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Design & Fabrication of Semi-Automatic Coconut Dehusking, Water and Shell Separation Machine

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Abstract *— World's third largest coconut producing country is India. All part of coconut is useful. Coconut husk is used in coir industry, water as nutritious liquid, shell as a fuel and copra as a food. The scope of this project is to design and fabrication of semi-automatic machine used to separate husk, water and shell from the coconut. The dehusking of coconut is the most time-consuming operation since it is hand operated using a machete so injuries sustained by dehuskers to their hands and other parts of body. it is dangerous and may causes back pain to dehuskers. The first process of the machine is to remove husk from coconut with the help of rollers having pointed spikes on its periphery. After that the second process is to make a hole in shell to remove water from it then last the process is shell removing process with the use of cutter. By utilizing above technique, coconut can be dehusked, deshelled and water extracted from it. Moreover, the system will be cost effective.*

Keywords-*Coconut, Dehusking, Deshelling, Water extraction, Semiautomatic machine*

i. INTRODUCTION

The project is based on the user defined problem faced by the individual dehuskers, Coir industries, Food processing industries.

Coconut is one of the world's most useful and important fruit. An individual coconut fruit is made up of an outer exocarp, a thick fibrous fruit coat known as husk, the hard-protective endocarp or shell called "eyes" are at one end of the nut. Coconuts are grown in more than ninety-three countries of the world, with a total production of 5.4 billion tons per year. India is the third largest coconut producing country in terms of area and production.
Coconut cultivation in India are the states of Kerala, Tamilnadu, Karnataka, Goa, Andhra Pradesh, Orissa, West Bengal, Pondicherry, Maharashtra and the islands of Lakshadweep and Andaman and Nicobar. Maharashtra ranks seventh in area and production. Water of coconut is a common refreshing drink and has been used as an excellent isotonic in several countries. It is not only a thirst-quenching liquid, but also a mineral drink, which is beneficial to human health. Worlds top five coconut producing countries are shown below.

Rank	Country	Coconuts Produced (tons)
1	Indonesia	18,300,000
2	Philippines	15,353,200
3	India	11,930,000
4	Brazil	2,890,286
5	Sri lanka	2,513,000

Table 1: Coconut producing country and their production [6]

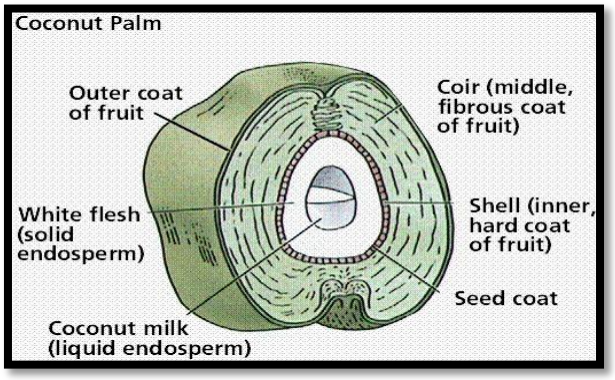

Figure 1: Parts of coconut [7]

1.1 Problem summary

The traditional production of coir from the husks is a laborious and time-consuming process. After separating of the nut, the husks are processed by various techniques which is usually done by hand. Coconuts are large, dry drupes, ovoid in shape, up to 15" long and 12" wide. The coconut is rough on the outside, brown in colour. Within the outer shell is a fibrous husk one to two inches (2.5 to 5cm) thick. The inner shell is brown and hard, surrounding the white coconut meat. Coconut husks are the rough exterior shells of the coconut. This outer shell or husk has to be removed for the usage of coconut copra as fruit, shell as fuel and husk for coir industry.
Dehusking of coconut is the most time-consuming operation since it is hand operated using a machete tool so injuries sustained by dehuskers to their hands and other part of the body. it is dangerous and may causes back pain to the dehuskers.

Figure 2: Manual dehusking tool [1]

Most commonly used for de-husking coconuts and is even highly domesticated. It consists of a sharpened edge on which the coconut is placed by applying force. Then the hinged edge is opened with the help of the lever. This in turn, cuts and opens the husk of the coconut. This is done in various orientations and the remaining husk is pulled out till the coconut is completely de-husked. It is a manual process and requires a lot of effort from the worker. It is also dangerous as an in-experienced worker may hurt himself in the process.

ii. LITRATURE SURVEY

1) Venkataramanan S, et al [1] presented in two horizontal rollers with blades. The coconuts however have to be held in place by some clamping force the projected sharp edges do the husk removal process. Which requires continuous labor force and husk is removed

2) Vaibhav Y. Potraje, et al, [2] presented in a sharp punching tool with the help of it water extraction process takes place by manually.

3) H. Azmi, et al' [3] Parallel roller mechanism operated through motor rotates with sufficient amount of torque required to remove the husk. Nut and husk are separated.

4) Roopashree C R [4] presented in a rotary arrangement of blades. It was intended for a large-scale application. The blades are fixed over the drum as well as on the concave surface. When the coconut is placed in the space between drum and concave surface it is pressed and moved forward. The blades on the drum punctures the husk on coconut and shear force peels it off.

5) P.A. Wadile, et al [5] presented a hydraulic arm-like structure, holding mechanism. The de-husking machine was powered by an electric motor which was powered by an electric motor which was at-tacked to hydraulic system. Hydraulic power was used to operate the arm like structure which was used for opening the coconut husks.

iii. METHODOLOGY

This machine is consisting of several components as shown below

1. Electric motor
2. Power transmitting through V-Belt drive
3. Pulleys
4. Dehusking rollers consisting spikes on periphery
5. Drilling for water extraction
6. Bucket as reservoir
7. Reciprocating small frame to keeping coconut at place
8. Cutter for shell separation
9. Main frame

These machine components mentioned above will be fixed over main frame (skeleton structure). Transmitting power to dehusking rollers through electric motor with the help of v-belt drive. dehusking rollers consisting spikes that are welded on its periphery. It will rotate in opposite direction to each other. Coconut will put between the rollers and husk will be removed after that drill will make hole in coconut shell and water will be collected in the bucket which is exactly below the drill. After the last process is shell removing process with the help of cutter that will cut the outer shell of coconut and copra will be separated. The drill and cutter both are mounted on single shaft also rotate with v-belt connected to the dehusking rollers. It is observed that Dehusking, Deshelling, Water extraction process are very fast compared to any manual tool and machine.

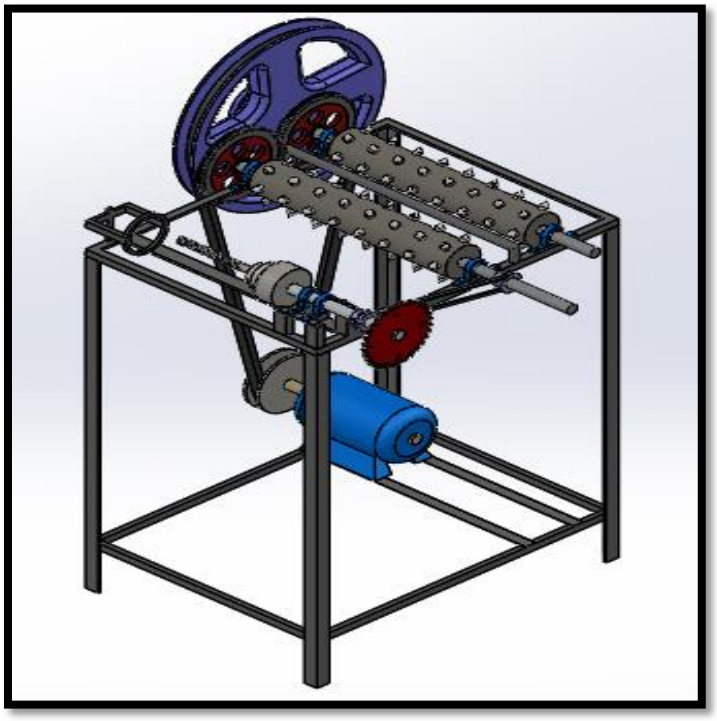

Figure 3: 3D view of CAD Model of Machine

The existing machine in market doing a single operation(Dehusking) and having lesser efficiency. In our model three different processes (Dehusking, Deshelling, Water extraction) are being done on one machine by using a single motor as a power source. This machine can be used at where huge amount of coconut needs to be dehusked, deshelled and water separated.

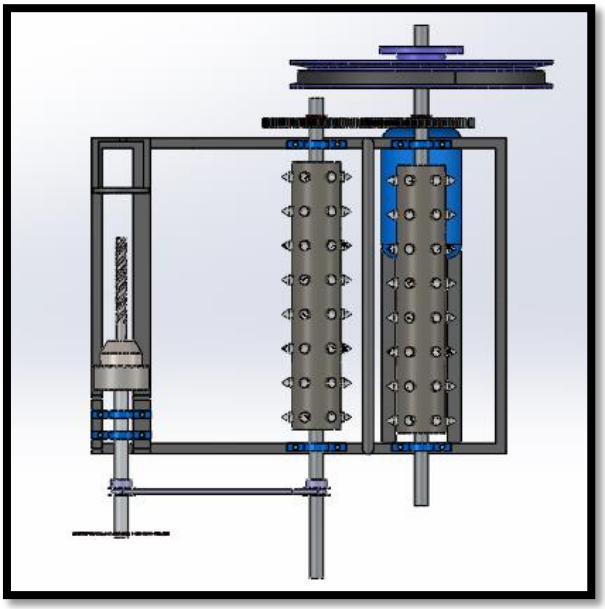

Figure 4: Top view

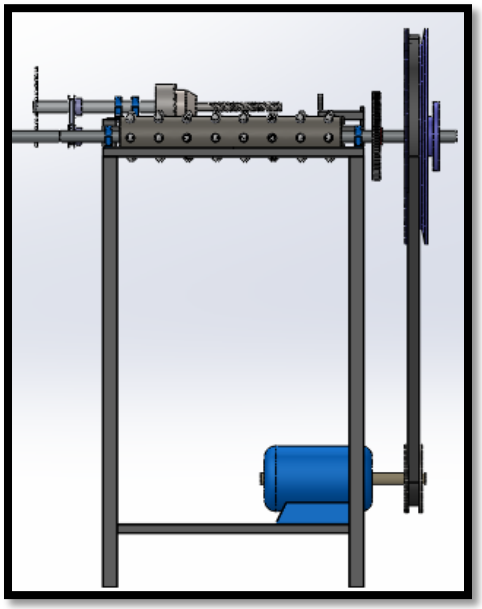

Figure 5: R.H.S view

The design of machine is made for different types of coconut size and shape. After go through literatures the physical properties of coconut are as follows.

Particulars	Dry coconut
Shape	ovoid
Length, (mm)	115-264
Diameter, (mm)	123-287
Weight, (kg)	0.62-1.25
Shell Diameter, (mm)	80-120
Husk Thickness-at pedicel end, (mm)	62
Husk Thickness-at apex end, (mm)	34
Husk Thickness-1/4 distance from pedicel end, (mm)	32
Husk Thickness-1/2 distance from pedicel end, (mm)	24
Husk Thickness-3/4 distance from pedicel end, (mm)	28

Table 2: Physical properties of coconut [2]

The dimensions of the dry coconut are very important thing to design machine. From the survey it has been found that coconut at Andaman and Nicobar Islands area very big compared to Tamil Nadu and Kerala in India the machine has been designed to overcome a large range of coconut sizes, with equal importance to productivity. Some of the coconut dimension is measured by Vernier caliper and other are collected from the literatures. X axis shows the height and Y axis shows diameter of coconut.

Figure 6: Dry coconut

Sr. No	X-axis (mm)	Y-axis (mm)
1	123	115
2	154	143
3	179	161
4	243	213
5	271	225
6	281	264

Table 3: Dimension of coconut

iv. EXPERIMENTAL SETUP

Figure 7: Actual model

Figure 8: R.H.S View

Figure 9: Top View

Sr. No	Size of coconut		Dehusking	Water Extraction	Deshelling
	X-axis (Height mm)	Y-axis (Diameter mm)	(Seconds)	(Seconds)	(Seconds)
1	139	104	4.2	2.9	9.7
2	142	106	4.6	3.1	11.7
3	149	131	5.2	3.1	12.6
4	162	137	6.5	3.2	11.3
5	183	171	8.4	3.3	13.9
Avg. Time			**5.78**	**3.12**	**9.84**

Table 4: Result of the Experiments

v. CONCLUSION

It has been concluded that the machine we have created for the three processes on coconut. The average time for dehusking was 5.78 seconds, and for water extraction process it took 3.12 and time for deshelling process was 9.84 seconds so, the machine is quite efficient and can be useful at food industries, coir industries. Where precision output is required.

vi. REFERENCES

[1] Venkataramanan S, Abhinav Ram B, Rahul R "Design and Development of Automated Coconut Dehusking and Crown Removal Machine" International Journal of Sciences: Basic and Applied Research (IJSBAR), 2014

[2] Rahul Sabale, Dr. K. P. Kohle "Review of Coconut Fiber Extraction Machines" International Journal of Science, Engineering and Technology Research (IJSETR), Volume 4, Issue 5, May 2015

[3] Stephen Kwasi Adzimah, and Samuel Oppong Turkson "Conceptual design of coconut dehusking machine" Innovative systems design and engineering, 2015

[4] H. Azmi , A. B. Sanuddin, M. Z. Zakimi, M. S. Jamali, H. Radhwan, A. N. M. Khalil, A. N. A. Akmal and A. F. Annuar "Design and Development of a Coconut DeHusking Machine (Machine Component Design)" Journal of Advanced Research Design 2015

[5] Roopashree C R "Conceptual selection of Coconut Dehusking Machine" International Journal of Innovative Research in Advanced Engineering, 2017

vii. WEB LINKS

[6] https://www.worldatlas.com/articles/the-world-leaders-in-coconut-production.html

[7] http://agroindustriindonesia.blogspot.com/2011/07/coconut.html