



IDC School of Design
अभिकल्प विद्यालय

DEP702

M.DES PROJECT - 2 REPORT

Project Title: **Modular Vehicle for Street Vendor**

Submitted by
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Project Guide

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Declaration

I declare that this written report represents my own idea in my own words, and were others, ideas or words have been included,

I also declare that I have adhered to all principles of academic honesty and integrity and have not falsified, misinterpreted or fabricated any idea, data, facts or source in my submission.

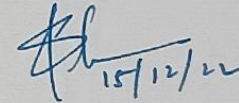
I understand that any violation of the above will be cause for disciplinary action by the institute and can also penal action from the source from which proper permission has not been taken, or improperly cited.

Rahul R (216390011)

Approval Sheet

This Mobility and Vehicle Design report titled - "Modular Vehicle for Street Vendor" by Rahul R is approved in partial fulfilment of the requirements for Master of Design degree in Mobility and Vehicle Design.

Project Guide :

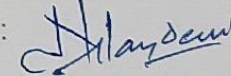
15/12/22

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Internal Examiner :



External Examiner :



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Last but not least, my thanks and appreciations also goes to my batchmates for their suggestions and criticism which helped me in developing the project.

Rahul R

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1.Introduction

The Street Vendors are people who sell essential grocery items and goods. They are contributors to the economy, society, and culture of our cities. Street vendors may be stationary in the sense that they occupy space on the pavements or other public/private spaces or, they may be mobile in the sense that moves from place to place by carrying their wares on push carts or in baskets on their heads.

Street vendors provide tremendous contributions to the economy, society, and culture of our cities. Despite this, the issue of recognizing and regulating street vending is one of the most intractable issues in cities. They might do various sorts of business in a single day, so he/she might transform the vehicle accordingly.

Street vendors have been in existence since ancient times. In all civilisations, ancient and medieval, one reads accounts of travelling merchants who not only sold their wares in the town by going from house to house but they also traded in neighbouring countries.

Indian Institute for Human Settlements (IIHS) in partnership with the Hungry Cities Project, surveyed 1000 food vendors across Bengaluru. Results revealed that about 47% of vendors were mobile food vendors operating out of a mobile cart, cycle, or bike and 18% of food vendors would sell their items in multiple locations in the city.

For most street vendors, trading from the pavements is full of uncertainties. They are constantly harassed by the authorities. The local bodies conduct eviction drives to clear the pavements of these encroachers and in most cases confiscate their goods.

The total employment provided through street vending becomes larger if we take into account the number of industries it sustains by marketing their products. A lot of the goods sold, such as clothes and hosiery, leather and moulded plastic goods, household goods and some items of food, are manufactured in small scale or home-based industries.

Methodology of research

The research was conducted to understand a typical day of the street vendors and to understand the type of installation for their business. This research was conducted particularly focusing on the street vendor who does their business on wheel or 2wheelers.

A research of the street vendors was done about the type of vehicle used by the vendor and the space where he conducts his business.

From the research it is known that the street vendors who use vehicle are having different kinds of installations. Some have makeshift kind of set up where they carry stuff and install them at the place where they conduct their business and others have extra attachments on their vehicle where they hang the products or essential equipments which they use in and interact with. I also got to know the range of distance they cover in a day. Some also overload their vehicle with the luggage in desire to sell more goods, and end up stuffing things beyond capacity of the vehicle. They also travel in busy traffic with this particular kind of set up which is not safe.

Profile of the Vendors While looking at the sex ratio of street vendors in the different cities, we find that an overwhelming majority are males. Females constitute around 30 per cent in all the cities taken together.

In most cities, stationary vendors outnumber the mobile vendors. Jaipur has more mobile vendors, which constitute 66% of the total vendors. Bengaluru and Lucknow have larger proportion of mobile vendors. The former has 48.5%, whereas the latter has 45.5%. Other cities have high proportion of stationary vendors. These include Bhubaneshwar (92%), Delhi (71.5%), Hyderabad (80%), Imphal (94.5%), Indore (79%), Mumbai (96%) and Patna (72.5%).

Street vendors living in permanent structures were found to be in Bhubaneshwar (62.5%), Imphal (98%), Indore (76%) and Mumbai (63.5%). This also indicates that the vendors in these cities are better off than other sections of the informal workforce.

Primary Research

Dosa Vendor (User 1)

The Street vendor is originally from Mysore. He came to Mumbai 20 years ago. He was working in a hotel becoming a street vendor. He is working as a Street Vendor For 20 years now. Running cost and Maintenances of the cycle cost Rs 2000-3000 He earns 20-25k a month out of which he only gets 5k as profit. No kind of Benefits from govt side. The left over materials to make the dosa are thrown away and not used for next day. Initial cost of investment was low back when he had made this set up. This a custom build bicycle during covid he had no business, could not go to native place, where he could have lived easily for one year.

Problems

Physical

- Weight of the Cycle,
- Back pain,
- Shoulder Pain,
- joint pain,
- He finds it difficult to do it alone due to age factor.

Psychological

lack of customer post Covid, bribing police, fine of Rs 100 or Rs200, Educational expenses of Children, Financial, Hospital bills, problems etc



Primary Research

Tea Vendor (user 2)

The name of the vendor is ASAK ALI, Age: 26 years, he is a Tea Vendor

Types of consumables he sells Milk Price, Tea Price, Coffee, Bournvita and Cigarettes, his Work shift is from Night 12pm to morning 6am.(Every Day), he carries a 10L thermos flask on the carrier of the cycle, the disposal cup are of 150ml. The flask contains warm milk with added sugar. In the front he carries a HDPE bag which contains all the materials required for preparing the required beverage.

Types of consumables he sells

- 1.Milk Price Rs20
- 2.Tea Price Rs 30
- 3.Coffee Price Rs 30
- 4.Bournvita Price Rs30
- 5.Cigarette Price Rs MRP (The price of the cigarette ranges from 70 to 200 Rs depending up on the brands)



Primary Research

Coconut Vendor (User 3)

The User is from Jharkhand, he came to Mumbai with his father. His father started doing this business and he continued on the same path, he started doing this business at a very early age and he has an experience of 10 years in this field. He works everyday unless there is a shortage in the storage area or if the delivery truck does not arrive that particular day. His day starts early in the morning around 6am and ends at 4pm in the evening.



Tool and materials

- bamboo basket
- Kitchen Knife
- Plastic Straw Pipes
- Bicycle
- HDPE Sacks
- Liquid packaging Bags
- Smart phone

He sells around 35 to 40 tender coconut on an average and sells 50 coconut on a good day. He charges 50 rupees per coconut and 5 rupees extra for the packaged one.

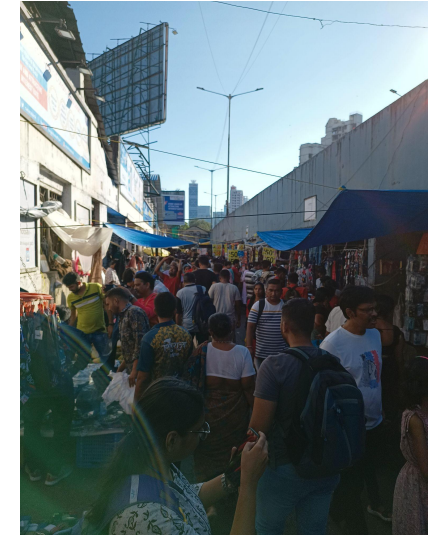
He previously sold the tender coconut in different area now he has changed his location to dadar market.

Design Direction

The field study of street vendor led me to large and dynamic community of vendors. There are wide range of hawkers (Street vendors) having different type of installation to their shop, it can be stationary, semi stationary or mobile.

Based up on the user research. the type of street vendors I am exploring are mobile vendors who carry whole setup required for with them to conduct their business, they stop when they get a customer and after that they resume their travel around the streets.

And narrowing it down further I am consider vendors who conduct their business in a very crowded and compact spaces, where it is very difficult to navigate, through the busy streets. And based up on the user research and above context user 3 **“the coconut vendor”** fits in perfectly.



Design Brief

To design a modular Vehicle for Street vendor that adds value in terms of ergonomics and ease of transportation.

- The vehicle should be easy to modify
- It should be easy to maneuver in traffic and crowd.
- It should be economical to maintain
- It should have good ergonomics and easy to operate
- The vehicle should not be heavy
- The vehicle should be easy to repair.

Persona

Name: **Saiful Shekh**

Place of Origin : **Jharkhand**

Current Place: **Maharashtra, Mumbai**

Age: **22 years**

Business type : **Tender coconut vendor**



Secondary research

How much does a coconut vendor makes in a day?

Now Tender coconut farmer provide the tender coconut per piece between 15 to 20 rupees

lets say acquisition: 20 Rs/piece

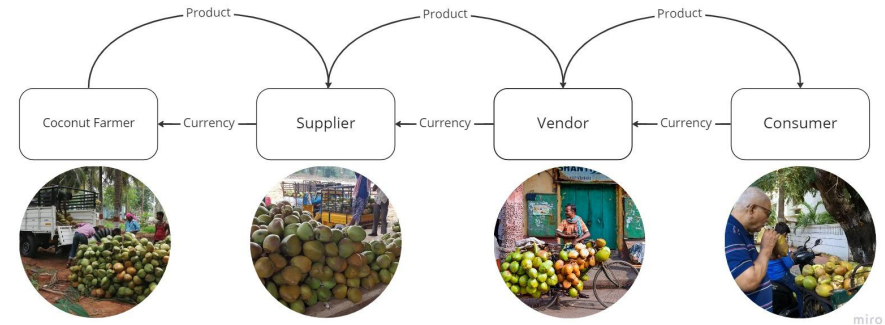
Transportation charge: 10 Rs/piece

Supplier margin: 5 Rs/piece

Total cost for acquisition of Vendor would be : $20+10+5=35$ Rs

Total cost he has to pay is : Rs 35/Piece

His selling price: 45 Rs/piece, which means a profit of Rs 10/piece. Daily they sell 40-50 Pieces and hence the earning is 400-500 on good days.



In the above flow chart you can see how each stage of money and product transaction occurs.

And on the left hand side table we can the price of the tender coconut increasing from stage to stage.

At the bottom end of the table we can see the average earnings of the coconut vendor in a good day.

Existing Products in the Market

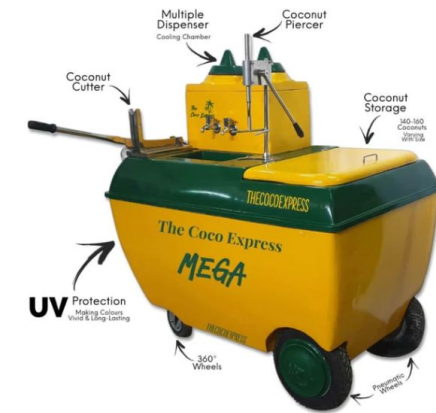
There are products existing in the market which has all the bells and whistles, there are two very similar products which you can see in the image right side.

These are having tools mounted on the to cut and pierce the tender coconut. These carts are very big in size they can hold up to 150 tender coconut in their storage compartment.

There is also a chiller mounted to this cart to chill the tender coconut. These carts also shows hygiene and ease of operation to cut open the tender coconut.

There are two kind of tools mounted on to this cart one is used to pierce the tender coconut and other one is used to cut the tender coconut into half.

The cart also has a utility compartment where the packaging materials are kept if the customer doesn't wants to drink directly from the tender coconut.



Insights from the Secondary research



the vendor makes hole with out spilling coconut water

he has got a set up to chill the coconut water

he cuts the coconut into half with lesser effort

the tool to cut the tender coconut is comparatively safer than conventional method

the set up has a filter to filter out the dust particles from the tender coconut

the vendor provides the coconut water and malai in polymer glass.

the vendor wears mask and gloves to maintain hygiene

he also has hand sanitizer with him

the set up has a height adjustable umbrella

the vendor it also follows a dress code.

Insights from the Secondary research



Current method is dangerous as the blade used to chop the coconut is very sharp

the might accidentally get hurt by the tool if not handled properly

the hands get wet due to spilling of the coconut water

water from the coconut spills out when makes a hole for drinking

the coconut is chopped basis of instinct

the splashes of the coconut water might ruin the clothes of the customer and the vendor

the spoon is made from the same outer shell of the coconut

the straws are kept out open unprotected from the dust and pollution

the blade used to cut the tender coconut is not cleaned after every use

The currency note gets wet because of the wet hands

the dust or pollutant from the blade is passed on to the next coconut when chopped.

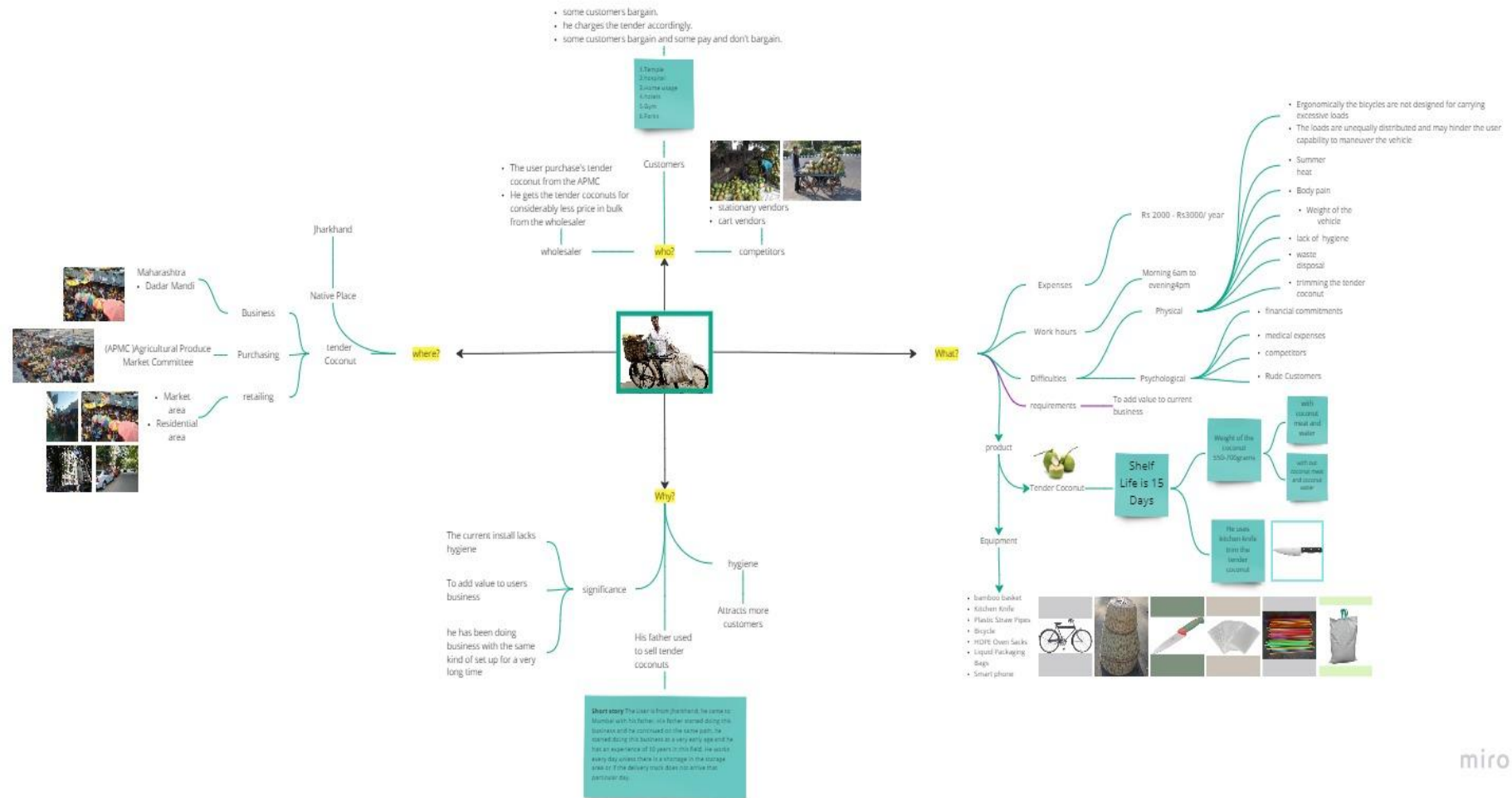
the chopping method is not ideal as it makes small residuals inside the tender coconut.

the process of cutting the whole coconut into half is also unsafe

there are chances of the coconut to slip from hand due to the spilling on coconut water

micro

Mind Map



miro

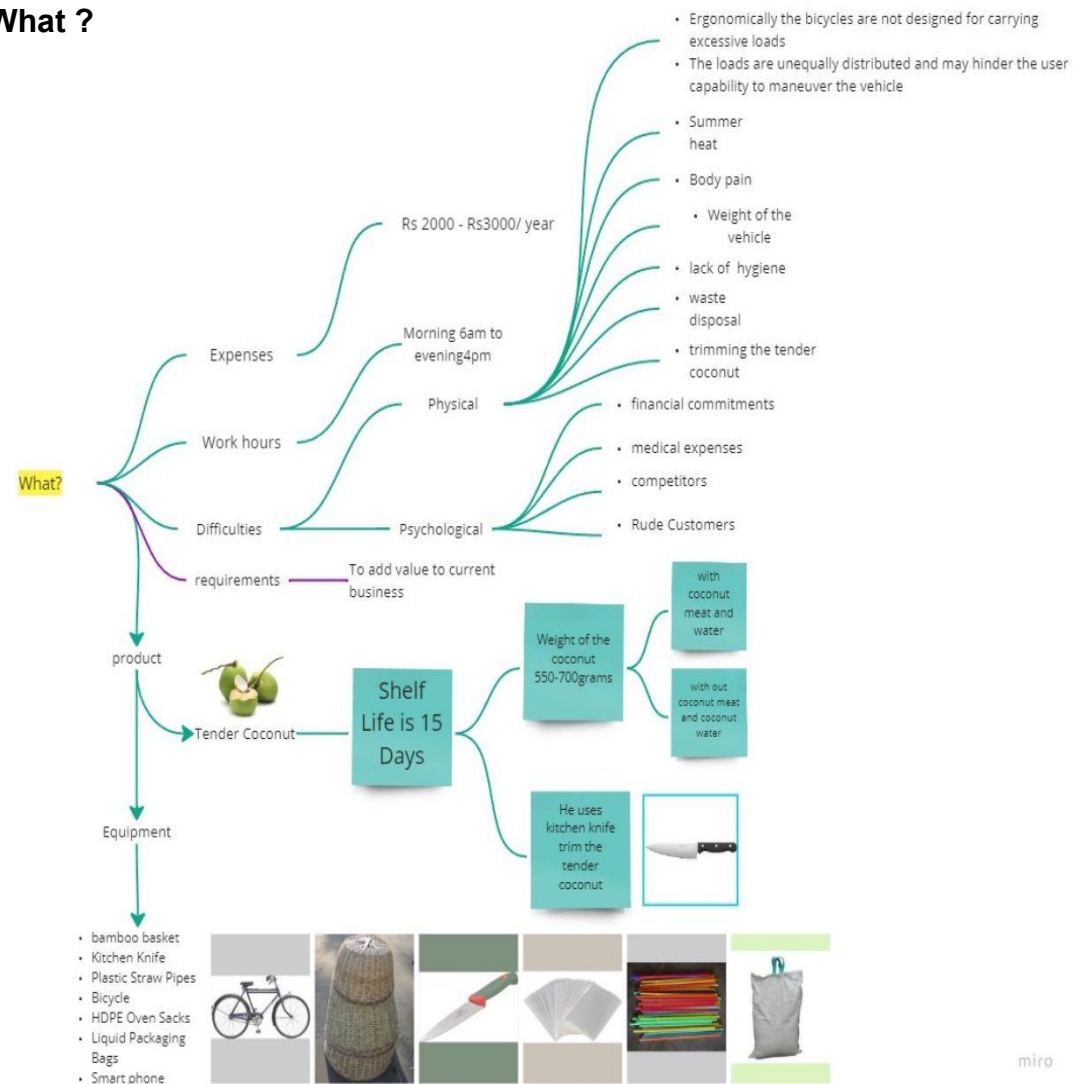
This arm of the mind map covers the **what** of the coconut vendor, which includes what kind of product he sells, expense over the year, what is the amount of work house he spends, what are the kinds of difficulties he faced.

The map spreads out in even further into what kinds of equipments he sells and what are the tools used by the vendor and what are the factors affecting his business such as physical and psychological.

Under psychological factors such as financial condition, medical expenses, competition from the competitors and rude customers are considered

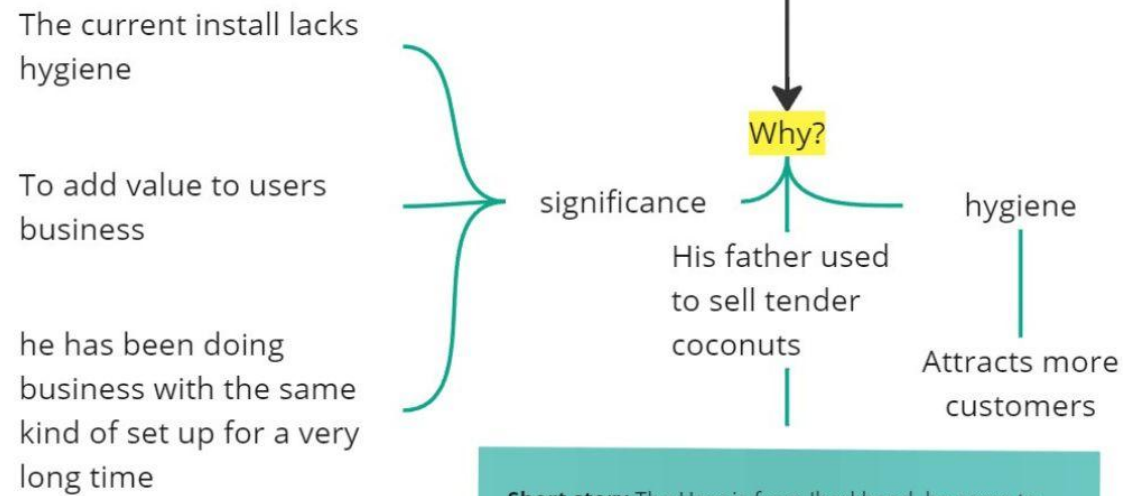
Under Physical conditions factors body fatigue, weather conditions, hygiene are to be considered .

What ?



miro

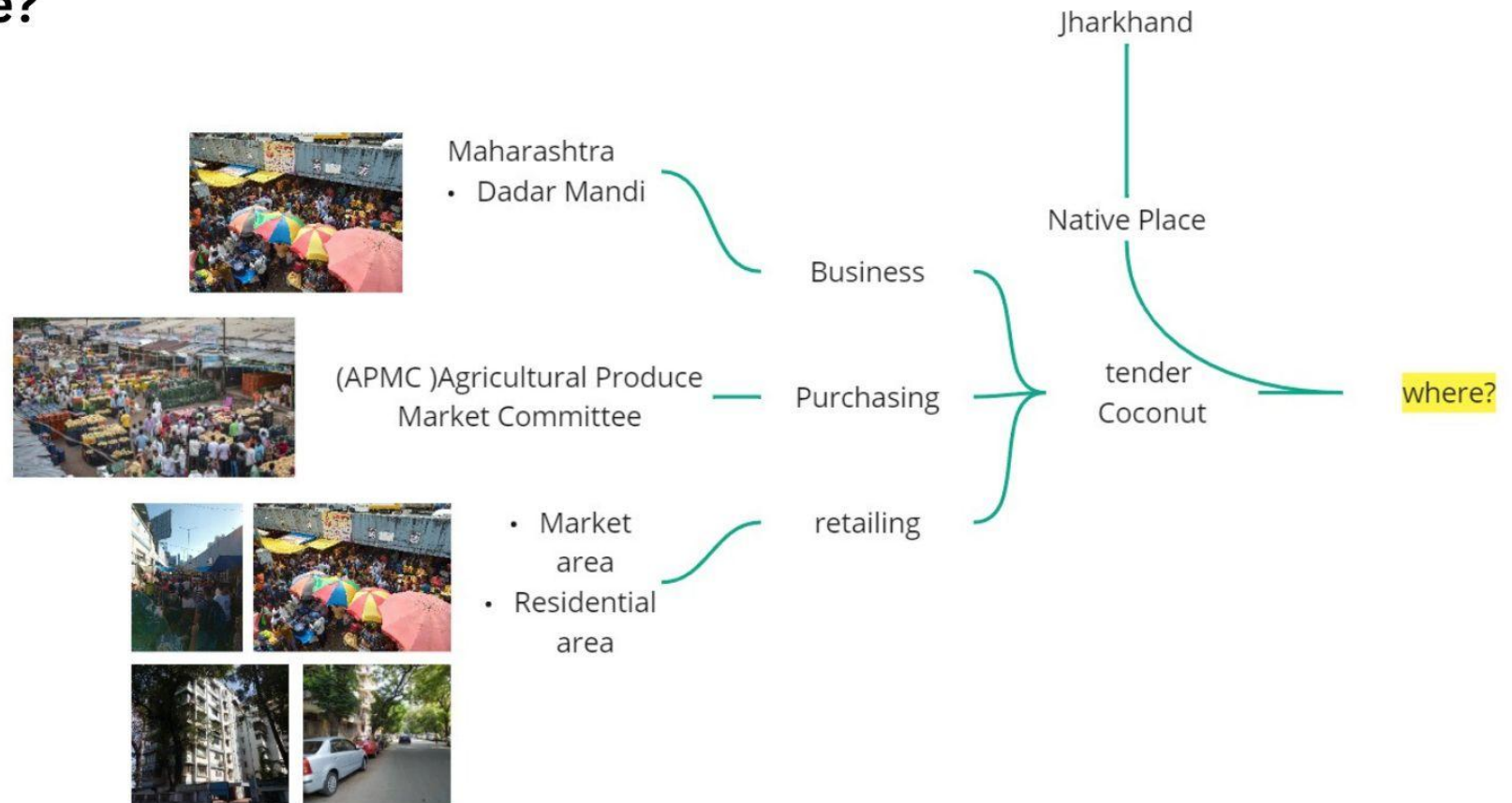
Why?



Short story The User is from Jharkhand, he came to Mumbai with his father. His father started doing this business and he continued on the same path, he started doing this business at a very early age and he has an experience of 10 years in this field. He works every day unless there is a shortage in the storage area or if the delivery truck does not arrive that particular day.

miro

Where?



miro

Who?

- some customers bargain.
- he charges the tender accordingly.
- some customers bargain and some pay and don't bargain.

1.Temple
2.hospital
3.Home usage
4.hotels
5.Gym
6.Parks

Customers

- The user purchase's tender coconut from the APMC
- He gets the tender coconuts for considerably less price in bulk from the wholesaler

wholesaler

who?



- stationary vendors
- cart vendors

competitors

miro

Storyboard

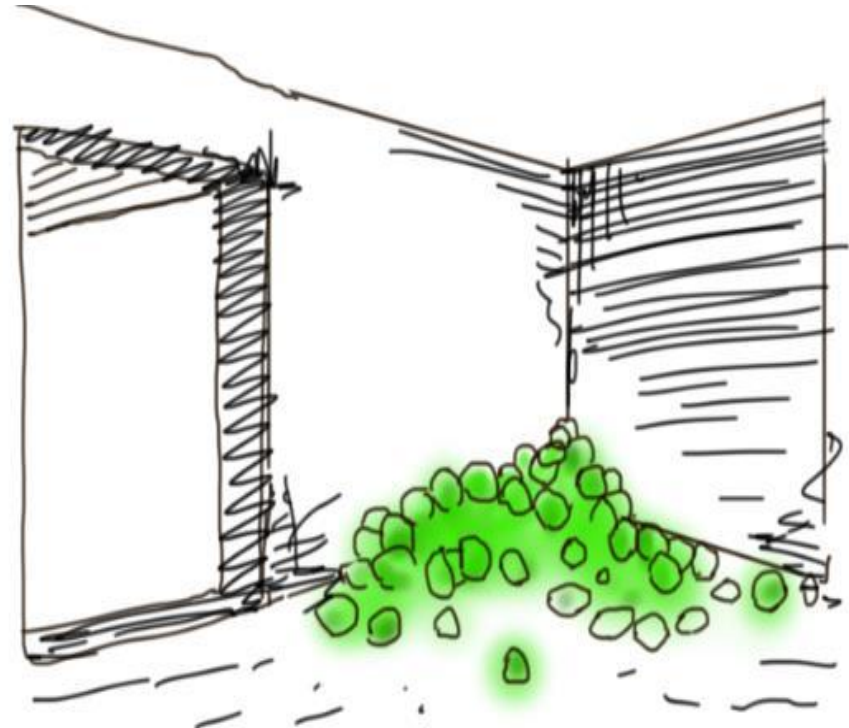


There is no day off for the vendor, but only when the delivery truck does not arrive to the market.

The vendor purchases tender coconut from the whole sale dealer which comes from the farm land.

The vendor purchase the tender coconut in bulk quantity from whole sale dealer.

The whole sale dealer sells the tender coconut includes the transportation and fuel charge. The coconut vendor after purchasing from the whole sale dealer stores them in the rented storage Space in the market.



The day of the coconut vendor starts from early in the morning. He covers the whole dadar market area.

The vendor sells around 30 to 35 tender coconut in a day and at peak season he sells around 50 tender coconuts.

He has to go through congested and tight space, sometimes he get stuck in a place and becomes difficult to go back to take a turn.

Most of the time it is very difficult to find a parking spot and trim the tender coconut.

The vendor starts his day early morning around 6am and ends around 4-5pm.

He travels in scorching hot summer without any kind of shade and does not carry a water bottle, he consumes the coconut water to quench his thirst.

When he runs out of tender coconut he goes back to the storage cell and refills the basket and gets back to the marketplace.





This is a scenario where the coconut vendor interacts with the tool to cut open the tender coconut.

The coconut vendor does not have a proper stand or platform to hold on to the tender coconut.



He holds and keeps it on the bicycle seat and starts trimming it.

The vendor slices the top and starts slicing off the edges, he uses regular kitchen knife to trim off the tender coconut and also uses the same knife to chop it into half.



The coconut vendor puts lot of effort to change the momentum to the bicycle.

The basket is kept above the center of the vehicle which affects the balance of the vehicle.

The loading and unloading of the tender coconut from the basket is also a time consuming task.

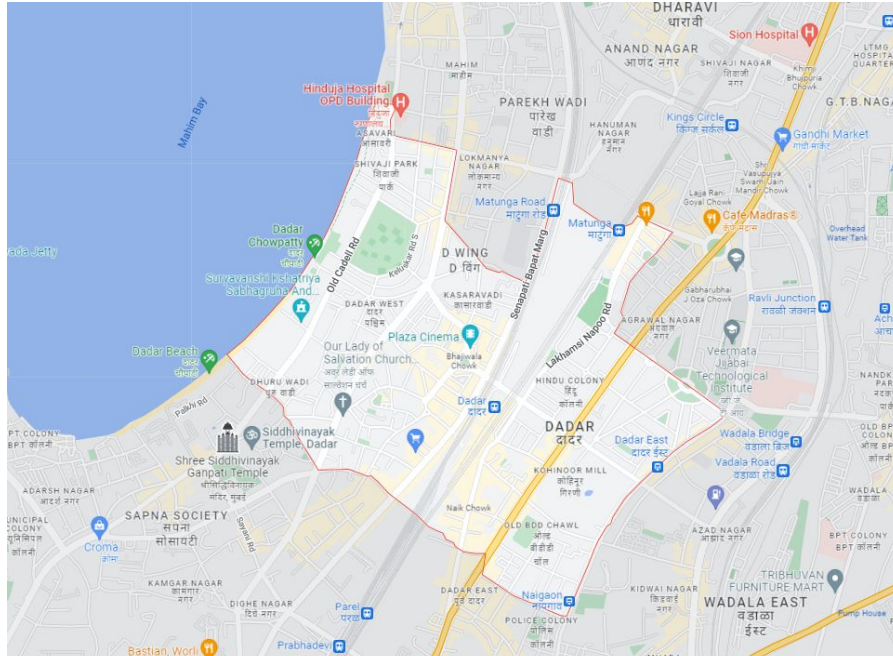
There is no proper shade or weather protection for the vendor.

There is lack of hygiene in terms of storing and delivering the product to the consumer.

It is difficult to ride the bicycle while the basket is filled with tender coconut.

Most of the time the vendor is Pushing vehicle, as it is more

Regions covered by the Vendor



- The vendor covers whole market region of dadar market and before coming to dadar he used to cover the region lower parel
- No of Tender coconuts purchased from the mandi in a day
: **50 - 60 (Tender Coconuts)**
- No of tender coconuts sold to customers in a day
: **40 - 50 (Tender Coconuts)**
- Working Days : **Weekends and weekdays**
- Working Hours : **Morning 6am to Evening 4pm**
- Yearly Expenses of the bicycle : **2000 - 3000 yearly**
- Any knowledge about allowances from the GOVT
: **No knowledge about the Govt allowances**

Insights



it becomes difficult for the vendor to dodge potholes in the crowd

the weight of the basket makes it difficult for the vendor if the wheel gets stuck in a pit

the basket is kept above the CG affecting the overall balance of the vehicle.

while going over potholes the coconut have tendency to fall

due to the added weight in the back it is difficult to handle the bicycle in the slopes.

the knife is kept in the HDPE bag which is not an ideal place for a sharp tool to be kept.

vendor sells during day time, from 6am to 4pm there is lack of shade and space to sit.

there is no proper place or support for the vendor to chop the coconut

the market area is crowded and it is very trick to navigate through the crowd.

vendor does not have a proper utility space to keep the essential things

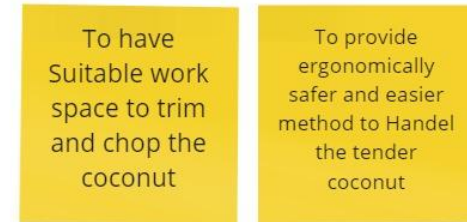
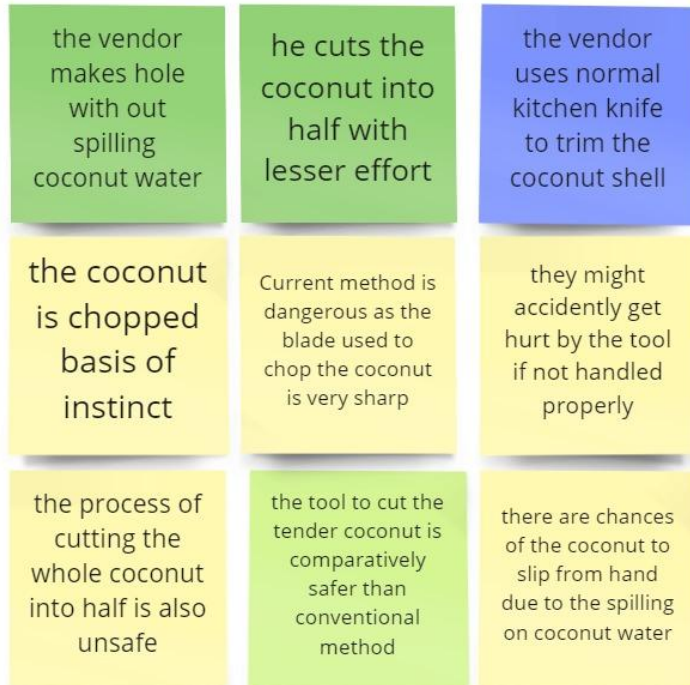
vendor hangs the HDPE bags on to the handlebars, which hinders the maneuverability of the bicycle

the vendor uses normal kitchen knife to trim the coconut shell

It is difficult to find a place in the crowded street to park and interact with the customer

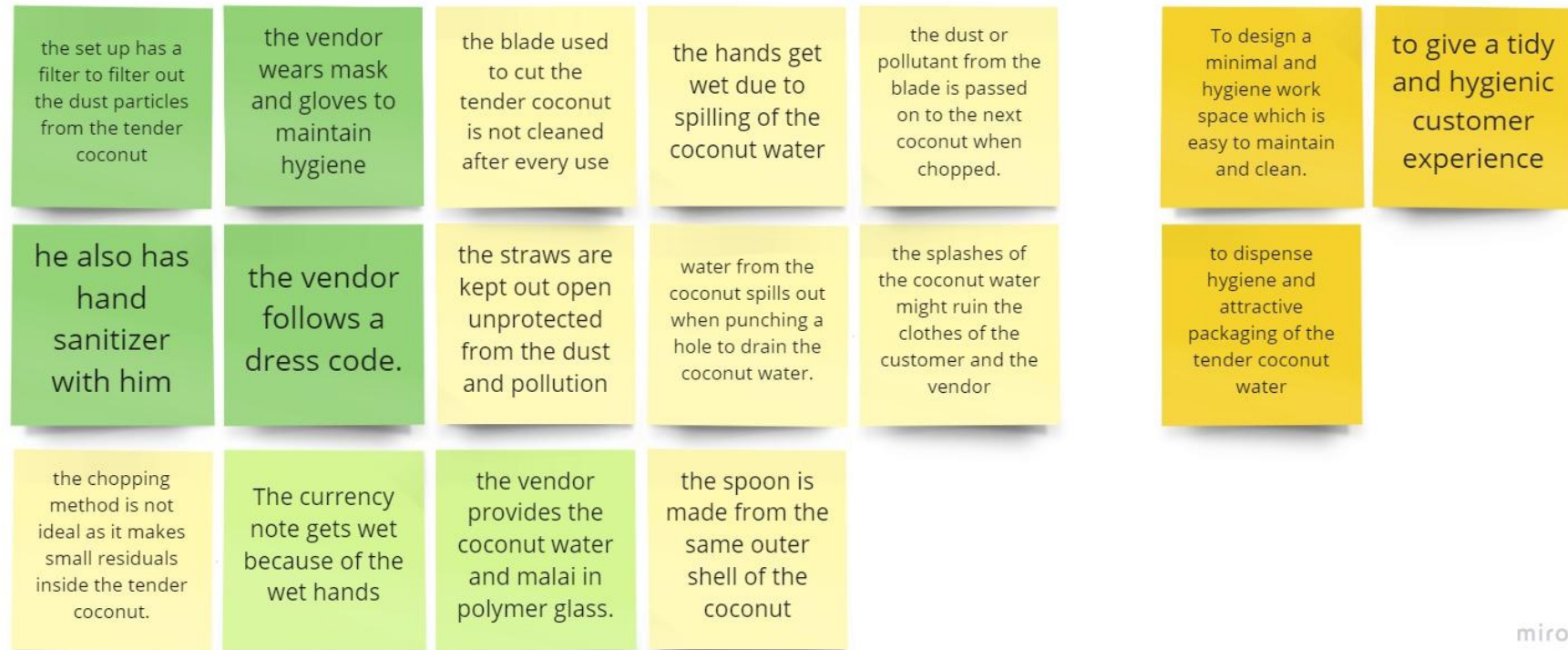
the tender coconut is open and vulnerable in a crowded market place

Safety



miro

Hygiene



miro

Ride and handle

vendor hangs the HDEP bags on to the handlebars, which hinders the maneuverability of the bicycle

the market area is crowded and it is very tricky to navigate through the crowd.

the basket is kept above the CG affecting the overall balance of the vehicle.

the weight of the basket makes it difficult for the vendor if the wheel gets stuck in a pit

due to the added weight in the back it is difficult to handle the bicycle in the slopes.

It is difficult to find a place in the crowded street to park and interact with the customer

it becomes difficult for the vendor to dodge potholes in the crowd

while going over potholes the basket filled with coconuts has a tendency to fall

to design a vehicle similar to motor-assisted vehicle which would help the user in maneuverability of the vehicle.

Providing a suitable space for waste disposal compartment to improve handling of the vehicle

to have proper weight distribution and stable platform of the vehicle with respect to ride and handling

miro

Utility and accessories

the tender coconut is open and can be stolen in a crowded market place

the set up has a height adjustable umbrella

there is no proper place or support for the vendor to chop the coconut

vendor sells during day time, from 6am to 4pm there is lack of shade and space to sit.

vendor does not have a proper utility space to keep the essential things

he has got a set up to chill the coconut water

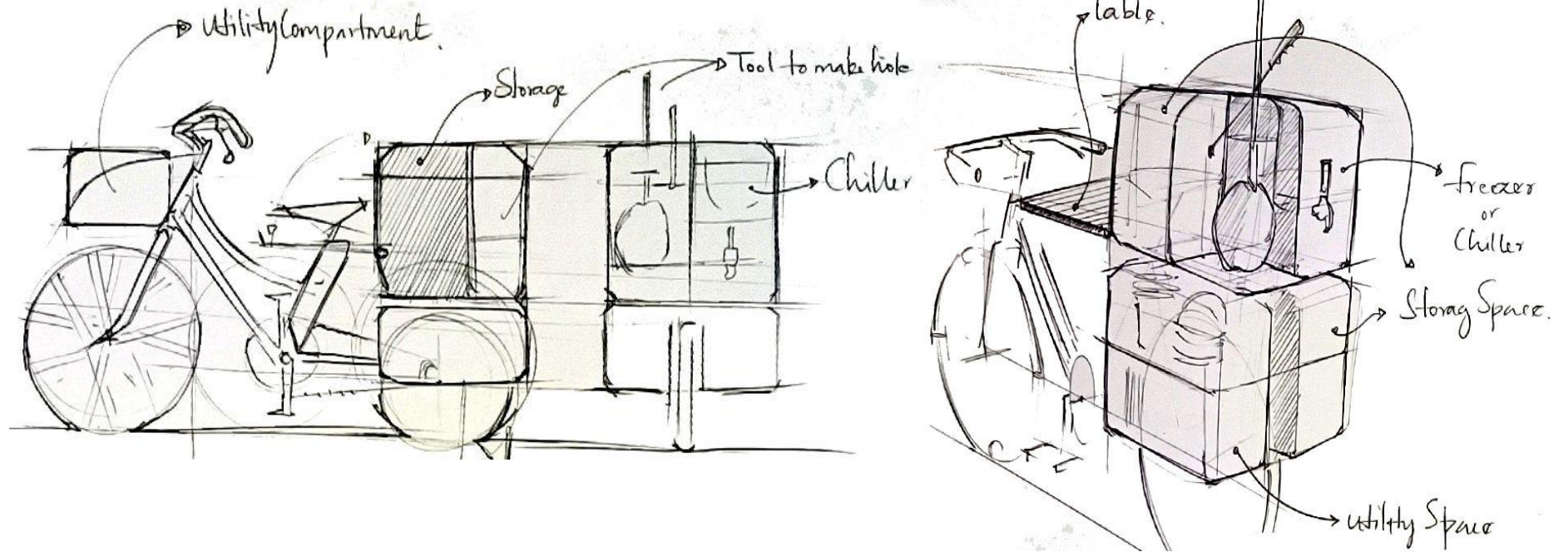
the knife is kept in the HDPE bag which is not an ideal place for a sharp tool to be kept.

to design support or a stable platform to handle the tender coconut

To provide a suitable space for keeping essential things and make it easier to access

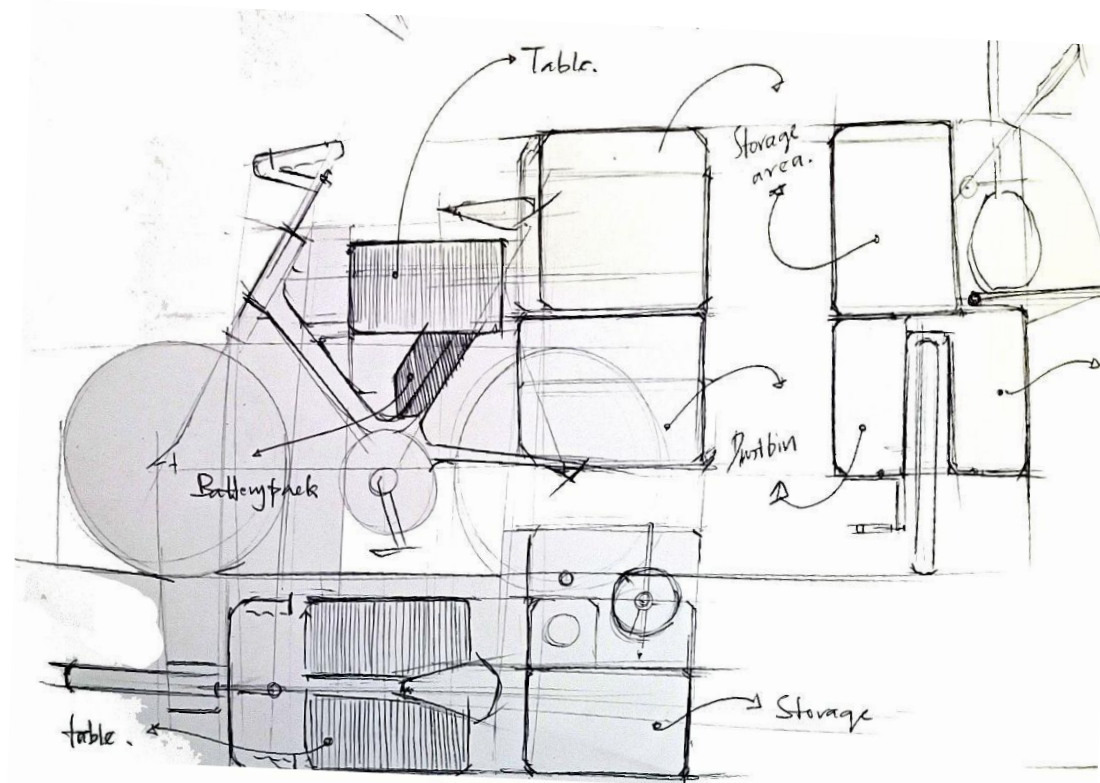
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Concepts Sketches

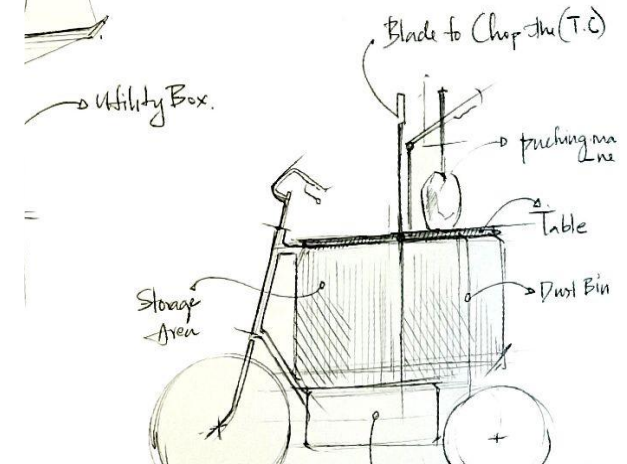


- This was the initial sketch which include battery pack and other accessories.

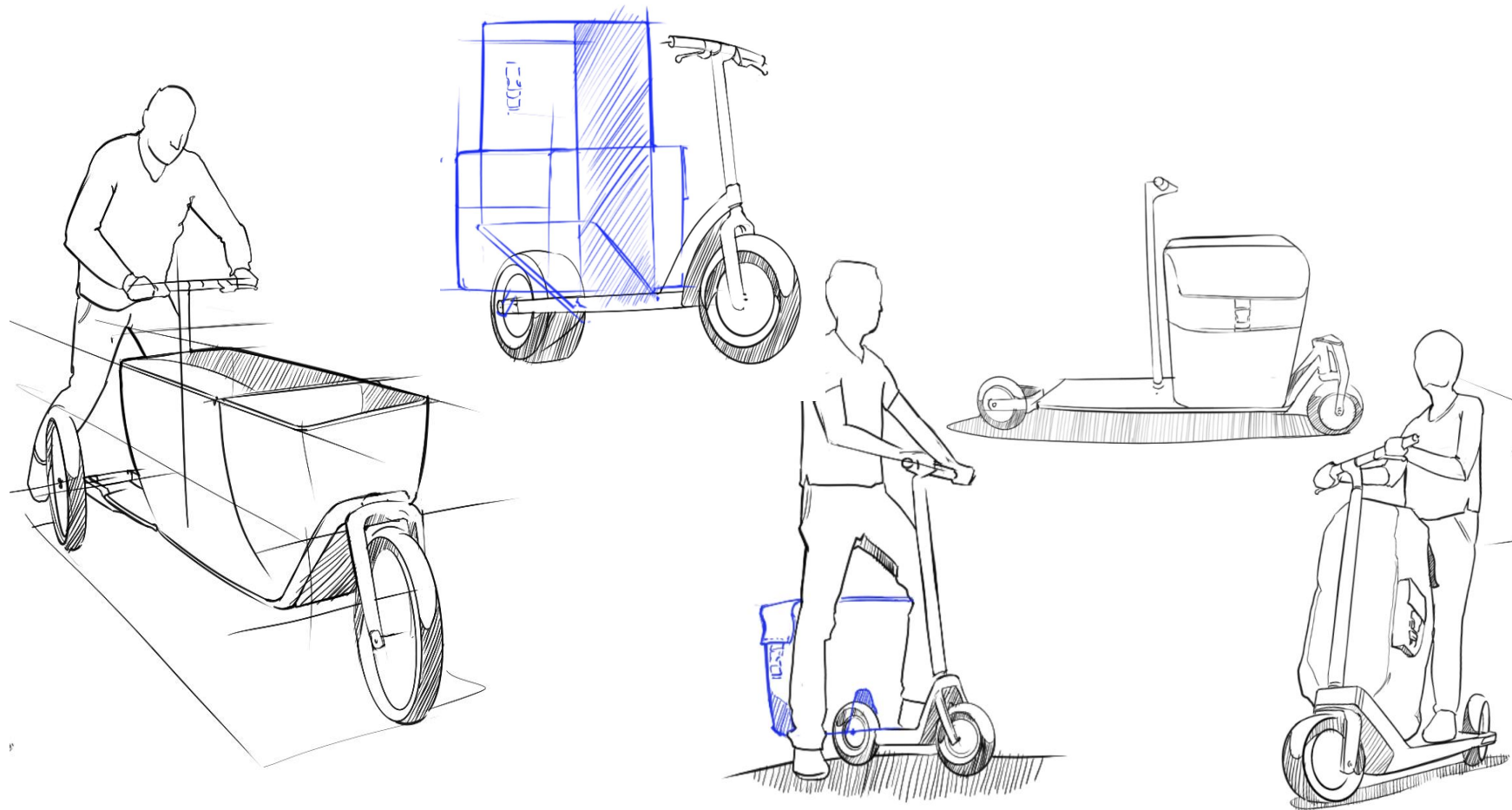
Concepts Sketches



- This sketch was the another concept wit few variation

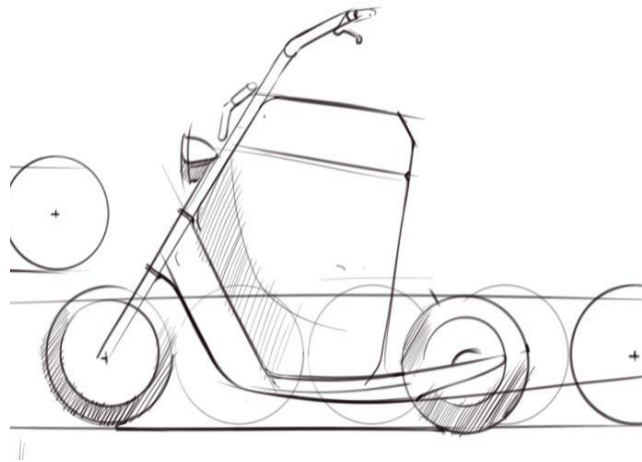
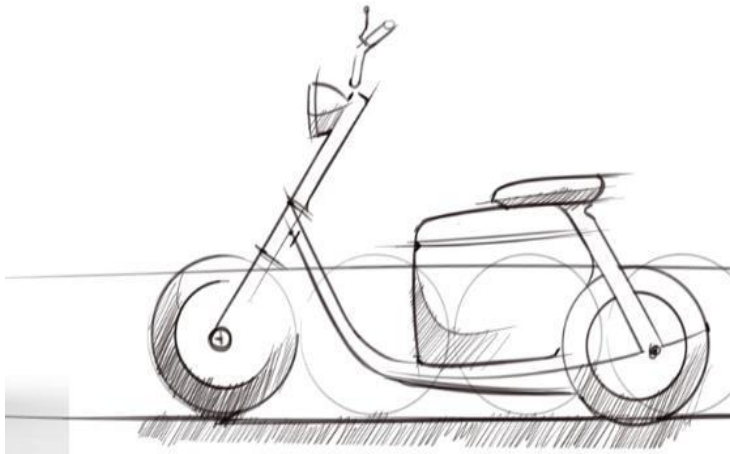


Concepts Sketches

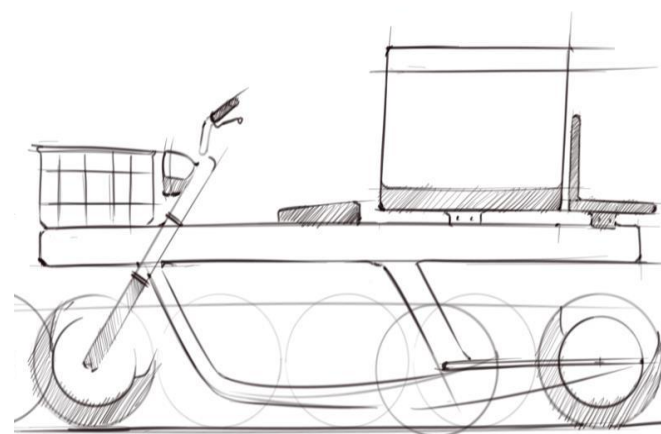
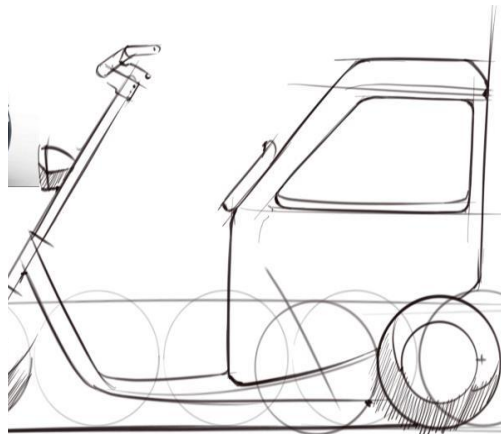


- These concepts were base on segway scooters

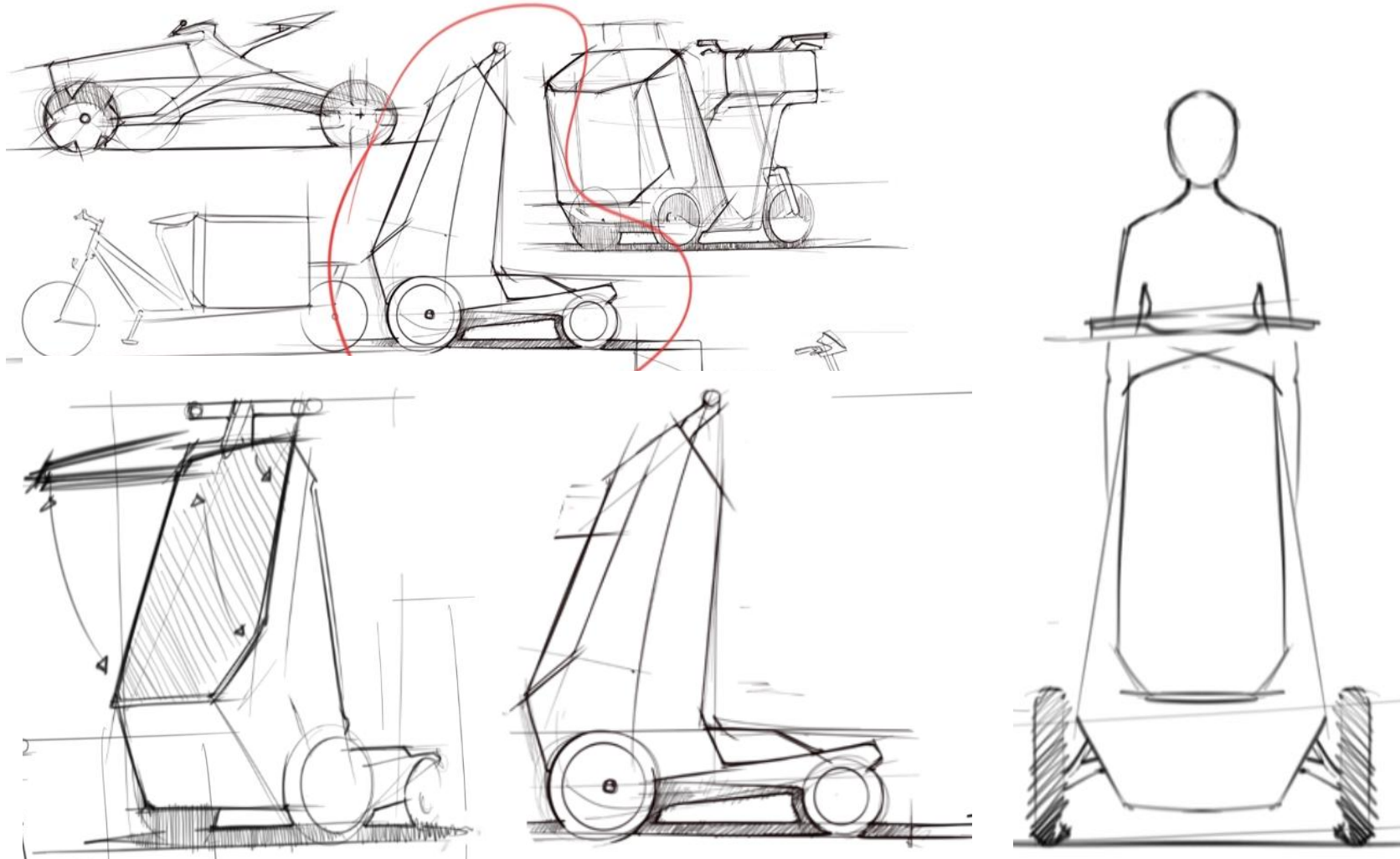
Concepts Sketches



- These concept sketches were inspired from the fat tire e-bike which a flat platform

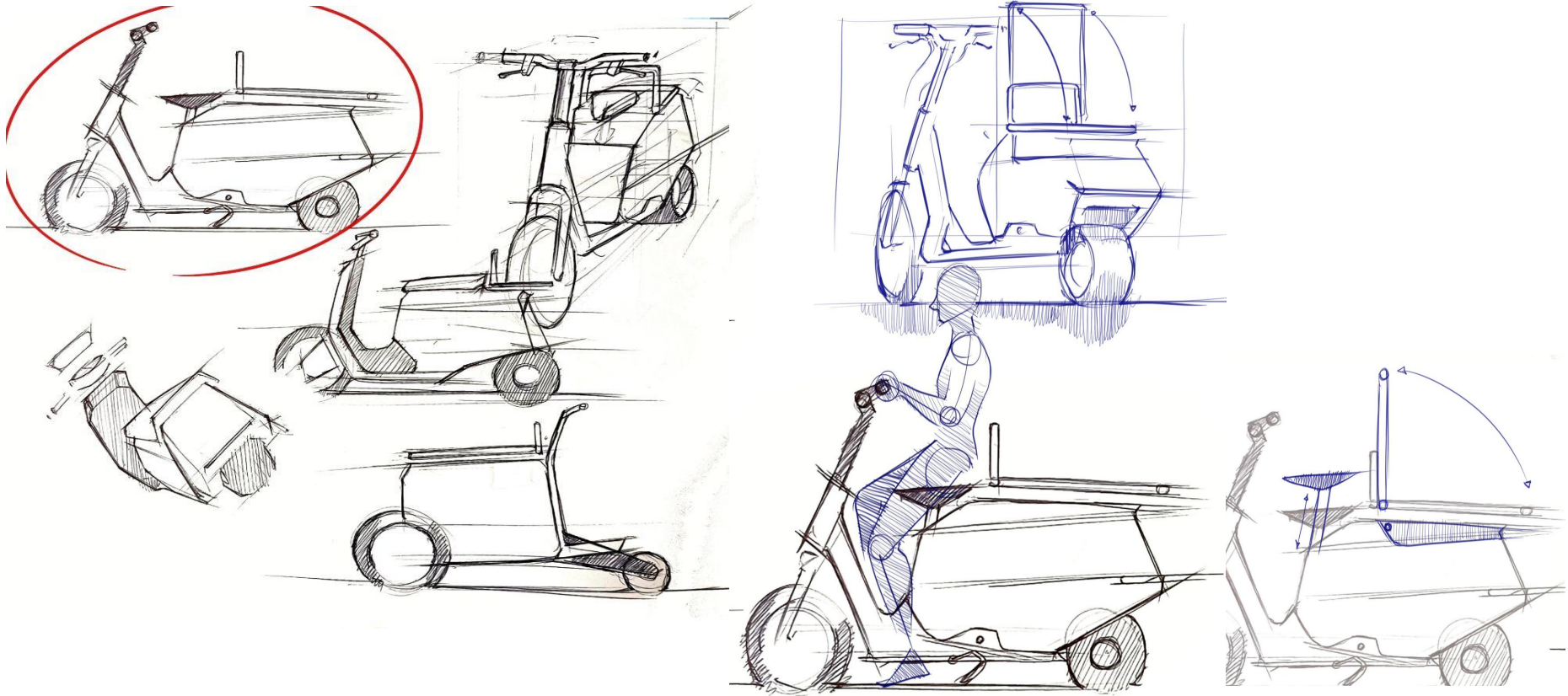


Concepts Sketches

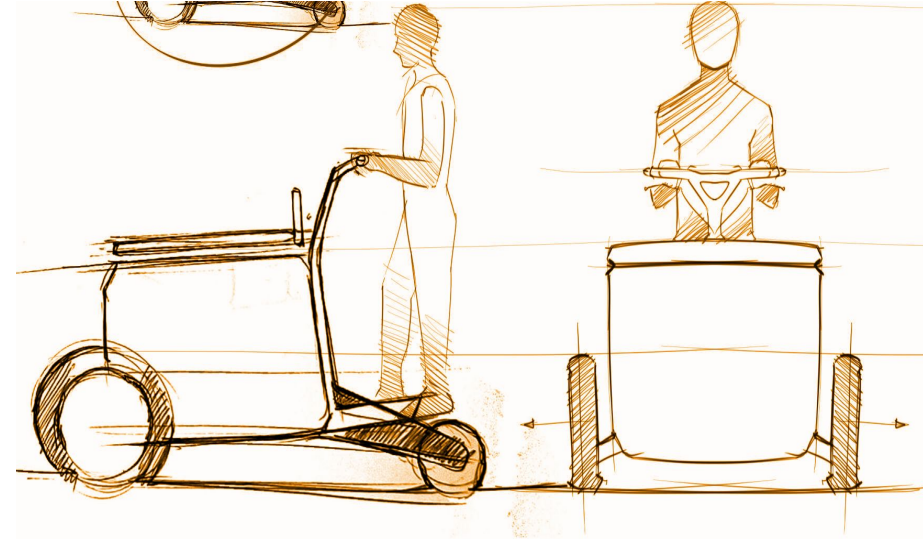
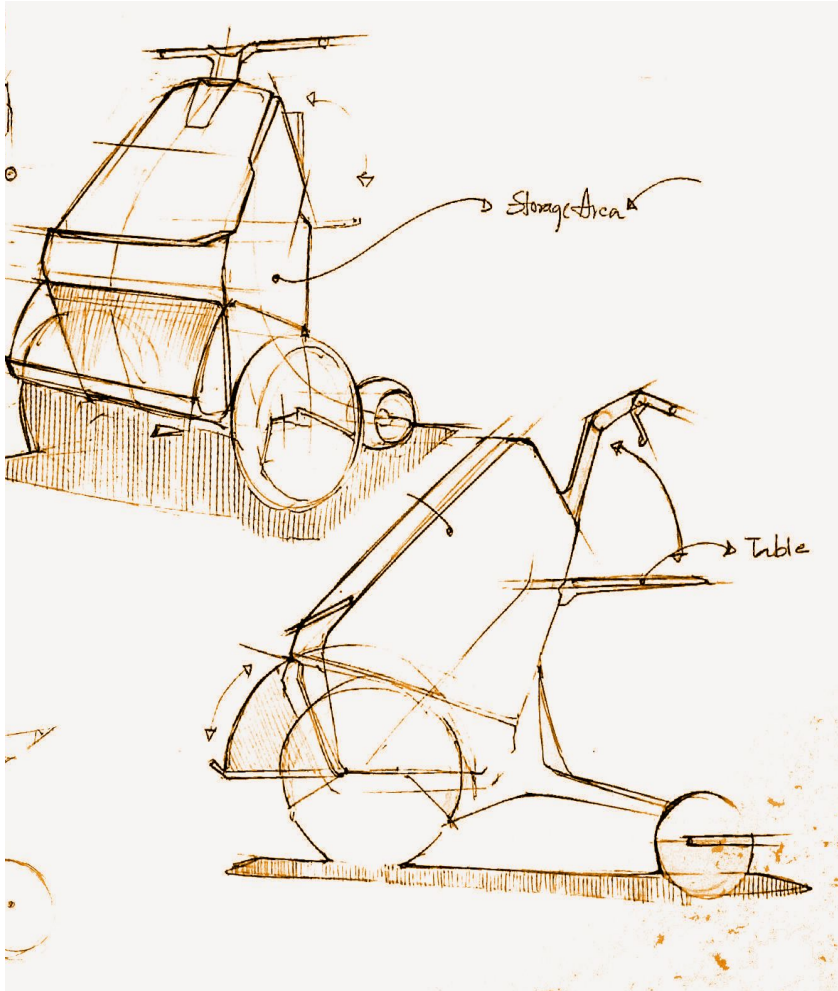


Concepts Sketches

- This concept sketch was developed with an intention of having a bigger storage capacity at the back of the vehicle



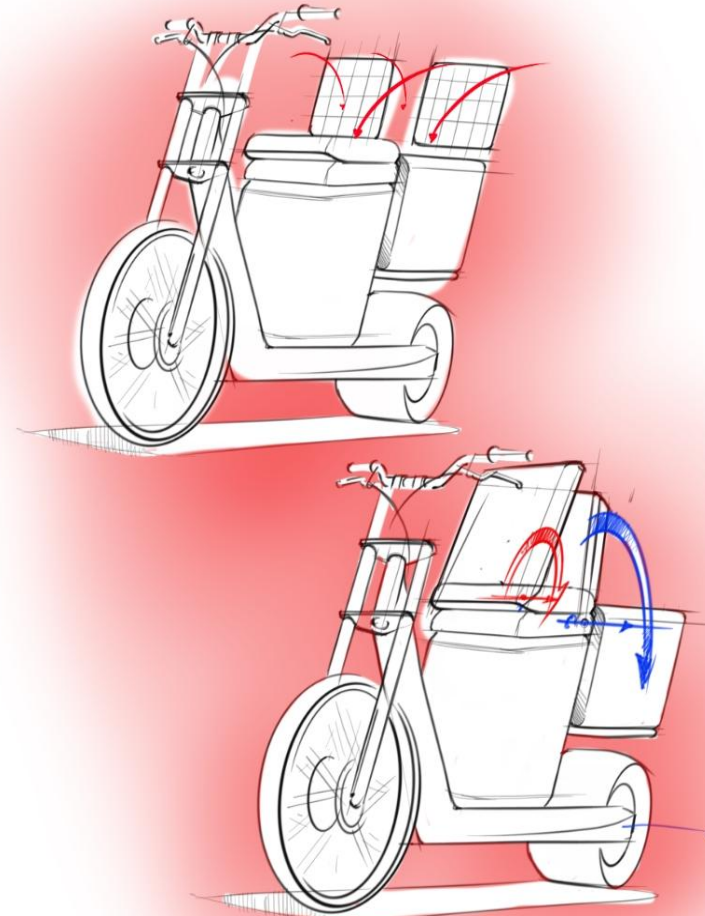
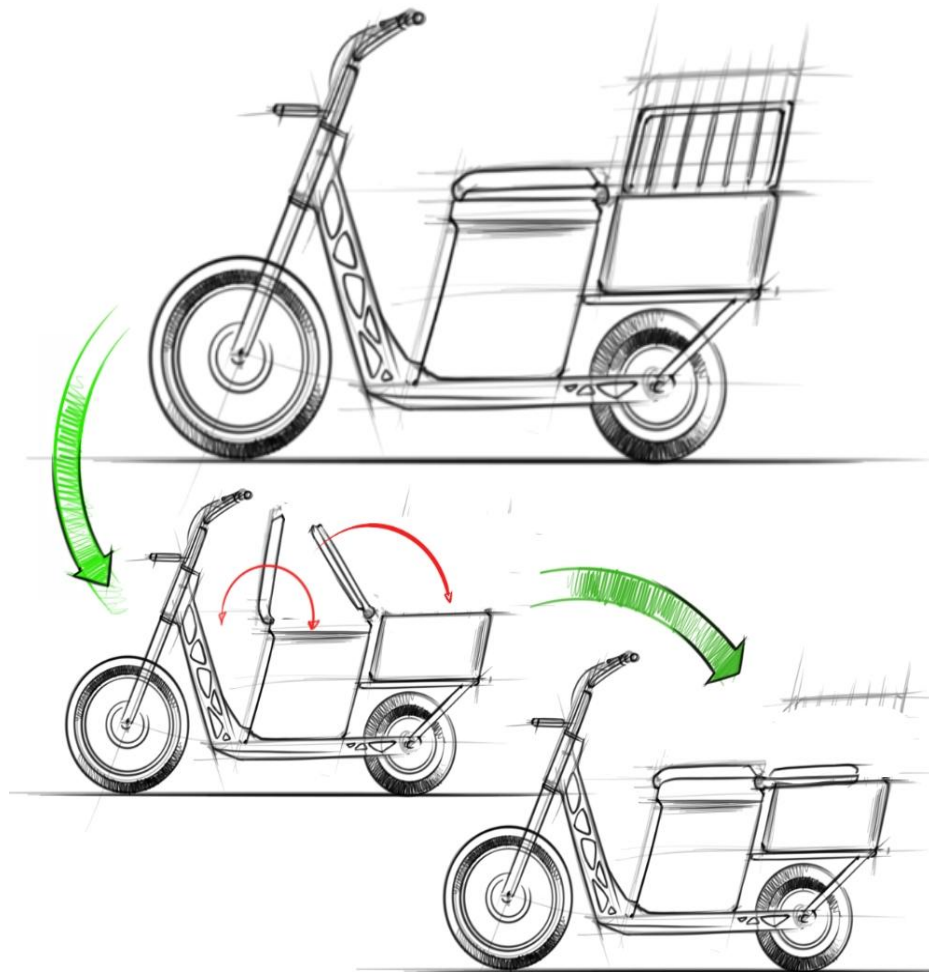
Concepts Sketches



- This concept sketch was developed with an idea of reverse trike platform.

This particular concept have storage unit in the front of the vehicle and this vehicle will be based on EV Powertrain.

Concepts Sketches

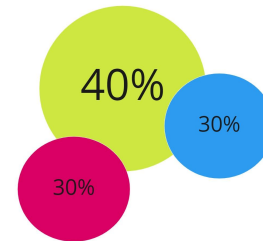


Categorization of concept sketches

Category 1

- In this concept I have tried to combine all the concepts which have storage space in the rear. The concept vehicles are designed majorly focusing on rear carriage capacity of the vehicle.

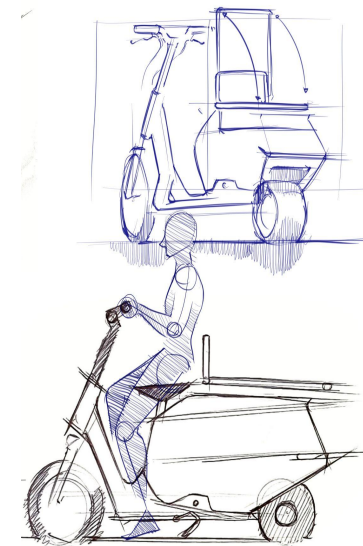
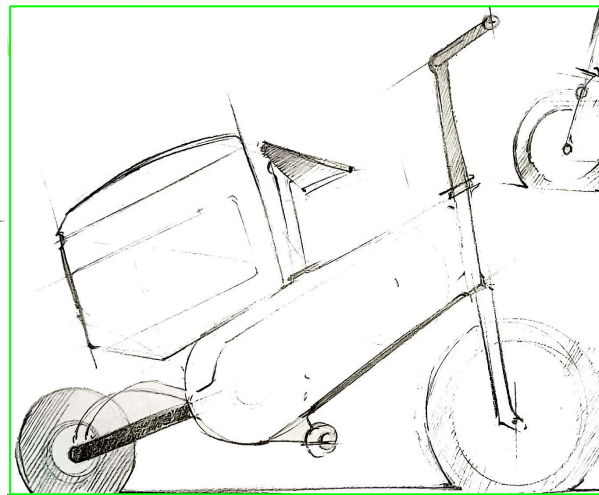
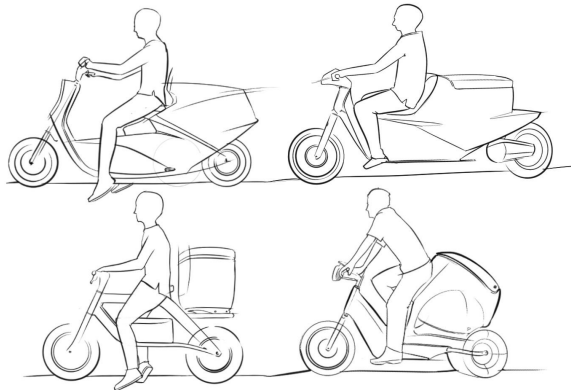
I have tried to achieve different form and space for the storage area .



Hygiene.

Ride and Handling.

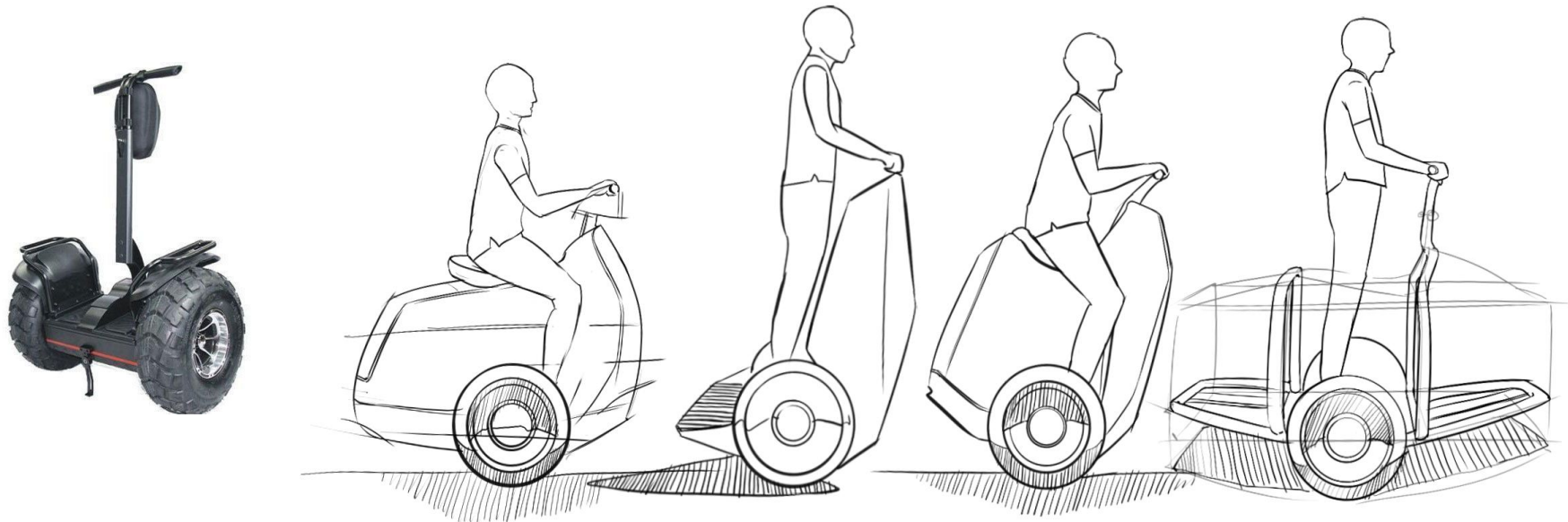
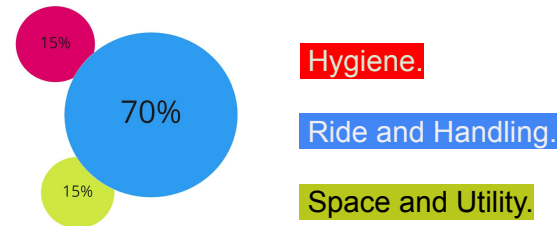
Space and Utility.



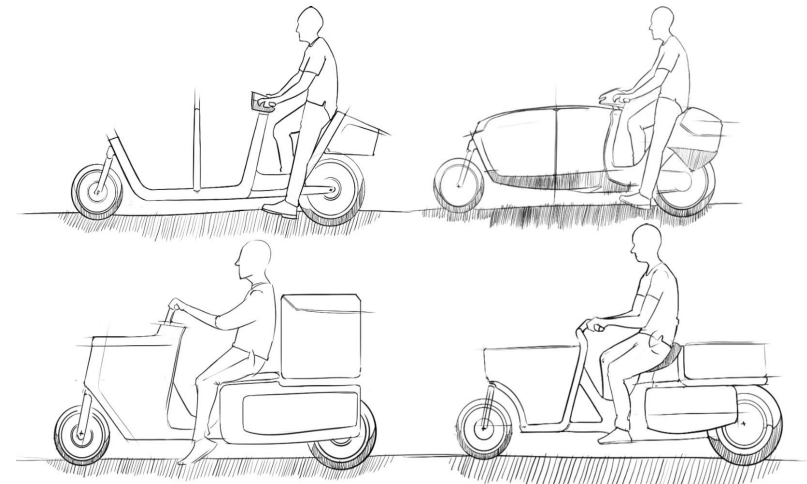
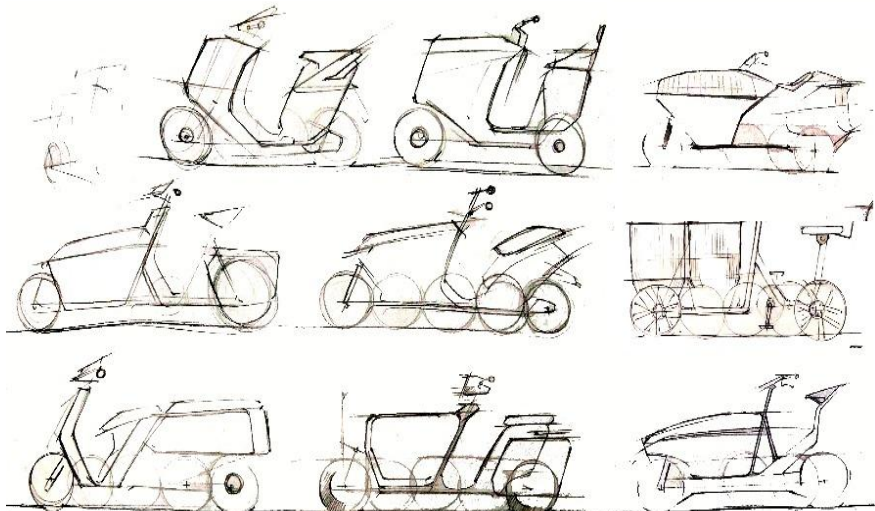
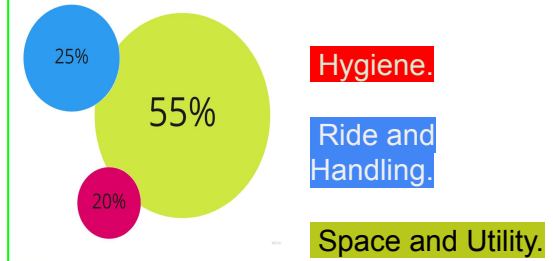
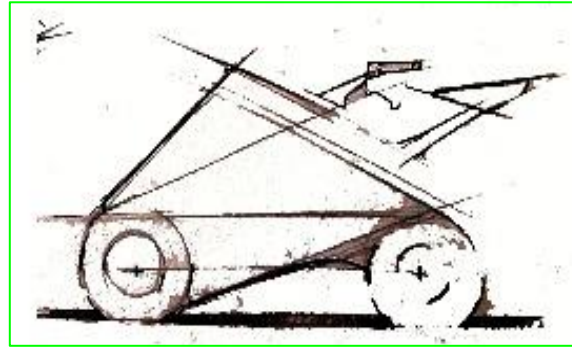
Category 2

- This concept is based on the platform of segway, like the he previous concept I have tried different configurations of riding position

You can observe that the percentage of driving factors such as hygiene and utility space are very less in comparison to the ride and handle.

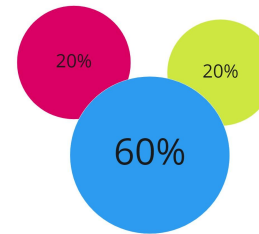
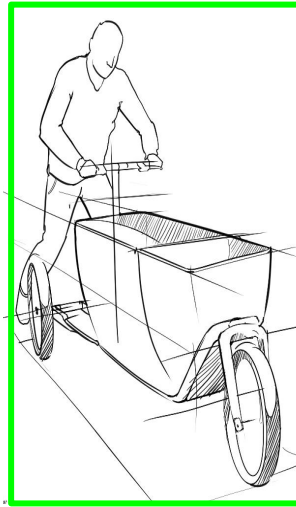


Category 3



Category 4

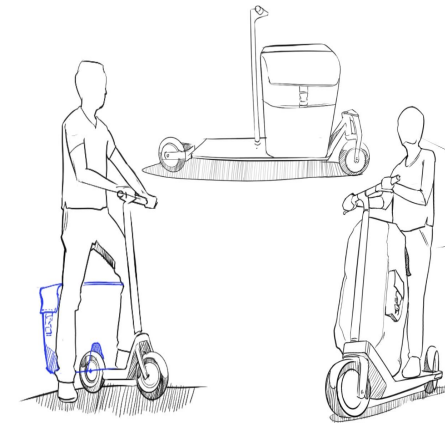
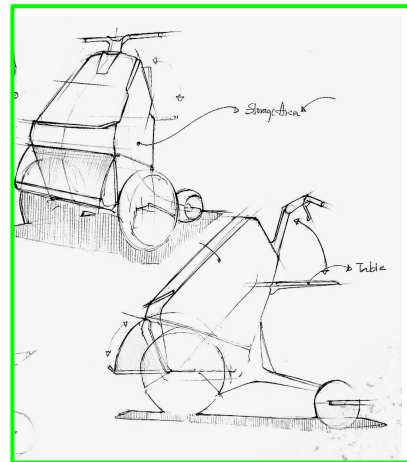
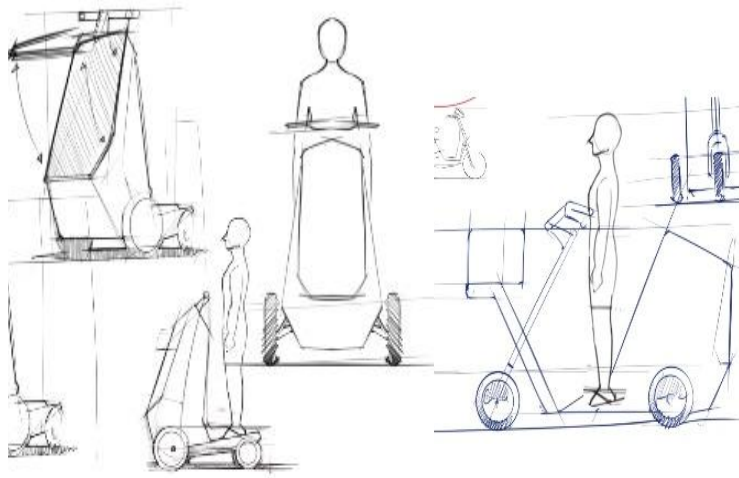
- In this concept the vehicles have cargo capacity at the front. Considering the design drivers the



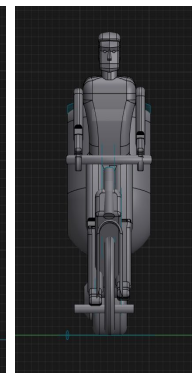
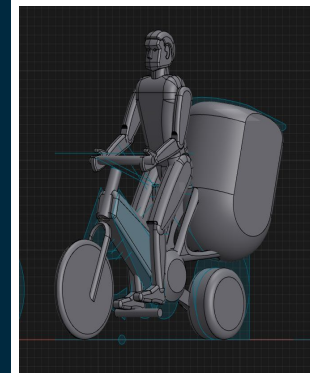
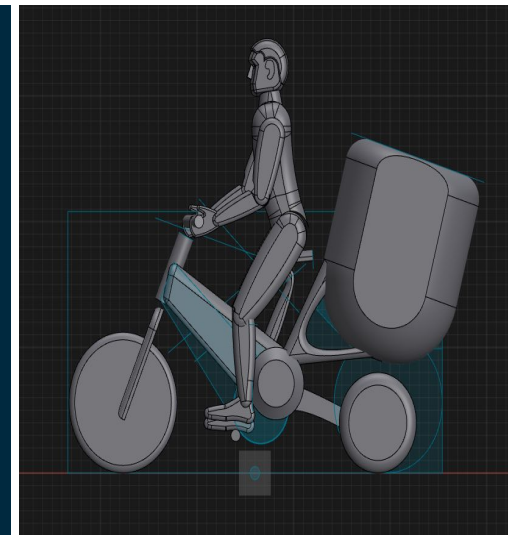
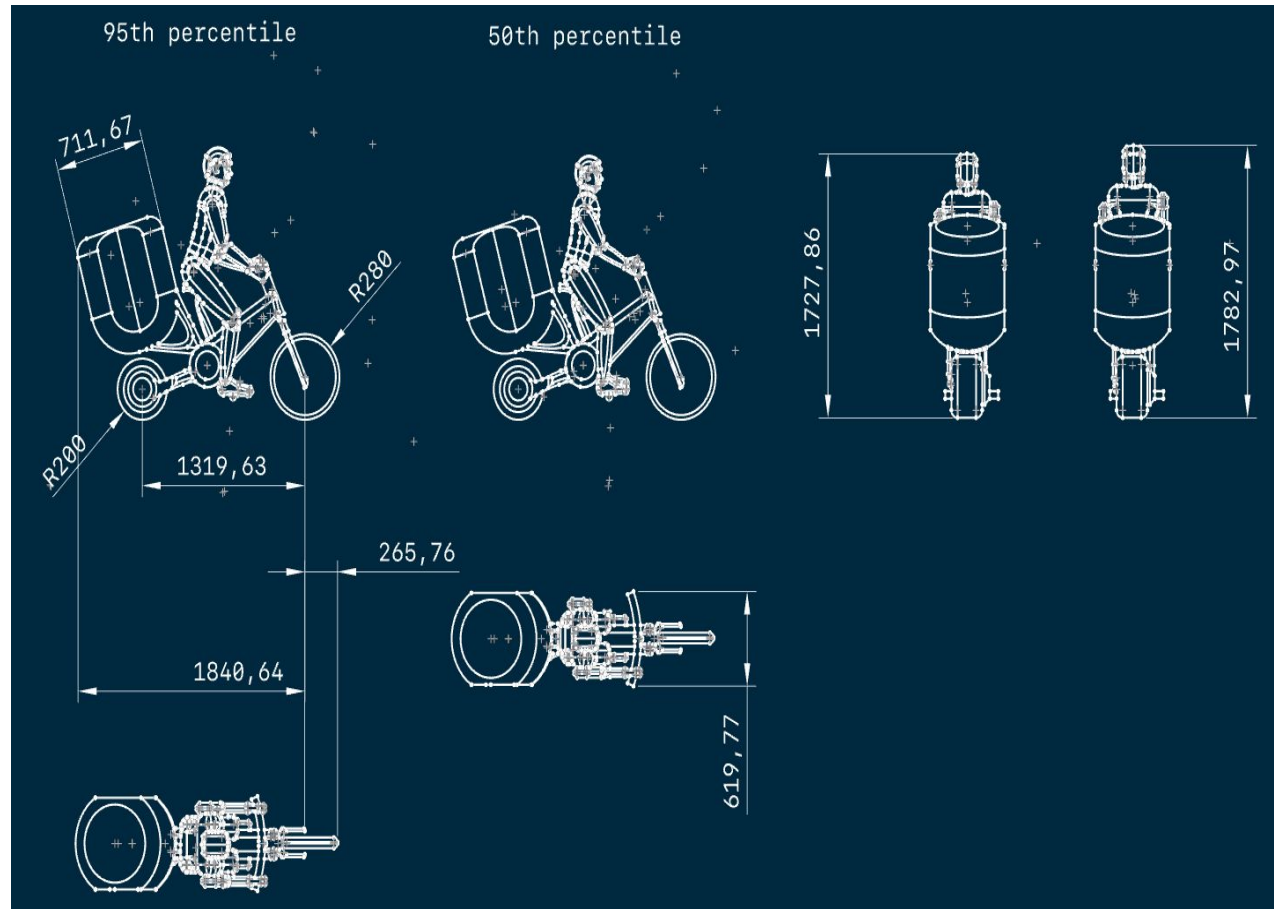
Hygiene.

Ride and Handling.

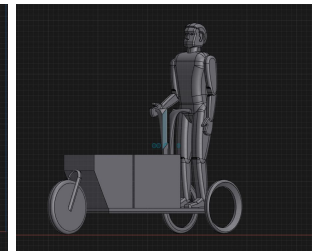
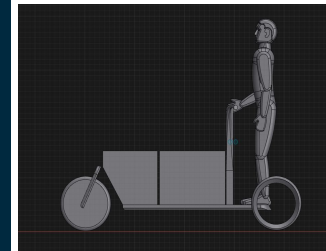
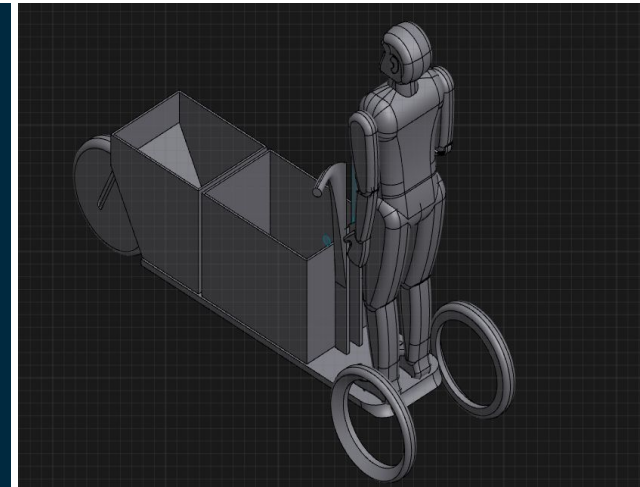
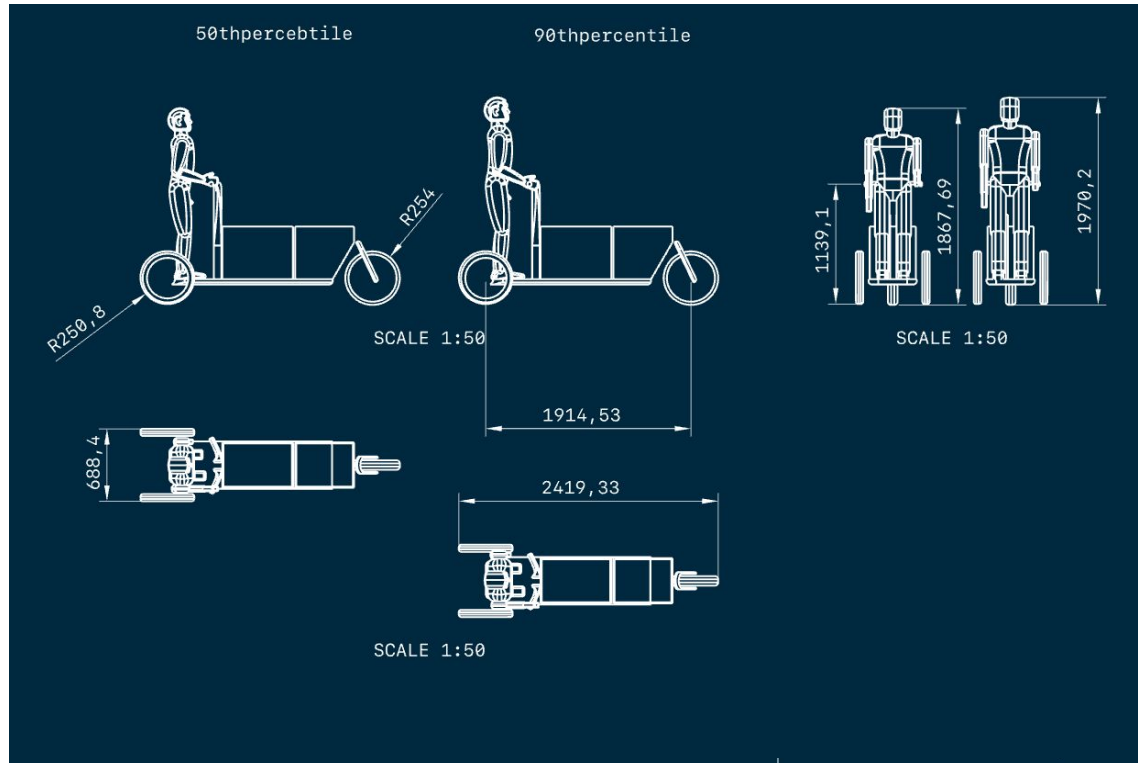
Space and Utility.



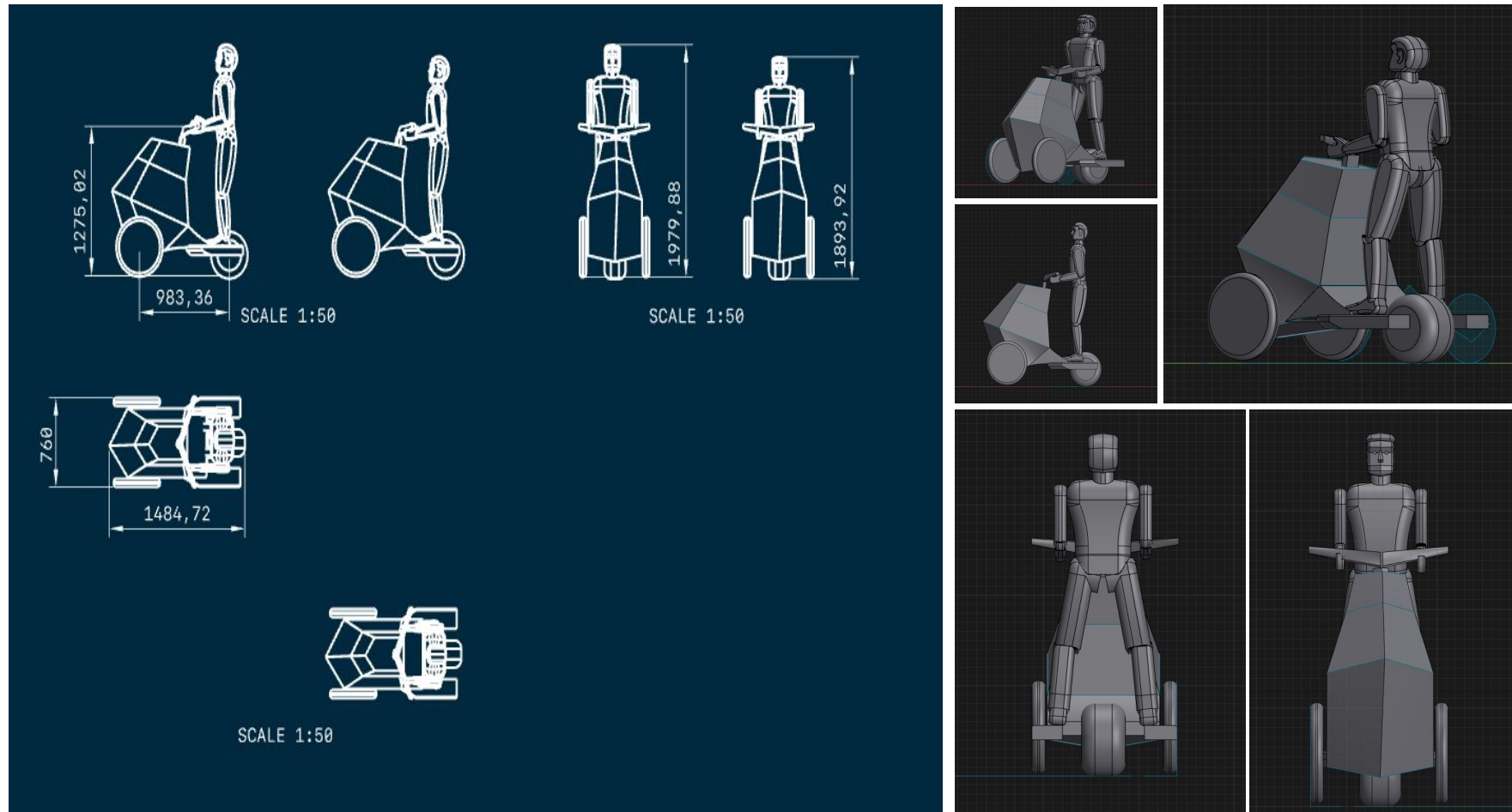
Concept 1



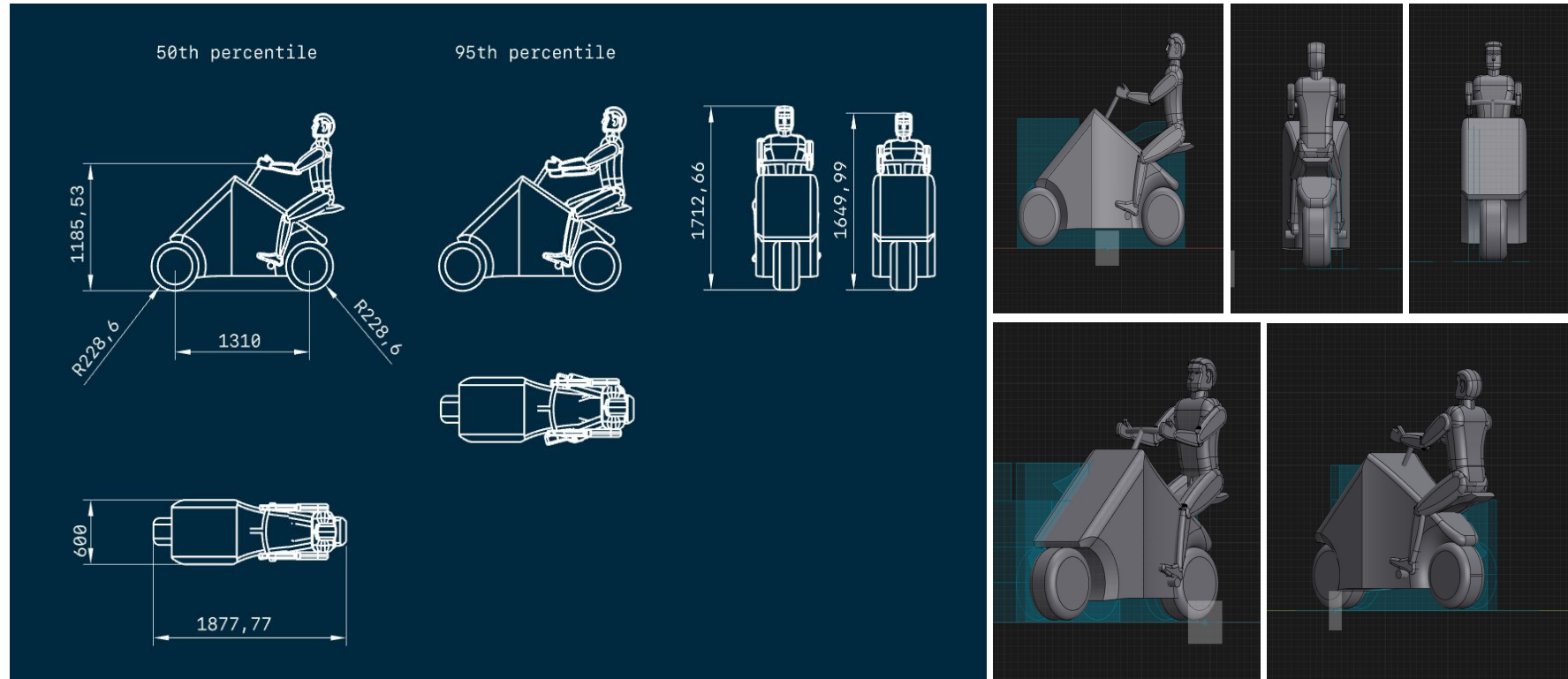
Concept 2



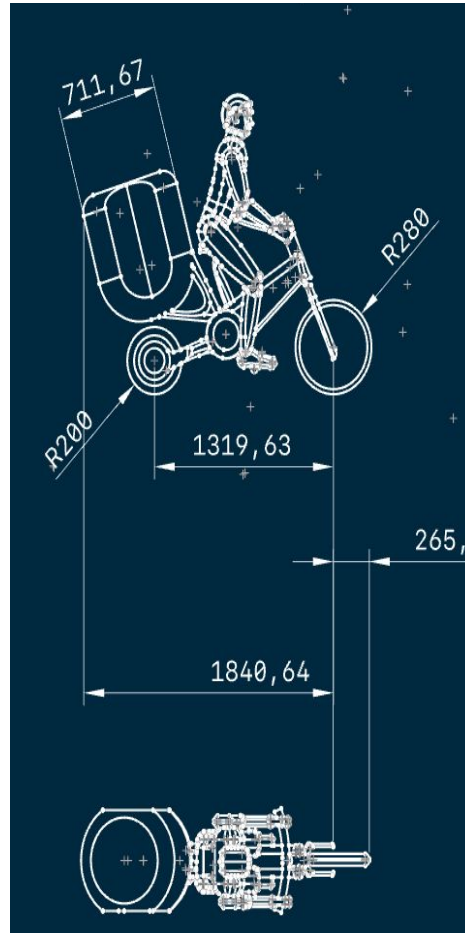
Concept 3



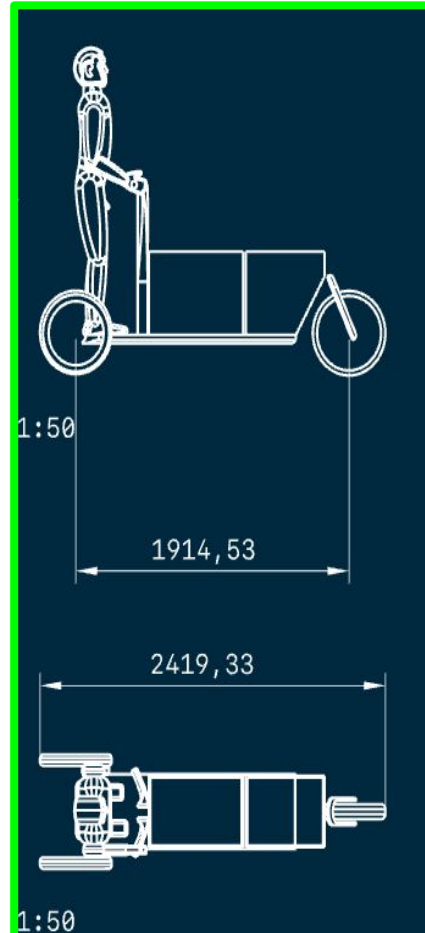
Concept 4



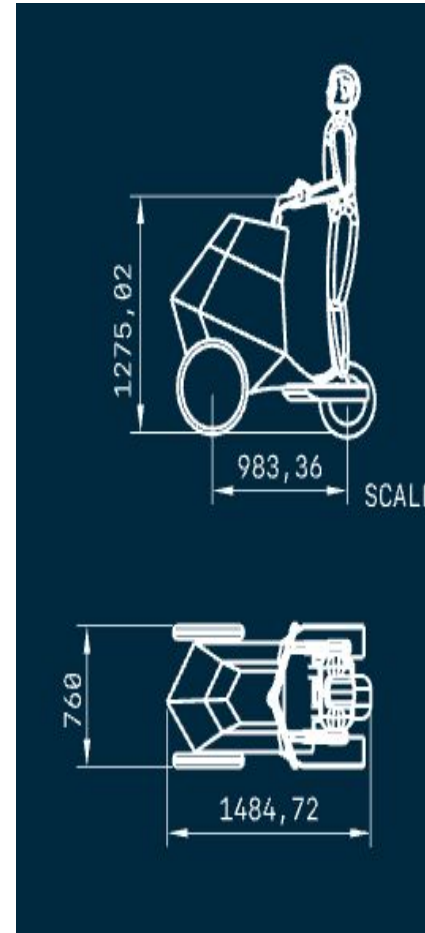
Concept 1



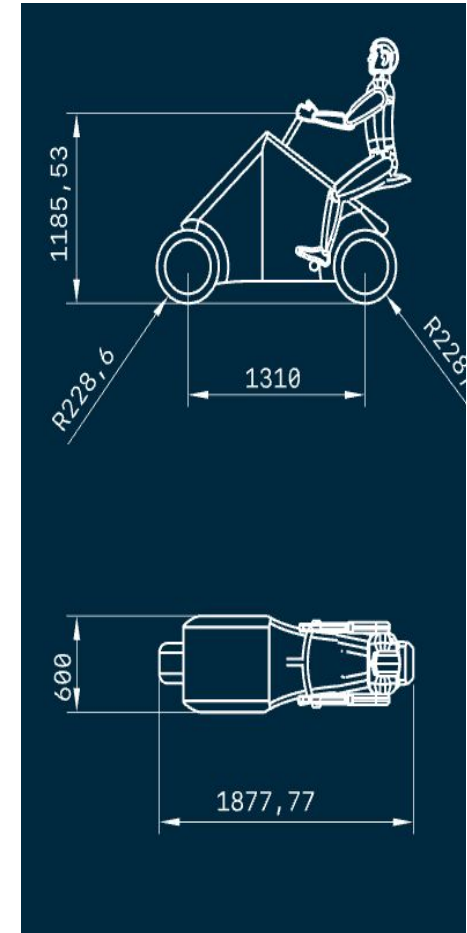
Concept 2



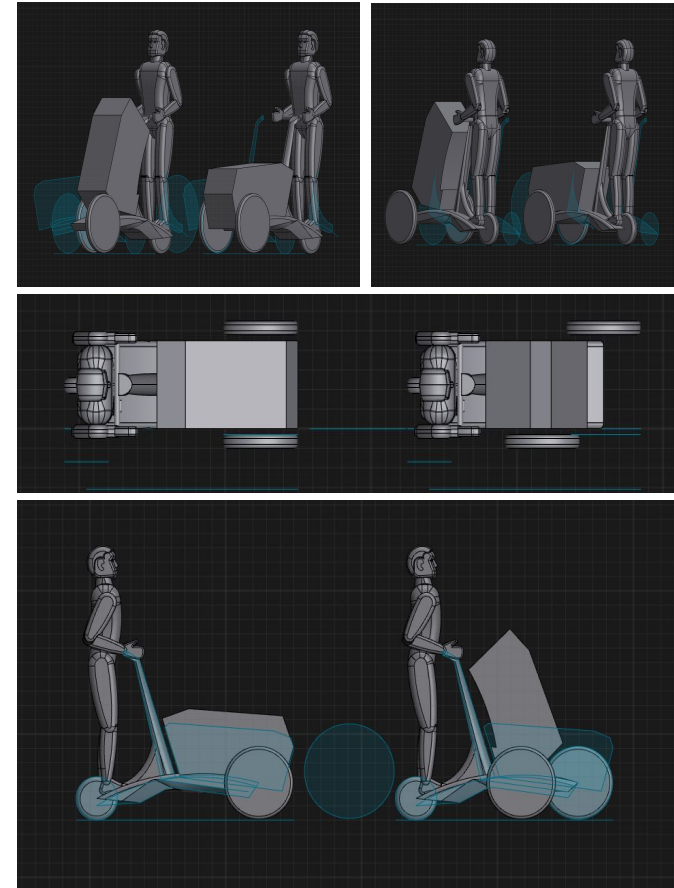
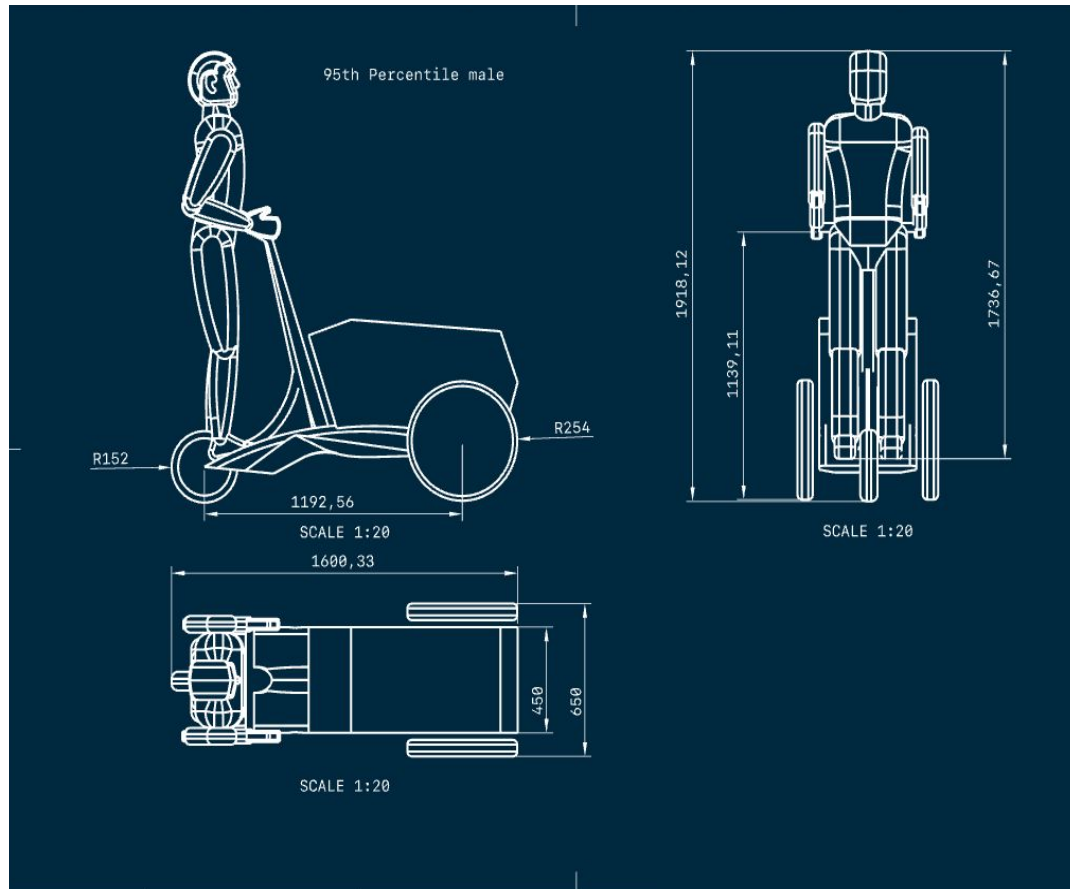
Concept 3



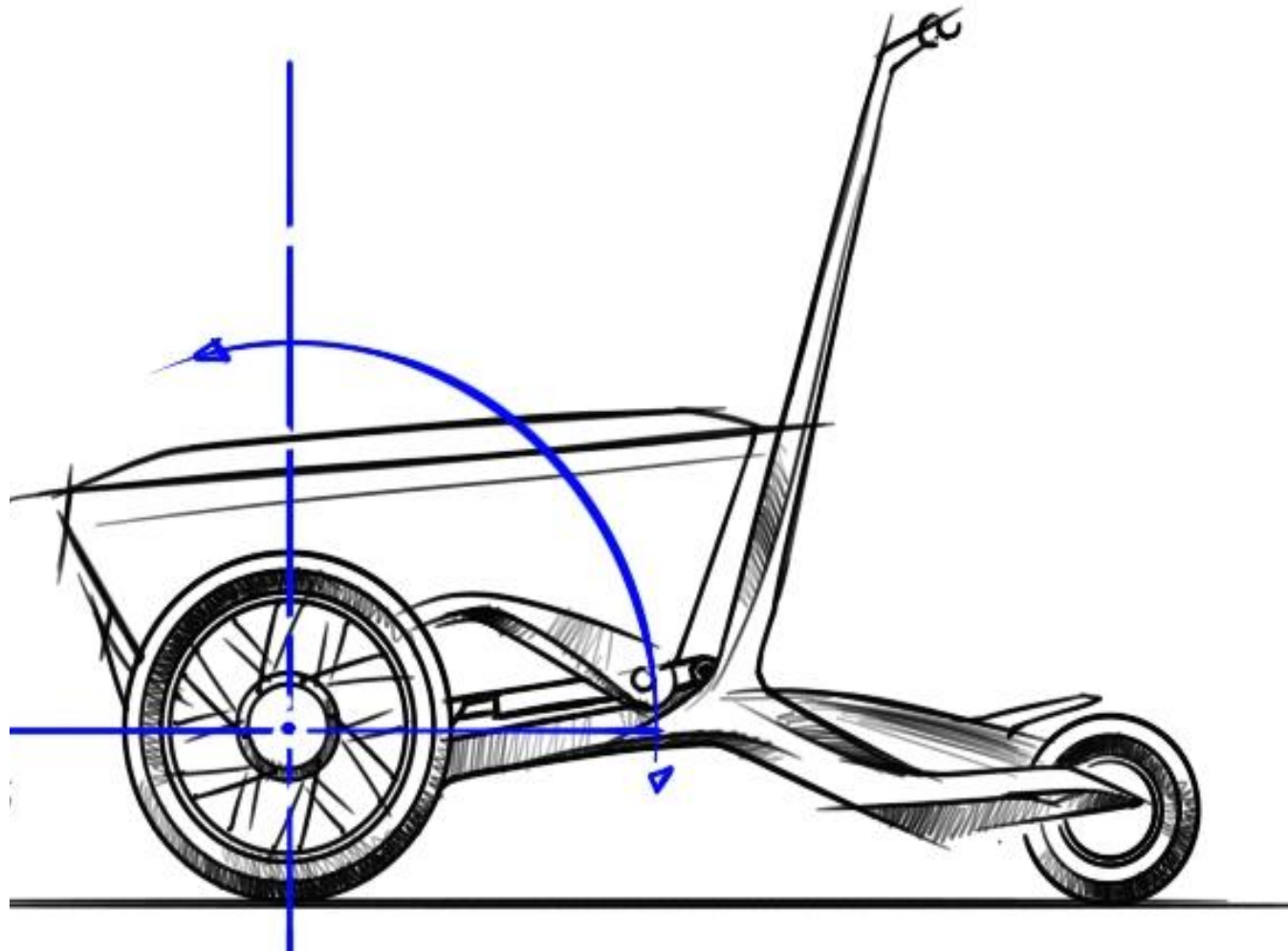
Concept 4

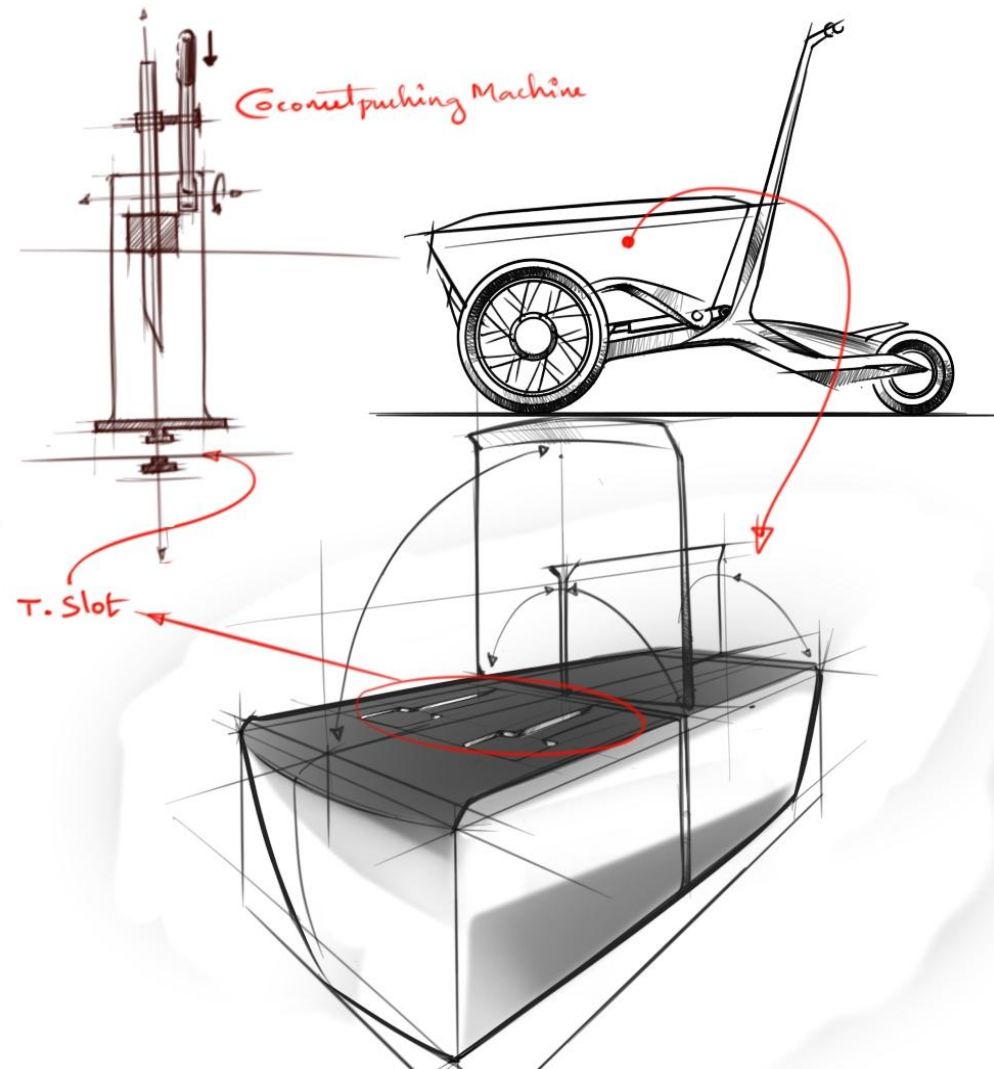
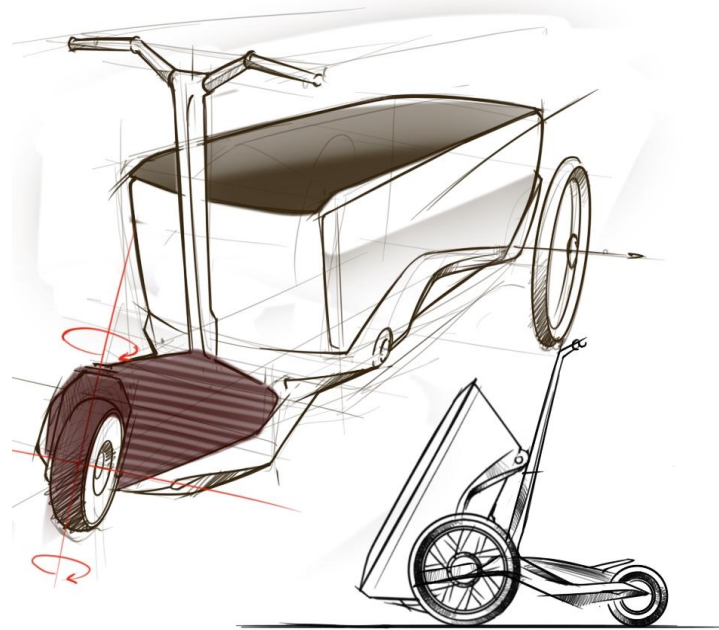


Final Concept



Final Concept Sketch

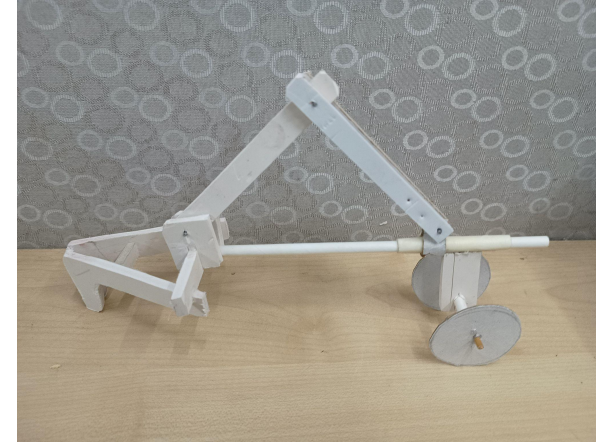




Mock up Model

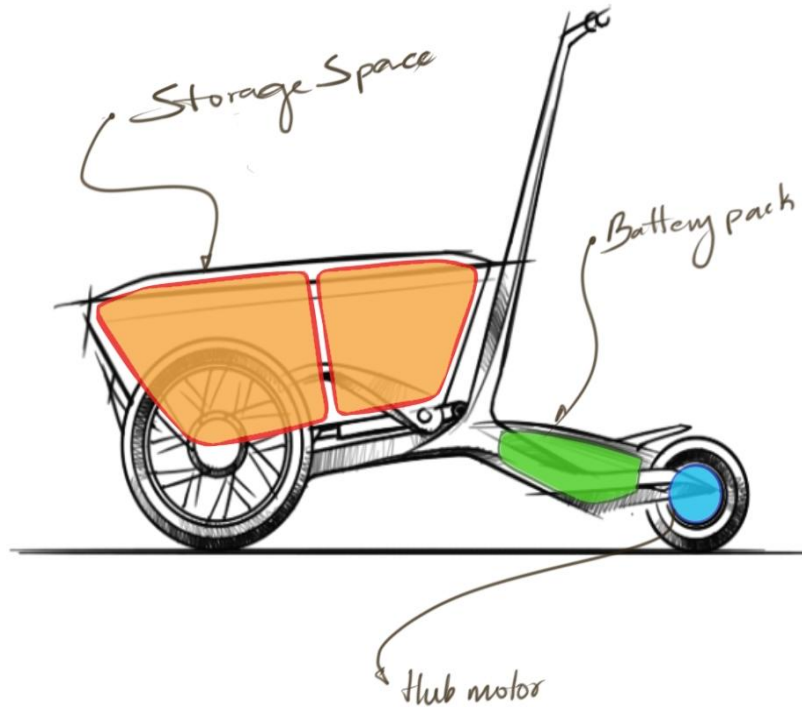


- The model contracted position reduces the wheel base. on the image given above, the point of contact of the vehicle to the ground is at three points. The storage basket will be attached to the front arm, And the wheels are attached to the same swing arm. The storage space/unit will be in vertical position and this is done when the user is not carrying any load or goods in the storage/space unit.



- In the above image you can see the mechanism in the extended form. The storage unit/space will be in horizontal position, this setup is used when the storage unit is fully filled

Vehicle Packaging



The Packaging Of the Vehicle Includes

- Storage Compartment
The storage compartment is situated in the front portion of the vehicle. This unit is connected to a lift mechanism which help in reducing the wheelbase of the vehicle
- Battery unit
Battery unit is situated under the floorboard over which the user stands.
- Motor Unit
A 12 inch hub motor mounted to the rear wheel of the vehicle.

Technical Details



Dimensions of Tender Coconut

Diameter: 15-16 cm

Height: 19-20 cm

Volume: 4.021 L

Dimension Of the Basket

Length: 55 cm

Diameter: D1=60cm, D2=65cm

Volume: 150728.37953148 cm³ = 150 L

No of Coconuts basket could accommodate = Volume of the Basket / Volume of the tender coconut
= 150/4 = 37.6

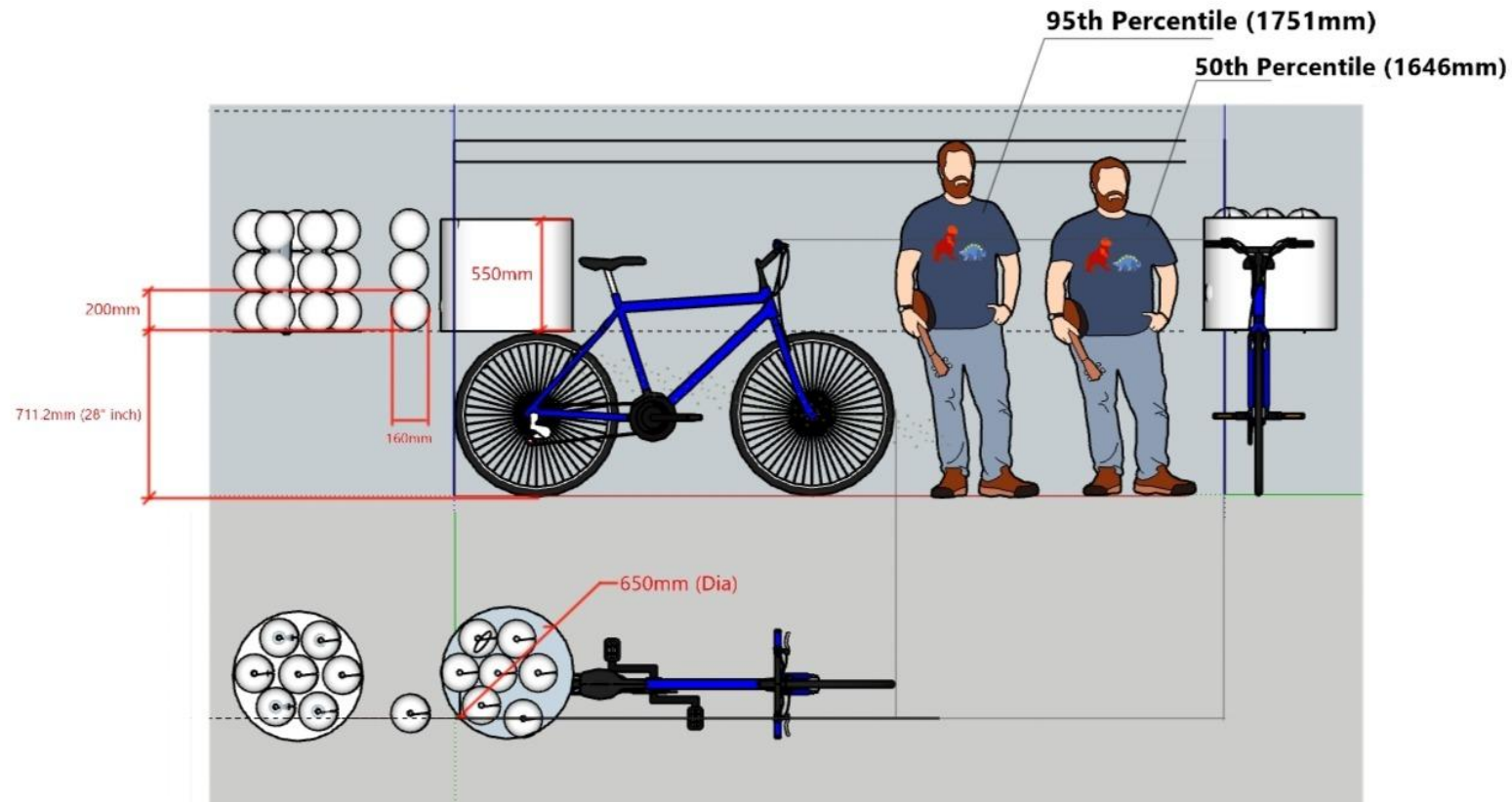
Approx. = 38 Coconuts

Weight of one coconut = 1.2Kg

weight of 38 coconut = 1.2 x 38 = 45.6 kg

miro

Technical Details



Inspiration Board

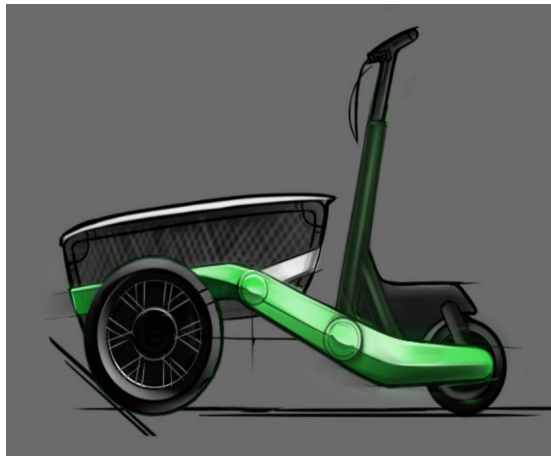
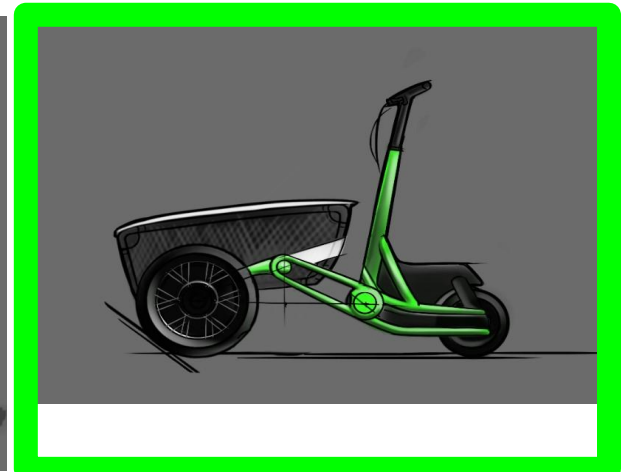
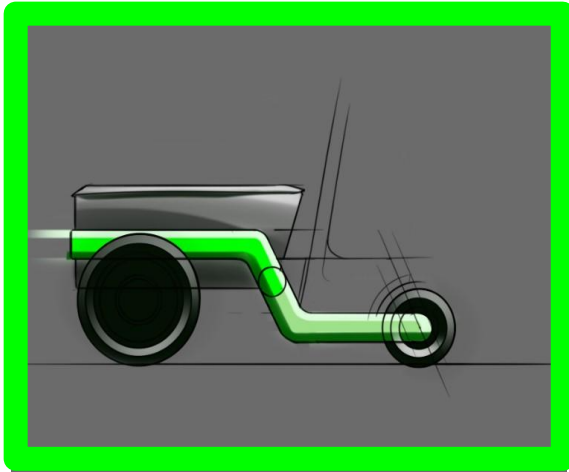
CLEAN



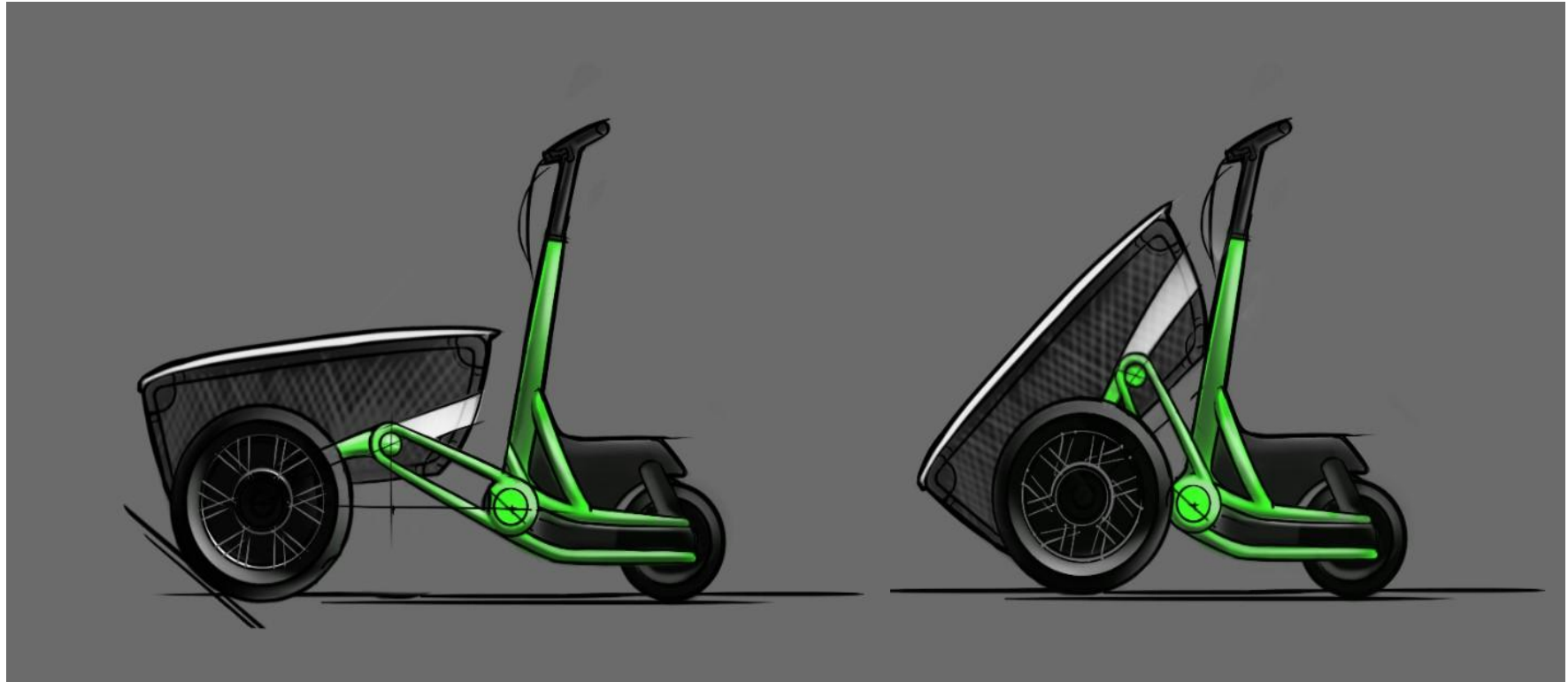
HARMONIOUS

UNIFORM

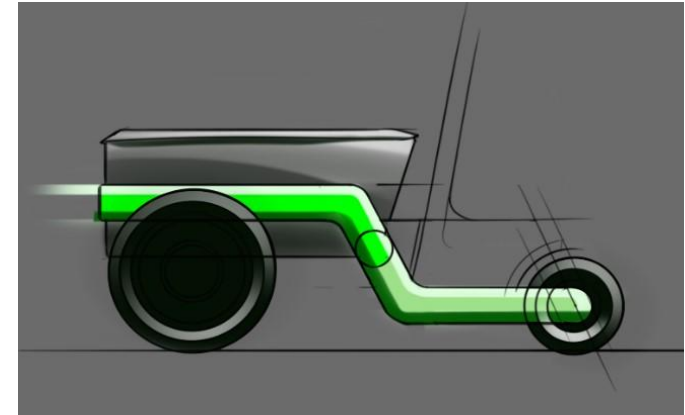
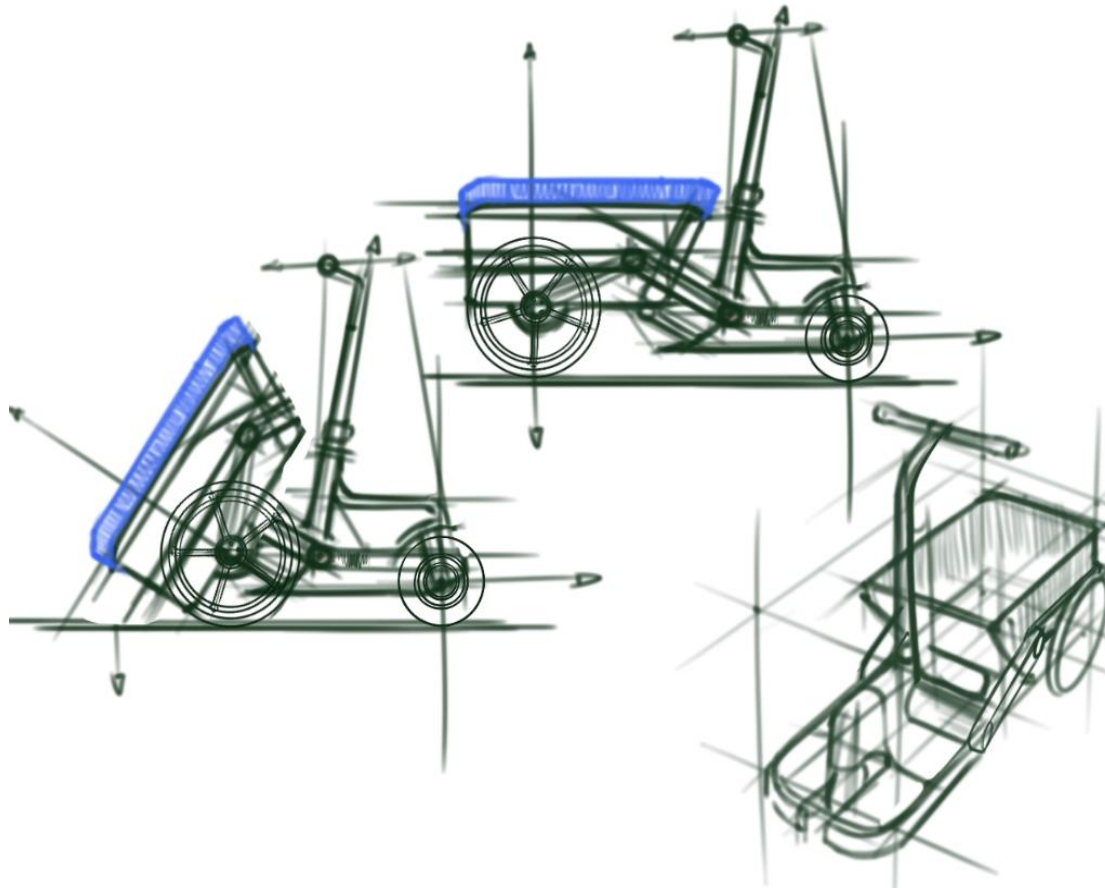
Form Ideation



Form 1



Form 2



Form 1



Form 2

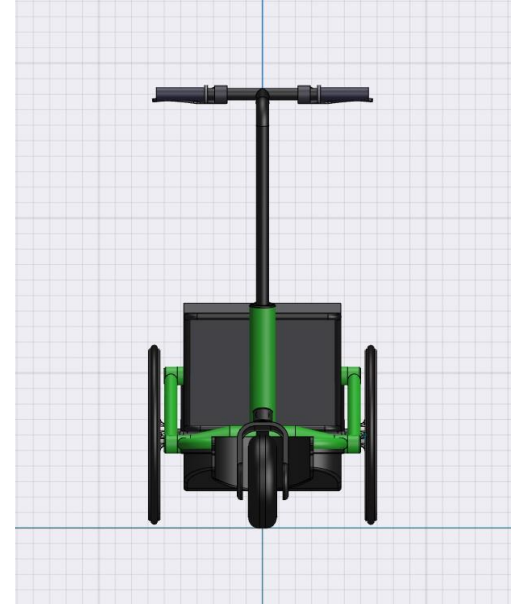


3D Model

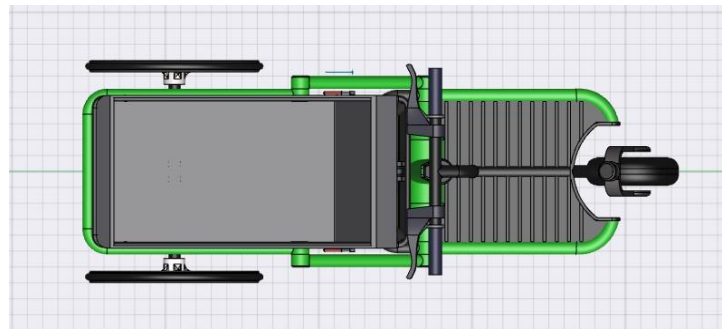
Side view



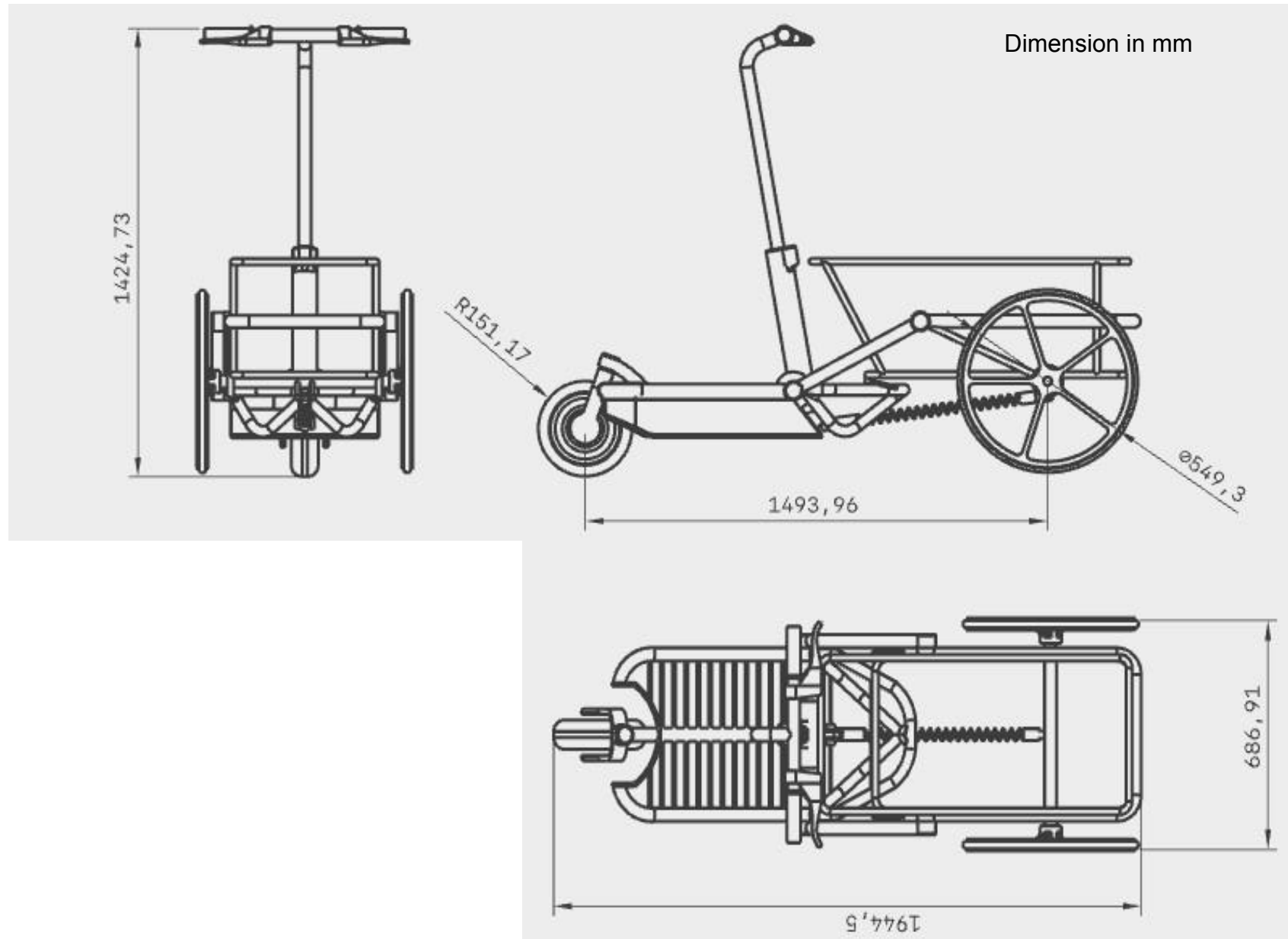
Rear view



Top view

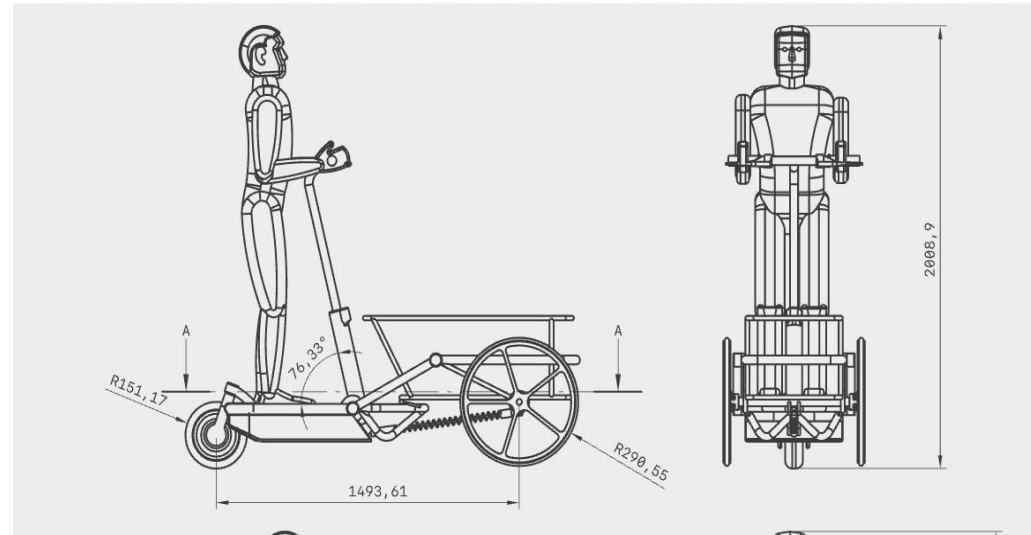


Vehicle Dimension

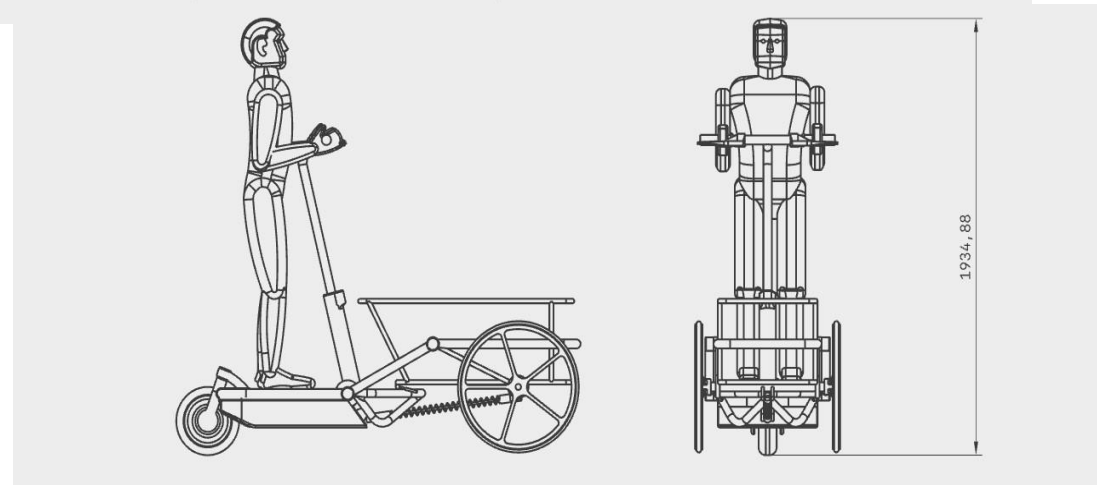


Vehicle Dimension

95th percentile



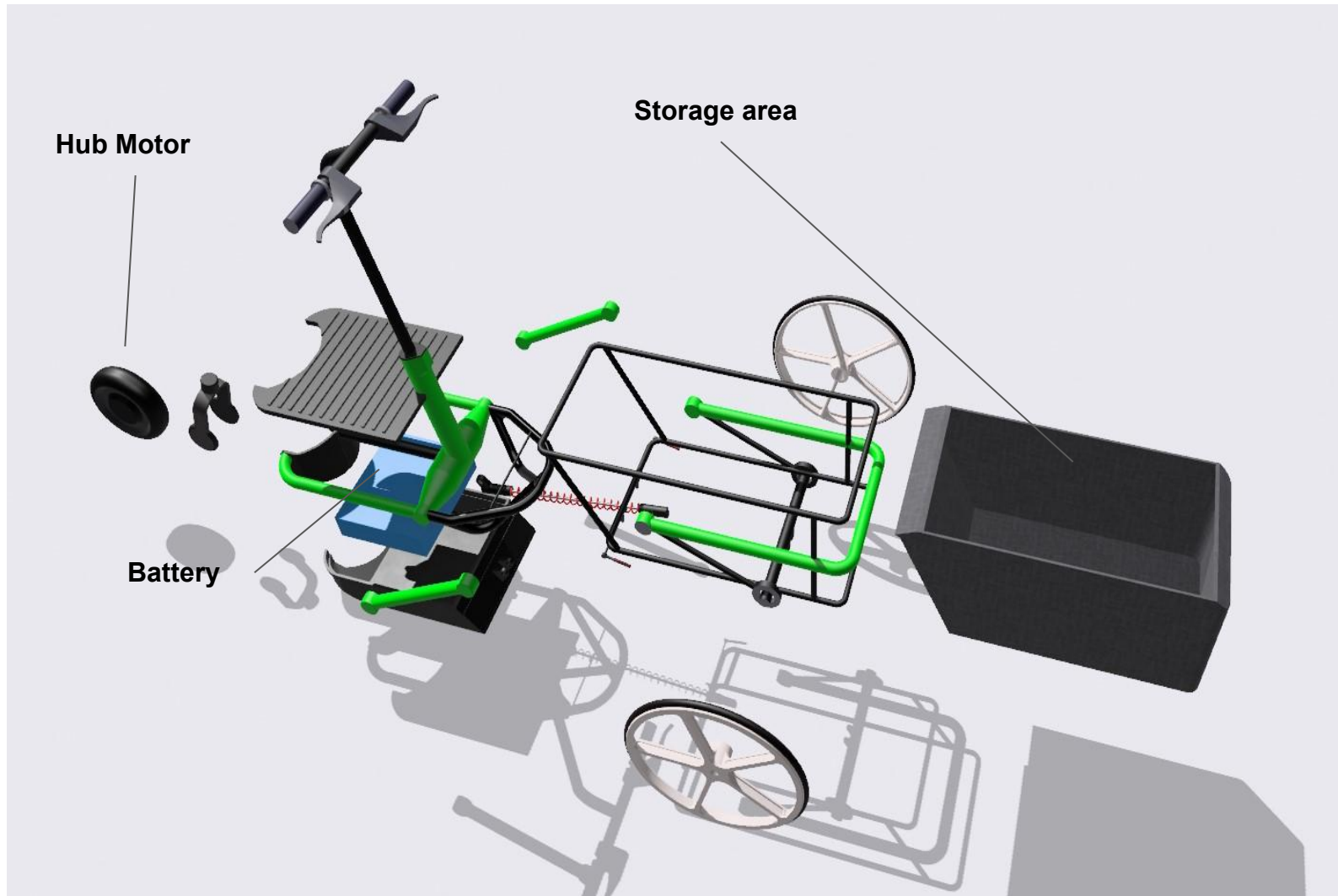
50th percentile



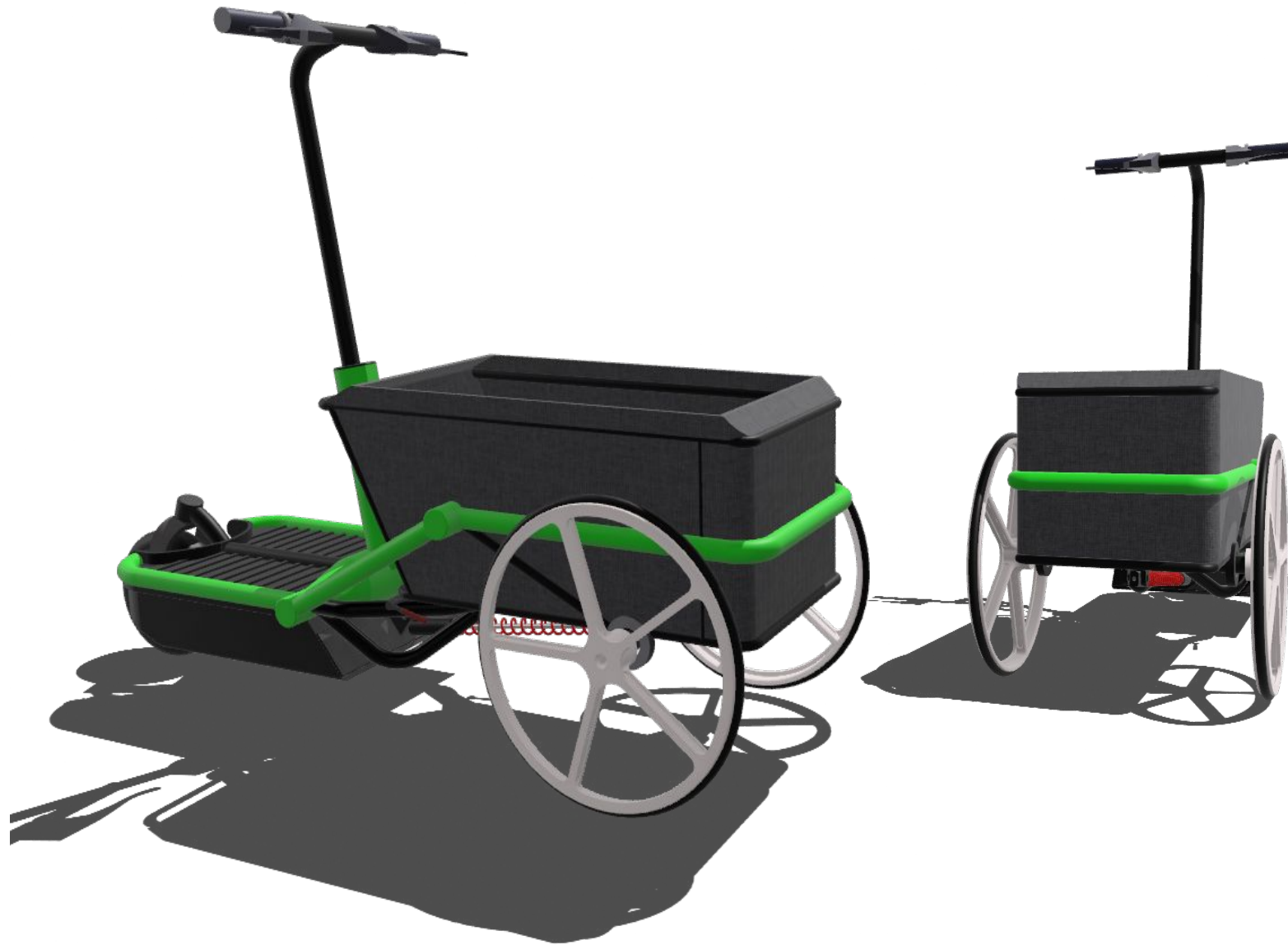
Vehicle Renders



Exploded Form

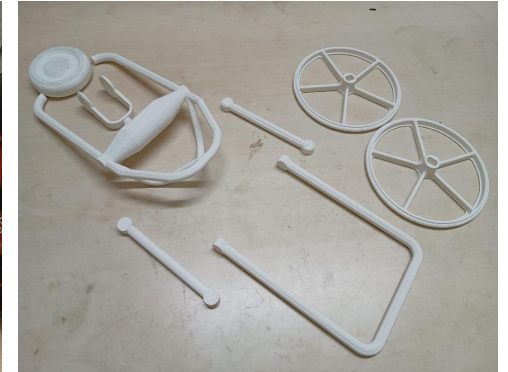








Physical Model



Reference

1. <https://nasvinet.org/research-document/Street%20Vending%20in%20Ten%20Cities%20in%20India.pdf>
2. <https://thecocoexpress.in/products/megapro-coconut-water-vending-cart>
3. <https://thecocoexpress.in/products/classic-coconut-water-cart>
4. <https://www.google.com/maps/place/Dadar,+Mumbai,+Maharashtra/@19.0200256,72.84764,15z/data=!4m5!3m4!1s0x3be7cedb0ea5.0cd0f:0x428a465039995bd0!8m2!3d19.0177989!4d72.847812>