Design and Fabrication of Arecanut Dehusker Machine & Automatic Segregation

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Abstract - *Area nut has to be processed in dry condition by peeling the outer shell completely. It is an Agri-machine that separates the husk from the nut of the area nut. Peeling Area nuts is very difficult by hand. However, it is being done manually using a sharp knife with a 3kg/hr production rate. So, it is essential to develop an Agri-machine that will increase labour production rate and safety. Separating an Area Nut with its quality, texture is very difficult; it requires a lot of manpower and a time-consuming process. Arecanut generation is the biggest in India as indicated by FAO insights and as per this, in 2013, Indian creation of area nuts was 49.74% of the aggregate world generation. The automation part of the computer vision system is integrated to classify Arecanuts. An automated grading machine is developed using image-processing techniques and lab view to classify area nuts harvested and processed. The aim is to grade the area nut based on its colour and texture features into high and low quality nuts*

Key Words: **Arecanut, Peeling, Dehusking, Agri-machine, Segregation**

1.INTRODUCTION

Indian agriculture and commerce both heavily rely on the areca nut. The Areca nut plant produces the Areca kernel as a seed. It has a tremendous impact on how Indians live their social, cultural, religious, and economic lives. The berry known as "betel nut," which is primarily used for mastication, is the income-producing crop. An areca nut is used in herbal therapy and animal treatments. [1] In comparison to other nations with agricultural areas growing crops, India produces more Areca Nuts. In India, it is the most economical product. The arecanut is produced and marketed most heavily in Kerala, Karnataka, Tamil Nadu, Assam, West Bengal, Meghalaya, and Maharashtra in India. Arecanut is heavily consumed by many people and is associated with sacred rituals. India is both the world's biggest producer and user of areca nuts. Karnataka (40% of the product is grown there), Kerala (25%), and Assam (20%) are the major producers. [2] Areca nut is one of the plantation products. Areca nut product in Indonesia is

cultivated in smallholder plantations such as in Aceh and Sumatra are places located in Indonesia. Indonesia is second in terms of agricultural land which is stated by researchers. In recent years, labour shortage has surfaced as one of the main problems in farming. Arecanut is one product that has been particularly impacted by this. According to FAO statistics, India is the country with the biggest arecanut production, and in 2013, Indian production accounted for 49.74% of the world's total arecanut production. [4] The most crucial activity in the complete dehusking process The most significant commercial and agricultural endeavor in arecanut production is dehusking. The freshly or fresh nut must be peeled in 24 to 36 hours in order to obtain its center. Cutting won't be simple after gathering if this doesn't happen, and the grade will start to suffer. Manual area nut dehusking requires expert labor. Due to a shortage of trained labor, green area nuts cannot be dehusked right away. The development of a dehusking machine for desiccated Areca Nuts has received some attention. [5] One of the most important marketing tasks is the grading or classification of Arecanuts. It makes it possible to categorize the produce into distinct uniforms using different measurements. This makes it easier for the producer to find rates that are consistent with the Area Nuts grade. Grading as a language is a useful tool for producers, traders, or both to translate customer requirements into action. Areca is a popular crunch nut that is eaten in India by all demographic groups, regardless of tribe, class, location, faith, age, or gender. A grading system may also be used by marketers of Arecanuts who handle big quantities of arecanut stock. The same methods can be applied to sorting other crops, such as blueberries, with only slight modifications. Therefore, the same equipment can be used for numerous sorting in a location where sorting is necessary to reduce running expenses. The MATLAB Toolbox is used in this suggested method to classify Arecanuts into various categories. Here, divide into various categories using supervised machine learning. The teaching phase and the assessment phase are the two phases of this method. Using test pictures, a database must be created for the training process Area nut dehusker already exists, but they are not very advanced. We typically don't get the first-grade area after dehydrating the kernel because it has been damaged.

For cultivators in India, there are no other automation methods accessible besides this one. [8] Building an areca nut preparation unit is the focus of this job. The machine can strip the arecanut, slice it into two sections, boil and dry it to desired hardness in a single go for two distinct evaluations. The design and production of the arecanut handling machine were reliant on the availability of arecanut in the Karnataka areas of Malenadu. A safe, reliable, and efficient automated equipment for preparing arecanut is designed and built in this work. [12]

Fig-1: Photo Showing Arecanut Cultivation

Fig-2: Dehusked Arecanut

1.1 PROBLEM DEFINITION

Areca nut processing costs are between 35-40% of the overall cost, with dehusking and seed crunching being labor intensive. Peeling is done mechanically with a sharp knife and an average daily output of 24 kg, with a production rate of 3 kg per hour, with an average daily output of 24 kg. There are currently a few devices on the market that are unable to completely remove the exterior skin from a variety of desiccated Areca nut sizes. It is essential to develop an Agri-machine that will increase labour production rate and safety. Separating an Areca Nut with its quality, texture is very difficult; it requires a lot of manpower and a time-consuming process. These devices are more expensive and complex, and their weight and inability to be moved are the major issues. Additionally, some devices can harm Areca nuts and are difficult to use. Therefore, there is room to create a system that can effectively and fully peel Areca nuts of various diameters.

1.2 SCOPE & OBJECTIVES

The project's objectives include creating a machine for dehusking areca nuts and addressing issues with machine adoption, such as inadequate husk removal, excessive cost, unsuitability for different areca nut diameters, etc. This project's main objective is to build the machinery required to peel areca seeds, to address the problems brought on by outmoded equipment, including inadequate shell removal, excessive production, and unsuitability for different sizes. By developing a device that can efficiently and affordably dehusk areca nuts, these problems can be overcome. We demonstrate a method for automatically identifying illnesses that could affect areca nuts by analyzing photographs of clusters and areca nut images. In this research, we propose a convolutional image processing model using areca kernel image training. Two regions of areca nuts are shown in the image, one of which is infected and the other which is not. Evaluation of their model's percentage of detection reveals that the proposed methodologies will accurately depict the phases of illness.

2. GRADES OF ARECANUTS

Sample Image				
Grades	Grade 1	Grade 2	Grade 3	Grade 4
Description	Good texture (Super Quality)	Cracked (Damaged)	With Husk (Medium Quality)	Black in Color (Low Quality)
Local Name	Supari	Patora	Ullagaddi	Kari

Fig-3: Grades of Arecanut

The primary grade, the sensitive kind of arecanut, has an uneven form and texture and typically appears darker than other grades. It contains both entire and half-cut Area Nuts. The grade-2 area nut has a consistent form, texture, and colour; it is only half-cut and brownish in hue. Although it is complete Arecanut and has a consistent texture, grade-3 Arecanut looks similar to grade-2 Arecanut in appearance. The grade-4 arecanut can be whole or half-cut, and it is fully ripe. The hue of white is brownish. In Grading of arecanut it will help for Marketing and it will reduce
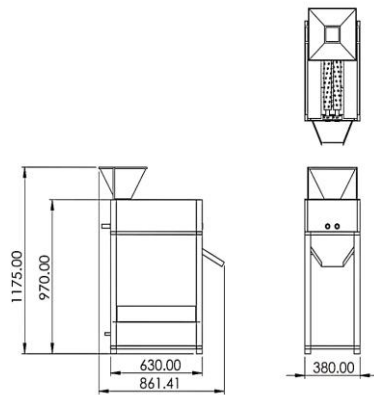
2. ARECANUT DEHUSKER MACHINE

Fig-4: 2D MODEL (All Dimensions in mm)

Fig-5: 3D Model of Arecanut Dehusker Machine
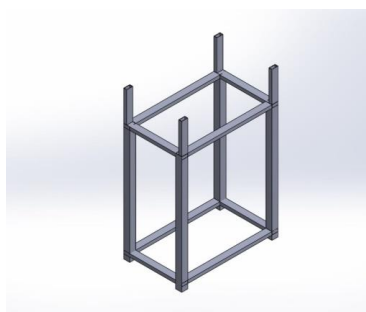
2.1 MAIN COMPONENT USED IN MACHINE
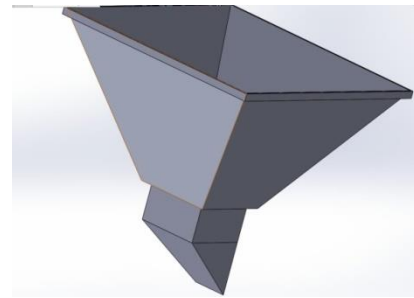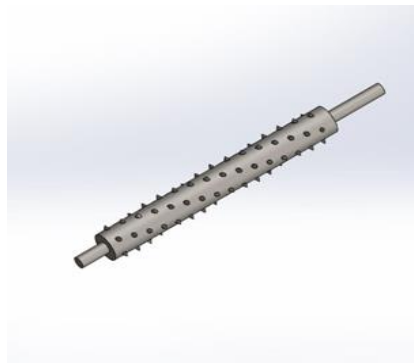

Fig-6: Frame

Fig-7: Hopper

Fig-8: Dehusking Roller

2.2 TECHNICAL SPECIFICATION OF ARECANUT DEHUSKER MACHINE

SL.no	Features	Description
1	Total Weight	35 Kg
2	Maximum Height	1175mm
3	Maximum Width	380mm
4	Maximum Length	861.41mm
5	Working Speed	125 RPM
6	Capacity	8kg/hr
7	Electric Motor	2HP

2.3 DESIGN SPECIFICATION AND CALCULATION

2.3.1 Design Specification

1. Diameter of Roller = 25mm
2. Length of the Roller = 500 mm
3. Height of the Frame = 970 mm
4. Width of Frame = 380mm
5. Diameter of spike = 10mm
6. Height of the spike = 10mm
7. No. of Spike = 40
8. Volume of one spike = 2.25 c.c
9. Mass of one Spike = 17.56 gm.
10. Mass of per pipe = 1.68Kg

11. weight of Pipe = 16.47 N

2.3.2 Calculation

1. Torsional moment force on gear shaft

A= Area of spike penetrating the
husk
T= Shear yield strength of Arecanut
To Calculate Lateral Area
$A = \pi*r*L$
$A = 8*5*3.141$
$A = 125.64 mm^2$

To Calculate T
Where δ_{gt} = Tensile strength of Arecanut
$T_{yt} = 0.577*\delta_{gt}$
      $= 150.9 N/mm^2$

$F = 150.9*125.64$
  $= 18960 N/mm^2$

2. Moment of Inertia

$M_t = FD_g/2$
  $= 18960*40/2 = 379200$ N-M

3. Bending Moment

W_r = Weight of Roller
W_n = Normal Load
W_G = Weight of Gear = 10 N
Θ = Pressure angle of the Gear

$W_r = F/Cos \Theta$
  $= 18960/Cos 20 = 20073$ N

4. Reaction on Bearing R_b & R_p
Now determined G taking moment about B

$M_B = 0, R_{p*}(650) + 20073* (120) = 18960*(325)$

$R_D = 5774.21$ N

$F_y = 0, 5774.21 + R_B = 18960 + 20073$
$R_B = 33258$ N-mm

If Bending moment at A&D = 0 N-mm
Then B = 3325800 N-mm

3. WORKING PRINCIPLE

The De-husker and Sorter, the two components that make up the entire device, are built independently and then put together in one frame. Belts and conveyors link each component. Dehusking, the major component of the de-husker rollers, has a spike that removes the nut's husk and a holder that secures the nut. . The Arecanut are in three different sizes i.e. small, medium, and large size with this

respective arecanut dehusks to be performed. The areca nut slider receives the nut from the hopper. The hopper's breadth is designed to prevent more than one areca nut from landing on the slider. The areca nut is now being peeled off by rollers with spikes. The operation is then repeated while the holder changes positions at an angle. Dehusked areca nut seeds are sent for sorting once the de-husking process is complete. As the areca nut approaches a plate with a hole of different sizes for sorting and is connected to a vibrator, the plate vibrates as the areca nut passes through the hole and is separated based on shape and size. Arecanut separation using image processing carried out by the processor. With the use of camera detection, a machine separates areca nuts depending on the grades of the arecanut like quality and texture.

4. WORK DONE & DISCUSSION

By varying the speed of the machine's dehusking rollers, we tested several methods for dehusking areca nuts. Regarding the removal of the Areca nut's outer shell, they have noted that at the. Dry According to their sizes and shapes, areca nuts may be divided into three basic varieties. Areca nuts are divided into three categories according on their parameter. These diverse scales include small, medium, and giant. Each kind of these areca nuts is employed in various tests under various RPM and speed settings to remove the husk. The removal of the outer skin of the areca nut dehusking machine was taken into account in each experiment while it was in the development stage. The machine is designed to be portable and is tiny. Additionally, compared to other machines, the cost of that machine is more efficient. Semi-skilled laborers may use the equipment as well. The areca nut processing unit's design and construction are done for 20 kg of Areca nuts, and the entire processing procedure takes 8 hours In this work, the ideal angle form is investigated in order to successfully peel dry areca nuts. The machine, which has been correctly built, is made of dried areca. The peeling procedure is changed to allow for full removal of the nut.

4. CONCLUSION

The Arecanut Dehusker Machine's design and construction were successful. This device is portable due to its small size and design. Comparing this equipment to other ones now in use, it is more cost-effective for agriculture. They conclude the conclusion that a semiskilled operator could be used. This device has a roller and a spike that makes it ideal for dehusking areca nuts. As a result, the issues with the previous computers have been solved by this one. After testing a dehusking machine at various speeds, it was discovered that the machine operates at a single cutter speed of 125 rpm with an efficiency of 75%. The development stage of the areca nut dehusking machine has begun. To make the gadget portable, it has a highly intricate design. Semi-skilled laborers may use the equipment as well. The

Roller cutters are capable of removing the areca nut husk. Many farmers may be able to solve their various De husking issues with its assistance. A new areca nut cutting machine's design and construction were completed.

Fig-9: Peeled Arecanut

5. ACKNOWLEDGEMENT

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