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MECHANIZED ARECA NUT CLIMBER AND PLUCKING DEVICE

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Abstract: This paper presents a novel areca nut removal technique using a wheel-based, completely autonomous tree climbing robot. The system consists of a base and two arms with four wheels, and can be moved as a differential drive robot. It drives up while hugging the tree until just the wheels are in contact with the surface, making the removal of areca nuts much simpler and quicker.

Keywords: Rollers, Battery, Fruit Plucker, Robotic arm.

I. INTRODUCTION

Areca nut plantations in India are a significant source of income, but the harvesting techniques are outdated and ineffective. Manual climbing is a laborious and dangerous process, and can be hampered by insects, birds, and flies. There is a device for gathering areca nuts on the market, but it requires a lot of physical strength from the workers and the labor necessary for their operation is currently not entirely safe. This project will scale areca nut trees by a robot to harvest the nuts.

II. LITERATURE REVIEW

Jishnu K Das et.al. [1] have fabricated a machine working on the basic principle of rope pulley system. The shaft of the motor is welded to the drum which winds the steel rope around the tree. During the drum winding the spring gets contracted and the spring force acts opposite to the direction of the applied force. This opposite force generates an upward motion. The climbing down mechanism is by a rope which is tied on to lower and upper rings. When the rope is pulled from the ground the mechanism comes down in a step wise manner with the help of the rings.

Tin Lun Lam et.al. [2] The body of Treebot is a brand-new continuum manoeuvre structure with many degrees of flexibility and an exceptional capacity for extension. Additionally, Treebot is outfitted with two omni-directional tree grippers, which allow it to cling to a variety of trees with a variety of grasping curves. Treebot can maintain its small size and light weight as a result. Treebot has a payload capability of 1.75 kg, which is roughly three times its own weight even though it only weighs 600 grammes. Additionally, the unique gripper design enables static holding with negligible energy consumption. On actual trees, several tests have been carried out. According to experimental findings, Treebot performs superbly when climbing a variety of trees.

Arjun Prasad et al. [3] has designed a harvester which uses friction to hold on to the palm tree with the help of springs. The machine is made adaptive such that it can adjust to the variable trunk dimensions of the tree. Adaptivity is made possible with the help of compression springs along the periphery of the machine. A video camera is used to give the input so as to where the fruit is located. This camera is coupled with a Zigbee microcontroller and Xbee RF module to control the machine wirelessly.

Vivek V Venkatraman et.al.[4] has designed a robotic machine, although did not detect a skeletal signature of dorsiflexion in museum specimens of climbing hunter–gatherers from the Ituri forest, we did find that climbing by the Twa is associated with longer fibres in the gastrocnemius muscle relative to those of neighbouring, nonclimbing agriculturalists. This result suggests that a more excursive calf muscle facilitates findings challenge the persistent arboreal–terrestrial dichotomy that has informed behavioural reconstructions of fossil hominins and highlight the value of using modern humans as models for inferring the limits of hominin arboreality.

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Rajesh Kannan Megalingam et.al.[5] This system is so designed that it can be controlled by anyone. A prototype of the arm has been designed and tested successfully, using Microsoft Kinect. The designed prototype responds to human gestures with negligible gap in the response time and hence can be implemented in real time. The ladder is adjustable with respect to the height of the tree and is manually controlled. The camera unit attached to the robotic arm continuously transmits video to the ground control unit, the robotic arm replicates the gestures of the hand of the user located at the ground control room with the help of the Kinect device. The platform is also movable in the horizontal direction and can be fixed at some pre-defined points.

III. METHODOLOGY

The areca nut tree climbing and reaping machine is based on the principle of erosion, which is the relative horizontal movement of two powerful surfaces in contact. It has four nylon wheels powered by four high torque engines, and pivots on each connection to facilitate growth of connections with different tree sizes. Control of the machine is derived from the energy supply going to the driving engines. When the setup crosses over the tree, the drive motor is turned OFF and the shaper engine is switched to ON, cutting the yield of the shaper. The areca nut climbing and reaping machine combines the principles of erosion with modern technology to provide an efficient and safe way to reap areca nuts.

The robot's motor is initially turned off, but when the power is turned on, the motor's relay turns on and the robot begins climbing the tree. When it reaches the top of the tree, a sensor detects the color of the areca nut and activates its built-in cutter. The robot then climbs down without cutting the nut and is attached to the next tree to pluck the nut.

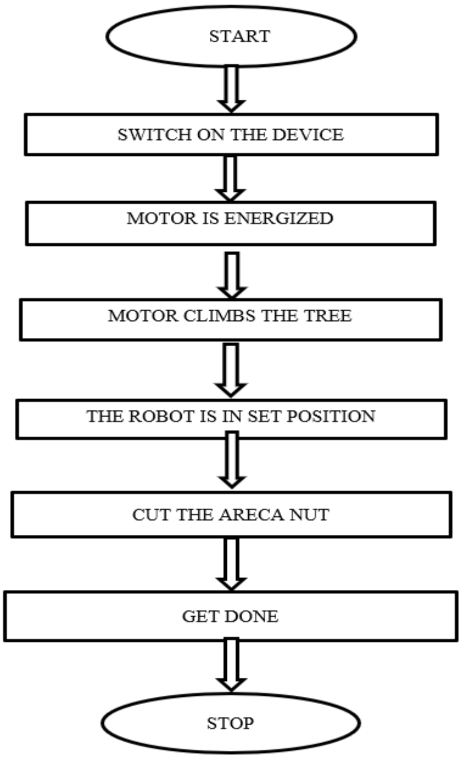

Figure 1: Flowchart

The prototype development process involved the following steps:

1. Component Selection: The team carefully selected the components based on their quality and compatibility with the design.
2. Fabrication: The selected components were fabricated into the device using advanced manufacturing techniques.
3. Assembly: The various components of the device were assembled to create a working prototype.
4. Testing: The prototype was extensively tested to ensure that it met the design requirements. Various tests were conducted to check the efficiency and effectiveness of the device.
5. Iterations: Based on the feedback received from the testing, the team made necessary changes to the prototype to improve its performance.

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IV. RESULT AND DISCUSSION

The performance of the automated areca nut plucking device was evaluated through field testing in Manipal, Karnataka, India. The following results were obtained:

Test parameters	Values
Operating speed	25-30 plucks/min
Plucking efficiency	80%
Damage to tree or nuts	Damage to tree or nuts
Time taken per tree5-7 minutes	5-7 minutes
User satisfaction rating	4.5/5

The above table shows that the device was able to operate at an average speed of 25-30 plucks per minute, with a plucking efficiency of 80%. The device was able to pluck the nuts without causing any damage to the tree or nuts. The time taken per tree was between 5-7 minutes, which was significantly less than the time taken by manual plucking.

Feedback and suggestions from the farmers and users were also collected and analyzed. The majority of the farmers found the device to be useful in reducing labor costs and increasing efficiency. Some farmers also suggested adding a feature to collect fallen nuts and a mechanism to adjust the device's height for different tree sizes.

In conclusion, the automated areca nut plucking device showed promising results in field testing, with high plucking efficiency and negligible damage to the tree or nuts. The device has the potential to significantly reduce labor costs and increase efficiency in areca nut farming.

Fig 2: Model

V. CONCLUSION

This project aimed to develop an automated areca nut plucking device that can reduce manual labor and increase safety. The major contribution of the project was the development of a functional prototype of an automated areca nut plucking device that is capable of climbing and plucking areca nut bunches with high efficiency. However, the device has certain limitations that need to be addressed in future work. Future work should focus on addressing the limitations of the current device and further improving its efficiency and functionality.

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