

# Design and Development of Portable Automatic Coconut Leaves Cutter

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**Abstract** - Coconut trees are a major source of income, food, fuel and many other useful things. Coconut branches are used to make shades, to make coverings from rain, to make decorative items. Coconut leaves are majorly used to make brooms which need delicately cleaned leaves. The branch of coconut trees is used as fuel in boilers or as firewood. To cut the leaves and branch considerable human efforts are required. Usually people use traditional Sickle-like equipment. This method is injurious and it exhausts the person. We have designed a mechanism that can be implemented to cut the leaves efficiently and in a way that bolsters the production with the help of technology. Hence motivation for the project is to reduce the human assistance required for increased efficiency of the operation and to ensure safety while operation. The project is intended to be an automated and least effort process. During this project we aspired to comprehend research papers and find a suitable optimised solution for the problem. A traditionally used method is challenged during the project to reduce human efforts and implement use of technology in the agriculture field so as to facilitate farmers with emerging technologies to enhance their production.

**Keywords:** Automation, Agro-Tech, Machine development, ease of operation.

## I. INTRODUCTION

Coconut is a crop of small and marginal farmers since 98% of about five million coconut holdings in the country are less than two hectares. While there is a concentration of coconut plantations in the coastal regions of the country, it is also grown in the hinterlands where the agro climatic requirements of coconut cultivation are met. Coconut is grown in more than 93 countries of the world and Indonesia, Philippines, India are the major producing countries of the world. In the coastal regions of India coconut has been a major part of the economy and daily lifestyle. It includes every part of the tree being used for various purposes. Traditional areas of coconut in India are the states of Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Orissa, Goa, West Bengal, Pondicherry, Maharashtra and Islands of Lakshadweep and

Andaman and Nicobar. However, several states like Assam, Gujarat, Madhya Pradesh, Bihar, Tripura, Manipur, Nagaland and Arunachal Pradesh have emerged as non-traditional areas for the cultivation of coconut [1].

In coconut farms every coconut tree shades 12 branches approximately every year. When the number of trees is in dozens or hundreds farms produce millions of nuts per year with tonnes of leaves shaded by trees. These compounds to a very big portion of land. To cut these leaves traditionally man power is used which leads to fatigue and conventional by-products. Our machine centralizes the idea to make use of these leaves for other purposes by decreasing the process cycle time and increasing operation speed.

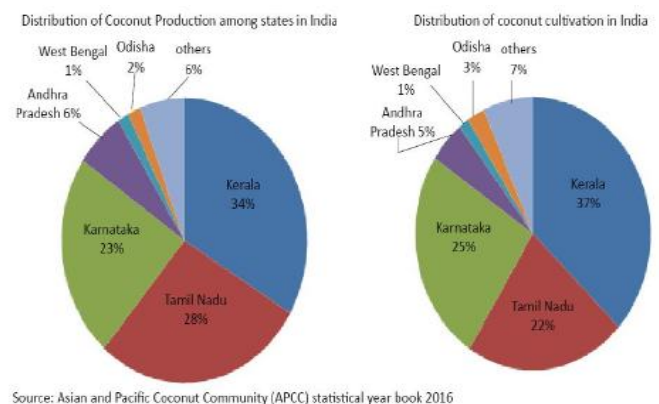


Figure 1: Area and production of coconut in India

## II. TRADITIONAL METHOD

In the traditional method, labour is appointed on big farms to separate the leaves from the branch of coconut trees. In coastal regions where environmental conditions are very befitting the leaves tend to grow up to 4 metres in length. The traditional process requires the branch to be upheld vertically and then the power strokes using a Sickle like tool cut the leaves separate. This is exhausting, time consuming and as the branch size is large, a very uncomfortable process. It also requires the user to hold the branch near the blade of the sickle which may harm the user.



Figure 2: Injuries due to Sickle

### III. PROBLEM STATEMENT

Traditional Sickle cutting method is tedious, time consuming. it compromises the safety of the operator. This reduces the efficiency of leaf cutting which requires immediate processing. The slow processing results in degradation of the leaves which then become entirely useless for any processing. To overcome such situations the project has built an efficient machine that enables fast, safe and comfortable operation.

### IV. EXISTING MACHINE

The current machines in the market include coconut shredding machines which essentially shred or chop the entire leaves for easy degradation.[2] This only helps in degradation but overlooks other applications of leaves. This leads to reduced use which does not benefit farmers with by-products and only deals with the space problem.[3][4] Also Coconut grating machines which deal with the coconut flesh are in market.[5]



Figure 3: Existing machine

A solar powered leaf waste leaf collector and shredder machine is developed. The proposed machine is tested to evaluate the performance of leaves collecting and shredder

machines by using different types of techniques. The effect of collecting the leaf and making the useful application without any harm to the environment is studied. The traditional way of burning the waste leaves with fuel is not only the hazardous disposal solution it also wasting useful energy with efficient collection system waste from agricultural production can be utilised as fuel for power and heat production [8].

### V. METHODOLOGY

Farm visit to understand actual problems. Measurements of number of branches to design the cutter and cutting table aspects. Detailed study for developing a dedicated machine for the coconut branches. Literature review to know existing machines and to understand the components to be used[6] . Field visit to wood workshop to analyse and optimise the design of table mount for cutter. Selection of cutting parameters to facilitate cutting of flexible leaves, to design a system for ergonomics. Actual manufacturing of the machine.

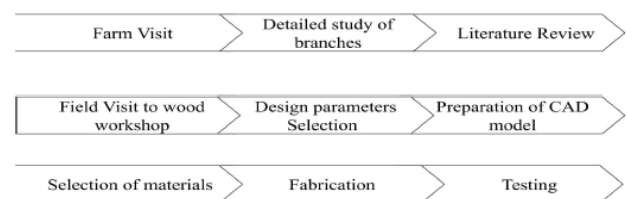


Figure 4: Methodology

### VI. DESIGN

The branch of the coconut tree is basically divided in two main parts: the mid rib which is a hard part of the branch with converging diameter and the leaves spread along the side of the branch. The leaves need to be cut from the mid rib without harming the delicate and flexible rachis which is used to make brooms and other items of decoration. Hence the cut needs to be very precise for the purpose. The designed machine has three major parts: The Table, the track and the rest table.

- 1) The table: It is the ergonomically designed table which acts as mount for the track and supports the entire working structure.
- 2) The track: This is the most crucial part of the machine. It is a long track of L shaped wooden bars on which the cutter slides. It has a wooden board attached at the bottom in between the two tracks which acts as a cutting bed. The bed has sharpened screws to mount the branch. The long rack has supports attached to it to avoid deflection when the machine moves on the track. To improve the machine slide path on the track a wooden block with engraved track structure is screwed to the machine itself. It has hinges to move the track for mounting and demounting of branches.

3) The rest table: It is the mount used for keeping the cutter at rest while mounting and demounting of the branches. It facilitates the user with the ability to change the branches without coming in direct contact with the cutting blade. It is essential to keep the machine at rest. It has hinges to allow the track flip around the rest table.

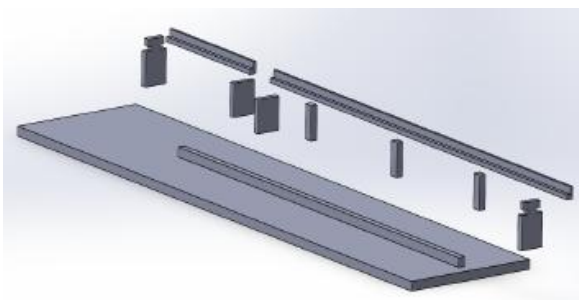


Figure 5: Table top with components of Tracks and Rest Table

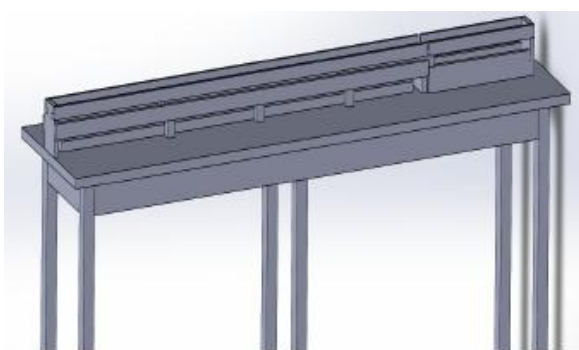


Figure 6: Table Top Complete Tracks and Rest Table Assembly

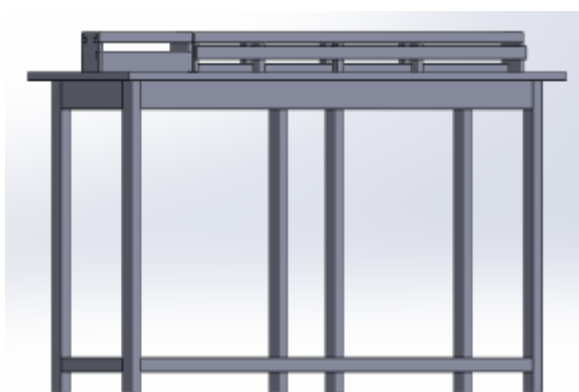


Figure 7: Complete Table

Dimensions of the table are:

Part of Machine	Dimensions (All in feet)
Length of Table	6.5
Breadth of Table	1.5
Thickness of Table	0.23
Height of Table	3
Length of Track	5

Breadth of Track	0.45
Thickness of Track	0.08
Height of Track	0.23
Length of Rest Table	1.5
Breadth of Rest Table	0.45
Thickness of Rest Table	0.06
Height of Rest Table	0.61

## VII. MECHANISM

The cutter is kept at the rest table.[7] The track is flipped with respect to the table. The branch is pierced through the sharpened screws to keep the branch at steady position while the cutter cuts the leaves. Now the track is repositioned. The cutter is made to slide over the L shaped tracks. The fast speed of the cutter blade to cut with precision. The wooden flat plate attached to the table top in between the tracks has a cutting line which is used as a guide for cutting the leaves. The converging diameter is made to align with this line for exact cut to the joint of leaves and branch. The cutter slides over the track which eventually cuts the leaves apart from the main branch. Now the one side leaves are cut, the machine is brought back to the rest table. Now the branch is flipped and the entire procedure is repeated.

## VIII. CONCLUSIONS

The setup was successfully built. The trial was performed which resulted in a satisfactory outcome. As the objective states it is better than traditional manual operations. The developed machine is simple, effective, requires less time and is cost effective when compared with the existing available model of leaves shredder machine. Importance is given towards user friendliness and safety of the operator. The Assembly was checked for its certain use and was found to be reliable. We can say that for the purpose of separating leaves from branches this is an economical and ideal machine.

Since the cost is very low as compared to other shredder machines. Also it is easy to manufacture and portable. It can be cleaned easily. Highly skilled labourers are not required. This machine can be used for domestic application as well as for small, medium and big scale businesses. In the process of completion of the work our ideas and thoughts are developed towards and Technology used while building the equipment. Finally we conclude that this machine is a better option to be used by farmers to reduce human fatigue and save the operation time. This project has a youtube scope in growing bamboo grass industry for cleaning of bamboos.

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