UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF SLICING MACHINE USING INTEGRATED APPROACH (TOTAL DESIGN)

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Design) (Hons.)

By

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

……

(Official Supervisor)

Engr. Dr. Hambali Bin Arep @ Ariff

DECLARATION

I hereby, declared this report entitled "Development of slicing machine using Integrated Approach (Total design)" is the results of my own research except as cited in references.

Signature : …….

Author's Name : Mohamad Fikri B Nasir

Date : 3/6/2013

ABSTRAK

Projek ini menerangkan tentang pendekatan, berdasarkan pendekatan bersepadu ataupun rekabentuk keseluruhan yang dapat membantu para pereka untuk mencipta rekabentuk baru daripada peringkat awal proses pembangunan produk. Objektif utama projek ini adalah untuk mencipta sebuah konsep rekabentuk mesin penghirisan baru dengan menggunakan kaedah pendekatan bersepadu. Selain itu, perbandingan konsep rekabentuk mesin penghirisan baru dengan rekabentuk sedia ada dinilai dan dipilih dengan menggunakan *Pugh Matrix*. Konsep rekabentuk mesin penghirisan baru yang dipilih dibangunkan dengan menggunakan perisian *Solidwork*. Terdapat pelbagai aspek yang perlu dipertimbangkan di dalam peringkat pembangunan rekabentuk mesin penghirisan baru. Oleh itu, spesifikasi dan juga fungsi mesin penghirisan harus berkaitan dengan ciri-ciri rekabentuk dan juga kehendak pelanggan. Rekabentuk keseluruhan dilaksanakan kerana membantu di dalam pembuatan mesin penghirisan baru bermula dari keperluan pengguna, spesifikasi produk, konsep rekabentuk, rekabentuk terperinci, pembuatan dan juga jualan. Oleh itu, rekabentuk keseluruhan mempertimbangkan segala alternatif dan faktor yang relevan yang akan mempengaruhi pembuatan mesin penghirisan yang akan mengurangkan kitaran masa pembuatan dan meningkatkan kualiti dan nilai produk. Kualiti fungsi penggunaan dan analisis Solidworkexpress juga digunakan di dalam pembangunan mesin penghirisan baru bagi menganalisis kekuatan rekabentuk produk. Sebagai keputusan, rekabentuk konsep 4 telah dipilih di antara tujuh alternatif yang lain. Fabrikasi rekabentuk mesin penghirisan akan dilaksanakan sebagai kerja masa akan datang.

ABSTRACT

This project describes an approach, based on the Integrated Approach or Total Design that can assist designer to develop a new design at the early stages of the product development process. The main objective in this project is to develop a new conceptual slicing machine design by using an Integrated Approach. Furthermore, the comparison of new design concept with the existing design of slicing machine are evaluated and selected by using a Pugh Matrix. The selected design concepts of a new slicing machine are developed by Solidwork software. There are various aspects that need to be considered in the development stage of new slicing machine design. Therefore, the specification and the function of the slicing machine must be related to the design and customer requirement. Total Design are implemented due to assist the new slicing machine development begins with user needs, product design specification, conceptual design, detail design, manufacture and sales. Therefore, the Total Design consider all the alternatives and relevant factors that influence the development of slicing machine due to reduce the development cycle time and improve product quality and value. Quality Function Deployment and Solidworkexpress analysis are being used in the development of new slicing machine to analyze the strength of the product design. As the result, design concept 4 is being chosen among to the other seven alternatives. As the future work the new slicing machine design will be fabricated.

DEDICATION

To my beloved parents, siblings, my friends, my lecture and also to all members of the Faculty of Manufacturing Engineering

ACKNOWLEDGEMENT

بسم الله الرحمن الرحيم

I am grateful to Allah S.W.T in His kindness and merciful which gave me the power and the opportunity to succeed in completing my final year project with joy

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LIST OF ABBREVIATIONS

PDP	-	Product development process
QFD	-	Quality function deployment
HOQ	-	House of quality
CAD	-	Computer aided design
PDS	-	Product design specification
PDD	-	Product design and development
BOM	-	Bill of material
DC	-	Design concept
FYP	-	Final year project
MPa	-	Mega pascal
Mm	-	Milimeter

CHAPTER 1
INTRODUCTION

This chapter discusses about development of slicing machine using integrated approach also known as Total Design approach. The briefing of the background, problem statement, objective, and scopes of the project are also discussed in this chapter.

1.1 Background of project

This project is a industry based project, a collaboration between Universiti Teknikal Malaysia Melaka and TR Technology SDN BHD. The company runs engineering activities such metal stamping services and supplies. Cutting rubber sheet product is one of supplies activity they do and need to produce in large amount. The cutting rubber sheet process is still using the conventional method which the operators use a knife and cutting jig as a tool to cut the product. The purpose of this project is to produce a slicing machine that can help the company to save time and cost, reduce labor work and increase product outcome. The conceptual slicing machine design was proposed using integrated approach. Integrated approach also known as Total Design approach is the systematic activity necessary, from the identification of the market/user need, to the selling of the successful product to satisfy that need. It is an activity that encompasses product, process, people and organization (Pugh, 1991). Implementing Total Design

offers a visible operational structure which allows for the integration of technological and non-technological parts enabling efficient and effective product development.

1.2 Problem Statement

Based on the observation during the visit at TR Technologies Company, the company was running a process of cutting rubber sheet and produce it in large quantities. The worker at the company faced difficulties to do the cutting process because the method that used is still fully conventional manner. Jigs and knife were used to cut rubber sheet that affect the time, cost, number of product produce and quality of product. The company also needs to use more workers to support the cutting process. Therefore, it is important to design and develop new slicing machine using integrated approach that can replace the conventional method. This integrated approach is a systematic method use to guide in developing a new slicing machine during development process. The new slicing machine will improve the time, cost, number of product produce, quality product and also reduce in using worker at the same time.

1.3 Objective

In this project the main objective is to design a new conceptual slicing machine using integrated approach. The specific objectives of this project are:

a) To compare the new slicing machine design with the other existing slicing machine design.
b) To evaluate and select the concept design using Pugh matrix.
c) To apply Solidwork software in the development of a new slicing machine design.

1.4 Scope of project

The scopes for this research using integrated approach are:

a) To study methods and concepts of integrated approach.
b) To apply integrated approach to the development process.
c) To investigate the suitable design concept to develop the slicing machine .
d) To compare and analyze the design of existing slicing machine.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter provides the definition of total design and a brief about slicing machine, types of design process, Quality Function Deployment, Pugh Matrix and the example. This chapter also covers areas that need to be reviewed and understood by applying integrated approach and information which already done by other people.

2.2 Slicing machine

There are many types of existing slicing machine in the market and this slicing machine has its specific purpose and specific product. This project is to develop a rubber slicing machine which can help worker to do their work easily. According to Arthur (1938), the existing invention a machine comprises a blade holder and a workpiece support, adjustment which use to adjusting the blade position, switch to switching the machine in, electric motor, belting and common rotary device. This machine has generally circular blades that are rotated by an electric motor. It has guiding which using belting and roller at the workpiece holder to support the workpiece from vibrating at the starting of the operation until the finish operation. The machine includes a rotatable cutting blades adapted of rotate about a vertical axis and a horizontal workpiece support table. On the cutting table it has a sensor which functions to work the machine automatically.

The sensor is set with the programs that will make sure the rubber cut according to the size. For the product it has 3 dimension widths which are 388cm, 429cm and 465cm and the size was fixed.

A safety device was provided which the machine develops with housing to prevent any injury while using the machine. Operator also close with the control panel which it can easy to switch off the machine if get any emergency cases. Figure 2.1 and 2.2 are the examples existing slicing machine in market.

Figure 2.1: Example existing slicing machine in market (Annoy, 2012)

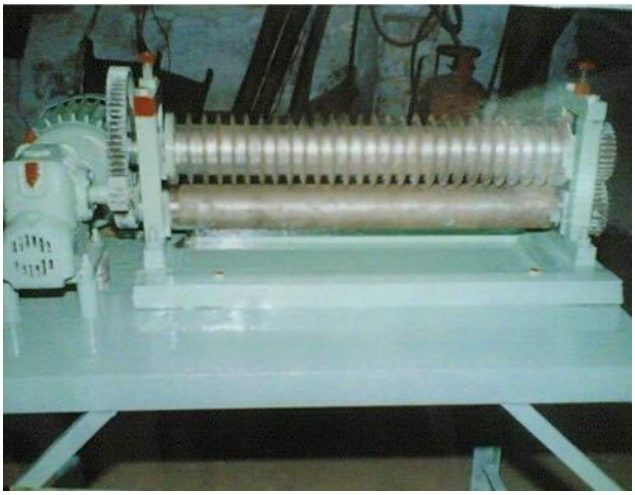

Figure 2.2: Example existing slicing machine in market (Annoy, 2012)

2.3 Machine design classification

According to Khurmi and Gupta (2012), Machine Design is the creation of new and better machines and improving the existing ones. A new or better machine is one which is more economical in the overall cost of production and operation. The process of design a machine is consuming time. There need to compare with other existing machine or existing idea and a new idea has to be conceived. Machine design also may be classified as follows:

i. Adaptive design

The designer's work is concerned with adaptation of existing designs. This type of design needs no special knowledge or skill and can be attempted by designers of ordinary technical training. The designer only makes minor alternation or modification in the existing designs of the product (Khurmi and Gupta, 2012).

ii. Development design

This type of design needs considerable scientific training and design ability in order to modify the existing designs into a new idea by adopting a new material or different method of manufacture. In this case, though the designer starts from the existing design, but the final product may differ quite markedly from the original product (Khurmi and Gupta, 2012).

iii. New design

This type of design needs lot of research, technical ability and creative thinking. Only those designers who have personal qualities of a sufficiently high order can take up the work of a new design (Khurmi and Gupta, 2012).

2.4 Design tools used in Product Development Process (PDP)

Product development process is a process for translating customers requirement into product design and manufacturing. It provides a roadmap to designers for the activities or processes and deliverable required in designing, developing and manufacturing a particular product. The main goals of a product development process are to minimize the life cycle cost, maximize product quality, as well as maximize customers' satisfaction, maximize flexibility and minimize lead time (Mazumdar, 2002). Product development process can be categorized into two main processes, first is deal with development of a product and second is deal with its production (Kausar et al., 2004). In this research several design tools was used in product development process starting from market investigation until the detail in the designing stage. Design tools such as Quality function Deployment (QFD) and Pugh Matrix were used to select the best design concept in the conceptual design stage. Meanwhile, Solidworks software was used to create detail 3D modeling purpose and CES used to selecting material for the product. This design tools used to assist and to perform effectively and efficiently in design activity to produce a product with a good quality.

2.4.1 Quality function deployment (QFD)

According to Rosenthal and Stephen (1992), Quality Function Deployment is a systematic approach to design based on a close awareness of customer desires, coupled with the integration of corporate functional groups. It consists in translating customer desires into design characteristics for each stage of the product development. In other words QFD "is a method for developing a design quality aimed at satisfying the consumer and then translating the consumers demand into design targets and major quality assurance points to be used throughout the production phase. QFD is a way to assure the design quality while the product is still in the design stage." As a very important side benefit he points out that, when appropriately applied, QFD has

demonstrated the reduction of development time by one-half to one-third (Akao, 1990). Ultimately the goal of QFD is to translate often subjective quality criteria into objective ones that can be quantified and measured and which can then be used to design and manufacture the product. It is a complimentary method for determining how and where priorities are to be assigned in product development. The intent is to employ objective procedures in increasing detail throughout the development of the product (Reilly and Norman, 1999). QFD is a systematic means of ensuring that customer requirements are accurately translated into relevant technical descriptors throughout each stage of product development. Therefore, meeting or exceeding customer demands means more than just maintaining or improving product performance. It means designing and manufacturing products that delight customers and fulfill their desires. QFD requires discipline. It is not necessarily easy to get started with. Below is the list of how to facilitate initially using QFD:

i. Obtain management commitment to use QFD.
ii. Establish clear objectives and scope of QFD use. Avoid first using it on a large, complex project if possible.
iii. Establish multi-functional team. Get an adequate time commitment from team members.
iv. Obtain QFD training with practical hands-on exercises to learn the methodology and use a facilitator to guide the initial efforts.
v. Schedule regular meetings to maintain focus and avoid the crush of the development schedule overshadowing effective planning and decision-making.
vi. Avoid gathering perfect data. Many times significant customer insights and data exist within the organization, but they are in the form of hidden knowledge not communicated to people with the need for this information. On the other hand, it may be necessary to spend additional time gathering the voice of the customer before beginning QFD. Avoid technical arrogance and the belief that company personnel know more than the customer (Crow, 2012).