyse the design efficiency (original design and redesign) by using DFA Boothroyd Dewhurst method.

1.5 Organization of the Project

(i) Chapter 1: Introduction

This chapter will simply introduce about the project. This chapter contains introduction, problem statements, objectives, scopes of project and expected results.

(ii) Chapter 2: Literature Review

This chapter shows about the studies and research that relevant to the project.

(iii) Chapter 3: Methodology

This part will show the canvas about the project methodology used in this project.

(iv) Chapter 4: Results

This part will state out the result that be obtained.

(v) Chapter 5: Discussions

This chapter will talk about the discussion of the result of the project.

(vi) Chapter 6: Conclusion

This chapter will discuss about the summarization of the project and the major conclusion of the project.

1.6 Expected Result

(i) Give a better result for new design compare to original design.

CHAPTER 2

LITERATURE REVIEW

As the time flies an associations need to learn so as to enhance their adaptability and efficiency toward future. In spite of the fact that this thought with the assistance of new technologies and philosophies of insight of contend with different competitors truly could improve the development process with good results to achieve target. As for now, there are a considerable of tools that could be used to help production team to solve their issue at an early stage. Subsequently, this chapter will review the past research from different sources with reference

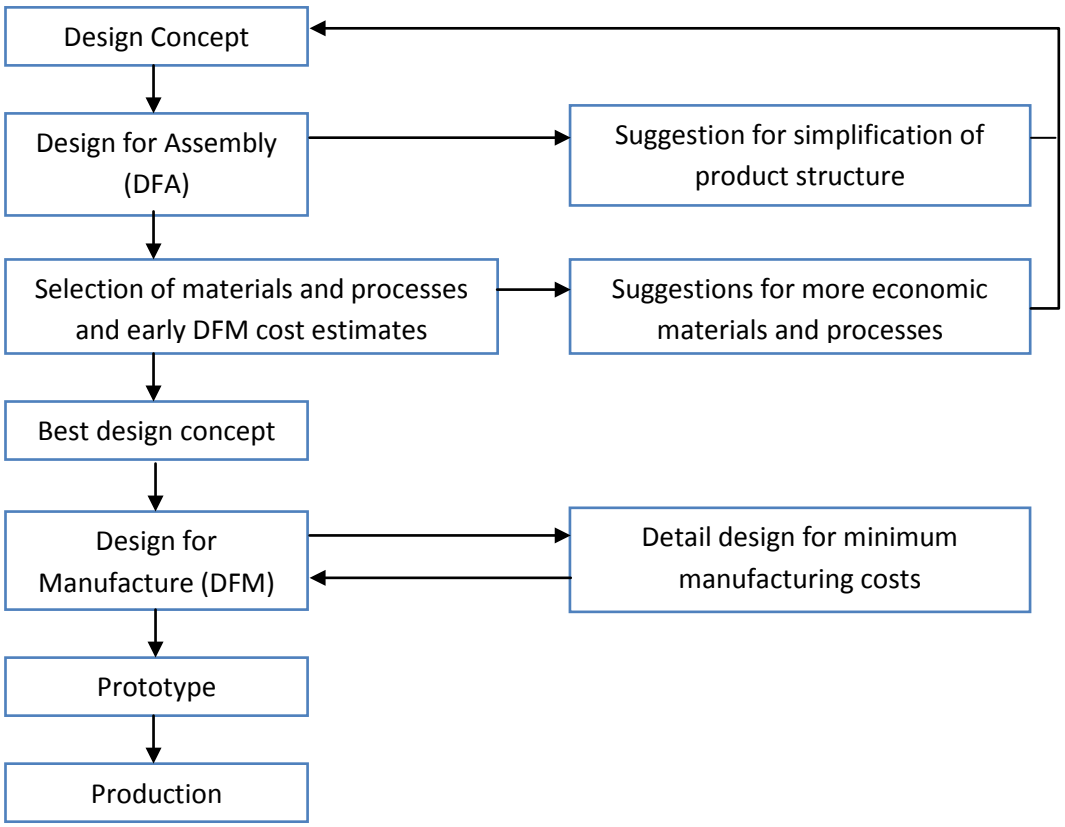
2.1 Designs for Manufacturing and Assembly (DFMA)

Design for manufacturer and assembly (DFMA) is a tool that aids in minimizing production cost by separating the product down to be the least difficult components and parts. Concurrent Engineering (CE) is proposed to bring about developers from the beginning, to consider plan, quality, cost, user demand and all component of product cycle from origination to transfer. Both of this Production Oriented Design (DFMA and CE) could run activities all the while in a parallel structure. They were using simulation method that could give a completely understanding among colleague to discover errors along the procedure and fix it before the development ends

There are two major concept in DFMA process in which design for assembly (DFA) and also design for manufacturing (DFM). DFA is a design of the product for simplicity of assembly (Boothroyd, 1994). It is an analysis technique that unites

multidisciplinary teams to assess and validate product design as for the manufacturer and assembly of its components parts. In the meantime, DFM is to design that depends on lessening the cost of production and time to market for a product, while maintaining fitting level of quality the material and tooling side of the new product. Consequently, DFMA refers to working on booth concepts together.

Figure below shows the typical steps taken in DFMA study using DFMA software.



(Sources: Boothroyd, G., 1994. Product Design for Manufacturing and Assembly, Computer Aided Design Volume 26.)

Figure 2.1: Typical steps taken in simultaneous engineering study using DFMA

DFMA can be used successfully to diminish part number in the assembly that brings to rearrange the assembly process, lower fabricating, overhead cost, and minimize assembly time and enhance quality by lessening the potential outcomes for introducing a defect. Additionally the amount of labour can be diminished once the component of parts gets to be less and less complex assembly processes. At the point

when the part number had been decreased, naturally the development cycle get to be shortened as the philosophy empowers simplifying the design and using standardize component whenever possible. The advantages of Boothroyd & Dewhurst DFMA system in reducing the number of part count. Reducing part count can saves assembly, save labour, inventory floor space, documentation and administration.

2.2 Designs for Assembly (DFA)

By and large, there are two objective of DFA in which to minimize part number and to have remaining parts of a nature that they are effortlessly assembled together. The DFA technique fulfilled the objective by:

(i) Providing an apparatus for the designer and even design group which guarantees that thought of product complexity and assembly happen at the earliest design stage. This wipes out the danger of concentrating too much of the entire things during early design on product function with insufficient regard for product cost and competitiveness.

(ii) Guiding the designer to simplify the product so that the cost of assembly and parts can be spare similarly.

(iii) Gathering data ordinarily possessed by the accomplished design engineer and arranging it advantageously for use by less-experienced designers.

(iv) Forming a database that involves assembly times and cost factors for variables design situations and production conditions

2.3 DFA Methods

The analysis of a product design for simplicity of assembly depends to a huge extent on whether the product is to be assembled manually, fixed or hard automation, soft automation (robotic) or a mix of these. The reasons of implement this method is to simplify product in order to reduce its assembly cost, improved quality and