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Development of automated satay assembly mechanism  
using gear design technique / Ab Rahman Saeman.



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPMENT OF AUTOMATED SATAY ASSEMBLY  
MECHANISM USING GEAR DESIGN TECHNIQUE**

This report submitted in accordance with requirement of the Universiti Teknikal  
Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering  
(Manufacturing Robotic and Automation) with Honours

by

**AB RAHMAN BIN SAEMAN**

**FACULTY OF MANUFACTURING ENGINEERING**

2009



# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

**TAJUK: Development of Automated Satay Assembly Mechanism using Gear Design Technique**

**SESI PENGAJIAN: 2008/09 Semester 2**

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I hereby, declared this thesis entitle “Development of Automated Satay Assembly Mechanism using Gear Design Technique” is the result of my own research except as cited in references.

Signature :  .....

Author's Name : AB RAHMAN BIN SAEMAN .....

Date : 22/5/08 .....

## APPROVAL

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 (Robotic and Automation) with Honours. The member of the supervisory committee is as follow:

  
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## **ABSTRACT**

The title of this project is Development of Automated Satay Assembly Mechanism using Gear Design Technique. The problems of manually Satay skewering process are tedious, unhygienic and lower mass production in industrial. The aims of the project are to develop automated satay skewering machine and analyze gear design mechanism that use for skewering meat. Therefore the gear design technique is introduced for optimum satay skewering process to solve such problems. Beside that, the suitable technique for skewering the meat also determined. In literature review stage, specific work is doing in order to collecting the information for this project. Through this literature, data has been collected from various types of books, journal and internet website. The detail discussion of the Satay meat, skewering process and gear design technique are describing in this stage. As analysis section, MDesign, and working model tool is implemented to evaluate and simulate the gear mechanism. Using the method unambiguous calculation of the gear design can be solved. At the end the result through this analysis will influence the gear design for the development.

## ABSTRAK

Projek ini merupakan suatu projek yang berkisarkan tentang pemprosesan makanan, tajuknya ialah Merekabentuk mesin automatik mencucuk satay dengan menggunakan teknik rekaan gear. Masalah utama bagi projek ini ialah mengenai proses mencucuk satay yang dilakukan sekarang. Dimana, kajian sebelum ini menyatakan proses mencucuk satay dengan menggunakan tangan adalah sangat lambat dan tidak dapat memenuhi permintaan ramai pelanggan. Oleh sebab itu, projek ini dilaksanakan untuk merekacipta mesin mencucuk satay secara automatik dan menganalisa rekaan gear yang digunakan untuk mencucuk satay. Konklusinya gear digunakan untuk mengatasi masalah yang berlaku ini. Pada peringkat kajian ilmiah, ia dilakukan untuk mengumpul data dan informasi yang berguna untuk membangunkan projek ini pelbagai sumber rujukan yang digunakan seperti buku, jurnal dan rangkaian laman internet. Seterusnya pada peringkat analisis, peringkat ini dijalankan dengan menggunakan perisian “MDesign” dan “Working Model”. Keputusan yang diperolehi akan mempengaruhi keseluruhan rekaan mesin ini. Ini kerana, perisian ini digunakan untuk menganalisa dan mengkaji penyelakuan gear. Secara konklusinya, perisian ini amat mempengaruhi proses rekaan gear dalam membina projek ini.



## **DEDICATION**

*Special dedication to:*

My father, Saeman bin Mamat; mother, Saprah bte Jalil; brothers, Abu Hasyim Muhadir, Abdul Rahim and Ahmad Rafee; sister, Asiah who are very concern, understanding, patient and supporting. This project and success will never achieve without all of you.



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I also would like to thank my parent, all my friends and lecturers who have done a lot of things and helped me to fulfill and finish this project. I also like to send my best of luck to everyone whom I have and will take the final year project and hopefully we together can complete and finish the project successfully.

Finally I hope this project can be used to help and improve for human life standard. Not just in industry and manufacturing but for all sectors in the real world.

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## **LIST OF ABBREVIATIONS**

<b>NPD</b>	-	<b>New product development</b>
<b>PDMA</b>	-	<b>Product development and management association</b>
<b>PDI</b>	-	<b>Product development Institute</b>
<b>MARDI</b>	-	<b>Malaysian Agriculture Research Development Institute</b>
<b>PLC</b>	-	<b>Programmable logic controller</b>
<b>CVTs</b>	-	<b>Continuously variable transmission system</b>
<b>MDesign</b>	-	<b>Machine Design tool</b>
<b>NURBS</b>	-	<b>Non Uniform Rational B – Spline</b>

# **CHAPTER 1**

## **INTRODUCTION**

This chapter consists of four sub – topic. There are background, problem statement, objectives of project and scope. The purpose of this topic is to describe the problem in traditional way and how to solved its

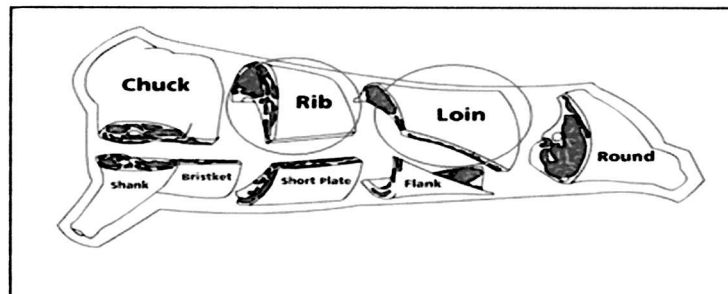
### **1.1 Background**

Satay is a dish consisting of chunks or slices of dice – sized meat on bamboo skewers. Satay originated from Indonesia, is now popular throughout Southeast Asia. The most common and popular satay are made with grilled beef, lamb, chicken or seafood. As referring in Macmillan Education Dictionary, Satay is meal that barbecued on long thin sticks over a fire and usually served with various spicy seasonings. Satay was invented by Malay or Javanese street vendors influenced by the Arabian Kebab. In the fact, Satay only became popular after the early 19th century.

Now satay is popular for many reasons. In American, satay is called “kebabs”. The traditional American will have cubes of meat and vegetables like onions, tomatoes, squash and potatoes, satay made from long strips of meat. The meat is threaded onto skewers to make it easier to handle and to spread the meat out for even cooking. Whereas the traditional Japanese, satay is know as “Yakitori”. Yakitori stands scattered all over Japan and serves up hot grilled chicken on a sticks and cold beer. Yakitori is a simple and versatile dish that consists of bite – sized chucks of chicken threaded onto bamboo skewers and grilled over a hot fire. This yakitori are intermixed with vegetables

like leeks and scallions and brushed with soy sauce while cooking to keep them moist and tender. The soy sauce baste be spiced up with ginger, garlic, chives and sake.

In Malaysian, the most common and popular Satay are made of beef and chicken. While, beef especially cows is one of the red meat. Red meat in culinary terminology refers to meat which is red coloured when raw, while in nutritional terminology refers to meat from mammals. Beef is divided into primal cuts. Kyle Miller (2008) mentioned that commonly the preparations of satay only use the parts of rib, and short loin, that is suitable for cooking by heat on a grill (direct heat). Figure 1.1 is shown the cuts.



**Figure 1.1:** Cuts of Beef (<http://www.certifiedangusbeef.com>, 2008)

Chicken is a type of white meat or poultry meat, and is frequently prepared as a food in a large number of ways because of its relatively low cost. Usually, chicken are cuts in 8 pieces. There are 2 breast halves with ribs and back portion, 2 wings, 2 thighs with back portion and 2 drumsticks. Usually the preparation of satay is use breast halves parts.

## 1.2 Problem Statement

The preparation of satay has been up until now very time consuming and labor intensity. In the processing of satay, the beef and chicken meat was first cut into thin strips about 1cm x 1.5cm x 2.5cm and seasoned with marinade and then threaded on to satay sticks (3 or 4 pieces of thin strips of meat per stick). Satay requires great care in handling and control of all stages of processing due to the potential seriousness of any contamination. Skewering process is one of manual operations in processing of satay.

Traditionally, the skewering process is carried out manually by inserting the spikes or skewers through the meat. The skewering process is a delicate, tedious and time – consuming job and not to mention the highly unhygienic factor due to manhandling of the meat strips. However, these techniques suffer from disadvantage of non – uniform food placement on the skewers. Safety has been issues, which is address with the satay maker. On average in the skewering process, a skilled worker is able to produce 1 000 – 1 500 satay per day working 8 hours a day.



**Figure 1.2:** Manually satay skewering process (<http://www.foodlah.com>, 2008)

Therefore, this problem has become the primary aim of the present invention, to develop the machine for skewering meat for the production of satay that provides unique, fast and safety equipment for the preparation of satay.



### **1.3 Objective**

The main objectives that have to be considering for this project; stated as below

- (a) To develop automated satay skewering machine.
- (b) To design and analyze gear design technique for skewering meat.
- (c) To increase mass production.

### **1.4 Scope**

The studies will focus primarily on development automated satay skewering machine and gear design technique. Other aspects such as the grilling and packing process after skewering meat is not covered in this project, but the main targets to develop this project are same; to reduce time, more efficient and hygienic environment by using relay approached to automated the system and gear as a mechanism technique. The summarization of the scope studies can be defined in the point form below:

- (a) Study the knowledge that related of satay properties and skewering methods from several sources such as books, journal and internet website.
- (b) Analyze gear mechanism that use for skewering satay.
- (c) Design 3D model for the invention
- (d) Develop a machine for skewering meat process.

## 1.5 Project planning

Table 1.1: Gantt chart for PSM 1

Week / Process	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
PSM Briefing and Project Selection	█													
Understand the title and project planning		█												
Chapter 1 (Objective and Scope)			█											
Research Finding Materials				█										
Chapter 2 (Literature Review)					█									
Chapter 3 (Methodology)										█				
Chapter 1, 2 & 3 Correction											█			
Draft Report													█	
Final Report														█



**Table 1.2: Gantt chart for PSM 2**

Week Process	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Conceptual design	Shaded	Shaded												
Experimental Analysis		Shaded	Shaded											
Mechanism selection		Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
Detail design				Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
Computational analysis									Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
Redesign and improvement										Shaded	Shaded	Shaded	Shaded	Shaded
Discussion and suggestion											Shaded	Shaded	Shaded	Shaded
Documentation												Shaded	Shaded	Shaded
Final Report													Shaded	Shaded
Presentation														Shaded

## **CHAPTER 2**

### **LITERATURE REVIEW**

When look at the satay, there are many questions about the process should be know. How to skewer the meat? What force that use to skewered its? How to make it? What the design technique that used to skewered the meat? What the automation element that uses at the machine and so on. For this project, gear and gear trains design approached is used as a mechanism to skewer the meat. In food industry the cleanliness is very important to avoid any contamination from the micro organism in the meat and rust from steel that used to build the machine. In that case, material that will be selected should be suitable for the future designing.

This chapter consists of six sub – topic. There are development, automation, satay, assembly, mechanism, and gear. The purposes of this topic are to know the term that related for the projects and also to compare the past invention and this development.

#### **2.1 Development**

Anonymous (2005) describe that product development can be defined as a broad field of endeavour dealing with the design, creation, and marketing of new products. Sometimes referred to as new product development (NPD), the discipline is focused on developing systematic methods for guiding all the processes involved in getting a new product to market.