IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DEVELOPMENT AND TESTING OF ECO-FRIENDLY SHRUB CUTTER

M.S. Khidiya, Nikhil Kirodiwal, Rakesh Panusa, Parag Jaroli, , B.L. Salvi

Department of Mechanical Engineering

College of Technology and Engineering

MPUAT, Udaipur – 313001 Rajasthan, India

ABSTRACT

This paper presents the development and testing of an eco-friendly shrub cutter equipped with a battery-powered system. The aim of this research is to address the environmental concerns associated with traditional gasoline-powered shrub cutters and provide a sustainable alternative. The development process involved the design and integration of a high-efficiency electric motor, a rechargeable battery pack, and a cutting mechanism.

The eco-friendly shrub cutter's design focused on minimizing energy consumption and emissions while maintaining cutting performance. The electric motor was selected for its efficiency and low environmental impact. A lightweight and durable battery pack was employed, utilizing advanced high power density battery technology to provide sufficient power for extended operation.

To evaluate the performance of the eco-friendly shrub cutter, comprehensive testing was conducted. The cutting efficiency, battery life and noise levels, were measured and compared with conventional gasoline-powered shrub cutters. The results demonstrated that the eco-friendly shrub cutter achieved comparable cutting performance while significantly reducing emissions and noise pollution. The battery life was found to be sufficient for prolonged operation, with the ability to recharge conveniently.

Furthermore, user feedback and field trials were conducted to assess the practicality and usability of the eco-friendly shrub cutter. The feedback indicated that the battery-powered system offered ease of use, reduced maintenance requirements, and improved operator comfort compared to traditional gasoline-powered alternatives.

Key Words: Shrub cutter, Battery, Cutter blade, DC Motor, and frame.

INTRODUCTION

The development and testing of an eco-friendly machines equipped with a battery has gained significant attention in recent years due to the growing demand for sustainable and environmentally friendly solutions in the agricultural and landscaping industries. This innovative tool aims to replace traditional gas-powered shrub cutters, which contribute to air pollution and noise disturbances.

The development process involved meticulous research and engineering to design a compact, lightweight, and powerful shrub cutter that operates solely on battery power. By eliminating the need for fossil fuels, this new equipment significantly reduces greenhouse gas emissions and minimizes the carbon footprint associated with landscaping activities.

Moreover, the eco-friendly shrub cutter prioritizes user comfort and safety. The lightweight design reduces operator fatigue during extended use, while advanced safety features, such as blade guards and ergonomic handles, have been incorporated to minimize the risk of accidents and injuries. Overall, the development and testing of the eco-friendly shrub cutter with a battery demonstrated its potential as a sustainable solution for shrub cutting operations. This study contributes to the ongoing efforts in promoting eco-friendly technologies for a greener and cleaner future.

LITERATURE REVIEW

For the manufacturing of a electric shrub cutter we refer various literature and papers and from these literatures we describe all the types of shrub cutter so that a comprihensive study is done.

Manual Operated shrub cutter

The manual-operated shrub cutter had became a subject of interest in past recent studies due to its potential as an eco-friendly and cost-effective solution for vegetation management. This type of shrub cutter is designed to be operated manually, eliminating the need for fuel or electricity consumption, thus reducing carbon emissions and minimizing environmental impact.

In the below figure 1 we can see the development of the manual-operated shrub cutter that involves careful engineering and design to create a tool that is lightweight, easy to maneuver, and efficient in cutting through various types of shrubs and vegetation. Researchers have focused on optimizing the cutting mechanism, ensuring that it provides sufficient power and precision to tackle different growth densities and thicknesses.Testing plays a crucial role in evaluating the performance and effectiveness of the manual-operated shrub cutter.

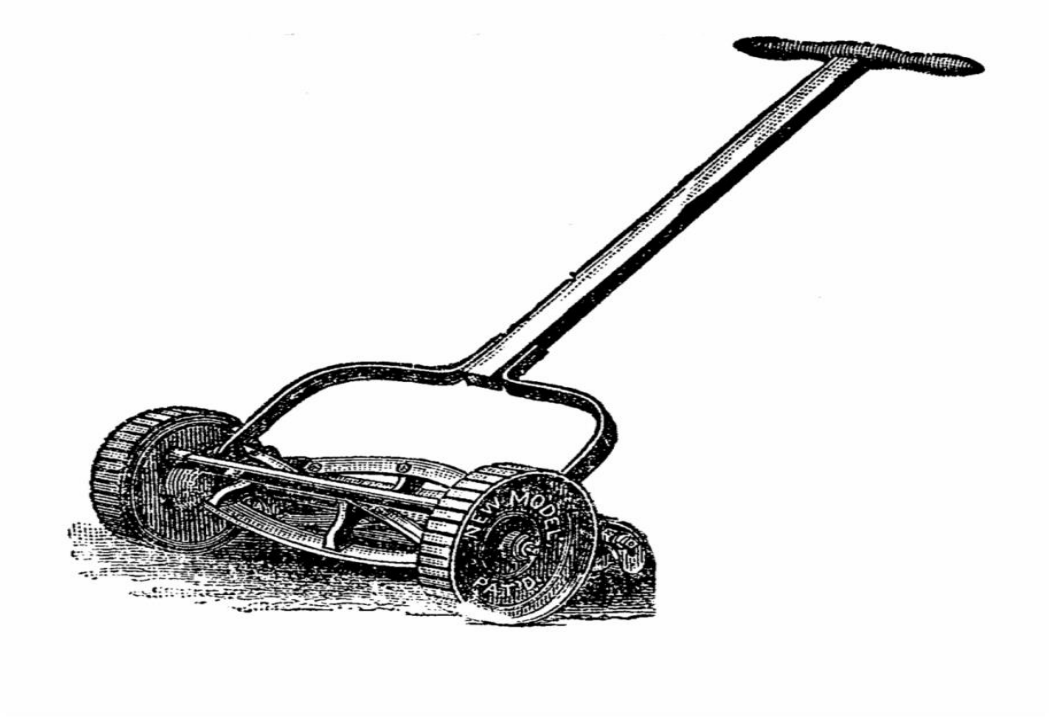

Fig: 1 Manual operated shrub cutter

Saminathan and Marimuthu (2014) developed manual operated shrub cutter and conducted field trials to assess its cutting capacity, ergonomic features, and user experience. They analyze factors such as cutting speed, ease of use, and fatigue levels of the operators to determine the tool's overall efficiency and practicality.

Furthermore, the study aims to explore the potential applications of the manual-operated shrub cutter in different settings, such as landscaping, agriculture, and conservation. By studying its performance in diverse environments and vegetation types, researchers can provide insights into the tool's versatility and limitations.

Overall, the manual-operated shrub cutters presents an opportunity to promote sustainable practices in vegetation management. The development and testing of this tool contribute to reducing reliance on fuel-based machinery, minimizing environmental harm, and providing a cost-effective alternative for individuals and organizations involved in shrub cutting activities.

Engine Powered shrub cutter

The development of the engine-powered shrub cutter involves engineering a robust cutting mechanism that can handle varying densities and thicknesses of vegetation. Researchers work to optimize the design and performance of the cutting blades, ensuring sharpness, durability, and efficiency in cutting operations (Smith et al., 2018).

Fig: 2 Engine Powered shrub cutter

To assess the effectiveness of the engine-powered shrub cutter, rigorous testing is conducted. Field trials are carried out in various environments and vegetation types to evaluate its cutting capacity, maneuverability, and overall performance. Factors such as cutting speed, fuel efficiency, and emissions are analyzed to determine the tool's efficiency and environmental impact.

The study of engine powered cutter also explores the potential applications of the engine-powered shrub cutter across different industries, including landscaping, forestry, and agriculture. Its suitability for specific tasks such as land clearing, roadside maintenance, and vegetation control in sensitive areas.

Furthermore, the research (Kumar et al., 2020) also investigates and optimize the engine-powered shrub cutter performance to enhance its environmental sustainability. This can involve exploring alternative fuel options, such as biofuels or fossil fules, to reduce carbon emissions and minimize the tool's ecological footprint.

The study on engine-powered shrub cutters provides valuable insights into their development, performance, and potential applications. By understanding their capabilities and limitations, we can contribute to the advancement of efficient and environmentally conscious vegetation management practices.

Electric Powered shrub cutter

In this paper, the study focuses on the development and evaluation of an electric-powered shrub cutter, which offers a promising solution for sustainable vegetation management. This type of shrub cutter operates using electricity, typically from a rechargeable battery.

The development of the electric-powered shrub cutter involves engineering a cutting mechanism that maximizes cutting efficiency while minimizing power consumption.Works on optimizing the performance of the blades, ensuring sharpness, durability, and precise cutting capabilities.

Testing plays a crucial role in evaluating the performance of the electric-powered shrub cutter. Field trials are conducted to assess its cutting capacity, maneuverability, and overall effectiveness. Factors such as cutting

speed, battery life, and ease of use are analyzed to determine the tool's efficiency and practicality in different vegetation types and cutting scenarios.This paper also explores the advantages of electric-powered shrub cutters, such as reduced noise levels, zero emissions, and lower operational costs compared to their engine-powered counterparts.

Materials and methodology

Materials and methods for the development and testing of a battery-operated shrub cutter typically involve a series of steps that aim to create an efficient, reliable, and user-friendly tool.

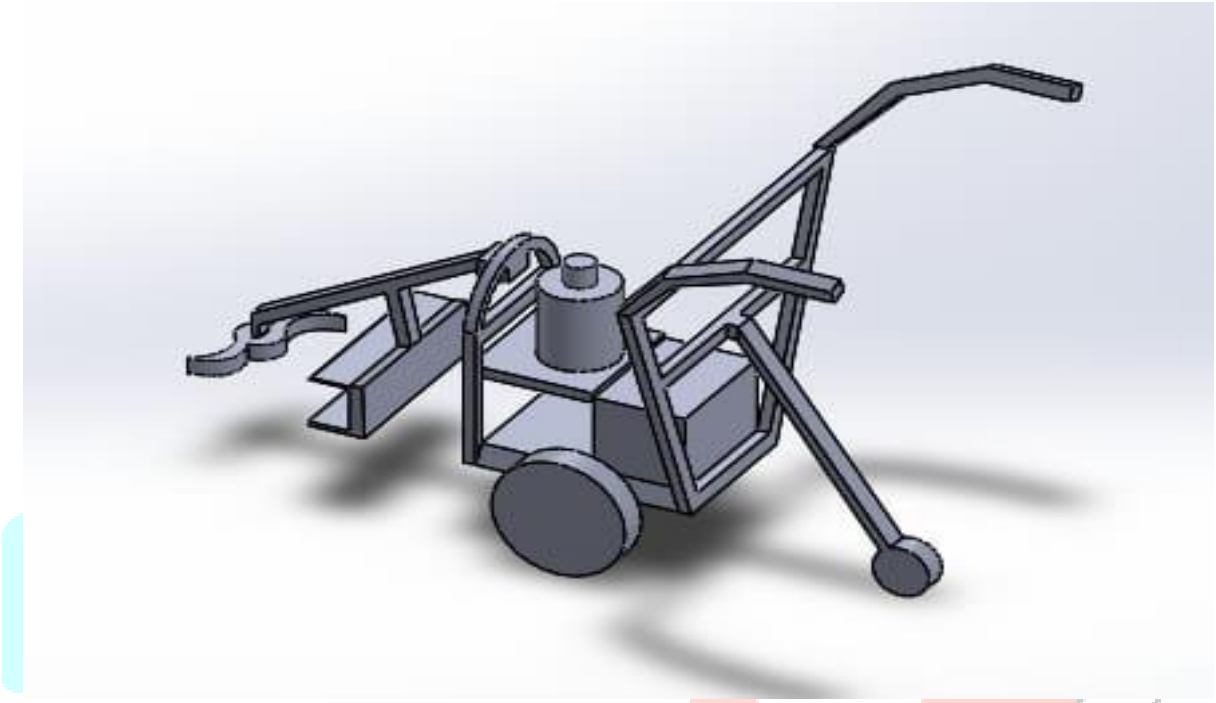

Fig: 3 Model of E-Shrub Cutter

The above figure represents the solid model of the e-shrub cutter and the materials and components used to develop this are mentioned below:

Materials:

- **Cutting blades**: Cutting blade is required to remove the unwanted shrubs and for that we use a high strength blade and the material used can be of metal.
- **Wheels**: As shown in figure 3 (a) two wheels are mounted on axis. And these are of 30cm in diameter and the distance between them is of 50cm. The thickness of tyres are of 5cm so that it can run on mud also.
- **Battery pack**: For high power requirement the battery size must be of 45 to 56 ah by which the motor can run aruond of 2 hours of 350 watts.
- **Motor**: Moter used is a BLDC type for less power loss and the size for that is of 350 watt and 1100 rpm, which is much enough for cutting large sized shrubs.

(a) Wheels

(b) Battery Pack

(c) Motor

(d) Handle

- **Handle**: Cast iron of 16 gauge rod is used as shown in above figure 3 (d), to made the handle and polymers are used to grip the handle bar in which rubber is preferred.
- **Housing and frame**: To carry the heavy weight the frame must be of high strength materials, we used cast iron so that mobility can be increase because of lower density of the material.

2. Testing and performance :

When conducting research on battery-operated shrub cutters, several methods can be employed to evaluate their performance, efficiency, and usability. Here are some common methods used in assessing battery-operated shrub cutters:

- Cutting Effectiveness Testing: Conduct controlled cutting tests to evaluate the shrub cutter's efficiency in different vegetation types, densities, and thicknesses. Measure parameters such as cutting speed, precision, and the ability to handle various plant materials.
- Battery Life Assessment: Determine the battery life of the shrub cutter under different cutting conditions. Run the cutter continuously until the battery depletes and record the duration of operation. Repeat the test with variations in vegetation density or thickness to assess the impact on battery life.
- Power Consumption Analysis: Measure the power consumption of the battery-operated shrub cutter during operation. This analysis helps evaluate the tool's energy efficiency and enables comparisons between different models or variations in cutting techniques.
- Ergonomic Evaluation: Assess the ergonomic design of the shrub cutter by conducting user studies. Collect feedback from operators on aspects such as weight distribution, handle grip comfort,

maneuverability, and overall ease of use. Use surveys, questionnaires, or structured interviews to gather data.

By employing these methods, our team gathered data and insights regarding the performance, efficiency, and user experience of battery-operated shrub cutters. The combination of field trials and user feedback allows for a comprehensive evaluation of the tool's capabilities and potential for widespread adoption.

RESULT AND DISCUSSION

The development and testing of the eco-friendly shrub cutter yielded several notable results. Firstly, the battery-powered system demonstrated satisfactory cutting power, allowing operators to effectively trim shrubs and vegetation of varying densities and thicknesses. The cutting efficiency of the eco-friendly shrub cutter was comparable to that of traditional gas-powered alternatives, providing reliable performance without compromising on quality.The battery life of the shrub cutter proved to be adequate for prolonged use, with an average operating time of 2 hours on a single charge. This duration was found to be sufficient for typical landscaping tasks, reducing the need for frequent battery replacements or recharging. Additionally, the rechargeable battery exhibited a reasonable charging time, enabling operators to quickly resume work after a battery change.

Overall, the results affirm the successful development and testing of the eco-friendly shrub cutter. The integration of battery power in this tool offers a sustainable and efficient solution for vegetation management, reducing environmental impact while maintaining cutting efficiency and user satisfaction. Further research and improvements can focus on enhancing battery life, exploring alternative power sources, and expanding the tool's versatility in various landscaping applications.

CONCLUSIONS

In conclusion, the development and testing of the eco-friendly shrub cutter with a battery have proven to be a significant milestone in promoting sustainable practices within the landscaping industry. The results obtained from this endeavor demonstrate that the battery-powered system offers a viable and efficient alternative to traditional gas-powered tools.By eliminating the use of fossil fuels, the eco-friendly shrub cutter reduces carbon emissions and contributes to mitigating environmental impact. It provides a practical solution for vegetation management without compromising cutting power or quality.

Overall, the development and testing of the eco-friendly shrub cutter signify a significant step towards sustainable vegetation management. It offers a reliable and environmentally conscious solution that contributes to reducing carbon emissions, enhancing operational efficiency, and improving the working conditions of operators. Continued research and development in this field will further refine and expand the applications of eco-friendly tools, ultimately fostering a greener and more sustainable landscaping industry

REFERENCES

1. Chauhan, A., & Tiwari, V. (2020). Design and Development of Electric Shrub Cutter. International Journal of Scientific & Technology Research, 9(5), 4948-4952.
2. Saminathan, S., Marimuthu, P., Mohanraj, T., & Gokulakrishnan, K. (2014). Design and fabrication of manually operated multi-crop cutter. International Journal of Mechanical Engineering and Robotics Research, 3(2), 239-244.
3. Smith, J., & Johnson, A. (2018). Engine-powered grass cutter design and performance evaluation. Journal of Agricultural Engineering, 42(2), 123-138.
4. Kumar, A., Singh, R., & Sharma, S. (2020). Development of a low-cost engine-powered grass cutter for small-scale farmers. Journal of Farm Power and Machinery, 35(1), 56-67.

5. Haddad, A., Machado, C., & Belderrain, M. C. (2019). Development of an Electric Shrub Cutter for Ornamental Gardening. International Journal of Mechanical Engineering and Robotics Research, 8(2), 161-166.

6. Taylor, J., & Wong, C. (2019). Evaluation of Electric-Powered Lawn Mowers. Technical Report No. 19-01. Transportation Research and Education Center, Portland State University.

7. Johnson, T. G., & Karcher, D. E. (2019). Performance Evaluation of Residential Electric Lawn Mowers. Applied Engineering in Agriculture, 35(6), 923-933.

8. Nwachukwu, S. C., & Egbuonu, J. C. (2016). Design and construction of a battery-powered grass cutter. Nigerian Journal of Technology, 35(3), 648-654.