

## SUPERVISOR DECLARATION

“I hereby declare that I have read this thesis and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Design and Innovation)..

Tandatangan : .....

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Tarikh : MEI 2015

## DECLARATION

“I hereby to declare that this project report entitle DESIGN AND FABRICATE THE MODEL OF AN INNOVATIVE PLUCKING DEVICE FOR SALAK FRUIT is written by me and is my own effort except the ideas and summaries which I have clarified their sources “.

Signature :.....  
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Date : MEI 2015

To my lovely parents, Mr. Majid b. Embong and Mdm. Zaipah bt. Salleh. For everlasting support, Mohd. Syazwan b. Ismail, friends, Nur Syafiqah bt. Ismuini, Fong Shon Feng, Nur Aizatul Ain bt. Md. Zahir, Nor Ana bt. Rosli, Nur Farah Izyan, Dayangku Khadijah. Lecturer, Dr. Mohd. Asri b. Yusuff for guiding and endless help during the preparation of the report.

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## ABSTRACT

The main purpose of this project is to design an innovative the Salak Fruit Plucker as such kind of the device has not been design yet. Although there are a few problem occur during picking process of this fruit, there are no solution has been discuss to overcome the problem. This is due to the lack exposure about this exotic fruit as it only planted at certain places in the world. This project primarily focus on development of salak plucker within the good design characteristic such as ergonomic, easy to fabricate, with aesthetic value with the lowest price and etc. The provision of mechanical salak plucking device, as aforesaid which is small in size and simple enough to be hand held and manually operated by the usual farm laborer whether such laborer be a man, woman or child. Nowadays, a variety of fruit plucker have been design and exist in the market. Unfortunately, there are no suitable fruit plucker can be used to pluck the salak fruit because the plucker has long pole and the hook does not strong enough to cut the stem. Normally, the farmer just use the knife to pick the fruit but it is inconvenient. Salak plucker with efficiently mechanism will be developed through this project and will meet customer requirement where can helps people easily pluck the salak fruit without getting hurt by its thorn.

## ABSTRAK

Tujuan utama projek ini adalah untuk mereka cipta “Pemetik Buah Salak” yang inovatif untuk bersaing dengan pihak lain di pasaran. Projek ini terutamanya berfokus pada proses mereka cipta pengait buah salak yang mempunyai kriteria rekebentuk yang baik seperti ergonomik, mudah untuk difabrikasikan, mempunyai nilai estetik, harga terendah dan lain-lain. Penyediaan pemetik buah peranti mekanik, sebagaimana disebutkan di atas, adalah bersaiz kecil dan cukup sederhana untuk dikendalikan secara manual oleh buruh tani biasa yang terdiri daripada golongan lelaki, perempuan atau anak-anak. Sebelumnya usaha telah dilakukan untuk menyediakan peralatan pemetik buah. Malangnya, tiada pemetik buah yang sesuai untuk digunakan bagi memetik buah salak kerana galah yang direka biasanya mempunyai batang yang panjang dan penyakutnya tidak terlalu kuat untuk memotong tandan salak. Biasanya, petani hanya menggunakan pisau atau sabit untuk buah ini tetapi cara ini tidak terlalu sesuai. Pemetik buah salak yang efisien akan direkabentuk dan mengikut keperluan pengguna dimana akan memudahkan kerja-kerja memetik tanpa sakit terkena duri salak.

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## CHAPTER I

### INTRODUCTION

#### 1.1 BACKGROUND

Salak's fruit plucker is a fruit plucking device which uses to help people pluck the salak fruit in easy way without getting hurt by its sharp, needle-like thorn during the plucking process. The salak's leaves resemble those of coconut trees with a 2m-long petiole, laden with spines up to 15cm-long and numerous leaflets. The fruit in between the leaves giving difficulties to the people to pick the fruit as it is surrounds with the thorn. The thorn can be elongated up to 7cm and very sharp to injure the fingers (fruitinfo, 2014). Normally, the people pick this fruit using the knife to avoid its thorn. They will chop down any menace leave that give difficulties to them from picking the fruit and the fruit will be apart from the bunch by using the knife. This will cause the unripe fruit also fall down besides damaging the ripe fruits. Due to this problem, the salak' plucking device is designed to proposed a suitable plucking device for the market.

## 1.2. PROBLEM STATEMENT

The salak is a species that native to Indonesia but now is grown and produced around Southeast Asia including Malaysia and Thailand. Although the salak tree is really short, growing on the ground, the fruit surrounds by the needle-like, sharp thorns on the petiole give difficulties to the people to pick the fruit. Normally, the people will use knife to dig the fruit up from the bunch to avoid the fingers from injured by the thorn. This unfortunately will cause the unripe fruit also fall down from the bunch as the fruit is so close to one another. Besides, the use of knife does not give a full protection to the hand from injured by the thorn unless the thick rubber gloves is worn.

There are a lot of fruit plucker that has been invented. However, such plucking equipment are mostly for plucking the fruits up on the tall trees. For example, the pluckers are normally have a long pole yet so heavy to be handle. The mechanism of the plucker also complicated and just suitable to hook the fruit down to the ground.

## 1.3. OBJECTIVE

In this project, a few objective must be achieve in order to ensure that the salak's plucker device can function perfectly according to its purpose of designed. Basically, the objective of this project are:

- a) To design and fabricate the model of the suitable device to pick the salak fruit safely.
- b) To propose an innovative picking device for the salak fruit for the market.



#### **1.4. SCOPE OF PROJECT**

This project is narrowed down to certain scopes which has been identified based on the project objectives. The scope that been emphases is to develop a salak fruit plucking device within the criteria such as ergonomic, easy to fabricate and with aesthetic value. This add on value is important as an attraction to the customer.

Besides, the provision of mechanical fruit plucking device is small in size and simple enough to be held and manually operated by the usual farm laborer whether such laborer be a man, woman or child should also be emphasize. The design should be focus on how to reduce the weight of the plucker and also study on how to reduce the force consume by the user with the strong output force.

Other than that, the scope includes to design and analysis using engineering software, CATIA V5R19 and CATIA structural analysis. Therefore, the software should be studied to analyses the design of the plucker before it is being manufactured.

#### **1.5. REPORT FRAMES**

This project entitled “Design and Fabricate the Model of an Innovative Plucking Device for Salak Fruit to Be Commercialized” can be divided into five chapters. Chapter 1 which is the introduction explains the general information of the fruit plucker. The element that consist in chapter 1 are background of fruit plucker, problem statement of the project, scope of projects, objectives of project and report organization.

Chapter 2 comprises literature review information which includes research of previous project of fruit plucker by others. This chapter also includes existing fruit plucker in market. Chapter 3 present the methodology of the project. This

chapter is discussing the method used throughout the development of salak plucker. It started with the section identifying customer needs using interview method. Concept selection method and software use to generate the design also had been explained in this chapter. The steps involve in the process of develop the salak plucker are described in detail in this chapter.

Chapter 4 present the conceptual design of salak plucker. This chapter show 4 new concept designs and explanation of each concept. Besides, 3D modelling drawing and part number also include in this chapter. Other element include in this chapter are the design analysis using CATIA Structural Analysis software and manufacturing process flow of the product. Chapter 5 will conclude the the report by discussing the conclusion and recommendation of the project based on the objective and the relationship with the problem statement present in chapter 1.

## CHAPTER II

### LITERATURE REVIEW

#### 2.0 INTRODUCTION

This chapter generally discuss about the detailed look and explanation of all the researched patents of the fruit plucker that have been done before and also a review of all the current product on the market. However, a few patents of fruit plucker have been selected that directly share a common ideology as the fruit plucker that will be designed. All of the following patents basically consist of a hand held pole with either a “shearing” or “pulling” assembly at the end of the shaft in order to cut down the fruit from the tree. Figure 2.1 illustrates what the “shearing” mechanism look like. Figure 2.2 on the other hand illustrates the “pulling” mechanism where it working principle requires the user to aim the stem of the fruit into the slotted cylinder. The user than pulls down the plucker and get the fruit from the tree. (Hernandez et al., 2000). Besides, this chapter also includes about the other study that are needed to be discussed in order to design a good salak fruit plucker based on the related study such as the suitable material, criteria for a good design, the study of ergonomic and so on.



Figure 2.1 Example of “shearing” mechanism.

(Source: Hernandez et.al, 2000)



Figure 2.2 Example of “pulling” mechanism

(Source: Hernandez et.al, 2000)

## 2.2 DESCRIPTION OF SALAK FRUIT

Salak fruit is a short-stemmed palm with big leaves up to 6m length, petiole up to 2m long with back up to 15cm long. The fruit always grow in branches at the base of the palm. It is also known as the snake fruit due to reddish-brown and scaly skin. They are about the size and shape of a ripe with a separate tip. The fruit inside consists of 3 lobes, each with large inedible seed. The lobes resemble, and have the consistency of large peeled garlic cloves (Christian, 2012).

The Salak is a species that native to Indonesia but is now grown and produced around Southeast Asia including Malaysia and Thailand. The taste is usually sweet and slightly acidic, but its apple-like texture can be varying from very dry and crumbly to moist and crunchy (Christian, 2012). Its tasty taste make people craving for this fruit but unfortunately the palm is full of thorn. In Malaysia, the seed is brought from the Indonesia and start to farm widely. Then, cottage industry begin to produce salak pickle which is very popular in countryside.

The leaves resemble those of coconut trees with a 2 m-long petiole, laden with spines up to 15 cm long and numerous leaflets. The fruit is in between the leaves giving difficulties to the farmer to pick the fruit as it is surrounds with the thorns. The thorn can be elongated up to 7cm and very sharp to injure the fingers. (Christian, 2012). There are no suitable device in the market that can be used by the farmer to pick the salak fruit. Besides using bare hand, sometimes the farmer will use the knife to get the fruit to avoid from the sharp thorn.



Figure 2.3 Salak Tree

(International Tropical Fruit Network, 2011)

Based on Mogeia (1986-1990), about nineteen species of *Salacca* has been identified. They are found over southern Yunnan, lower Burma, Thailand, the Malay Peninsula, Sumatera, West-Java, Borneo (Kalimantan) and the southern part of the Philippines. The largest number of species is found in Borneo, about ten species. In the Malay Peninsula and Sumatera, seven species each are found. Out of nineteen species, thirteen have been identified in South-East Asia (see Table 2.1). Of the species listed in Table 2.1, *S. sumatrana*, *S. zalacca* and *S. wallichiana* are cultivated the first two mainly in Indonesia (Mogeia, 1986; Schuiling and Mogeia, 1991), the latter almost exclusively in Thailand (Polprasid, 1991). The most distinct character of this group is that the species are dioecious (reproductive way) and need pollinator plants to produce fruits.

Table 2.1 South-East Asian species of the genus *Salacca* (Haryani, 1994).

<b>No.</b>	<b>Species</b>	<b>Found in</b>
1.	<i>S. magnifica</i> Mogeia	Sarawak (Malaysia) East Kalimantan (Indonesia)
2.	<i>S. multiflora</i> Mogeia	Malaysia
3.	<i>S. affinis</i> Griff.	Sumatera (Indonesia) Malaysia
4.	<i>S. sumatrana</i> Becc.	North Sumatera (Sumatra) Tapanuli (Indonesia)
5.	<i>S. zalacca</i> (Gaertner) Voss	Sumatera, Java (Indonesia)
6.	<i>S. glabrescens</i> Griff	Malaysia
7.	<i>S. sarawakensis</i> Mogeia	Sarawak (Malaysia)
8.	<i>S. dubia</i> Becc.	South Sumatera (Indonesia)
9.	<i>S. flabellate</i> Furtado	Terengganu (Malaysia)
10.	<i>S. minuta</i> Mogeia	Malaysia
11.	<i>S. dransfeildiana</i> Mogeia	South Kalimantan (Indonesia)
12.	<i>S. vermicularis</i> Becc.	Kalimantan (Indonesia)
13.	<i>S. wallichiana</i> Wall. & Mart	Thailand

\*Scientific names according to Ferguson (1986) and Mogeia (1986).

## 2.3 RESEARCHED PATENTS

### 2.3.1 Hand-operated Fruit Picker

This fruit picker consists of a pole and a fruit-receiving cage. This cage is an adjustable, outwardly concave scoop. It has a gap that helps capturing and gathering the picked fruit. The interior of the cage is a cushioned lining that provides protection to the perishable ripe fruit. This design helps to develop ideas about fruit gathering. It is more efficient to pick the fruit down the tree into the basket instead of gathering one by one in the ground. However, this particular fruit picker has two disadvantages. First, the fruit has to be pulled from the branch, leaving the great potential for fruit damage. Second, by gathering fruits in the cage at the end of the pole, large moment will be produced causing operator fatigue. From this patent, it give the picture on how the mechanism of the plucker should operate although the cage mechanism does not quite suitable for the salak fruit.

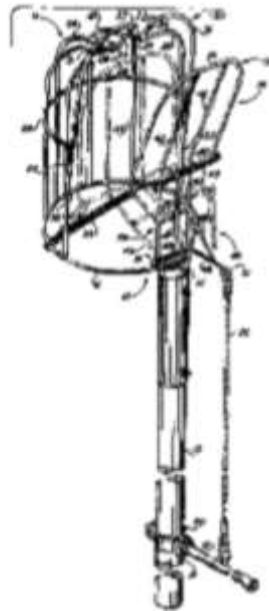


Figure 2.4 Hand –operated fruit picker

(Source: Hernandez et.al, 2000)