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Fabrication & Modeling of Multi-blades Areca nut Dehusking Machine

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Abstract- The multi-Blades areca nut dehusking machine is a semi-mechanized agricultural tool developed to reduce the labor and time required for dehusking Areca nuts and Coconuts. This machine operates using a DC motor and eliminates the need for automation, making it cost- effective and accessible for small scale farmers. It comprises a mechanical setup driven by a low- voltage DC motor, which powers dehusking sharp spike to strip the outer husk from Areca nuts and Coconuts. The manual feeding system ensures better control and safety. This report details the literature survey, objectives, methodology of the machine. Results indicate improved efficiency, reduced manual strain, and enhanced processing capacity compared to traditional manual methods.

Keywords: Multi-blades Areca nut Dehusking Machine, Agriculture machine, fabrication, kernel separation, low-cost design.

I. INTRODUCTION

Multi blades areca nut dehuskig machine are specialized equipment designed to removal the outer husk of Areca nuts and coconuts efficiently and consistently. Areca nut, also known as betel nut, is a vital agricultural product in many tropical regions, particularly in India, Southeast Asia, and the Pacific Islands. Traditionally, dehusking Areca nuts and coconuts was a labor- intensive and time consuming manual process, often requiring significant physical effort and skill.

The advent of dehusking machines has revolutionized this task by offering a mechanized solution, leading to improved productivity, reduced labor costs, and consistency in quality. These machines come in various designs and capacities to cater to different scales of operations, from small-scale farms to industrial processing units.

Multi blades areca nut dehuskig machine are innovative tools that address the challenges of processing Areca nuts and coconuts, a crop widely cultivated in tropical regions for its cultural medicinal, and economic importance. Commonly known as betel, is a key component in practices, rituals, and industries such eschewing, medicinal preparations, and exports.

The process of dehusking, which involves removing the tough outer shell to reveal the usable kernel, has historically been a manual task, requiring considerable effort and skill.

II. NEED OF THE STUDY

The increasing demand for agricultural productivity has highlighted the importance of efficient post-harvest processing methods. Multi blade is a crucial operation that directly affects storage, quality, and market value of the produce. However, in many rural areas, this process is still carried out manually, leading to low efficiency, higher labour requirements, and increased time consumption.

Traditional deseeding methods not only reduce productivity but also cause physical strain to farmers. Moreover, manual operations often result in uneven kernel separation and higher chances of grain damage. On the other hand, available commercial machines are expensive, bulky, and not suitable for small-scale farmers due to high initial cost and maintenance requirements.

There is a significant need for a cost-effective, portable, and easy-to-operate blade that can be used efficiently in rural conditions. Such a machine should be capable of reducing manual effort,

improving processing speed, and ensuring minimal damage to kernels. It should also be fabricated using locally available materials to make it affordable and accessible to farmers.

The proposed portable multiple blades address these challenges by providing an economical and efficient solution for kernel separation. It helps in reducing labour dependency, improving productivity, and supporting sustainable agricultural practices. Therefore, the development of this machine is essential for enhancing the overall efficiency of small-scale farming operations.

III. RESEARCH METHODOLOGY

The development of Multi blades areca nut dehuskig machine follows a systematic engineering approach involving design, material selection, fabrication, assembly, and testing. The objective is to develop a compact, efficient, and cost-effective machine suitable for small-scale agricultural applications. Each stage of the methodology is carried out carefully to ensure proper functioning, durability, and ease of operation.

Design and Development

Modeling plays a crucial role in the development of the machine, as it helps visualize the design and analyze its performance before fabrication. Using modern design tools such as CAD (Computer-Aided Design) software, a detailed model of the machine can be created. This allows engineers to optimize the design, identify potential issues, and make necessary modifications to improve efficiency and reliability. Modeling also aids in understanding the assembly of components and ensures proper alignment and functioning of the machine.

The proposed multi-blade motorized arecanut dehusking machine aims to provide an efficient, safe, and cost-effective solution for farmers and small-scale industries. By reducing dependence on manual labor, the machine can significantly lower operational costs and increase productivity. Furthermore, the compact design makes it suitable for use in rural areas where space and resources may be limited.

Another important aspect of this project is its contribution to rural development and technological advancement in agriculture. By introducing affordable mechanization solutions, farmers can improve their income and working conditions. The machine also promotes the adoption of modern engineering practices in traditional farming activities, bridging the gap between agriculture and technology.

In addition to improving efficiency, the machine is designed with safety and ease of operation in mind. Proper guarding, stable structure, and simple controls ensure that the machine can be operated by individuals with minimal training. Maintenance requirements are also kept low to make the machine practical for everyday use.

Selection of Materials

Material selection plays a crucial role in ensuring the strength, durability, and cost-effectiveness of the machine. The materials are selected based on factors such as mechanical strength, availability, weight, corrosion resistance, and ease of fabrication.

Mild steel is selected for the frame due to its high strength and good weld ability. Square tubes are used to construct the frame structure. The shaft is also made of mild steel to withstand tensional and bending stresses during operation. The use of locally available materials reduces the overall cost and simplifies maintenance.

Fabrication Process

Based on the finalized design, materials were cut, welded and assembled. Precise alignment of the spike and motor was ensured during construction. Safety covers and chutes were fabricated to match the layout. The machine is fabricated using standard manufacturing processes:

Cutting and welding of frame, Machining of shaft, Blade shaping and sharpening Assembly of motor, blades and Cam link.

Fig 1: Fabrication of Multi blades areca nut dehuskig machine

Cost Estimation

The total cost of the machine is estimated by considering both material cost and fabrication cost. The major components include the mild steel frame, motor, cam link, shaft, bearings, and other accessories.

The estimated cost of the machine is approximately Rs. 12,500. This cost is significantly lower compared to commercially available machines, making it affordable for small-scale farmers. The use of locally available materials and simple fabrication techniques further reduces the overall cost.

Testing and Performance Evaluation

Final Implementation: After successful testing and improvements, the machine is finalized for practical use by farmers, ensuring.

Proto type Testing: The machine was tested under controlled conditions. Various nut sizes were used to analyze performance. Speed, dehusking efficiency, and nut damage rate were measured.

Performance Evaluation: Results from testing were compared to manual methods. Parameters like time per nut, number of nuts per minute, and ease of operation were documented.

Iterative Improvements: Feedback from testing led to minor adjustments in roller spacing, motor speed regulation, and nut feeding tray design. The final version was optimized for continuous operation.

Documentation and Reporting: All stages were documented in this report, and photographs, diagrams, and test results were compiled for transparency and further research. This structured methodology ensured that the final machine was practical, affordable, and effective for small- scale Arecanut processing without reliance on automation.

IV. RESULTS AND DISCUSSION

The multi-blades motorized areca nut dehusking machine (4-blade configuration) was designed and evaluated to improve the efficiency, productivity, and ease of areca nut processing. The experimental results obtained from testing the machine under different operating conditions clearly indicate that the incorporation of four rotating blades significantly enhances the dehusking process compared to both manual methods and single-or dual-blade mechanisms.

• Performance Evaluation

The introduction of four blades played a crucially in increasing the overall performance of the machine. The blades were arranged symmetrically on a rotating shaft, ensuring continuous and uniform contact with the areca nuts.

During testing, the machine achieved an average processing capacity of 50–60 kg per hour, depending on the size, variety, and moisture content of the areca nuts. This represents a substantial improvement to manual dehusking, which typically processes only 10–15kgper hour.

• Quality of Dehusked Areca nuts

The quality of output is a critical factor in determining the market value of areca nuts. The 4-blad system provided a smooth and controlled cutting action, which minimized damage to the nuts. Around 88–92% of the nuts remained intact, only a

small percentage experienced minor surface scratches Very few nuts were broken or crushed.

• Time and Labor Reduction

The results demonstrated a significant reduction in both time and labor requirements. The machine required only one operator for feeding and one for supervision, whereas manual dehusking requires multiple workers. The machine was powered by a0.5–1 HP electric motor, which was sufficient to drive the four blades effectively. Despite the addition of extra blades, the power consumption.

V. CONCLUSION

The multi-blades motorized arecanut dehusking machine represents a significant advancement in agricultural processing technology, particularly for arecanut farmers. By integrating multiple cutting blades with a motorized system, the machine ensures faster, more efficient, and uniform dehusking compared to traditional manual methods. This innovation reduces labor dependency, minimizes physical strain on workers, and improves overall productivity. It also helps in reducing processing time and post-harvest losses, leading to better economic returns for farmers. Additionally, its relatively simple design and ease of operation make it suitable for small- and medium-scale farming operations.

The Multi-Blade Motorized Areca nut Dehusking Machine represents a transformative shift in agricultural processing, effectively bridging the gap between traditional labor-intensive methods and modern industrial requirements. By integrating a high-speed motorized system with a multi- blade configuration, this technology dramatically enhances throughput while reducing the physical drudgery and high costs associated with manual peeling.

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