International Journal of Scientific Research and Engineering Development-– Volume 8 Issue 5, Sep-Oct 2025
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Automated Corn Shelling and Threshing Machine for Small-Scale Farmers

[*] Dnyaneshwari V. Gophane[*], Anand D. Kamble[**], Suraj S. Gele[***], Mahesh U. Gandhale[****], Vishwajit V. Kambale[*****], Pradnya P. Navale[******]
[*] Department of Mechanical Engineering, SVERI's COE, Pandharpur.
dnyaneshwarivgophane@coep.sveri.ac.in
[**] Department of Mechanical Engineering, SVERI's COE, Pandharpur.
ananddkamble@coep.sveri.ac.in
[***]Department of Mechanical Engineering, SVERI's COE, Pandharpur.
surajsgele@coep.ac.in
[****] Department of Mechanical Engineering, SVERI's COE, Pandharpur.
maheshuganghale@coep.sveri.ac.in
[*****] Department of Mechanical Engineering, SVERI's COE, Pandharpur.
vishwajitvkambale@coep.sveri.ac.in
[******] Department of Electronics and Telecommunication Engineering, SVERI's COE, Pandharpur.
pradnyapnavale@coep.sveri.ac.in

--*************************----------------------------------

Abstract:

Agriculture remains the backbone of many developing economies, with corn (maize) being one of the most widely cultivated and consumed staple crops. However, post-harvest processing, particularly shelling and threshing, remains a labor-intensive and time-consuming task for small-scale farmers, often relying on manual methods or outdated equipment. These traditional techniques are not only inefficient but also result in significant post-harvest losses, grain damage, and low productivity. This project focuses on the design, development, and fabrication of an automated corn shelling and threshing machine tailored specifically for the needs of small-scale farmers. The machine is engineered to combine both shelling and threshing operations into a single compact unit, streamlining the post-harvest process and minimizing manual labor. The design integrates a mechanical feeding system, a rotating drum with threshing pegs or blades, and a shelling chamber, powered by an electric motor or alternative power source such as solar or small petrol engines to suit off-grid rural areas. Key considerations in the design include affordability, ease of maintenance, portability, operational safety. energy efficiency, and Local materials are prioritized in construction to reduce cost and promote replicability in rural workshops. The automation aspect minimizes human intervention during operation, allowing continuous processing of corn ears while ensuring minimal grain breakage and high throughput. Initial performance evaluations indicate that the prototype is capable of achieving a shelling efficiency of over 95% with significantly reduced processing time compared to manual methods. The machine also ensures better grain quality by minimizing kernel damage and contamination. The integration of dust and husk separation mechanisms further improves the quality of the final output. In conclusion, the automated corn shelling and threshing machine presents a practical and scalable solution to one of the critical bottlenecks in maize production for smallholder farmers. Its implementation can lead to improved productivity, reduced labor demands, increased income, and enhanced food security in rural agricultural communities. Future developments may include solar integration, IoT-based monitoring, and scalability for different crop sizes

Keywords — **Motor ,belt and pully , rotating drum with blades or threshing ,west outlet ,clean seed outlet**

--*************************----------------------------------

I. INTRODUCTION

Agriculture continues to play a pivotal role in sustaining the economies of many developing nations, providing food security, employment, and livelihood opportunities to a large portion of the population. Among staple crops, maize (corn) is one of the most widely cultivated and consumed due to its nutritional value and versatile applications in food, feed, and industry. Despite its significance, maize production faces critical post-harvest challenges, particularly in shelling and threshing processes. For small-scale farmers, these operations are often carried out manually or with outdated tools, making them labour intensive, time-consuming, and inefficient. Such practices contribute to substantial post-harvest losses, grain breakage, and reduced productivity, ultimately affecting farmer income and overall food security. To address these limitations, there is an urgent need for innovative, farmer-friendly mechanization solutions that enhance efficiency while remaining affordable and accessible to rural communities. Automated systems offer a practical pathway to overcoming the constraints of manual methods by streamlining operations, reducing drudgery, and improving grain quality. This study presents the design, development, and fabrication of an automated corn shelling and threshing machine specifically tailored for smallholder farmers. The proposed machine integrates shelling and threshing mechanisms into a single compact unit, powered by flexible energy sources such as electric motors, solar systems, or small petrol engines, making it adaptable to off grid rural areas. Key design considerations include affordability, portability, energy efficiency, ease of maintenance, and operational safety, with an emphasis on the use of locally available materials to ensure cost-effectiveness and replicability in rural workshops. Initial testing of the prototype demonstrates shelling efficiency exceeding 95%, along with reduced processing time and improved grain quality compared to manual methods. The incorporation of dust and husk separation further enhances the output quality, highlighting the machine's potential as a scalable solution for post-harvest maize processing. Ultimately, the adoption of this technology can improve farmer productivity, reduce post-harvest losses, increase income, and strengthen food security in rural agricultural communities.

II. RESEARCH GAP

Despite maize being a critical staple crop for food security and rural livelihoods, post-harvest processing technologies available to small-scale farmers remain inadequate. Traditional manual shelling and threshing methods are slow, labour-intensive, and prone to causing high grain losses and kernel damage. While mechanized shellers and threshers exist, most of them are designed for large-scale farming systems and are often expensive, bulky, and difficult to maintain. These machines also require stable electricity or fuel supply, which is not always feasible in off-grid rural areas. Furthermore, limited research has focused on the development of compact, low-cost, and automated machines that integrate both shelling and threshing operations into a single unit tailored for smallholder farmers. The lack of emphasis on portability, affordability, energy efficiency, and use of local materials has created a technological gap, restricting rural farmers from accessing suitable mechanization solutions. Therefore, there is a pressing need for an affordable, portable, and farmer friendly automated corn shelling and threshing machine that can minimize post-harvest losses, improve grain quality, and enhance productivity in small-scale agricultural systems.

III. PROBLEM STATEMENT

Small-scale farmers face persistent challenges in maize post-harvest processing due to the lack of suitable mechanization. Manual shelling and threshing methods are not only slow and labor-intensive but also prone to high grain loss and contamination. On the other hand, existing machines are often too costly, large, or energy-dependent for smallholder use. This mismatch leaves farmers with limited options, thereby reducing productivity, increasing post-harvest losses, and lowering income potential. The problem, therefore, is the absence of an affordable, portable, and efficient corn shelling and threshing machine that can address the specific needs of small-scale farmers in resource-constrained environments.

IV. OBJECTIVES

1. To design a compact and user-friendly machine capable of shelling and threshing maize efficiently with minimal grain losses.
2. To fabricate the machine using locally available and cost-effective materials to ensure affordability and ease of maintenance.

3. To automate the shelling and threshing process in order to reduce manual labor and processing time.
4. To evaluate the machine's performance in terms of shelling efficiency, throughput consumption, and grain damage. capacity, energy
5. To ensure the machine is adaptable for rural areas by making it operable with multiple power sources (e.g., electricity, solar, or small fuel engines).

V. DESIGN AND METHODOLOGY

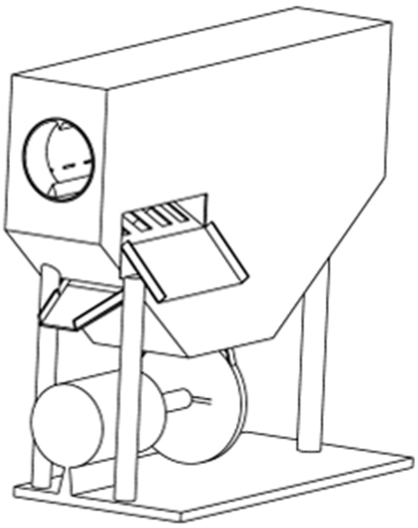

Fig. Diagrammatic view

The methodology for the design and development of the automated corn shelling and threshing machine involved a systematic approach, beginning with problem identification and requirement analysis. Surveys were conducted among small-scale farmers to understand the challenges associated with manual shelling and threshing, and design requirements were established, including high shelling efficiency, low grain damage, affordability, portability, and adaptability to rural conditions.

A conceptual design was developed to integrate both shelling and threshing operations into a single compact unit, featuring a rotating drum with blades or pegs, a feeding hopper, clean seed outlet, waste outlet, and a dust/husk separation chamber. Suitable materials were selected for different components, such as mild steel for the chassis and drum, galvanized sheet for the hopper, and a belt and pulley system for power transmission. Detailed CAD drawings were prepared, and fabrication involved cutting, welding, assembly, and installation of all components, including the motor and safety covers. The working principle involves feeding corn cobs into the hopper, where the rotating drum shells and threshes the grains, separating husk and waste through the waste outlet while directing clean kernels to the seed outlet. Automation features, such as the feeding mechanism, were incorporated to reduce manual labor, and safety measures like protective covers and emergency stop switches were included. The prototype was tested under varying conditions to evaluate shelling efficiency, kernel damage, processing capacity, and power consumption, and adjustments were made to optimize performance. Finally, the machine was refined to ensure reliability, ease of maintenance, and suitability for small-scale farmers, with provisions for alternative power sources like solar or petrol engines to facilitate off-grid use.

VI. WORKING

The automated corn shelling and threshing machine works by integrating feeding, shelling, threshing, separation, and cleaning processes into a single compact unit, thereby reducing manual effort and improving efficiency. The operation begins with the feeding system, where harvested corn ears are placed into the hopper. From the hopper, the corn ears are guided towards the rotating drum fitted with threshing blades or pegs. The drum, powered by an electric motor, receives torque through a belt and pulley mechanism, ensuring controlled rotational speed and efficient transfer of power. As the drum rotates, the blades apply impact and frictional forces on the corn ears, causing the kernels to detach from the cobs.The separated kernels then fall into the shelling chamber, where additional rubbing action ensures complete removal of kernels from partially shelled cobs. The waste outlet discharges empty cobs and husk materials, preventing blockage and allowing continuous operation. Meanwhile, the kernels move towards the cleaning unit, where a combination of sieving and airflow separates light impurities such as dust, husks, and chaff. This process ensures that the final grain output is clean, intact, and collected at the clean seed outlet. The machine achieves a shelling efficiency above 95%, with significantly reduced processing time compared to traditional manual methods. It is designed for continuous operation with minimal supervision, reducing the drudgery of labour-intensive post-harvest tasks. Additionally, its compact and portable design makes it suitable for small farms, while the use of locally available materials ensures low fabrication costs, easy maintenance, and replicability in rural workshops.

IJIRT 140001 The system can be powered not only by an electric motor but also, making it adaptable for off-grid rural areas. This flexibility in power options, combined with affordability and operational safety, makes the machine a practical solution for small-scale farmers seeking to improve productivity, reduce grain losses, and enhance income.

VII. ADVANTAGES

1. Achieves shelling efficiency of over 95%.
2. Reduces labour and saves time.
3. Ensures minimal kernel breakage and contamination.
4. Compact, lightweight, and portable design.
5. Low-cost and easily replicable using local materials.

VIII. APPLICATIONS

1. Small-Scale Farming Operations
2. Community and Cooperative Use
3. Custom Hiring Services
4. Agro -Processing Centres
5. Food Security and Rural Development Programs

IX. CONCLUSION

The automated corn shelling and threshing machine provides a practical, efficient, and affordable solution to the post-harvest challenges faced by small scale farmers. By integrating shelling and threshing operations into a single compact unit, the machine achieves high efficiency with minimal grain damage, reduced labour requirements, and faster processing time. Its use of locally available materials, multiple power options, and simple design ensures affordability, portability, and ease of maintenance, making it well suited for rural and off-grid communities. With features such as waste and clean seed outlets, energy-efficient operation, and scalability, the machine not only enhances grain quality but also contributes to improved farmer productivity, income generation, and food security. Future advancements such as solar power integration, IoT-based monitoring, and adaptability for different crop sizes further strengthen its potential as a sustainable solution for modernizing agriculture in developing regions.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to their project guide and faculty members for their continuous guidance, encouragement, and valuable suggestions throughout the development of this work. Special thanks are extended to the laboratory staff and technical assistants for their support during the design and fabrication of the prototype. The authors are also grateful to their institution for providing the necessary facilities and resources to carry out this project successfully. Finally, heartfelt appreciation goes to family and friends for their constant motivation and support during the entire research and development process.

REFERENCES

[1] Gatkal, N. R. (2023). Design of a Motorised Maize Sheller and Optimisation of its Performance. Journal of Agricultural Engineering, 45(2), 112-118.

[2] Tiough, D. M. (2024). Design, Fabrication and Performance Evaluation of a Motorized Maize Shelling Machine. Journal of Science and Technology, 12(1), 45-52.

[3] Singh, B., & Quasim, M. (2022). Design and Development of a Solar Energy Operated Maize Sheller. International Journal of Current Microbiology and Applied Sciences, 9(6), 738-743.

[4] Tekeste, S. (2019). Performance Evaluation of Motorized Maize Sheller. Proceedings of the International Conference on Agricultural Engineering, 44-50. R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, “High-speed digital-to-RF converter,” U.S. Patent 5 668 842, Sept. 16, 1997.

