MECHTRIX 2025

SOCIETY OF MECHANICAL AND AEROSPACE ENGINEERING STUDENTS- SOMAES

A Presentation On 3D Design Hackathon

Design of a Modular, Versatile, Frugal, Small- Scale Multi-crop cultivation Machine for cash crops in Nepal

Prepared By:

Bikram Bhandari

Sachin Saud

Saroj Basnet

Bibek Bhattarai

CONTENTS

1 Background

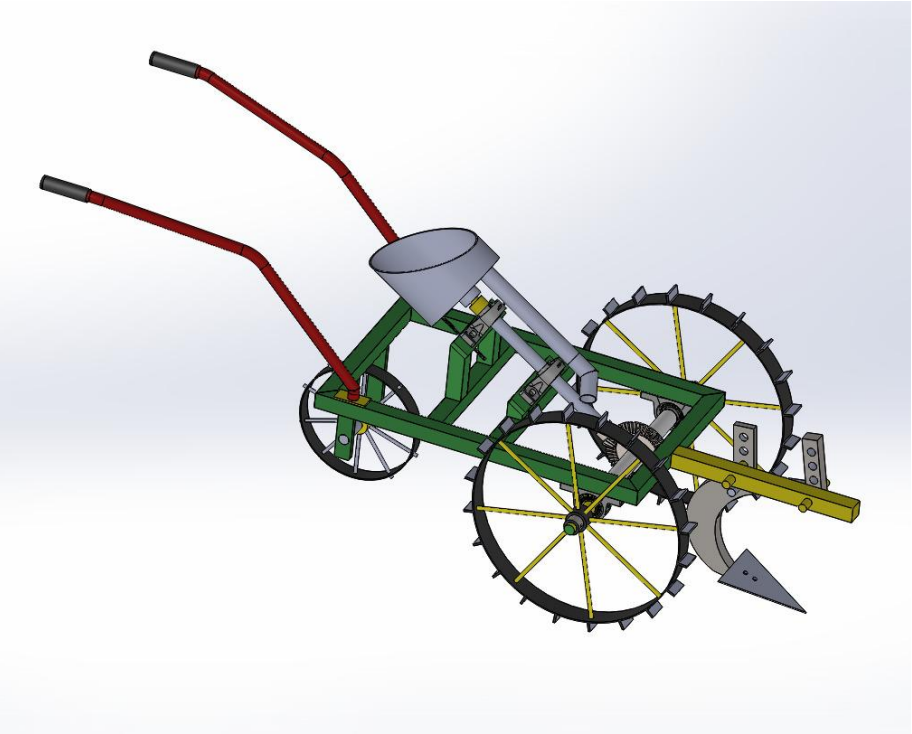
2 Objectives

3 Problem Statement

4 Design & Discussion

5 Budget Estimation

Background



- ***The agricultural landscape of Nepal is diverse and challenging due to varying terrains, soil types, and climatic conditions. Farmers, particularly small-scale ones, face difficulties in increasing productivity due to dependence on manual labor, high-cost machinery, and limited availability of adaptable tools. Addressing these issues, I have designed a modular, versatile, frugal, small-scale agricultural machine that supports cash crop cultivation, optimizing operations for both dry and wet soil conditions. This project was developed during the 3D design hackathon using SolidWorks software.***

Problem Statement

- Farmers in Nepal need affordable machines for cash crops.
- Machines should work in both dry and muddy soil.
- Modular design to adapt to different crops.

Objectives

Primary Objective

- To design a frugal, versatile, small-scale, and modular mechanical machine to assist farmers cultivating a variety of cash crops
- Adapting to both dry and wet soil conditions.
- To design modular mechanism for the cultivating machine that can be adapted for different crops with similar cultivation.
- Operating in a cost-effective and efficient manner with future automation potential.

Secondary Objective

- Design with low in cost for final product.
- Designing an planter that is ergonomical in using.
- Designing of the planter machine that can be manufactured by locally available materials and resources and be manufactured with existing campus or local workshops.
- Maintenance should be simple, with easily replaceable parts.

Design and Discussion

Our innovative multi-crop planting machine addresses these challenges through a modular design. Its core feature is a replaceable rotor plate system, which allows quick adjustments for different crops' seed types, spacing, and depth. This versatility eliminates the need for multiple machines, making it a cost-effective and practical solution

Inspired by the need for modernized planting solutions, our machine simplifies operations for small to medium-scale farmers. Traditional machines are often single-purpose and costly, whereas our frugal modular design ensures adaptability and ease of use. The replaceable rotor plates ensure consistent performance across various field conditions, while the ergonomic design makes it accessible for all users.

Design and Discussion

Key Features of the Designed Machine

1. Small Scale Farming

a. Compact and light weight machine.
b. Operable by individual farmer or small groups.

2. Versatility

a. The machine supports multiple farming tasks such as planting, seeding.
b. It is adaptable to varying crop types like coffee, cardamom, maize and any crops with seed plantation method. (using replaceable metering rotor)
c. Can be made automatic if needed using electric motor or any gasoline engine.
d. Can be operated in any mud condition.

Design and Discussion

3. Frugality

a. Very simple and effective design.
b. Low cost in manufacturing.
c. Simple manufacturing process.
d. Can be manufactured by locally available raw materials and resources.

4. Modular Design

a. Interchangeable attachments and components allow farmers to switch configurations for different crops without investing in new machines such as :

- Detachable plough
- Replacable rotor plate as per crops variation
- Every machine parts can be assembled and disassembled. (Complete modular design)

Design and Discussion

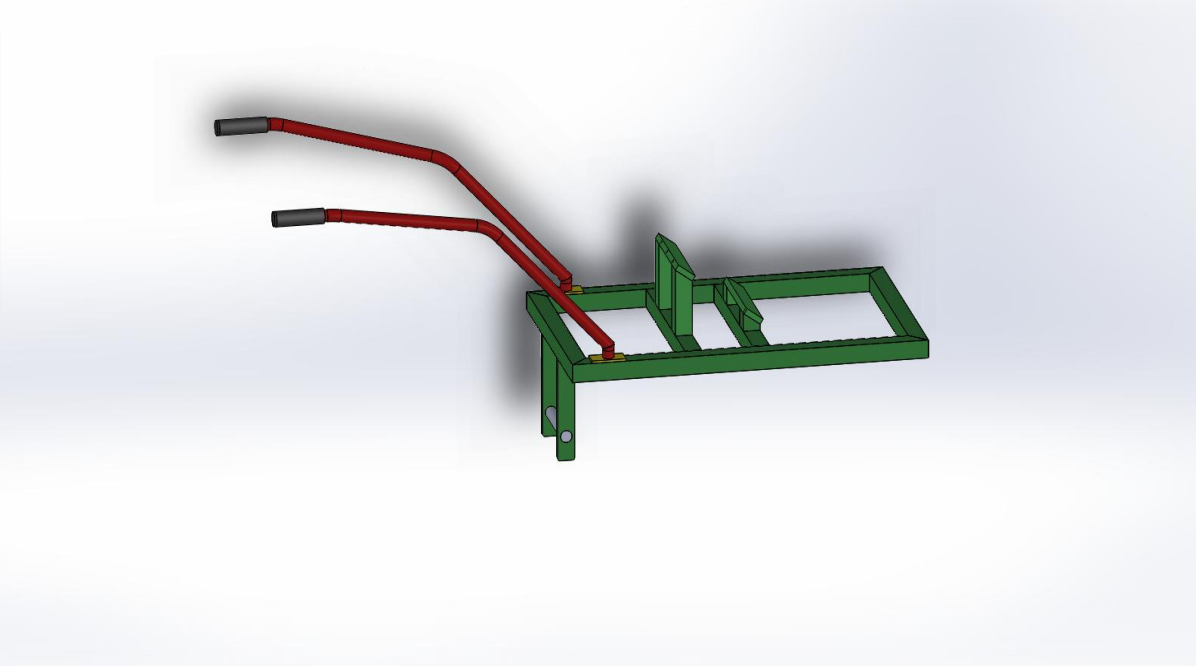
5. Advantage

a. Interchangeable attachments and components allow farmers to switch configurations for different crops without investing in new machines such as :

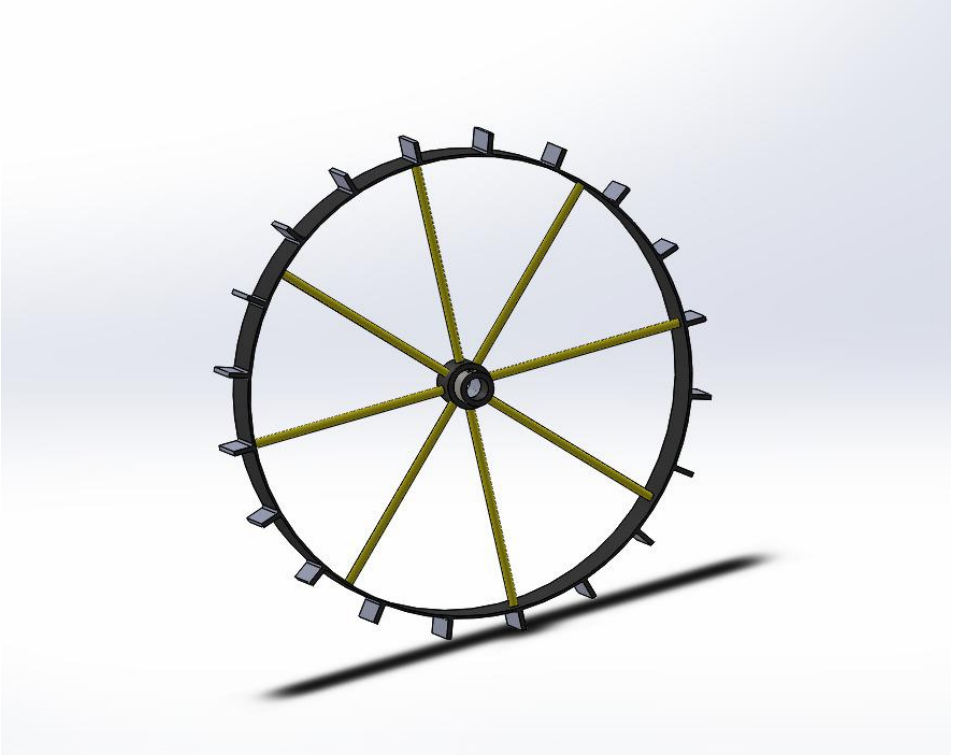
- Detachable plough
- Replacable rotor plate as per crops variation
- Every machine parts can be assembled and disassembled. (Complete modular design)

Mechanical Construction

1. **Frame Structure**

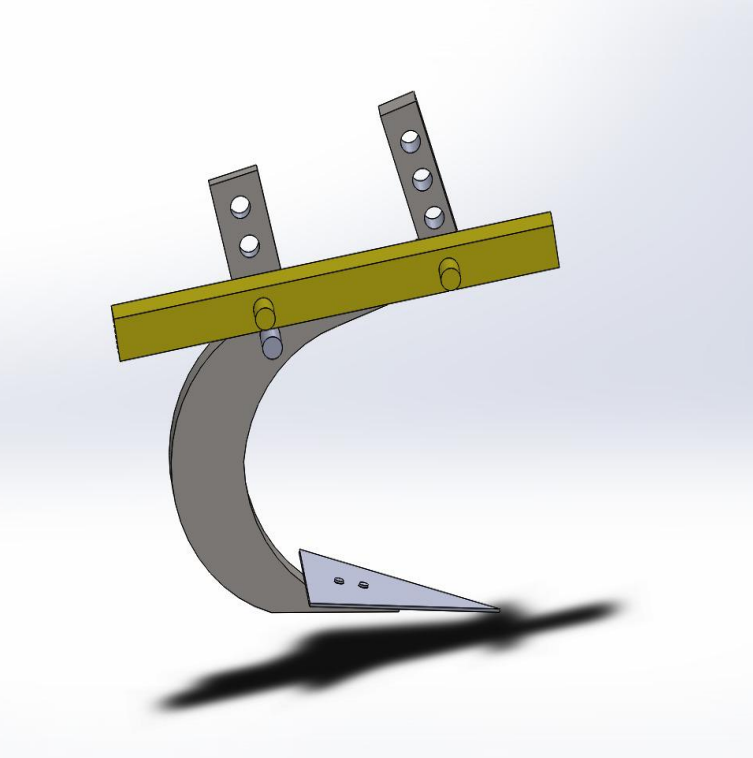


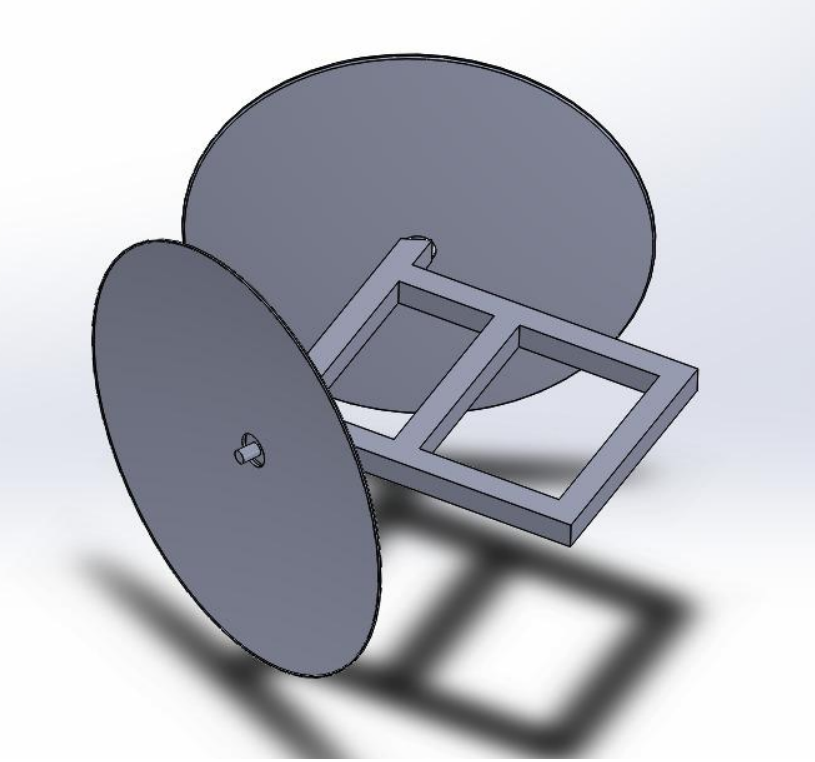
2. **Wheels**



Mechanical Construction

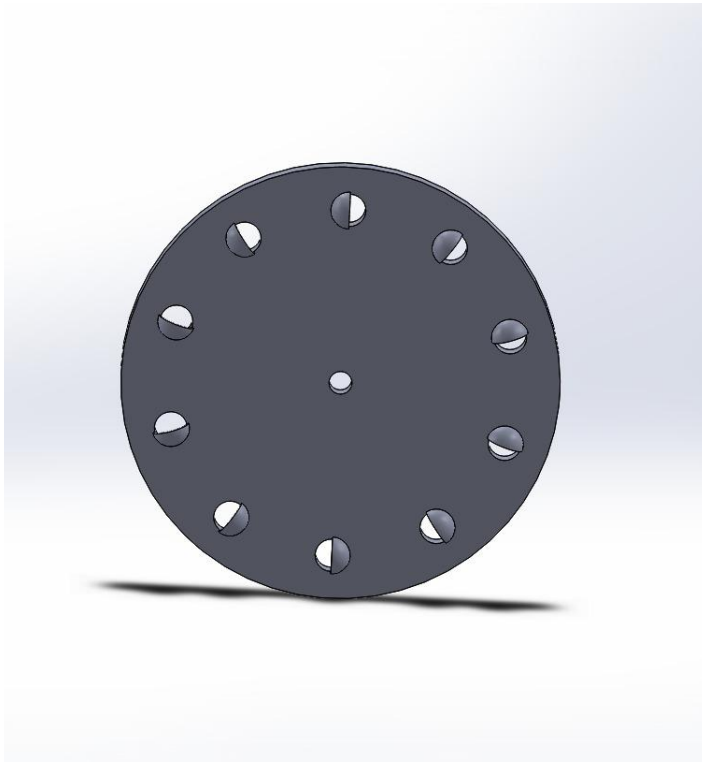
2. Plough and Furrow coverer



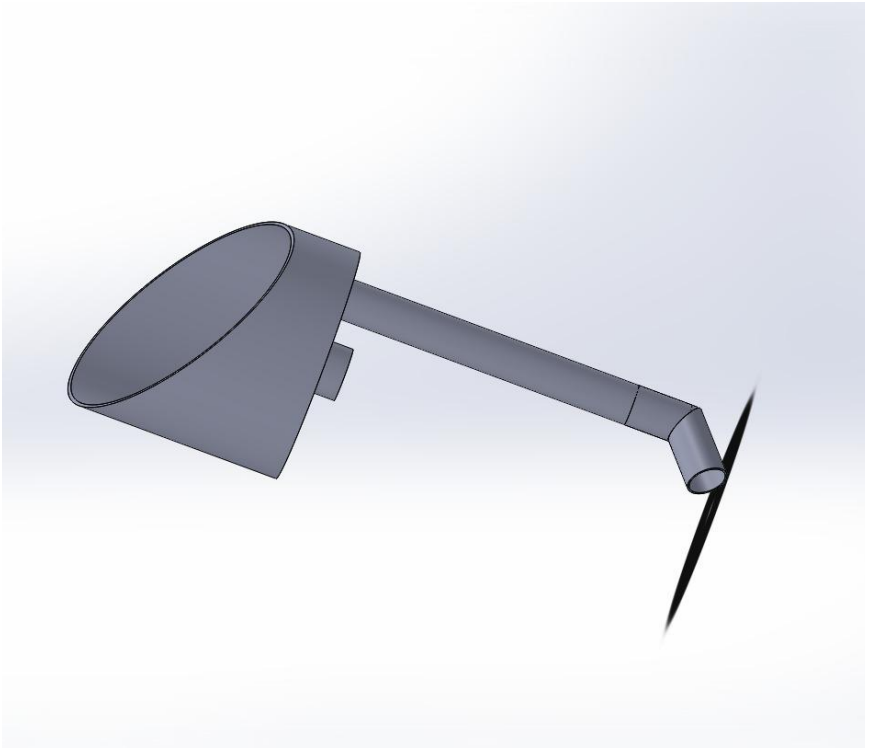


Mechanical Construction

3. Metering Mechanism (Rotor Plate)

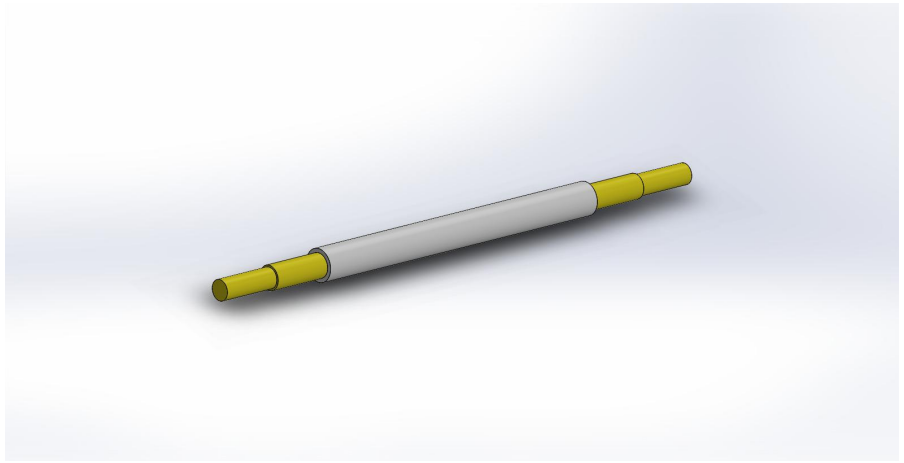


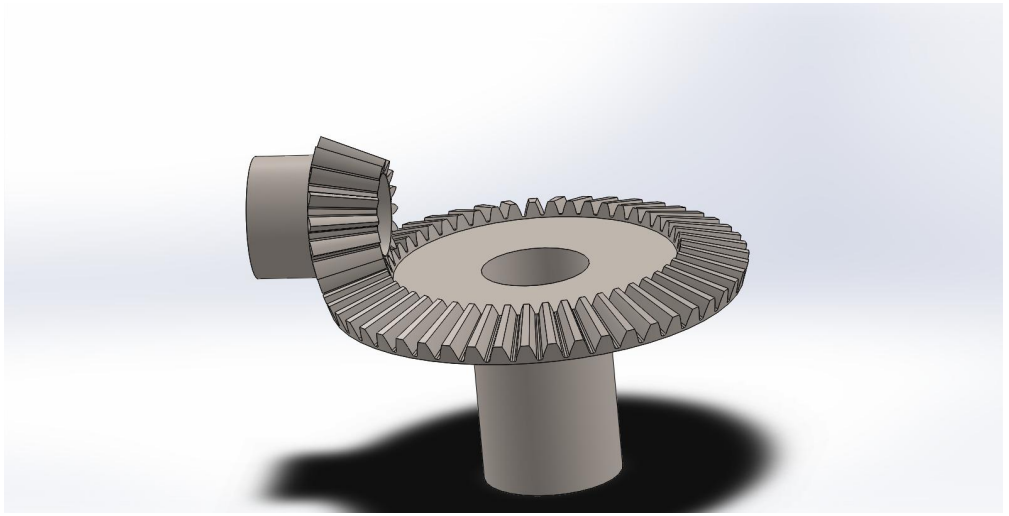
4. Hopper and Chute Duct

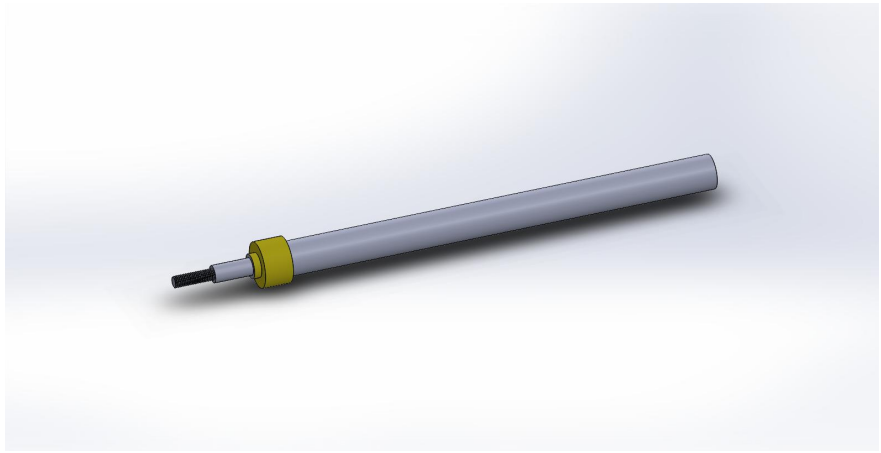


Mechanical Construction

5. Gears and shafts

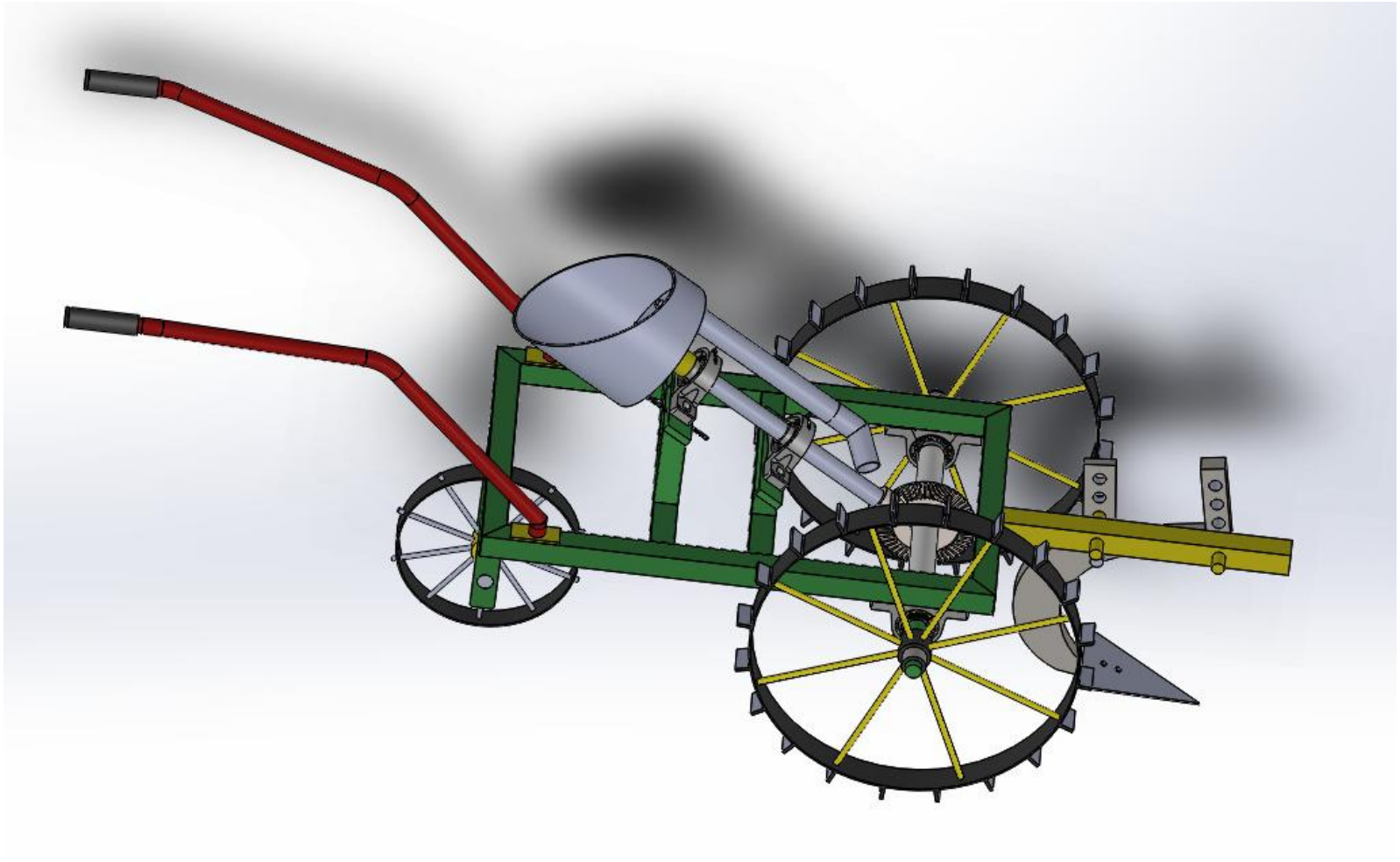






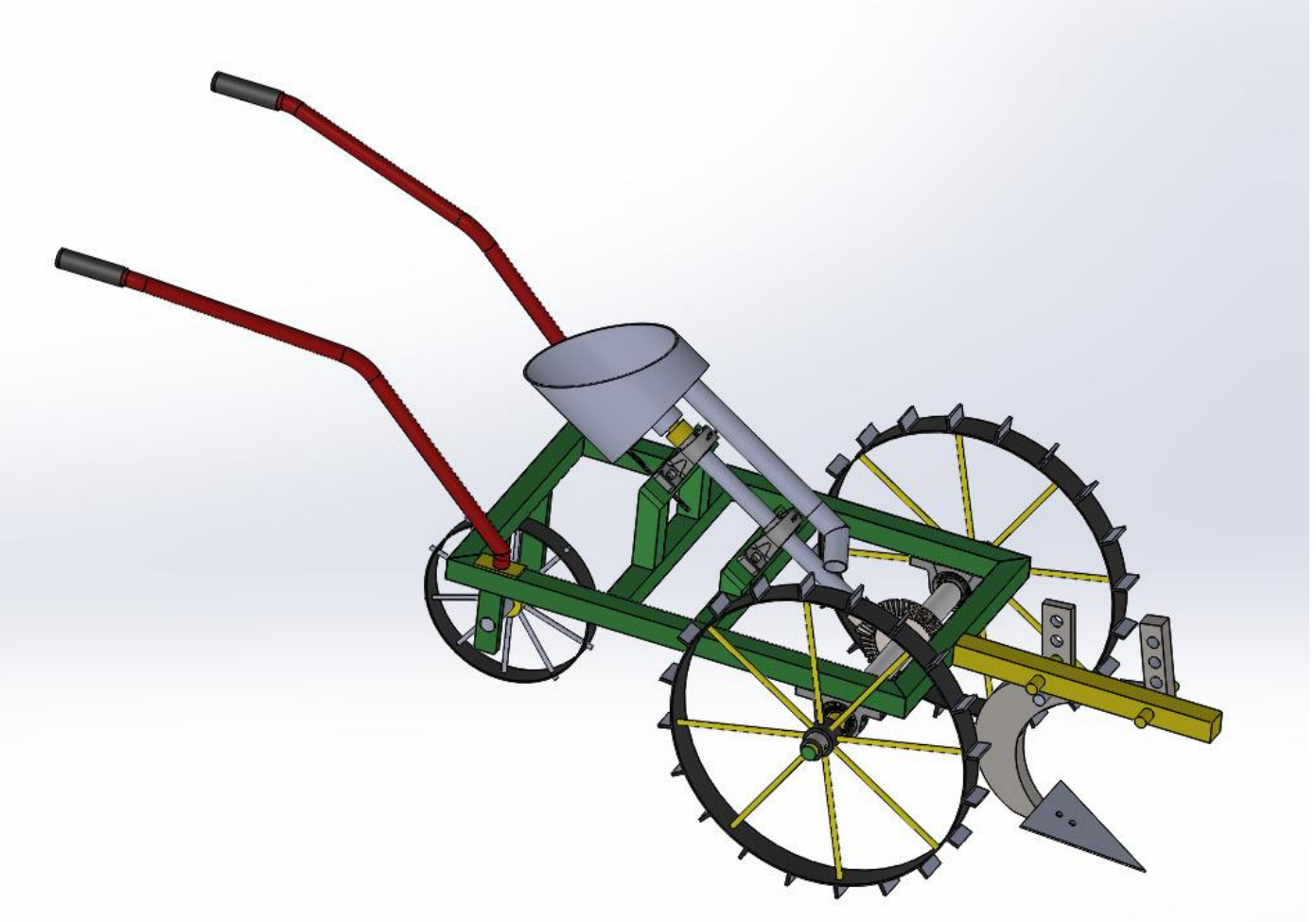
Mechanical Construction

7. Total assembly

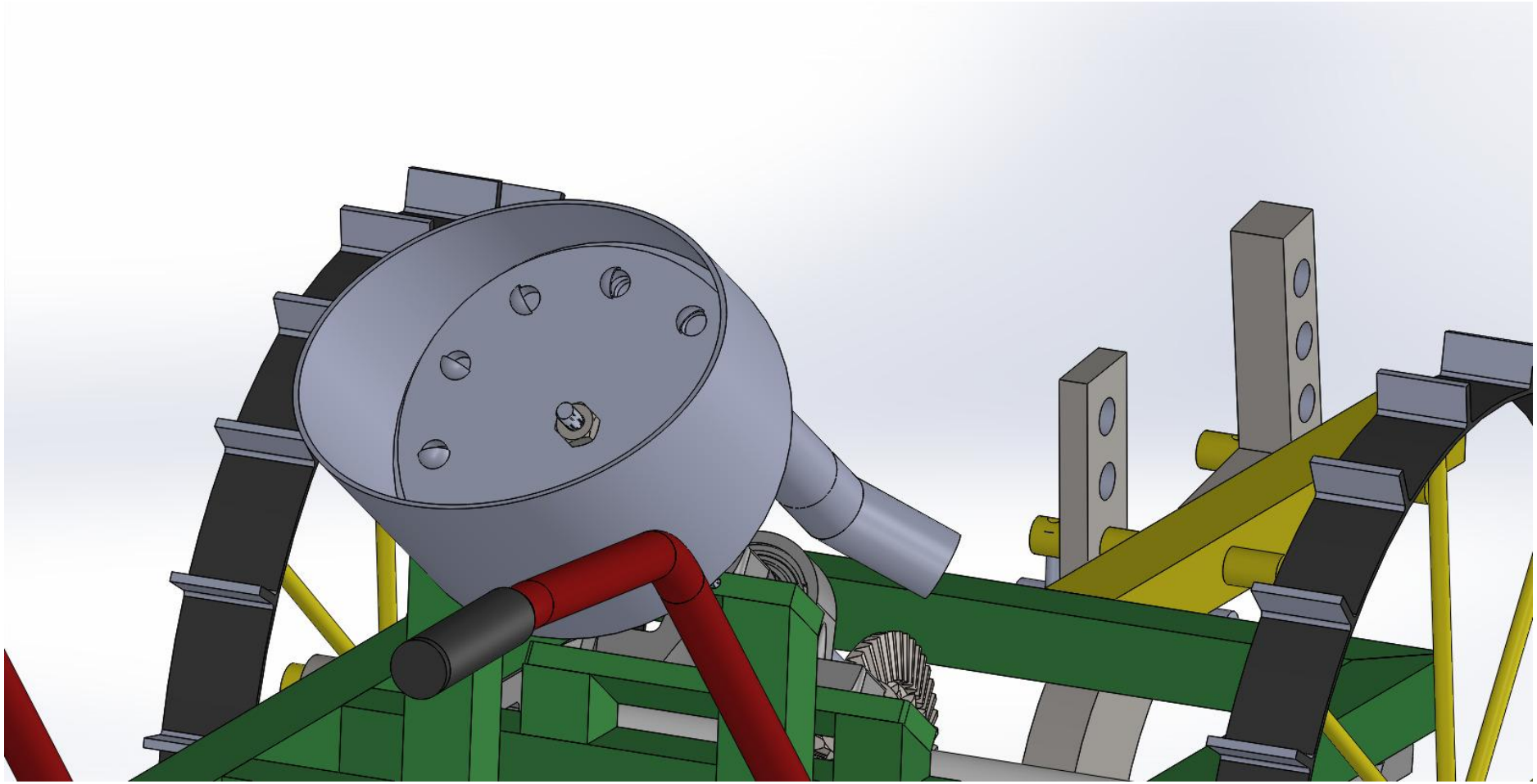


Mechanical Construction

7. Total assembly



Metering mechanism



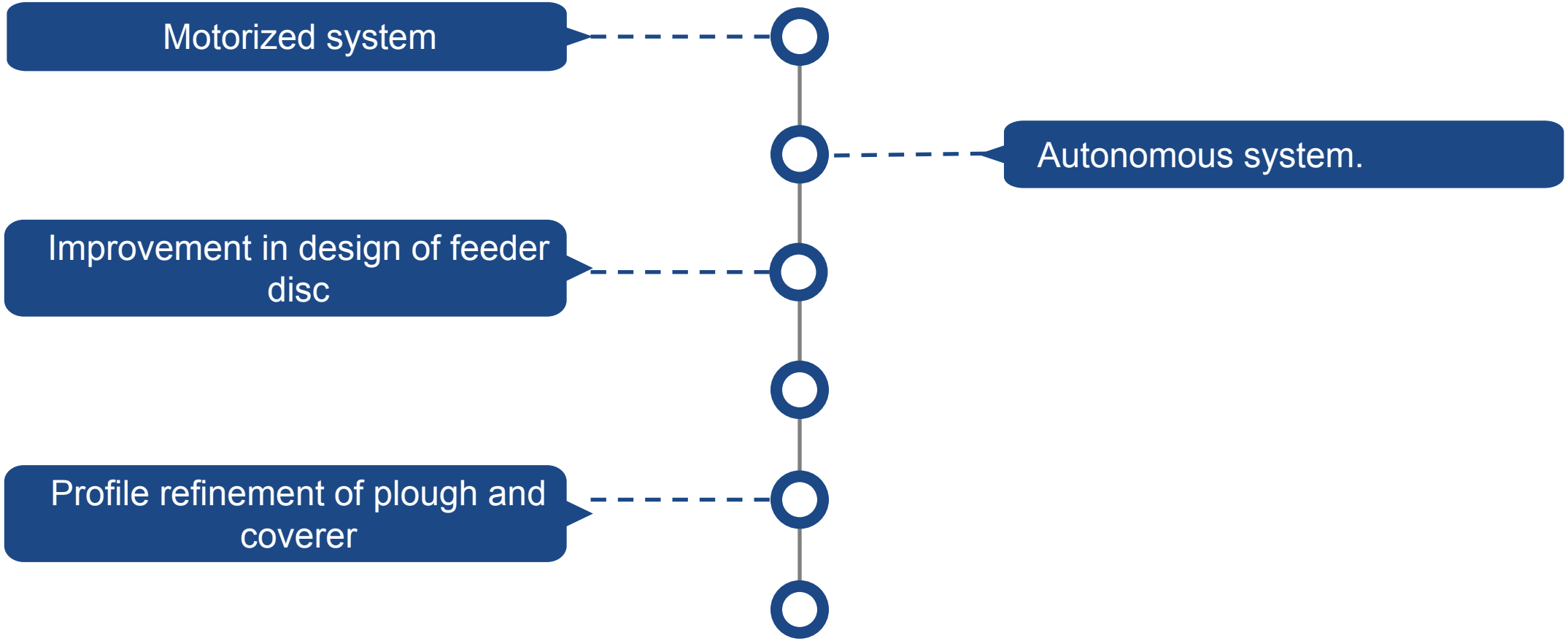
Mechanical Construction

7. Total assembly

Budget Estimation

Component	Quantity	Cost per Unit (NRS)	Total Cost (NRS)
Bevel Gear Unit	2	1000	2000
Wheel Shaft	1	650	650
Rotor Shaft	1	500	500
Wheel Strip	1	3000	3000
Wheel Spike Bar	1	1600	1600
Wheel Bush	1	450	450
UCP P30 Pillow Block Bearing	2	650	1300
Hopper Sheet	1	200	200
Hopper Base Plate	1	200	200
Square Pipe	1	2200	2200
Material Handle Unit	2	300	600
- Wheel Strip (Front)	1	1500	1500
- Wheel Spike Bar (Front)	1	800	800
- Wheel Bush (Front)	1	225	225
Rotor Plate	1	500	500
Machining Cost	-	6500	6500
Miscellaneous	-	2000	2000
Total	-		24725

Areas for improvement



Thank You !