

# Design and Fabrication of Pineapple Endocarp Removing Slicing Machine

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**Abstract:** Automation was the rage of the engineering world. The investigation on the existing fruit slicer machine reviews the following drawbacks such as high investment cost, the contamination, additional manpower and time consumption caused by manual processing. The design purpose is to design an automated type fruit slicer to slice the fruit and vegetables. The setup involves the hopper arrangement and the rotating or fixed blade is operated by the electric motor.

The intricacy involved with such a system is the type of vegetables and fruits it can process. The system is advantageous in the fact that existing automation is high in cost and the power consumption is high. The proposed work is benefited by automatic cutting with shaft and pulley arrangement after electric motor. Here we have to fixed pineapple in jaw and tool will move vertically on pineapple manually waste material will collect and through outside after pilling then it will mount on fixed blade by pushing pineapple will turn in slice.

**Keyword** - Slicing, Peeling.

## I. INTRODUCTION:-

Fruits and vegetables are highly permissible spoil primarily due to biochemical changes microbial activity are control or destroyed to preserve the fruits and vegetables. Pineapple is a tropical plant with edible multiple fruit consisting a coalesced berries, and the most economical significant plant in the bromillianceae process. Total production of pineapple in India is 1415 tones .Manually pilling and slicing of pineapple are the time consuming and labor intensive process. Different shape and size of pineapple such as round oval and conical are available in market various factor of food material affect significantly the tissue structure and slicing operation. Sharpness of cutting instrument is fundamentally important parameter in all cutting application and strongly influences. The force generated and energy required during the cutting operation and the surface finish or quality of the cut surface is to be improved. Automation was the rage of the engineering world. The investigation on the existing fruit slicer machine reviews the following drawback such as high investment cost the contamination, additional manpower and time consumption cause by manual process. The design purpose is to design and automated type fruits slicer to slice the fruit and vegetable. The setup involves the hopper arrangement and the rotating or fixed blade is operated by the electric motor.

The intricacy involved with such a system is the type of vegetable and fruits it can process. The system is advantageous in the fact that existing automation is high in cost and the power consumption is high. The proposed work is benefited by automatic cutting with soft and geared motor arrangement. In this project we have automated the operation of pineapple pilling and slicing in various places. Machine consists of motor and air supply to operate the pineapple pilling and slicing equipments. Some needs of automation are describes below. A

Automation can be achieved through the computer, hydraulics, pneumatics, robotics, etc. of these sources pneumatic form and attractive medium for low cost automation, now a day's almost all the manufacturing process is being atomized in order to deliver the product at a faster rate. The manufacturing operation is being atomized in a following reason.

Pineapples are consumed worldwide due to its rich tested, flavor and size. pineapple is an one of the commercially important fruit crops of India and hold fifth place all over the worlds for producing pineapple with annual output of about 1.2 million tones with worlds production estimated at 14.7 million tones .though the production of pineapple is increasing day by day in India but still there is no such equipment or device in market for the Indian household, small business which can reduce their difficulty of cutting the pineapple. the purpose of this project was to design and developed pineapple pilling and slicing device for household people of India which can solved ergonomic issues for pineapple cutting .The pineapple skin is thick and it is not easy to pill the skin off .due to that after one pineapple is pilled a person will feel the pain around the hand and upper body including arms .the pain that a person experienced is called musculoskeletal disorder(MSD).due to this reason the design and development of portable pineapple pilling machine is necessary In this research work, *Design And Fabrication Of Pineapple Endocarp Removing And Slicing Machine* has been carried out.

## II. Working:-

- **PINEAPPLE HOLDING:-**

In pineapple holding the pineapple is fixed in holding nails which are made up from aluminum. In this a disc is attached to shaft in which disc pointed rods like nails are having attached which holds the pineapple. Where one holding jaw is fixed with bearing and other having movable for fix or removing of pineapple with mechanism.

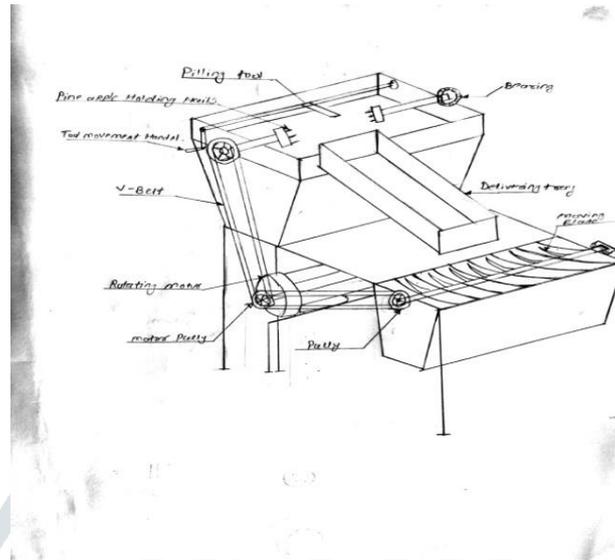


Fig. 2.1

- **PEELING OPERATION:-**

After the fixation of pineapple the peeling operation is performed by moving tool on pineapple horizontally. The pineapple is rotate with the help of motor, and tool is horizontally moved on it due to this the endocarp is removed. The tool has the spring-socket mechanism due to which the minimum wastage of pineapple achieved. The removed waste material is fall on collecting tray which is placed below the tool.

- **REMOVING:-**

After peeling the pineapple is removed. The pineapple is removed by manually. Where the second jaw is move by mechanism. Due to this the pineapple is removed and it will sudden fall on delivering tray. This tray will pass pineapple to second stage.



Fig. 2.2

- **DELIVERING TRAY:-**

The delivering tray is component which is attached below the pineapple when it is fixed in jaw. When pineapple is removed from jaw it will suddenly fall on this tray. This tray is open at the second stage means at cutting machine.

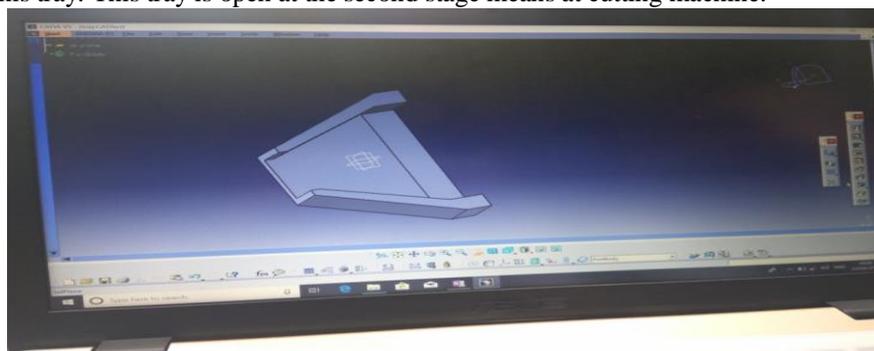


Fig. 2.3

- SLICING OPERATION:-

The second stage of this machine is cutting section or slice making section. In this operation the blades are attached on movable shaft. This shaft is continuously moving with the help of motor. When the pineapple is fall on the blades the blades cut the pineapple and convert it into slices. Then these slices are fall on the tray which can proceed for eating.

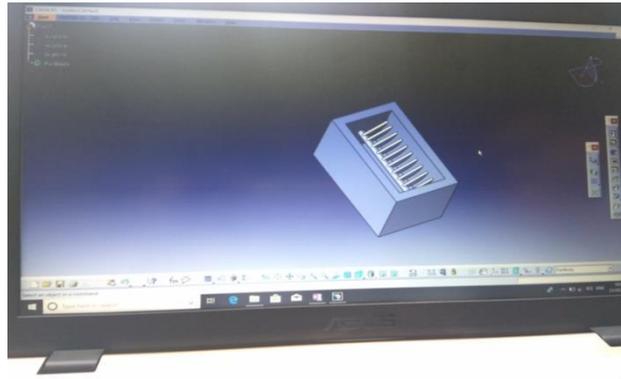


Fig. 2.4

- FINAL ASSEMBLY:-

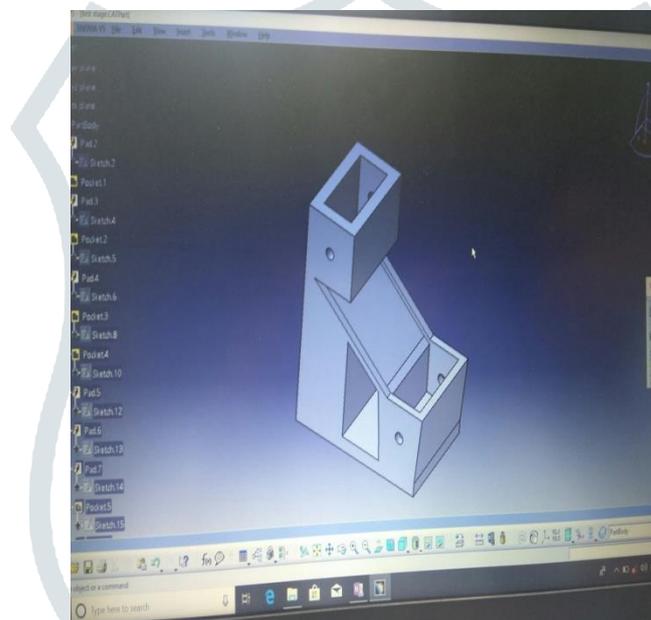


Fig. 2.5

### III. Comparison of the Models:-

1. E-survey: - In this survey machine are available but this do one operation at a time.

A. Pineapple peeling machine: - In this machine first the pineapple is fixed in the jaw after that the jaw rotates the pineapple then the tool is fixed in vertical direction which moves up and down. Due to this the endocarp of pineapple is removed.



Fig. 3.1

B. Pineapple cutting machine: - This is a machine which cuts pineapple into round pieces or we can say slice. For this pineapple must be peeled or without peeled. After peeling the pineapple is placed in this machine and makes the slice.

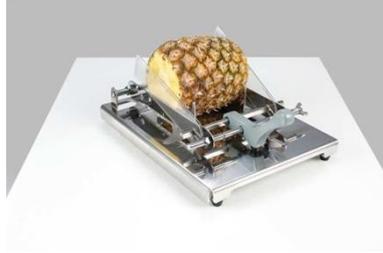


Fig. 3.2

This two surveys are individual i.e. both the operation are perform separately which is more time consuming as well as more effort full.

## 2. Regional survey :-

In this survey the machine which are present but there is only one disadvantage is that can perform only one operation at a time. So, due to this time is consumed and more effort is required. In some of machine time is less consumed but at a time of peeling the material of pineapple is also removed with endocarp of pineapple. While at a time of cutting the slice are break or obtained very thin. In the food processing industries first pineapple is peeled with the help of cylindrical device and then it is cut and this operation occur very fast in this the percentage of wastage of material is more.

### EXISTING MACHINES: -

#### 1. PINEAPPLE CORER SLICER PEELER CUTTER:-

- It peels cores and slices fresh pineapple with ease.
- Simply cut the crown off the pineapple, position the cutting desk on the pineapple and twist whilst pushing down slightly.



Fig. 4.1.1



Fig. 4.1.2



Fig. 4.1.3

#### 2. DEL MONTE AUTOMATIC PINEAPPLE PEELER CORER MACHINE:-

- In this machine pineapple is fixed in jaws.
- After that there is a vertical tool arrangement which is moves up- down and peels the pineapple.
- In this operation the excess of pineapple is peeled due to this the wastage of pineapple is seen.



Fig. 4.2.1



Fig. 4.2.2

- V. **Our designed model:** - In this model to combine both the above operations in one machine this is our main task in this project. Here we divided both operations in two stages. In first stage pineapple is fixed in fixtures where it will peel first with the help of tool and then it will pass to second stage where blade assembly is situated due to which pineapple will cut into slices. Due to this the time is saved, less effort required and ergonomically best suited design.

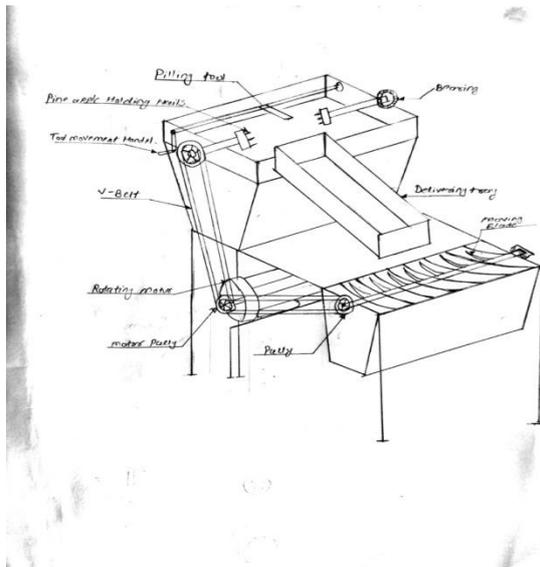


Fig. 5.1

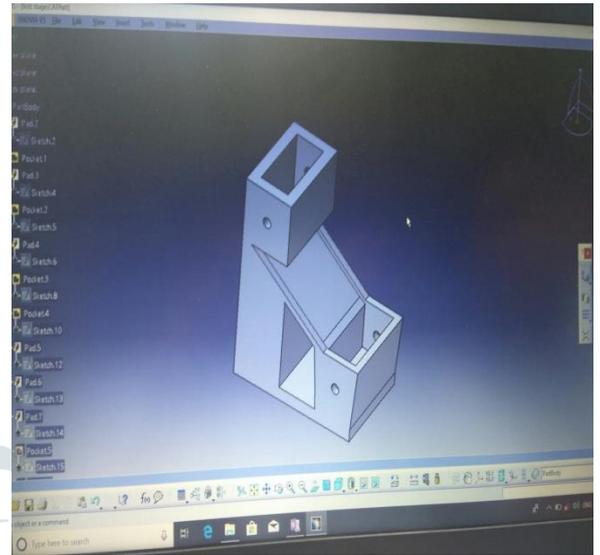


Fig.5.2

This is our suggested model where both the operation can perform simultaneously.

#### VI. Theoretical framework: -

- Personal Need: This is the project which is develop for small scale industry and for small vendors which is easily install and easy to use
- Past Experience: According to small scale industrial holders operation of Pilling and Slice making on pineapple it is quite tough. By observing all this problems we make such an ergonomic design. By using this design it is easy for making slice and pilling of pineapple.
- Needs/Expectation: This machine is design for small scale industries for perform on pineapple expectation of this project to fulfil the shopkeeper as well as customers
- Marketing survey:
  1. E-Survey: In this survey machine are available but this do one operation at a time which is time consuming as well as not well ergonomically design.
  2. Regional Survey: there are some machines which are present in market .but there is one disadvantage that only one operation can perform at a time and it is more effort required .in some of machine time is less consume but at a time of pilling the material of pineapple is also removed by endocarp.
 This all same problems are generated in existing machine survey.

#### VII. Design procedure:-

- I. Blade: - we use stainless steel blade for the cutting of pineapple.
  - (i) Thickness = 4 mm.
  - (ii) Length = 228.6 mm.
  - (iii) No. of blades = 7
- II. Tool: - material of tool for peeling operation is made up of stainless steel from front side.
- III. Bearing: - we used here 6202 ball type of bearing for the rotation of jaw.
- IV. Motor: - permanent magnet DC gear motor.
  - i. Input = 20 Amp.
  - ii. Output = 12 Volt.
  - iii. RPM = 100 rpm.
- V. Lead screw: - it is a component which is used to move the jaw up and down.
  - i. Diameter = 19 mm.
  - ii. Pitch = 0.7 mm.
  - iii. Length = 8 mm.
- VI. Bottom shaft: - it is a shaft which is mounted on motor to fix the lower jaw.

i. Diameter = 14 mm.

VII. Jaw: - it is a component which is used to hold pineapple for peeling operation.

- i. Diameter = 88.9 mm.
- ii. Material = mild steel.
- iii. Nails on jaw
  - a. 1 inch = 4 nails.
  - b. 2 inch = 1 nail.

VIII. Tool supporting shaft: - it is shaft which holds the tool for the movement.

- i. Length = 304.8 mm.

IX. Stand: - It is a supporting member for the whole assembly.

- i. Thickness = 6.3 mm.
- ii. Area = 1\*1 inch.
- iii. Material = mild steel.

X. Inclination of tool: - 23 degree.

XI. Delivering channel: - it is a channel from which pilled pineapple will delivered to cutting blade.

- i. Material = metal sheet 22 gauge.

XII. Ply: - it is covering part which helps to collect removal of endocarp.

- i. Material = mica sheet.
- ii. Thickness = 5 mm.

XIII. Power supply: - it is a main source two runs the machine.

- i. Input = 240 AC.
- ii. Output = 12 volt, 10 Amp.

XIV. Total height: - 3 feet height and 2 feet width.

## VIII. CALCULATION:-

### I. DC MOTOR: -

DC Motor will have variable speed. The main factors are the DC voltage applied to armature coil and the amount of torque load you are trying to drive.

- i. Power of machine in hp = 1.2 hp = 0.8948 kW.
- ii. Rpm of motor = 100 rpm.
- iii. Torque =  $(9.548 * 0.8948) / 100$   
= 0.08473 Nm.
- iv. Power =  $(\text{torque} * \text{speed}) / 9.548$   
= 100.832 RPM.
- v. Efficiency =  $(P_{out} / P_{in}) * 100$

$$P_{in} = V_f * I_f + V_a * I_a$$

$$= 12 * 3.75 + 120 * 20$$

$$P_{out} = (2\pi N T) / 60$$

$$= 0.8872 \text{ kW.}$$

### II. Bearing : -

Bearing number = 6202

6



Roller  
Bearing

2



light load

02



2 \* 5 = 10 mm (diameter)

Given data: -

$N = 100$  rpm

$F_r = 3$  KN

$F_a = 1$  KN

a) Equivalent load :-  $f_e = (X f_r + Y f_a) * K_s * K_o * K_p * K_r$

Assuming,

$K_o = 1$ , for constant rotational speed of race

$K_p = 1$ , for non preloading bearing

$K_r = 1$ , for outer race fixed and inner race rotating

$K_s = 1$ , for uniform and steady load

$K_f = 1$ , for 90% of reliability

$F_E = 20$  KN

b) Life in million revolution

$L_{10} = (C/f_e)^n / krf$

As a given

Bearing no. 6202

From pg. 149 (T-13-2)

$C = 40500$

$n = 10/3$  for roller bearing

$L_{10} = (40500/20 * 10^3)^{10/3} / 1$

$L_{10} = 10.505$  millions revolutions.

c) Bearing life in hrs.

$L_{10} = (hrs * n * 60) / 10^6$

Hrs. = 1750.83 hrs

## IX. Research Methodology: -

1. Data and Sources of data: for this study data has been collected from survey, social media, internet research paper etc. all this data is collected from these sources on the basis of online-survey and offline-survey and from internet research papers on this topic.
2. Analytical framework: for this we are going to offline market survey or regional survey in this we are observed that pilling and slicing operation are not performed of existing machine so such a machine which performed both the operations simultaneously .after this we suggest our design for consumers and we got successfully positive response from them.
3. Selection of material for each part.
4. Selection of proper mechanism to pill the pineapple.
5. Selection of cutting tool and material for it which we used.

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