

# Electronic Coconut Plucker

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**Abstract:** This paper presents an electronic machine that serves the purpose of plucking the coconuts from the high canopies of the coconut trees with a safer-than-traditional approach. The project is developed using various chassis, gears, motors, microcontrollers, etc. that are interfaced together according to our self-designed blueprints of the machine. Some issues, regarding the economic benefits of the tree-owners and risk to the lives of the tree-climbing men, are the problems of major concern that are solved by this electronic coconut plucker.

**Keywords** – Tree climbing, Coconut plucking, Robotic arm, Chassis, Microcontroller

## 1. Introduction

As mankind is progressing towards development, it need not be a growth that overlooks facilitating the sector that is most important for us i.e. agricultural sector. This sector in India has various tasks that are made easier or could have been made easier with the help of latest machinery and technology, but these facilities are expensive. An average Indian farmer, according to his income, cannot afford them and thus, without having any other option, opts for manually carrying out these tasks. This is one of the main reason why this project is developed having an agricultural background, also the above mentioned statistics channelize the project towards coconut and their harvesting process.

**Table 1. India Amongst Other Countries in Coconut Production**

Rank	Country	Coconut Production (tons)
1.	Indonesia	18,300,000
2.	Philippines	15,353,200
3.	<b>India</b>	<b>11,930,000</b>
4.	Brazil	2,890,286
5.	Other Countries (21 Countries)	12,299,762

The coconuts that we eat and relish grow way higher than the ground level on the canopies of the

coconut trees which are around 60-100 feet tall. Generally to harvest these coconuts the tree owner, irrespective of the number of trees he own, has to seek out for an individual who will climb the tree and cut down the coconuts. This is a risky method since even a small mistake, made by the climber while gripping the tree, can cost him his life. Also these individuals charge a lot of money to do the same.

With the help of Electronic Coconut Plucker this traditional approach of harvesting the coconuts by risking a man's life can be transformed to an easier and safer-than-traditional approach. This machine can be opened, with respect to its hinges, and placed around the trunk of the tree. The wheels mounted on the machine helps the machine in its horizontal as well as vertical movement throughout the trunk of the tree. Lastly the main element of the machine i.e. the arm, has a sliding mechanism and a coconut plucking element with which it cuts the coconut from the tree. The machine makes use of various motors, pneumatics, etc.

This method is also cheaper for the tree owners in order to harvest the coconuts as it is a onetime investment and also costs lesser in its maintenance.

## 2. Objectives

- To make an efficient machine that holds the trunk firmly, while it climbs up the tall coconut trees and reaches the canopy.
- To make a movable arm attached to the tree climbing assembly that can help in the harvesting process of the coconuts by simple and selective plucking of coconuts from their respective branches.
- Let the end user have a better control over the selection of the coconuts to be plucked and also over every movement of the machine.
- Reduce the risk of human lives by making the coconut harvesting process safer.
- Creating an economic and cost-effective option for the coconut tree owners, in order to pluck the coconuts.

### 3. Methodology

Electronic coconut plucker is to be designed in order to reduce human efforts and to cease risking their lives in climbing up the tree of average height 60 to 100 feet. Major efforts that this robot has to take is to climb up the tree and pluck the coconuts on its own. Thus electronic coconut plucker is a robot that will climb up the coconut tree and will pluck the coconuts with the help of its arm assembly. The Electronic Coconut Plucker is constructed using three major parts and they are as follows.

#### 3.1. Tree Climbing Assembly

Tree climbing assembly is a part of the robot that will take it to the top of the tree i.e. near to the canopy form where coconuts are to be plucked.

This assembly consists of two hexagonal aluminium frames joined by the hollow aluminium square pipes at each vertex with respective vertex of other hexagon. Each frame has three wheels placed with planes containing them at 120 degrees with respect to each other. Each wheel is attached to a bearing which is mounted on an aluminium plate as shown in structure in figure 1. The aluminium plate is mounted on alternate edge of the hexagon so as to get a proper alignment of wheels at 120 degrees. The mounting of aluminium plate is done by means of a rigid support and springs. The rigid support will restrict the wheel motion in vertical direction while spring will give adjustments to the wheel in direction perpendicular to the trunk. Wheel shaft is then joined with a high torque motor shaft by means of a coupler which will give rotations to the wheel so as to climb up the tree.



Figure 1. Tree Climbing Assembly

#### 3.2. Coconut Plucking Element

In order to separate the coconut from the coconut tree, we are using the same tool that is used while following the traditional coconut harvesting approach i.e. we make use of sickle. A sickle or bagging hook is a hand-held agricultural tool designed with variously curved blades and typically used for harvesting, or reaping grains. Although the sickle has a sharp blade, a significant amount of force is needed to cut the coconut from the tree. Thus, here we make use of pneumatics in order to get the required amount of force. While the rest of the arm does the work of reaching to the coconuts, the sickle and the pneumatics i.e. the coconut plucking element cuts the coconut from the tree.

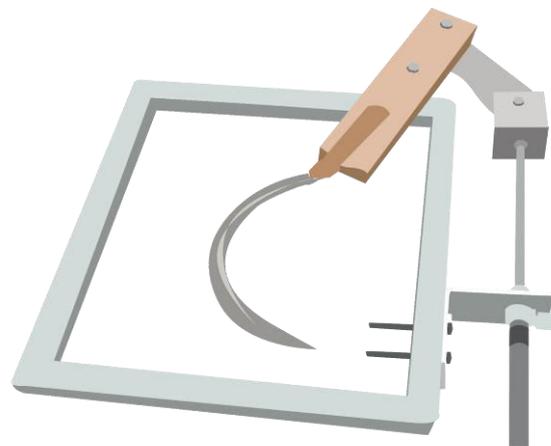


Figure 2. Coconut Plucking Assembly

The sickle and the pneumatics are mounted on the arm of the electronic coconut plucker. The sickle is attached to a cuboidal wooden block which is fitted to the square frame of the arm, with the help of a screw, from its center. This fitting of the wooden block is done such a way that the screw with which this block is attached to the frame acts like a pivot and allows rotational movement of the wooden block, in an arc, with the axis of rotation perpendicular to the block and passing through the screw. On one end of the wooden block the sickle is fitted and the other end of the block is attached to a metallic plate with a screw.

This metallic plate is further attached to the pneumatic. The pneumatic assembly does the job of pushing and pulling the metallic plate. Due to this, the metallic plate also causes the movement of the cuboidal wooden block which finally takes the blade of the sickle back and allows it to hit the branches of the coconut tree with the required impact.

### 3.3. Controlling of Machine

Three vertical wheels placed at 120 degrees are responsible for vertical motion of the robot and 2 wheels placed at 180 degrees are responsible for circular motion of the robot around the tree. The circular motion of the robot around the tree helps to place arm according to position of the coconut on the tree. In order to cut the coconut principle of air pressure is used. The movement of sickle is controlled by air pressure using pneumatic. The end of the pneumatic shaft is connected to aluminium plate. Pneumatic shaft pushes aluminium plate, due to which the wooden piece on which sickle is bound, makes rotational movement forcefully.

### 4. Implementation

Implementing various components together, according to our model, we created the machine "Electronic Coconut Plucker".



Figure 3. Coconut Demonstration of Electronic Coconut Plucker



Figure 4. Demonstration of Electronic Coconut Plucker

### 5. Conclusion

This project can bring together several components and ideas of robotic technology to use it for the society to handle the risky task of the coconut farmers to pluck the coconuts instead of personally climbing the tree by the farmers. This project can be utilized for the similar kinds of task for other similar kind of trees and risky climbing applications.

### 6. Acknowledgements

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