International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

TREE CLIMBING DEVICE

[1]MR.K RAGHAVENDRA, [2]K.HARSHITHA, [3]K.NAGA SAI VINEESHA, [4]K.SHARANYA

[1]Assistant Professor, Department of Electronics and Communication Engineering, **MALLA REDDY ENGINEERING COLLEGE FOR WOMEN,** Maisammaguda, Dhulapally Kompally, Medchal Rd, M, Secunderabad, Telangana.

[2,3,4]Student, Department of Electronics and Communication Engineering, **MALLA REDDY ENGINEERING COLLEGE FOR WOMEN,** Maisammaguda, Dhulapally Kompally, Medchal Rd, M, Secunderabad, Telangana.

ABSTRACT

With over five billion coconuts harvested annually, coconuts significantly contribute to the economies of several regions and countries. In India, the primary states involved in coconut harvesting are Tamil Nadu, Kerala, and Karnataka. The traditional method of harvesting involves climbing the tree and manually cutting the coconuts. While this process may appear straightforward, it is, in fact, quite hazardous. Consequently, there is a pressing need to develop a device for climbing and harvesting coconut trees. Our study reviews various research papers related to this field, revealing substantial potential for innovation due to the high costs and complexities of existing devices. The main objective of this study is to design a prototype for a coconut tree climbing and harvesting device that minimizes complexity and reduces costs.

Keywords: Coconut Harvesting, Challenges Faced, Injuries During Harvesting, Coconut Tree Climbing Robot

I. INTRODUCTION

Coconut palms are cultivated in over 80 countries, yielding a total production of 61 million tonnes annually. Belonging to the “Arecaceae” family, which encompasses around 200 genera and 2,500 species, coconuts are a vital export commodity, generating significant revenue for many tropical nations. Beyond economic value, every part of the coconut is utilized in various ways, earning it the title of “The Tree of Life” among villagers. India accounts for approximately 25% of the world's coconut meat and fiber, which are used in products such as soap, oil, shampoo, rope, and door mats. Additionally, coconuts hold cultural significance in India, often featured in religious ceremonies and weddings. Kerala, which produces nearly half of India's coconuts, derives its name from the Malayalam words for “coconut” and “land.”

Despite the importance of coconuts, harvesting methods remain primitive, highlighting the need for innovative devices. An experienced climber typically takes 7-10 minutes just to ascend the tree, not including the time needed for cutting coconuts and descending. In more developed regions, climbing gear and spiked shoes are employed, but these methods are impractical for large-scale harvesting. In Tamil Nadu, climbers earn Rs. 40-50 per tree, yet few individuals seek this line of work due to unsafe conditions, low income, and social stigma, resulting in a significant labor shortage. Moreover, coconut harvesting is predominantly performed by men, driven by traditional views that deem it a "man's job" due to its physically demanding nature.

With over five billion coconuts harvested each year, the fruit plays a crucial role in the economies of various regions. This study focuses on India, particularly in Tamil Nadu, Kerala, and Karnataka, where the majority of coconuts are harvested by climbing trees and cutting the nuts manually. This process, while seemingly simple, poses considerable risks. Thus, there is a genuine need for the development of a safer harvesting device. The primary goal of this study is to design a device that assists farmers and residents in climbing and harvesting coconuts. Climbing a coconut tree manually presents challenges due to its cylindrical shape and single trunk, unlike other trees that have branches for support. Only trained professionals can effectively climb coconut trees. Currently, there is no completely safe coconut harvesting device available on the market. Considering this scenario, we will design a device to facilitate the easy harvesting of coconuts. This device will be beneficial for individuals with extensive coconut plantations as well as those with fewer trees. By making coconut harvesting more accessible, we aim to encourage more people to engage in the agricultural sector. Our group intends to develop a coconut tree climbing and harvesting robot that achieves the following objectives:

- It will be controlled from the ground.
- The robot will be operable by not only men but also women and children.
- The harvesting process will be as fast as, or faster than, current methods.
- The robot will be capable of climbing coconut trees of varying diameters and heights.

II. LITERATURE REVIEW

Akshay Dubey, Santosh Patnaik, and Arunava Banerjee [1] presented "Autonomous Control and Implementation of Coconut Tree Climbing and Harvesting Robot," which focuses on designing a low-cost coconut tree climbing and harvesting robot. The kinematics and motion of the robot are modeled after the movements of a coconut harvester. The robot comprises two segments connected by threaded rods that are coupled to motors. The mechanical frame is designed using drafting software and constructed with aluminum segments and threaded rods. It features two motor-driven arms for holding and locomotion, powered by six motors—four for the arms and two for vertical movement. Additionally, a robotic arm for cutting coconuts is mounted on top of the climbing structure, controlled manually from the ground via remote. However, the prototype suffers from slow climbing speeds and potential misalignment issues in the threaded rod and nut.

B.C. Widanagamage, T.N. Gallege, S. Salgado, and J. Wijayakulasooriya [2] introduced "Treebot: An Autonomous Tree Climbing Robot Utilizing Four Bar Linkage System." This paper emphasizes the mechanical structure and gripping mechanism of the Tree Robot. Utilizing a four-bar linkage system and screw mechanism, the robot is designed to replicate the upward motion of a human tree climber. Its gripping system allows it to secure itself to the tree, facilitating ascent. The project's scope is limited to climbing

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

coconut trees with diameters between 15 cm and 25 cm.

Salice Peter, Jayanth M, Arun Babu M.K, Ashida P.V, and Akhil K.T [3] presented “Design and Construction of a Tree Climbing Robot,” focusing on motion planning and gripping techniques. The robot features arms with sharp-ended feet, enabling it to ascend against gravitational forces through coordinated movements. The gripping mechanism allows it to anchor into the tree, promoting upward movement. The results demonstrate its successful tree-climbing capabilities, suggesting potential applications in harvesting, tree maintenance, and observing tree-dwelling animals. The project is limited to coconut trees with diameters between 10 cm and 20 cm, and the robot has a load capacity of only 0.75 kg.

Senthilkumar S K, Aashika Srinivas, Maria Kuriachan, Sibi S M, Veerabhadhran, Vinod B, and Sundar Ganesh C S [4] explored the “Development of Automated Coconut Harvester Prototype.” Their design aims to create a tree-climbing robot that can operate autonomously without the need for human labor, other than controlling it remotely. Traditional coconut harvesting relies on manual labor, raising concerns about worker safety and labor costs. The robot features a triangular design with a movable side and three wheels, one on each side, adjusted by two springs to accommodate varying tree diameters. High-torque DC motors drive the wheels, controlled by L293D drivers, with an RF transmitter/receiver unit for remote operation. A rotary-blade arm is attached for coconut harvesting, but the triangular structure limits adaptability to variable tree diameters.

Eldho Jacob and V.P. Haridasan [5] developed “An Autonomous Tree Climbing Robot” designed for autonomous climbing and pesticide spraying. Inspired by human pole climbers, this robot employs a wheel mechanism for efficient climbing. The design is modeled using 3D software, with an L293D motor driver, PIC 16F877A microcontroller, and a 7805 voltage regulator. An electronic compartment houses all electronic components, and power requirements, upward force, and torque calculations are performed. However, the robot’s single-layer hexagonal structure poses stability issues.

Rajesh Kannan, Megalingam, R Venumadhav, Ashis Pavan K, and Anandkumar Mahadevan [6] presented “Kinect-Based Wireless Robotic Coconut Tree Climber.” This paper discusses various models for tree climbing and coconut harvesting, focusing on safety, reliability, and usability. The robot is designed to climb trees, cut coconuts, and maintain tree tops, providing a comprehensive solution for coconut harvesting.

III. CONCLUSION

Our review of existing literature on coconut tree climbing and harvesting robots highlights significant advancements in this field, yet it reveals that no device achieves 100% accuracy. While various designs have shown promise, they often come with complexities and limitations regarding tree size compatibility. Our proposed model aims to simplify these challenges by offering a straightforward design that minimizes control complexity compared to existing systems.

By selecting a hexagonal structure, our robot is designed to adapt to varying tree diameters through a spring-action mechanism. This approach not only enhances usability but also ensures that the system can be operated by individuals with little to no technical training. Ultimately, this design contributes to the integration of technology into agricultural practices, addressing economic and social barriers faced by coconut farmers.

IV.ACKNOWLEDGEMENT

We are pleased to present our review paper on the "Design and Fabrication of Coconut Tree Climbing and Harvesting Robot." We extend our gratitude to everyone who contributed to this work. Special thanks to our project guide, Dr. A. D. Dhale, whose invaluable suggestions aided in the systematic and timely completion of our project synopsis. We also appreciate the support from Prof. A. S. Shirodkar, our project coordinator, and express our thanks to our Head of Department, Dr. A. D. Dhale, and our esteemed Principal, Dr. J. W. Bakal, for their cooperation and guidance. Finally, we would like to acknowledge our teaching and non-teaching staff, as well as our friends, who supported us throughout this journey.

V.REFERENCES

- Akshay Dubey, Santosh Patnaik, Arunava Banerjee (2016). "Autonomous Control and Implementation of Coconut Tree Climbing and Harvesting Robot," Procedia Computer Science, 85, 755–766.
- B.C. Widanagamage, T.N. Gallege, S. Salgado, J. Wijayakulasooriya (2014). "Treebot: An Autonomous Tree Climbing Robot Utilizing Four Bar Linkage System," SAITM Research Symposium on Engineering Advancements.
- Salice Peter, Jayanth M, Arun Babu M.K, Ashida P.V, Akhil K.T (2015). "Design and Construction of a Tree Climbing Robot," IJAREEIE, Vol. 4, Issue 4, ISSN (Online): 2278–8875.
- Senthilkumar S K, Aashika Srinivas, Maria Kuriachan, Sibi S M, Veerabhadhran, Vinod B, Sundar Ganesh C S (2015). "Development of Automated Coconut Harvester Prototype."
- Eldho Jacob, V.P. Haridasan (2015). "Development of An Autonomous Tree Climbing Robot," IRF International Conference, Chennai, India, ISBN: 978-93-82702-83-2.
- Rajesh Kannan, Megalingam, R. Venumadhav, Ashis Pavan K, Anandkumar Mahadevan (2013). "Kinect Based Wireless Robotic Coconut Tree Climber," ICAEPE.