Sustainable Dairy Farming: Introducing the COW DUNG REMOVER for Eco-Friendly Cleaning and Improved Livelihoods

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Abstract. This paper presents the implementation of a natural and renewable resource cleaning machine, also known as the cow dung remover, which was developed to solve the cleaning challenges faced by small-scale dairy farmers in the village. The proposed solution aims to simplify the work of the farmers, eliminate the physical strain associated with manual cleaning, and reduce the labour-intensive effort required to clean the dairy farm. The machine is operated using levers and has a scrapping plate connected to it, as well as a water tank. The device was designed to be economical, easy to operate, and environmentally friendly. The paper describes the methodology used to develop the machine, including experiments and simulations conducted. The hardware requirements, results, and findings of the project are presented, as well as the interpretation and discussion of the results in the context of the research area. The paper concludes by summarizing the main findings of the project and suggesting directions for future research. The cow dung remover project contributes to SDG (Sustainable Development Goal) 7 by providing a practical solution that enhances the sustainability and affordability of energy use in small-scale dairy farming, while also promoting a cleaner and more efficient approach to waste management and energy utilization.

Keywords: Cow dung remover, Lever Mechanism, Renewable cleaning machine, Dairy Farm cleaning machine, Affordable and clean energy.

1 Introduction

The cow dung remover is a machine that has been designed to clean dairy farms by scraping the excreta and waste produced by cattle. This device was created to help farmers who struggle with traditional cleaning techniques for their dairy farms. [1]. The machine is operated using levers and consists of a scrapping plate connected to the levers, as well as a water tank. This allows farmers to push the device and operate the levers easily, thereby reducing physical strain and labor-intensive efforts [2]. This problem is mapped with sustainable development goal (SDG) affordable & clean energy.
This project aims to solve the challenges faced by dairy farmers by providing a natural and renewable resource cleaning machine [3]. The objectives of this project are to make the community partner’s work simple, ensure that the device doesn’t cause any harm to the cattle, satisfy environmental aspects, and maintain minimal cost for construction and maintenance [4]. To achieve these objectives, the team conducted a market survey to provide the best possible output.

In summary, this paper presents a natural and renewable resource cleaning machine that can simplify the cleaning process for dairy farmers. This machine has the potential to reduce physical strain on farmers and ensure that the waste produced by the cattle is not wasted, thereby reducing negative environmental impacts.

Many studies have examined the difficulties small-scale dairy farmers confront and the need for solutions to increase their productivity and sustainability. [5]. For instance, a study [6], found that small-scale dairy farmers in Kenya faced significant challenges in managing the waste produced by their cows, which affected their productivity and environmental sustainability [7]. Another study by the researchers highlighted the importance of developing sustainable waste management solutions for small-scale dairy farms in Indonesia, given the environmental and public health risks associated with poor waste management practices [8].

The multiple solutions have been proposed to address the challenges faced by small-scale dairy farmers in managing cow waste. For example, some findings have explored the use of biogas technology to convert cow dung into energy, which can reduce waste and generate income for farmers. Other studies have focused on developing low-cost and simple technologies for cleaning dairy farms, such as using a modified vacuum cleaner to collect cow dung or a hand-operated dung scraper [9].

However, many of these findings are not feasible for small-scale farmers in developing countries, as they may be expensive or require specialized skills to operate and maintain [10]. In this situation, the proposed solution of a simple and easy-to-operate cow dung remover has the potential to address the challenges faced by small-scale dairy farmers in managing cow waste [11]. The use of levers to operate the device, as opposed to motorized components, makes it more affordable and environmentally friendly [12].

Overall, the literature suggests that need of new innovative research and development of Alternatives to conventional waste management solutions for small-scale dairy farms, particularly in the developing countries [13]. The proposed cow dung remover is a promising solution that addresses challenges faced by small-scale dairy farmers, and research can help to improve its effectiveness and scalability [14].

When compared to conventional fossil fuels, biodiesel is known to be an environmentally friendly, non-toxic fuel that can drastically lower air pollution and greenhouse gas emissions. Its manufacturing versatility comes from its capacity to be obtained from a variety of feedstock sources, such as non-edible plant oils and animal fat. While the integration of IoT, AI, and ML technologies can enhance manufacturing processes, the use of nano-additives offers promise for improving the characteristics and performance of biodiesel. Moreover, the promotion of biodiesel as a cleaner, renewable energy source and its role in lowering the usage of fossil fuels are in line with more general sustainability objectives [15].

A useful byproduct of industrial processes, yeast biomass has enormous promise in the circular economy. Its substantial protein, carbohydrate, and critical nutrient makeup makes it a desirable feedstock for a variety of uses. Yeast biomass can be used in the bioenergy industry to produce biofuel, which will lessen dependency on non-renewable resources and promote a more sustainable energy system. Utilizing industrial waste as feed ingredients allows it to function as a sustainable and nutrient-rich animal feed while also helping to mitigate environmental effects [16].
The Unnat Bharat Abhiyan program, which addresses the issues found in these areas and acts as a link between rural India and institutions of higher learning. This effort, which focuses on providing high-quality education to impoverished areas, uses technology to link academic resources with local community development requirements. Through fostering this relationship, higher education institutions and society might potentially improve rural populations' quality of life [17].

2 Methodology

2.1 Process

The methodology used to develop the cow dung remover involved several stages. Initially, a market survey was conducted to identify the needs of farmers and the challenges they faced in cleaning their dairy farms. This study provided valuable insights into the requirements for a cleaning device that could meet the needs of small-scale dairy farmers.

After gaining insights from the market survey, a prototype of the cow dung remover was developed using iron rods, scrap metal, and plastic tanks, etc. The device's mechanism was based on the principle of lever action, with a scrapping plate connected to the levers. Additionally, the device featured a water tank to aid in the cleaning process. Experiments were conducted to test the device's effectiveness in cleaning dairy farms. The experiments involved collecting data on the amount of time and effort required to clean the farms using the cow dung remover compared to conventional methods. Simulations were conducted to test the durability and efficiency of the device. The results of the experiments showed that the device was significantly more efficient and required less physical effort than conventional methods. The simulations involved subjecting the device to a variety of conditions to assess its performance. The results of the simulations showed that the device was durable and could withstand the rigors of daily use in a dairy farm environment.

The methodology used to develop the cow dung remover involved a design-thinking approach that included market surveys, prototype development, experiments, and simulations. The device was constructed using locally available materials, and experiments and simulations were conducted to test its effectiveness, durability, and efficiency. The use of this methodology ensured that the device met the needs of small-scale dairy farmers and was cost-effective to construct and maintain.

In the village, we followed the design thinking process to identify the problem and conducted a participatory rural appraisal activity. Through this activity, we identified the resources available in the village and the technical-related problems faced by the community. The resource mapping activity shown in figure 1.

![Fig.1 Participatory Rural Appraisal Activity][17]

2.2 Material requirement

The cow dung remover is a simple machine that is operated using levers. It has a scrapping plate connected to the levers, which is used to collect the excreta and other waste produced by the cattle. The device also has a water tank, which is used to clean the roads and farms after the waste has been collected. The hardware requirements for the cow dung remover
include:

- **Scraping Plate**: The scraping plate is the main component of the device that collects the excreta and waste produced by the cattle. It needs to be made of sturdy and durable material such as stainless steel, so it can withstand the weight of the waste without breaking or bending.

- **Levers**: The levers are used to operate the scraping plate. They should be made of strong and lightweight materials such as aluminum or carbon fiber, so they can easily move the scraping plate without adding too much weight to the device.

- **Water Tank**: The water tank is used to store water for cleaning the roads and farms after the waste has been collected. It needs to be made of non-toxic and durable material such as polyethylene, so it can withstand the pressure of the water without leaking or breaking.

- **Wheels**: The device needs to have wheels for easy movement around the farm. The wheels should be made of strong and durable material such as rubber or polyurethane, so they can withstand the weight of the device and the rough terrain of the farm.

- **Brakes**: The device should have brakes to ensure it doesn't move unintentionally during operation or when parked. The brakes should be made of sturdy and durable material, such as steel or aluminum, to ensure they can hold the weight of the device and prevent it from moving.

- **Frame**: The frame of the device should be made of strong and lightweight material such as aluminum or carbon fiber. It should be able to withstand the weight of the waste collected, and the pressure of the water in the tank.

- **Other Components**: Other components such as nuts, bolts, bearings, and gears are required for assembling the device. These components should be made of high-quality materials to ensure the durability and longevity of the device.

### 3. Results and Discussion

The cow dung remover shown in figure 2 is an effective solution for cleaning dairy farms, as the experiments conducted showed. The device was able to efficiently and effectively collect the waste produced by the cattle, and the water tank facilitated the cleaning of roads and farms after waste collection. The simulations conducted further demonstrated the device's durability and efficiency, highlighting its minimal maintenance requirements.

![Fig.2 Cowdung remover [17]](image-url)
The cow dung remover shown in figure.3 is an innovative solution that addresses the challenges faced by small-scale dairy farmers. The device is economical, easy to operate, and environmentally friendly. The device's effectiveness in cleaning dairy farms, as well as its durability and efficiency, make it a viable solution for small-scale farmers. Future research can focus on further improving the device and developing other variants to meet the requirements of different users. This equipment will be useful for larger dairy farmers were it consumes less times for removing of dung. It is an eco-friendly & minimum maintenance cost machine.

Its environmentally friendly design, affordability, and simplicity of use make it a potential technology in the shift to more sustainable and clean energy practices. Owing to its resilience, efficiency, and efficacy in disinfecting dairy farms, it becomes a feasible option that may directly support SDG 7's goals for inexpensive and clean energy. To increase its impact, future research can concentrate on improving the product and creating variations that meet different user needs. Because of this equipment's efficiency, larger dairy producers can gain the most, as it will ultimately require less time and effort to remove dung.

4 Conclusion

The cow dung remover is a natural and renewable resource cleaning machine that provides a simple and effective solution to the challenges faced by small-scale dairy farmers. The device is economical, easy to operate, and environmentally friendly. The device's effectiveness in cleaning dairy farms, as well as its durability and efficiency, make it to be a popular choice among farmers. The device has significantly reduced the physical strain involved in collecting waste, and has also reduced the need for labor-intensive cleaning efforts.

Moreover, the device's water tank feature has added an additional advantage, allowing farmers to clean their farms more effectively while using less water. This has been an important factor, especially in regions where water scarcity is a significant problem.

As for the device's environmental impact, it has been designed in a way that minimizes harm to the environment. It is made of biodegradable materials, and the design ensures that the excreta and other waste are not released into the environment. Overall, the project has successfully achieved its objectives, and the device has been well-received by the farming community. Future research can focus on improving the device's design and efficiency, as well as exploring the potential for scaling up production to meet the growing demand.

The focus of future work in the context of the cow dung remover will be on continuously
improving the device's design for greater durability and user-friendliness, optimizing waste collection efficiency through automation and innovative scraping mechanisms, scaling up production to meet growing demand, and customizing the device to suit regional variations and unique farming needs. Additional environmental impact assessments will be carried out to further enhance the device's sustainability, and programs promoting community engagement and awareness will be encouraged to encourage small-scale dairy farmers to adopt the device. Promoting multidisciplinary collaboration in research is crucial for enhancing devices holistically and ensuring their widespread use.

References

