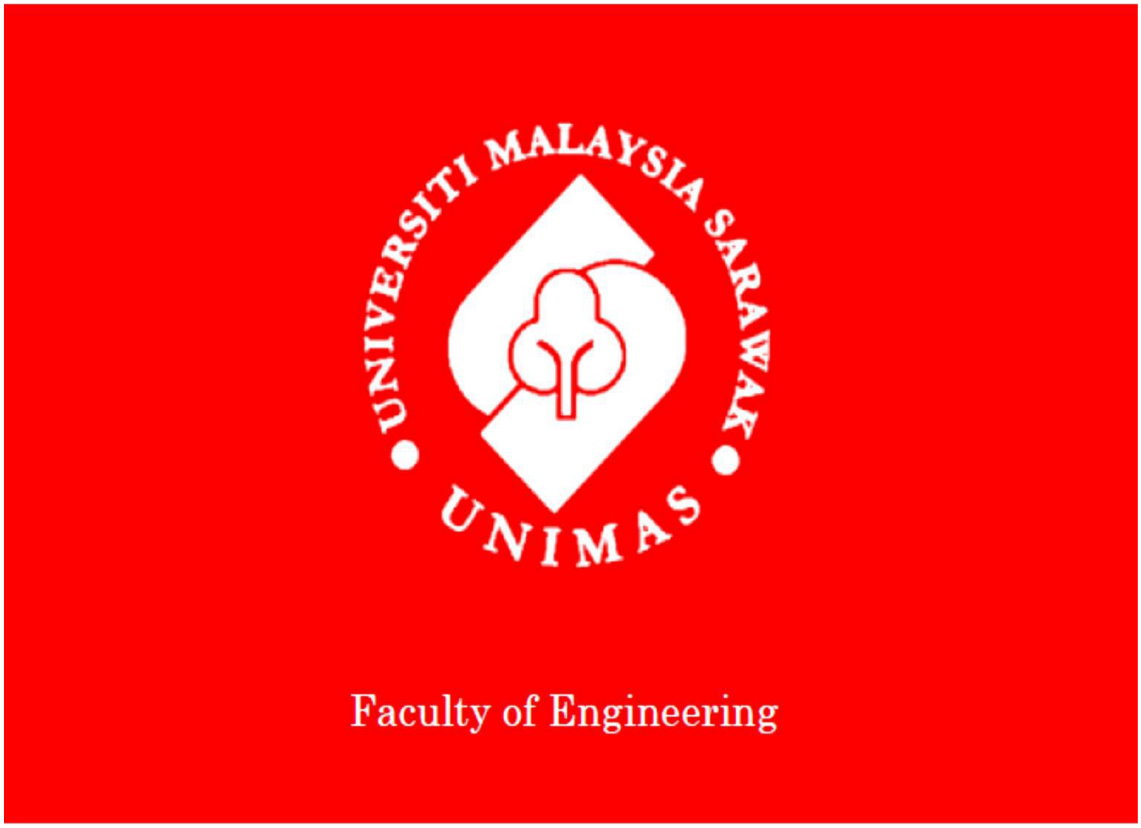

MECHANISED SLICING TOOLS FOR SARAWAK LAYERED CAKE

Nur Mehranie Binti Shamsul Bahri

Bachelor of Engineering with Honours

(Mechanical and Manufacturing Engineering)

2017

UNIVERSITI MALAYSIA SARAWAK

Grade: A-

Please tick (√)

Final Year Project Report	✓
Masters	
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MECHANISED SLICING TOOLS FOR SARAWAK LAYERED CAKE

NUR MEHRANIE BINTI SHAMSUL BAHRI

A dissertation submitted in partial fulfilment of the requirement for the degree of Bachelor of Engineering with Honours (Mechanical and Manufacturing Engineering)

Faculty of Engineering

Universiti Malaysia Sarawak

2017

For my beloved parents, friends and family

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ABSTRACT

Sarawak Layered Cake is the Sarawak's signature in terms of local and tourist attractions. The manufacturing of the cake includes mixing, baking(layering), cooling, slicing and packaging. The conventional method for the slicing process for Sarawak Layered Cake is by using typical cake knife. This method requires skillful workers. The purpose of this study is to improve the slicing process of the Sarawak Layered Cake and to improve the ergonomics in terms of cutting process. The objectives are to minimize the probability of the occurrence of uneven loaf size.

Before proposing a design, relatable information regarding the project are collected by journal reading, interviews and questionnaires. The proposed design is revised few times and analyzed. There are 5 designs of base for the mechanisms which the selection is done based on the result of Deformation and Von Mises Stress Analysis by using the software Catia V5. The blade on the other hand is the modification of the conventional cake knife. The mechanism of the slicing mechanism is the implementation of press mechanism where the blade is pressed on top of the cake with the aid of the blade holder. Thus, the moment the design is finalized, fabrication will be done. The fabrication process done are based on the type of materials chosen and the dimensions of the design.

The proposed design and mechanism is still manual. However, with the similar space in between the blade, the size will be the same and even. Besides that, the time consumption for the slicing process can also be reduced.

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INTRODUCTION

1.0 Introduction

This project is about the design of a mechanized slicing tool for standard loaf size of Sarawak Layered Cake. By introducing a mechanized slicing tool, this research is expected to ease the slicing process of the cake to standard loaf size as well as to increase the productivity of the company itself.

1.1 Background of Study

This project aim is to propose a mechanized slicing tool for standard loaf size of Sarawak Layered Cake.

1.1.1 Sarawak Layered Cake

Sarawak is well known for its multiracial ethnics with diverse cultural backgrounds. Each ethnic has their own beliefs and identities. Thus, Sarawak is rich with the uniqueness of these multiracial culture. Sarawak Layered Cake had become significant when it comes to one of Sarawak attractions and are well-known among the locals as well as international tourists. The uniqueness of its vibrant colours and texture captures the heart of those that eat it. Previously, it is only served during festive seasons and cultural celebrations but as the country developed, the locals had successfully introduced the product that was resulted from their hobby as their source of income.

This layered cake business is said to be involved in the program of One District

One Industry under the state of Sarawak where there are centralized area for Sarawak Layered Cake selling which is located at Kampung Gersik (Speri, 2014). Women entrepreneurs originated from this village started the small-to-medium scale business and popularised the product.

1.1.2 Mechanized Slicing Tools

Slicing tools refers to the device that is used to cut or slice the cake or bread to a preferred size. Currently, entrepreneurs of Sarawak Layer Cake practices conventional way in cutting the cake. They use hand knife which limits the productivity of the factory itself. With this outdated technology, one person can only process the cake to loaf size one at a time. Thus, the production rate will increase since the slicing process requires a lot of time. In addition, with the limitation of human capability, the company have to hire extra human labour to focus on the cutting process to cope with the market demand.

The word “mechanized” itself shows the modernization of the slicing tools. Based on Oxford Advanced Learner’s Dictionary, mechanize is something to change process so that the work is done by machines rather than people. Regardless, be it for household purpose or industrial purpose, modern tools are effective in their performance, user-friendly and minimizing the food contamination risk by reducing the handling of food materials (Kaur & Sidhu, 2011).

1.1.3 Ergonomics

Based on Oxford Advanced Learner's Dictionary, ergonomics is the study of working condition, especially the design of equipment and furniture, in order to help people work more efficiently. Thus, we can say that it is a relationship of human capabilities with their working environment.

Ergonomics (or its synonym human factors) is defined as "the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human wellbeing and overall system performance" ("Definition and Domains of Ergonomics | IEA Website," 2016).

1.2 Problem Statement

Basically, the manufacturing process of Sarawak layered cake is quite similar with any type of cake. The ingredients will be mixed and the batter will be baked at certain temperature and period. As soon as it is fully baked, the cake will be cool down before it undergoes slicing process. Slicing process is one of the crucial parts before packaging. Currently, entrepreneurs of Sarawak Layered Cake uses typical kitchen knife to cut the 8"X8" or maybe larger cake to loaf size. Unfortunately, these traditional methods have few drawbacks.

This method requires skilful workers. The slicing process is crucial because if the workers did not cut it according to the standard size, the loaf could not be pack and sell to the customers. Apart from that, the carelessness during slicing process can cause uneven loaf size. If this occurs repeatedly, the company will experience losses. Besides the high probability of human errors, this traditional method also takes up a lot of time. This is because, one worker can only conduct this process one at a time. In terms of ergonomic, this method could adapt a back pain and cause a bad posture after a period of time. This is because, during the slicing process, the worker will have to bend for extra focus.

1.3 Research Questions

This project focuses on the design and simulation of Mechanized Slicing Tools to improve the slicing process of Sarawak Layered Cake. Specifically, this study will answer the following questions:

a) What are the standard sizes of the loaf of Sarawak Layered Cake?

b) What are the type of blade that are suitable for slicing process of the cake that would not affect the surface of the cake?

c) Does the current slicing process is perform ergonomically?

1.4 Research Objectives

1. To reduce the probability of having uneven loaf size.
2. To introduce new slicing mechanism.
3. To fabricate the proposed design.
4. To implement ergonomics during the slicing process of Sarawak Layered Cake.

1.5 Scope of Work

The project scope of this study to achieve the objectives are:

1. Design the CAD model of the proposed mechanized slicing tool
2. Simulation of the design using CATIA V5 to analyse the limitation of the device
3. Fabrication of the final proposed design.

1.6 Expected Outcome

The expected outcomes for this project are:

1. To minimize the slicing process.
2. To propose the mechanized slicing tool design and mechanism.
3. To fabricate the proposed design and mechanism of the slicing tools.
4. To improve ergonomics in terms of cutting process.

1.7 Project Outline

This report consists of 5 chapters. Chapter 1 includes the introduction and background study of the project followed by problem statement and project objectives of this project. It also shows the summary of the project.

Chapter 2 on the other hand, discuss about Sarawak Layered Cake, current cutting tools and its mechanism and other important terminology related to this project study. It is incorporated with citation from journals, books and other scientific materials.

Chapter 3 is methodology. It covers the scientific processes and methods that are applied for this project study. The processes and methods will be explained thoroughly to ease the readers in understanding.

Chapter 4 provides results obtained from the simulation software. The factors, limitations and system parameters are further discussed and analysed.

Lastly, Chapter 5. It contains conclusion and recommendation. Overall progress and performance are summarised. This concludes the result and knowledge obtained through this project study. Recommendations are proposed for further improvement purpose.

1.8 Summary of Chapter

This chapter attempt to identify the problem encountered by the entrepreneurs of Sarawak Layered Cake. The main purpose of this project is to lowers the production rate for the manufacturing process from raw materials to package loafs in terms of shortening the time consumed by the slicing process. Thus, the objectives come out is to solve this problem by introducing a new slicing mechanism.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter provides overview about Sarawak Layered Cake and the variety of current type of cutting machine; manually, semi-automated or fully-automated device with different cutting method that can help in increasing the production rate of the company by minimizing the process time. This chapter also provides overview about suggesting ergonomics in the Sarawak Layered Cake industry.

2.2 Sarawak Layered Cake

Culture can be classified into two that is material culture and non-material culture (Awang Pawi, 2010). Traditional food is considered as material culture. For Malays, one of their famous traditional food is Sarawak Layered Cake. As we know, Sarawak Layered Cake is the local delicacy that will be served during festive seasons such as Hari Raya Aidilfitri and other cultural event. Basic raw ingredients include flour, sugar, milk, eggs, ovalette and flavourings. Typical Sarawak Layered Cake consists of 16 or more of colourful yet delicious layers. The batter is either steamed, baked or freeze in refrigerators to complete its manufacturing process. The moment it had completely baked, steamed or froze, it is readily served. However, the one that is usually sold in the industry is the one that is baked in the oven.

As the country developed, tourists had come from near and far exploring the beauty of Sarawak culture. Apart from other local attractions, Sarawak Layered Cake had become the product signature for souvenirs (Dahlia Johari, 2014). This shows that the demand of the cake will be increasing from time to time as the numbers of tourists grow and the popularity of the cake has widened. Thus, in order to cope with the demand, the technology of the product manufacturing shall be improvised and modernized in accordance to the globalisation of the food industry.

In addition, on 25th of March 2008, Sarawak Layered Cake had been well known as the Signature product of Sarawak based on the One Village One Product Program (OVOP) (Speri, 2014). This can also be one of the factors of increasing demand of the production of the cake since this program is introduced to the whole country.

2.2.1 Manufacturing Process of Sarawak Layered Cake

Previously stated in Chapter 1, the manufacturing of the cake consists of several processes which include mixing, baking (layering), cooling, slicing and packaging. Figure 2.1 shows the flow of Sarawak Layered Cake manufacturing process from raw materials to loaf in packages.

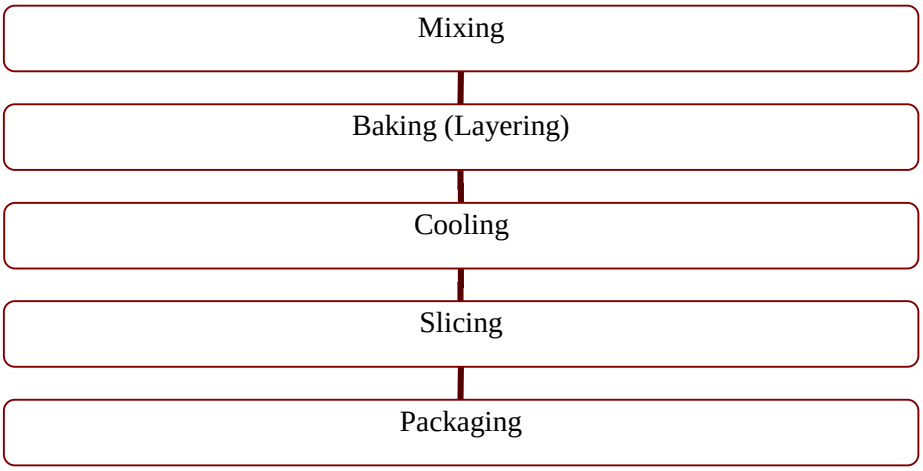

Figure 2.1:Flow of Sarawak Layered Cake Manufacturing Process

Mixing process refers to the mixing of the raw ingredients to form batter. The ingredients are put into the bowl of the mixer according to the recipe in order to achieve a good batter. The batter will be customized according to the preferred flavours before it is poured into the baking mould.

Next is the baking (layering) process. During this process, the batter will be baked layer by layer in the oven. Sarawak layered cake usually possessed two or more colour. Thus, minimum two different colours and flavour of batter will be needed to bake a decent Sarawak Layered Cake. Typically, the thinner the layer, the better. The batter will be baked and layered simultaneously according to preferred pattern until it achieves minimum 20 layers.

Between the layering processes, there is another required process which is known as pressing. As obvious as it names, pressing is the process where the previously baked layer are pressed with a typical Sarawak Layered Cake metal-like presser. This is to avoid presence trapped air within the layers and that the layers are compressed with

each other (Abidin et al., 2014).

Before the cake is cut into loaf size, the cake will be cooled for a few minutes. Normally, the cooling process is done with the aid of natural air which means that the baked cake is left on its own at the cooling station. This is to give the chance for the cake to finish baking from within and achieve room temperature.

2.3 Uneven Loaf Size

The conventional method of slicing Sarawak Layered Cake is by using a typical kitchen knife. Since the conventional way is operated manually by human, the probability of human error to occur is there. Even though they had measured the standard dimension of the loaf, it can be guaranteed that the worker would not slice the loaf larger or smaller than the preferred size. This can occur due to human error and parallax error.

2.3.1 Human Error

The combination of the meanings of the word "human" with the word "error" leads to an examination of "human error" that is the characteristics of human beings that involve unintentional deviations from what is correct, right, or true (Hansen, 2006). Human can never be perfect. As hard as they try to, they can only do their best and strive to be close to perfect. Humans have limitations, unlike robot that is programmed to be precise and fast and almost perfect since perfect is subjective.

One of the limitations of human is to focus and pay our whole attention to something. Attention on a task can only be sustained for a fairly short period of around 20 minutes, after which, fatigue sets in and errors are more likely to occur, depending on the specifications of the task (Report, Enterprise, Island, & Shuttle, 2001). This shows that, after 20 minutes, a person is no longer paying their attention towards their assigned task.

However, if a task is repeated often enough, we become able to do it without conscious supervision (Report et al., 2001). This could lead to another problem where if one person is performing the same task over and over again, they would conduct their duty in perfunctory manner.

We can relate these facts with the condition of workers assigned for Sarawak Layered Cake. As we know, the workers assigned for this slicing process will perform the same task repeatedly throughout their long working hours. The task had become their routine. Thus, there would be a high probability that they would overcut or undercut the loaf from the preferred standard size since they no longer pay attention to the measurement as it is kind of tedious. Besides, pressurised by the amount of cake that needs to be sliced and to keep in track with the daily target can also distract the worker during handling the slicing tools.

2.4 Slicing Tools

Based on Oxford Advanced Learner's Dictionary, slice is a thin flat piece of food that has been cut off a larger piece. The slicing technology is said to had been already developed mature abroad in the 1970s, in the mid-eighties most of the slicers can process monocrystal with large diameter up to 125 mm (5 inches), like the horizontal inside diameter slicing machine manufactured by Mayer Bbu Geyer company in Switzerland which can slice materials with the maximum diameter up to φ304.8 mm (12 inches) (Jiang, 2013). This shows that the development of slicing/cutting tools are proposed and designed over and over again in line with the development of the food industry.

Several of slicing tools or devices are available in the market. The mechanisms are introduced to increase the productivity of the company by lowering the production rate. As the traditional food industries is experiencing a vast expanse, the conventional manufacturing tools have undergo modernization. Apart from that, the introduction of the modernized slicing tools for industrial purpose will help in reducing labour cost. Since the slicing process is now easier, they can reduce the number of worker needed.

There are few slicing tools that are related to this study, which includes meat cutting machine, vegetable slicing machine, cheese slicing machine, bread slicer machine and cake slicing machine. These cutting/slicing machine came with various cutting speed, blade and dimensions of the cutting size.