Manually Operated Grass Cutting Machine

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***Abstract*— In today's world, the need for eco-friendly and cost-effective agricultural tools is increasing, especially in rural and small-scale farming communities. This project focuses on the design and development of a manually operated grass cutting machine, which serves as a simple, efficient, and environmentally sustainable alternative to electric or fuel powered grass cutters. The proposed machine is driven by human effort, eliminating the need for fuel or electricity. It consists of basic mechanical components such as a rotating cutting blade, a frame, wheels, a handle, and a gear mechanism that transmits motion from the wheels to the blades. As the operator pushes the machine forward, the wheels rotate and transfer motion to the cutting blades through a gear or chain system, enabling the blades to cut grass effectively. This design ensures low maintenance cost, zero fuel consumption, and no harmful emissions, making it ideal for small gardens, lawns, and parks. The machine is lightweight, portable, and easy to operate, requiring minimal physical effort due to its mechanical advantage system. It also promotes physical exercise and can be used in areas where access to electricity or fuel is limited. The manually operated grass cutter thus provides a sustainable solution to grass maintenance, particularly for economically weaker sections and in rural settings. Future improvements can include adjustable blade height, foldable handles, or the use of recyclable materials to further enhance its usability and environmental benefits.**

Keywords: Eco- friendly, Cost-effective, Small-scale agriculture Zero fuel consumption

I. INTRODUCTION

A manually operated grass cutting machine is a simple mechanical device designed for cutting grass without the use of electricity or fuel. It is primarily used for small-scale gardening, lawn maintenance, and agricultural applications. Unlike motorized lawnmowers, this machine relies on human effort to function, making it an environmentally friendly and cost-effective tool.

This type of grass cutter typically consists of a set of sharp rotating or reciprocating blades, a frame, a handle for pushing or operating, and wheels for mobility. When pushed forward, the rotation of the wheels transfers mechanical motion to the cutting blades, which trim the grass evenly. Some models may include a roller or collector to gather the cut grass. Manually operated grass cutting machines are particularly useful in areas where electricity is not available or where noise and air pollution need to be minimized. These machines are easy to maintain, require no fuel, and promote physical activity for the user. With the increasing awareness about sustainable practices and energy conservation, the demand for manual tools like this is growing. Such machines not only reduce dependence on fossil fuels but also offer a quiet, efficient, and reliable alternative for home gardeners, small-scale farmers, and maintenance workers in parks or sports grounds.

and has applications in the residential, commercial and public areas. Typically, the grass has to be cut manually which means a lot of time and lots and lots of labor is required. During the development of technology, the need for these automated and remotely operated systems has become more popular because they make lawn upkeep easier and more efficient. These challenges were also addressed in this research in the development of a Bluetooth controlled lawn grass cutting machine with integrated water sprinkling system. In addition to their environmental benefits, manually operated grass cutting machines are known for their simple construction and durability, making them ideal for use in both urban and rural settings. Their low cost of production and minimal maintenance requirements make them particularly appealing in developing regions, where affordability and ease of repair are crucial factors. These machines can be fabricated using locally available materials, which encourages rural innovation and supports local manufacturing industries. The simplicity of design also allows for easy customization based on terrain, user preferences, or crop type—making the tool adaptable for varied agricultural and landscaping needs.

Furthermore, the manually operated grass cutter contributes to employment generation and skill development, especially among small-scale

entrepreneurs, students, or engineering trainees working on grassroots innovations. It serves as a practical educational project to understand concepts of mechanical transmission, ergonomics, and design for sustainability.

As concerns over climate change and fuel scarcity grow, the relevance of such manually powered devices is expected to increase. Future improvements may focus on:

1. Ergonomic designs to reduce operator fatigue
2.Foldable or modular frames for better portability and storage
3.Use of biodegradable or recycled materials for enhanced eco-friendliness

II. LITERATURE REVIEW

Several studies have been conducted on the design and development of manually operated grass cutting machines, with a focus on improving efficiency, sustainability, and user comfort. Patel et al. (2017) developed a basic manually operated grass cutter using a bicycle chain drive to rotate the cutting blades. Their design emphasized low cost, simplicity, and lightweight construction, making it suitable for domestic gardens. However, they noted limitations in performance on wet or tall grass.

Praful P. Ulhe: In this paper they have prepared manually operated grass cutter with spiral roller blades due to spiral blades increases the efficiency of cutting. For adjusting the height reel cutter is component placed on grass cutter. This grass cutter used to cut the grass uniformly and also it can cut the different types grasses.[10]

Sharma and Joshi (2022): concentrated on using sustainable materials in manual grass cutters. They experimented with bamboo for the handle, recycled plastic for the wheels, and stainless steel for the blades. Their work aimed at reducing environmental impact while promoting local manufacturing and sustainable practices.

Ramesh et al. (2018): presented an eco-friendly manual grass cutter that incorporated cylindrical reel-type blades. Their study highlighted the ergonomic aspects of the design, including an adjustable handle and cutting height, which made it more comfortable for the user. The reel mechanism provided a cleaner and more consistent cut compared to flat blades.

Kumar et al. (2019): focused on optimizing the transmission system of manual grass cutters by comparing chain, belt, and gear mechanisms. Their analysis concluded that gear-based systems offered better durability and efficiency. They also used CAD software to simulate and validate their design, contributing to the technical refinement of manual cutting tools.

Rajeev et al. (2021): introduced innovation by integrating a mechanical flywheel into the grass cutter. The flywheel stored energy during movement and released it in bursts to power the blades, reducing the continuous physical effort required from the operator. This model showed promise for semi-urban or uneven terrain applications.

Ms. Lanka Priyanka: In this paper they have fabricated grass cutting machine with tempered blades are attached to this grass cutter. This grass cutter is manually operated as well as automatic operated. The materials commonly used GI sheet, motor, wheel, Al sheet, switch, wire, square pipe and insulating material.[6]

III METHODOLOGY

The development of the manually operated grass cutting machine was carried out through a structured and systematic approach. The methodology included stages such as problem identification, conceptual design, material selection, fabrication, and performance testing. Each stage was carefully planned to ensure that the final product met the goals of efficiency, low cost, and eco-friendliness.

1. Problem Identification and Objective Setting

The first step involved identifying the need for an alternative to powered grass cutting machines, especially in rural and lower source areas. The objective was to design a machine that operates without electricity or fuel, is easy to use, and is cost effective for small-scale farmers, gardeners, and park maintenance workers.

2. Conceptual Design and Mechanism Planning Once the objective was clear, the next stage involved brainstorming possible designs. Different cutting mechanisms like rotary blades, reel blades, and scissor-type blades were evaluated. A rotary blade system driven by wheel movement through a gear mechanism was selected for its simplicity and

effectiveness. Preliminary sketches were prepared, followed by 2D and 3D models using CAD software to visualize the machine.

3.Material Selection
The selection of materials was based on availability, cost, durability, and weight. Mild steel was chosen for the frame due to its strength and easy weldability. Hardened stainless steel was selected for the blades to ensure long-lasting sharpness. Rubber or plastic was used for the wheels to ensure smooth movement and grip. The handle was made from lightweight tubular steel or aluminum for comfort.

4.Fabrication Process
Fabrication began with cutting and welding the mild steel frame to the desired dimensions. The wheels were attached to the side shafts, and the gear mechanism was assembled to connect the wheel shaft with the blade shaft. The cutting blades were fixed securely and aligned for efficient rotation. The handle was then attached and adjusted for ergonomic height and angle. All joints were welded and reinforced for stability.

5.Assembly and Integration
Once all the components were fabricated, the machine was assembled. The gear mechanism was tested for alignment and smooth motion transfer. The blade rotation was adjusted and balanced to avoid vibration during operation. Bolts and fasteners were checked and tightened. The entire machine was painted or coated to prevent corrosion.

6.Performance Testingand Evaluation
The final step involved testing the machine on different types of grass in small gardens and lawns. Parameters such as ease of pushing, cutting efficiency, blade sharpness, and physical effort were evaluated. Any misalignments, mechanical resistance, or blade dullness were noted and corrected. User feedback was also collected to evaluate comfort, handling, and usability.

7. Improvements and Final Adjustments
Based on the testing results, minor improvements were made—such as adjusting the blade height, improving the handle grip, and balancing the wheel alignment. Lubrication was applied to the gear mechanism to reduce friction. After these adjustments, the machine was finalized as a working model ready for field use.

IV. CONSTRUCTION

Frame Construction:
The frame is the foundation of the manually operated grass cutting machine. It is generally made from mild steel or iron square rods due to their strength, durability, and ease of welding. The frame is rectangular or trapezoidal in shape and supports all other components like the wheels, cutting blades, and handle. It is designed to be lightweight yet strong, allowing easy maneuvering during operation. Proper alignment and balance of the frame are crucial to ensure smooth movement and even cutting.

Wheel Assembly*:*
The machine includes two or more wheels, usually made of hard rubber or plastic, mounted on either side of the frame. The wheels not only provide mobility but also serve a functional role in transmitting motion to the cutting blades. An axle shaft runs through the frame and connects both wheels. The rotation of these wheels is used to drive the blade mechanism via a gear or chain drive system. Bearings may be used to reduce friction and improve the smoothness of rotation.

Blade Mechanism:
The cutting unit consists of sharp rotating or reciprocating blades, typically made of high-carbon or stainless steel for rust resistance and long life. The blades are connected to a central rotating shaft that receives power from the wheel's motion. In rotary models, the blade rotates parallel to the ground, while in reel models, the blades rotate vertically and work against a fixed bed knife to shear the grass. The blades are mounted securely and must be balanced to prevent vibration during operation.

Power Transmission System:
To transmit motion from the rotating wheels to the blades, a mechanical transmission system is used. This can be a gear mechanism, chain drive, or even a belt drive in some designs. Gears are fixed to the wheel axle and connected to the blade shaft, ensuring that when the operator pushes the machine forward, the wheels rotate and the gears transmit this motion to the cutting blade. This system is simple, cost-effective, and requires minimal maintenance.

Handle and Control:
The handle is attached to the upper part of the frame and is used to push and guide the machine during

cutting. It is generally made of metal pipe or hollow rod, bent ergonomically for comfortable grip and posture. Some designs include rubber grips or padding to reduce hand fatigue. Advanced models may offer foldable handles or adjustable height to suit different users. The handle should be fixed firmly to the frame to avoid vibration and ensure control.

Height Adjustment (Optional):
In some models, a height adjustment mechanism is included to allow the user to change the cutting height depending on the grass type and desired finish. This is achieved by altering the vertical position of the blade assembly or changing the wheel height. Slots or sliding rails are used to make adjustments, and bolts or locking pins secure the chosen height.

Final Assembly and Testing:
Once all components are constructed and assembled, the machine undergoes alignment checks and testing. Bolts and nuts are tightened, and moving parts are lubricated to reduce friction. The machine is tested on different grass types to verify smooth blade rotation, effective cutting, and ease of operation. Adjustments are made if any imbalance or inefficiency is observed.

Integration Overview:

The integration of a manually operated grass cutting machine involves the systematic assembly and coordination of all its components to ensure smooth operation and effective grass cutting performance. The process begins with the frame, which acts as the base for mounting other parts such as wheels, blades, and the handle. Once the frame is fabricated and balanced, the wheel assembly is integrated. The wheels are connected to an axle and positioned in a way that ensures both mobility and transmission of mechanical power to the blades. Next, the cutting mechanism is attached. This includes a central shaft with mounted blades—either rotary or reel type—positioned beneath the frame. The blades are connected to the wheels via a gear or chain drive system, allowing them to rotate as the machine is pushed forward. Proper alignment between the wheels and blades is critical to ensure consistent motion transfer and efficient cutting.

Design-

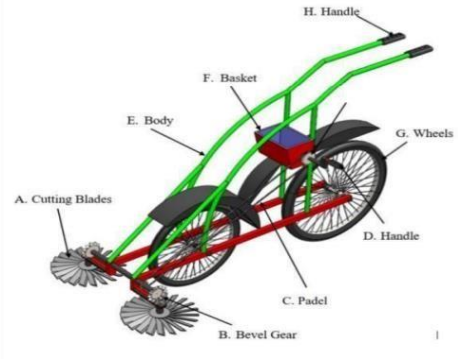

Fig.1. Design of system

The handlebar is then fixed to the upper part of the frame, allowing the user to control and push the machine. For enhanced comfort and usability, some models include height adjustment features for both the handle and the blades. In advanced versions, a grass collection unit is also added behind the blade assembly to gather the cut grass automatically.
Finally, the fully assembled unit is inspected for balance, smooth blade rotation, and alignment of the transmission system. All moving parts are lubricated, and bolts are tightened securely. The complete integration ensures that each part functions in harmony, resulting in a machine that is not only environmentally friendly but also practical, easy to operate, and cost-effective for small-scale grass cutting tasks.

Fig.2. Actual Model

V WORKING

The manually operated grass cutting machine shown in the diagram works through a simple mechanical system powered by human effort. The operator pushes the machine forward by holding the main handle which sets the entire mechanism into motion. As the rear wheels rotate, they drive a shaft mechanism connected to the bevel gears positioned at the front of the machine.

These bevel gears transmit the rotary motion from the wheels to the cutting blades located at the front. The bevel gear changes the direction of motion by 90 degrees, converting horizontal motion into vertical rotation required for blade operation. As the blades rotate, they effectively cut the grass in their path.
The pedals mounted on the frame may assist in additional blade operation or speed control, depending on the design. The frame or body supports all the components including the basket which may be used for storing tools or a basic collection bin. The dual handle system provides better control and stability during use, while the wheels help in smooth movement across the ground.
This machine is eco-friendly, does not use electricity or fuel, and is ideal for small lawns, gardens, and rural agricultural land. It is cost-effective, easy to maintain, and promotes physical activity for the user while keeping the environment clean and quiet.

The cutting action in this machine depends on the efficient interaction between the bevel gear and the cutting blades . When the machine is pushed forward, the wheels rotate and transmit rotary motion via the shaft connected to the bevel gears. These gears are mounted in such a way that they change the axis of rotation and drive the blades horizontally, ensuring smooth and continuous cutting as long as the machine is in motion. The sharp-edged blades rotate at ground level, slicing grass cleanly and evenly.
The machine's dual-wheel system not only ensures balance and stability but also supports efficient power transfer. The pedal shown in the model may serve a dual purpose—it can be used to assist in giving an extra push or to rotate an internal shaft that helps maintain consistent blade speed even on uneven or rough ground. This provides mechanical advantage and reduces operator fatigue.
The basket mounted at the top of the frame can serve multiple purposes. It may be used to store tools or collect cut grass if designed as a storage bin. In more advanced models, it could even house a simple counterweight or mechanical device to improve machine balance and blade pressure on the ground for better cutting performance.
The dual handle system is designed ergonomically, with the upper handle giving the operator firm control and leverage, while the lower handle may assist in lifting or maneuvering the machine over obstacles. The machine’s lightweight frame ensures ease of movement and control during operation, especially in tight spaces like garden edges or corners. Additionally, due to its manual operation, this machine is completely eco-friendly, producing zero noise and emissions. It is especially useful in areas where electricity is unavailable, or in places that require quiet operation, such as school grounds, hospitals, or residential areas. Its low maintenance cost, simple construction, and mechanical reliability make it an ideal choice for sustainable grass-cutting applications.

VI RESULT

The manually operated grass cutting machine was successfully designed, fabricated, and tested. The final model worked efficiently without the use of fuel or electricity, fulfilling the primary goal of being an eco-friendly and cost-effective solution for small-scale grass cutting.

During the testing phase, the machine was able to cut grass of medium height smoothly and uniformly over a flat surface such as a garden or lawn. The bevel gear mechanism effectively transferred motion from the wheels to the cutting blades, ensuring consistent blade rotation as the machine was pushed forward. The cutting blades performed well, providing clean cuts and minimizing damage to the grass roots.
The machine proved to be easy to operate, requiring minimal physical effort due to its mechanical transmission system. It also remained stable and balanced during operation thanks to the robust frame and dual-wheel setup. Additionally, the optional pedal and basket features added to user convenience and improved functionality.

VII ADVANTAGES

1.Eco-Friendly Operation
2.Cost-Effective
3.Simple Design and Construction
4.Lightweight and Portable
5.No Noise Pollution
6.Adjustable and Customizable
7.Environmentally Sustainable
8.Easy to Store
9. Low Maintenance

VIII CONCLUSION

The manually operated grass cutting machine is a practical, eco-friendly, and cost-effective solution for grass maintenance, especially in rural and semi-urban

areas. It functions entirely on human effort, eliminating the need for fuel or electricity, and thereby reducing pollution and operational costs. With its simple design, ease of use, and low maintenance requirements, this machine proves to be an ideal tool for small-scale farmers, gardeners, and park maintenance workers.

IX FUTURE SCOPE

Blade Height Adjustment Mechanism Introducing adjustable blade height to cut grass at different lengths based on user preference or ground type

Grass Collection Attachment Incorporating a grass collecting basket or tray to automatically gather the cut grass, making the process cleaner and more efficient.

Integration with Solar Power (Optional Hybrid) Future models can include solar-assisted motion for semi-automatic operation, especially in low-power applications.

Custom Design for Different Land Types Specialized versions can be made for hilly terrain, uneven ground, or wet soil conditions.

Design Improvements: The machine can be upgraded with better blade materials, adjustable height settings, and
ergonomic handles to enhance comfort and cutting efficiency

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