RuTAG IIT DELHI

Rural Technology Action Group IIT Delhi

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Smart Vending Cart

Problem Statement and Survey

presented by **Team 1**

The need to improvise vending carts

Vending Carts, one of the most common medium for peddling and well as setting up roadside stalls, is one of the most integral part of lives of rural household as well as everyone that buys from them . Ground Level Surveys by our team in 4 different cities: Jaipur(Tier 1 city), Nasik & Varanasi (Tier 2 city) and Hathras (Tier 3 city), have conclusively shown that the vendors are moderately satisfied with their carts but there is still a lot of scope of improvement.

Ground level observations clearly show that the design of carts hasn't changed much over a century and modern technological improvements available are far beyond the means of an average vendor and thereby hard to inculcate.

So, it’s the need of the hour to improve vending cart keeping in mind the financial constraints of a rural household.

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An insight into our survey

Tier 1 (Jaipur) → Tier 2 (Varanasi, Nasikh) → Tier 3 (Hathras)

Surveyed more than 30 cart vendors

- Our team surveyed them about their problems ranging from financial aspects to locomotive issues.
- Being habituated to these problems, it was difficult for them to explain, initially, but as we talked them through all awkwardness and became more friendly, they started telling us about their problems more clearly.
- Further, we found that the cost of cart owned by people differed from 3K to 12K along with many people renting at 600-1000 monthly to even 20 rupees daily.

Link to the Raw data of our survey is present

- Here

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Movement issue

Steering issue

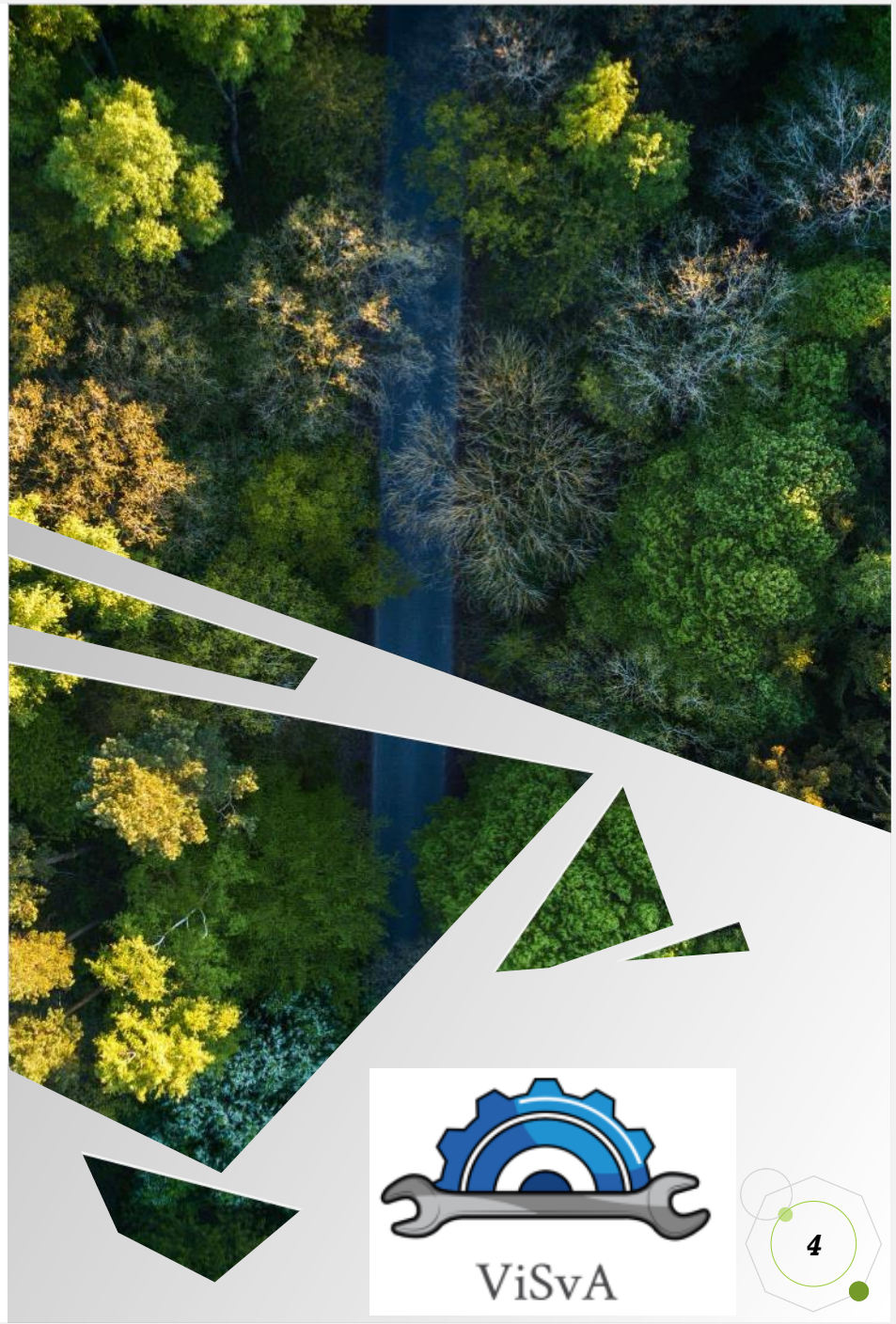
It is difficult to turn a heavily loaded cart and they have to lift the cart to turn it

Braking problems

To stop the cart on a slope, the vendors often use stones or bricks to block the movement

Navigating through the traffic

Due to large surface area of cart without any proper driving controls, the carts often become a cause of traffic jam on narrow roads



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Pushing/Pulling Filled Cart

Huge Inertia

The cart weighs more than 250 kg at the start of day and the huge inertia makes it difficult to move

Moving uphill

Heavy carts are almost impossible to push on steeper roads.

Moving Downhill

The cart carries a lot of momentum while going downhill and it often becomes difficult to stop

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Maintaining quality of products

Maintaining freshness of fruits and vegetables

Regular sprinkling of water on certain vegetables is required to prevent the organic products from spoiling.

Maintaining Dryness

Particular vegetables(onions and garlic), paper/wooden products and prepared food products face issues in monsoons.

Maintaining Temperature

Appropriate refrigeration for ice-cream vendors, and keeping the food warm for fast food vendors

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Space management

Cart Loaded with a variety of plastic and cloth products

- For vendors with plastic products or other products of daily usage, the necessity to carry a diverse set of products, often loads up the cart way beyond its capacity

Occasional theft and falling of products

- Products often fall from the loaded cart on uneven roads
- Owing to the exposed nature of the cart, the vendors reported in the survey that often they found some products missing

Water storage problems

- Fruits and green leafy vegetables require constant sprinkling of water to keep them fresh
- The water requirement is high, and it's not possible for them to store this large amounts of water at one place
- Some vendors need to fetch water from places located nearly 1-2 km away

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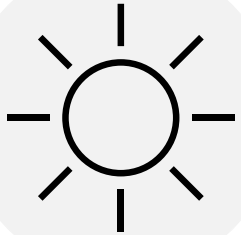
Auxiliary concerns

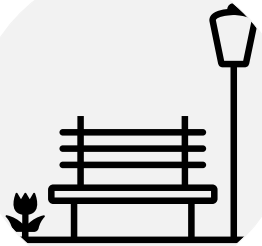


Sunlight degrades certain products

Coconuts need shade and so do the green leavy vegetables. Excessive heat and sunlight dehydrates the products.

Health Issues due to Lack of Shade and Hygiene

Standing in the sun without a shade and any proper sitting for a long time causes several health problems.



Dearth of apt places to park the cart

In busy market-places with buzzing shops and traffic, cart vendors find it difficult to get a right spot to park

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Picking a problem to resolve

The physical and financial condition of the cart vendors and the findings of our survey clearly indicate "the movement issue" and availability of cost-effective solutions for the same is most prominent issue in carts for vendors. In the survey, when we asked the vendors about the movement issues, most of them gave a positive response

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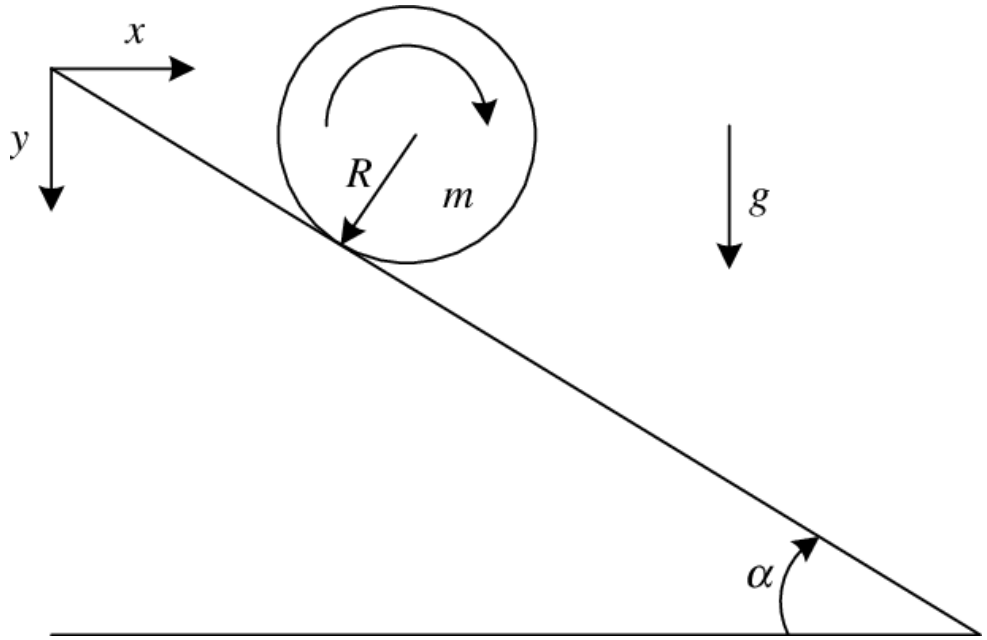

PHYSICAL ASSUMPTIONS FOR SOLUTIONS

Some explanations for our assumptions can be seen in the document:

Physics behind the vending cart

- Physical parameters of the cart, such as weight, diameter of wheel, average speed in steady motion, rolling friction between tires and different types of surface are very important while thinking of a feasible solution and modelling it properly.
- The basic assumptions we have taken are :
  - Weight = 300 kg
  - Diameter of the wheel = 0.675 m
  - Average max speed = 10 km/hr.
  - Average max angular velocity of wheels = 8.23 rad/s
  - Coefficient of rolling friction on average = 0.054
  - Average max force to be applied in steady motion = 810N

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SOLUTIONS TO BRAKING PROBLEMS

Power Brakes

There are many instances where the vendors need to reduce the speed of their cart for selling their goods to the mobile customers

This requires a lot of force to stop that much massive cart because of its inertia

So, we need a powerful braking system for reduction of speed

A feasible solution to this would be using power brakes similar to the ones used in cycles, rikshaws and even some motorcycles.

Parking Brakes

Often vendors need to stop their cart for a long time when they are parking in market or where they need to stop for large number of customers.

As we collected to info from our survey, we came to know that most of the vendors used a stone to check the motion of cart on slope and face problems when stones are not around

A simple solution to this problem is to incorporate the simple model of parking locks which are used in bicycles which can be attached to the cart.

The parking lock can be fitted at the bottom surface of cart above the 2 rear tires.

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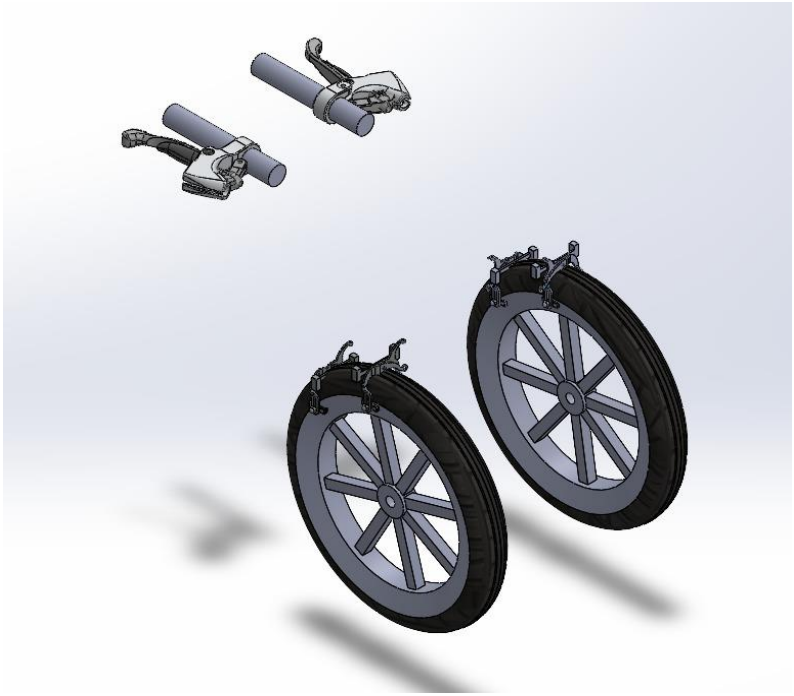
Working of brakes

Power Brakes

- The power brakes like in cycles are easy to use and we will implement the same model.
- The only key difference will be the design of the lever.
- We will increase the length of the lever to increase mechanical advantage and attach them just below the 2 handles on the back, so it is natural to use them.



Parking Brakes

1. The parking lock will be fitted on the bottom surface of the cart above the rear wheels.
2. 2 hooks can be provided near the locks, where the locking chain can be stuck when we are not locking the tires
3. This simple model is almost adding negligible cost.

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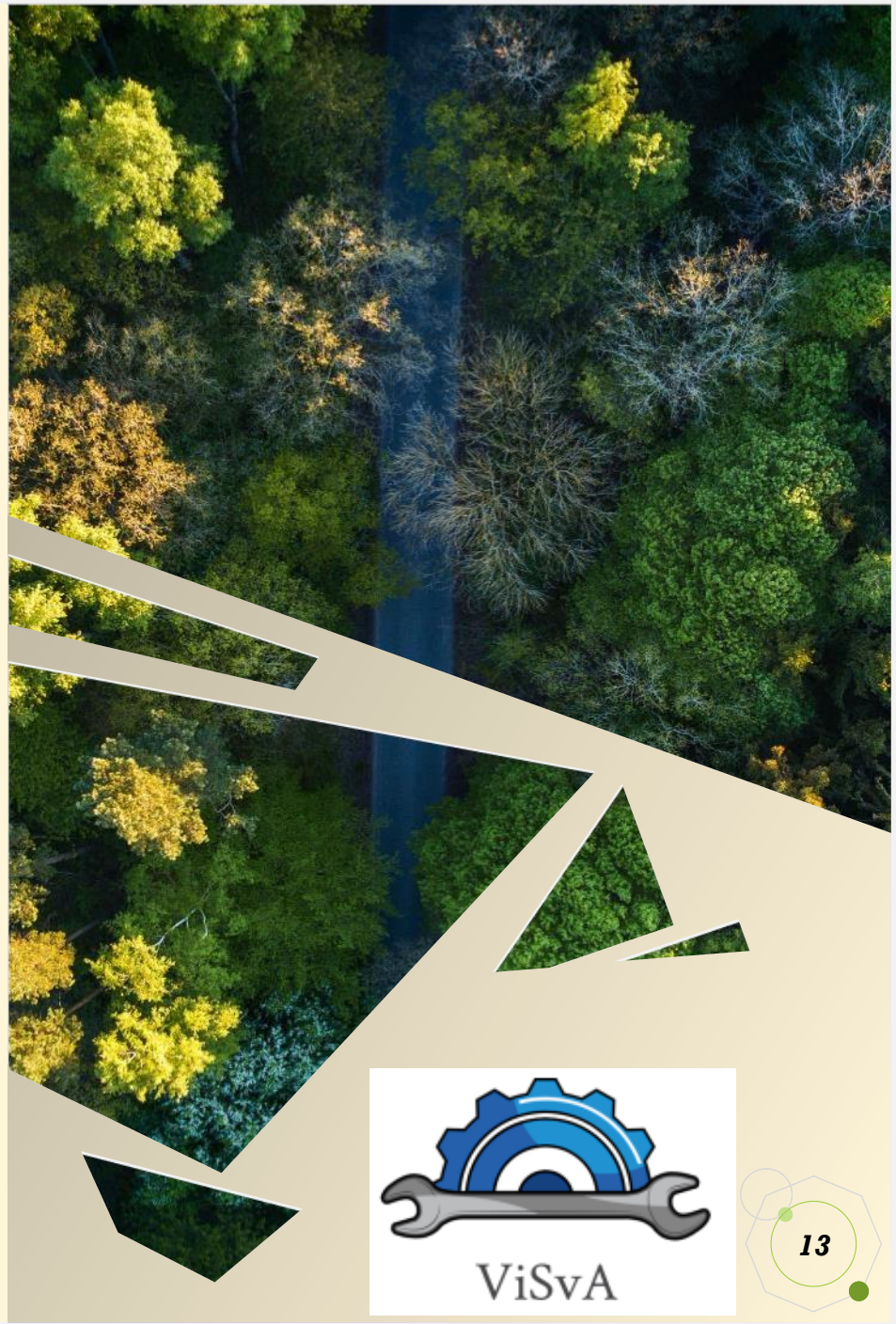
SOLUTIONS TO STEERING PROBLEM

MODELS FROM WHICH WE ARE INSPIRED



Shopping Cart

The almost free and super smooth turnability of front wheels in shopping trolleys can come quite handy in solving the turning issue in Vegetable Carts. So, our idea is to scale up this model for large weights up to 300 kg.

Wheelbarrow

Directly incorporating wheelchair or shopping cart-wheels could be problematic so we can take wheelbarrow type turnable wheels(more resilient at higher weights) and limit their maximum rotation to let us say 60 degree

Wheel-Chair

The turnable front wheels of the wheelchair don't join perpendicularly, rather they join at an angle and the connecting rod is slightly turned at one end. This helps in ease of rotation of wheel, and we plan of incorporating the same in our design.

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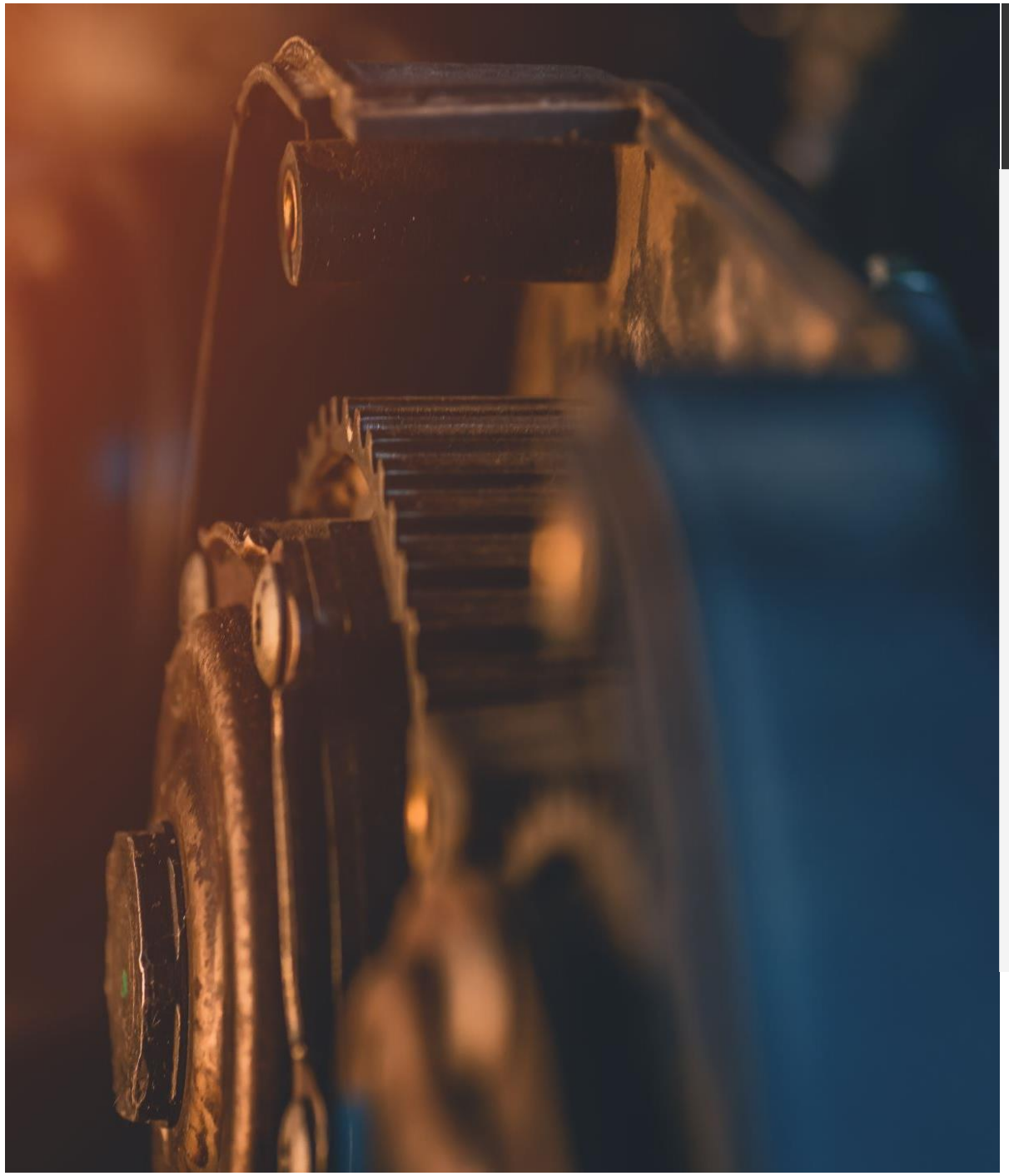

Dynamo and motor

1. Firstly, addition of a dynamo on one axle and motor on the other axle. The shafts can be connected via belt or chain. Also, the axle would have to be thicker than what it currently is to sustain the weight of new attachments.
2. Dynamo would help convert energy on going downhill or when the cart vendor is pushing the cart(preferable an empty one back to his home), this energy can be used by the motor for various purposes like generating the initial push in a filled-up cart(Cart weighs almost 300kg and almost all vendors mentioned this issue) or moving uphill, etc.
3. Based on the physical assumptions we have taken; we would need a motor of max 2.5kW and approx. 100 rpm specifications.

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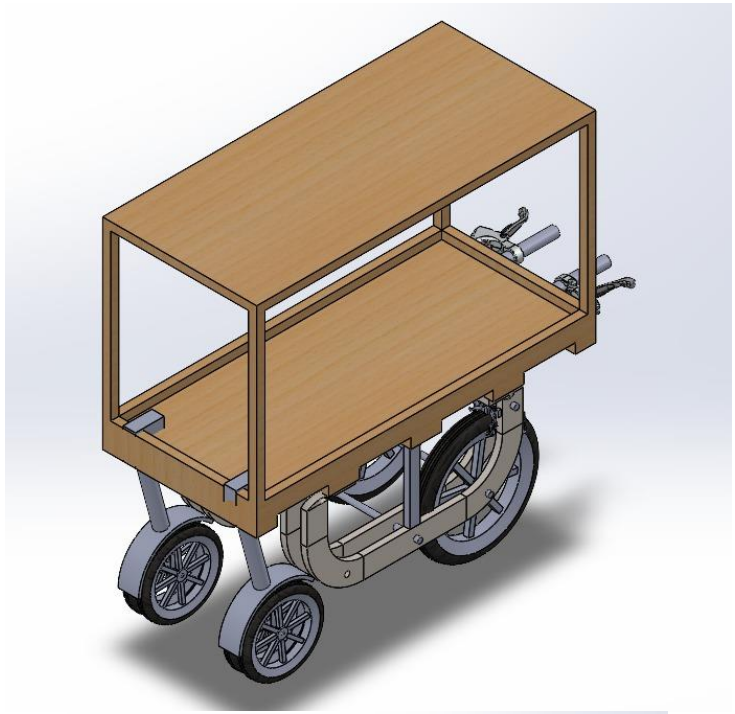
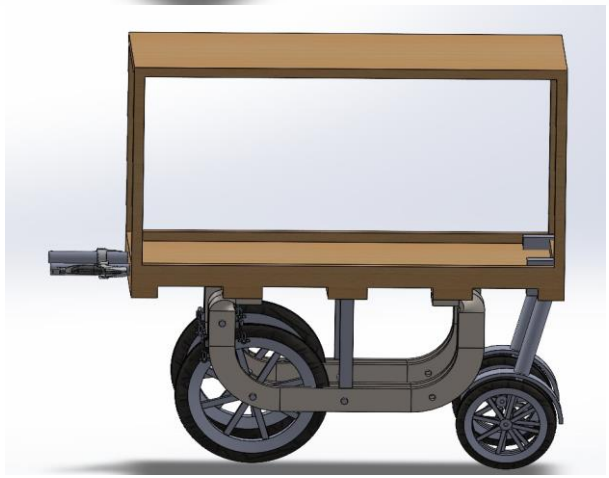
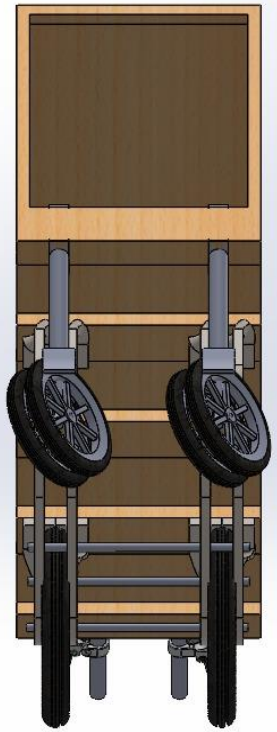
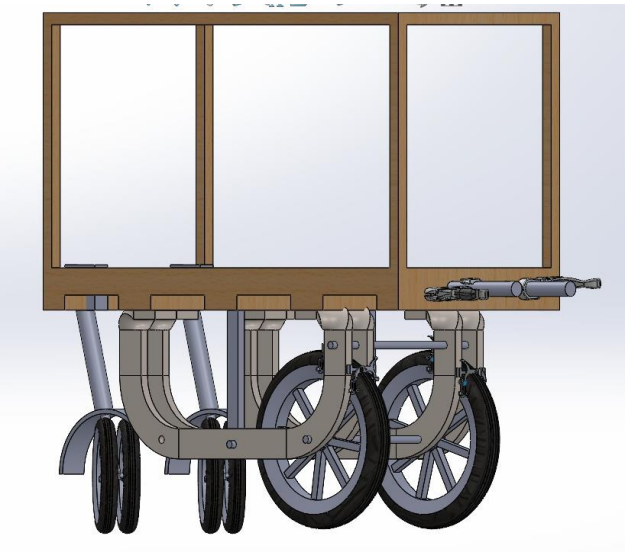
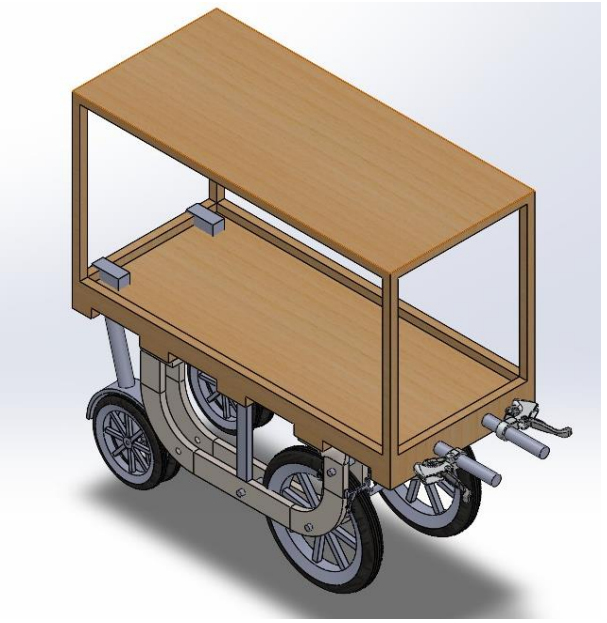
GLIMPSES OF OUR FINAL MODEL











Link to our complete model design in solid works:

CAD Model

Note : The CAD model is made up to scale to real world with almost ready to be 3D printed and tested in life .
For all features to work open it using latest version of SOLIDWORKS only (version 2021)

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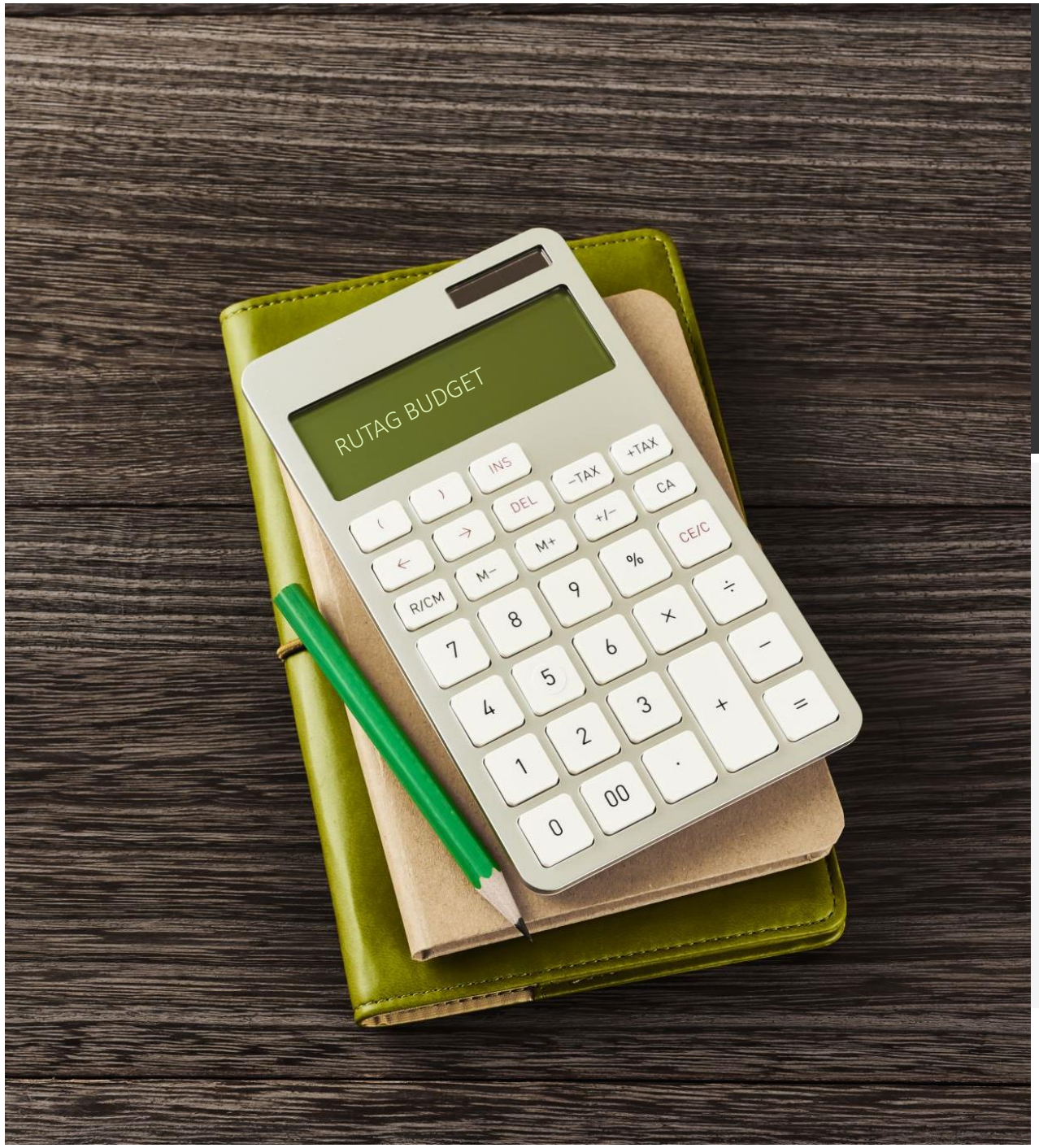

Budget

Approximate costing after analyzing prices of various features we are incorporating

Feature	Cost(In Rs)
Current cost of cart	7000
Power Brakes	500
Parking Lock	200
Dynamo	2000
Motor	2000
Steering model	1000
Cost after incorporating all features	12700

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Thank You

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