

# Compact cargo bike for Indian market

DEP702- Design project-II

Project by:

**Tekhengutso Therieh**

**216390014**

Guided by:

**Prof. Nishant Sharma**

Mobility and Vehicle Design

IDC School of Design



**IDC** School of Design  
अभिकल्प विद्यालय

## DECLARATION |

I hereby declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated any idea/data/ fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Tekhengutso Therieh

216390014

Date:

Master of Design

Mobility and Vehicle Design

IDC School of Design, IIT Bombay

## **ACKNOWLEDGMENT |**

I am writing to express my immense gratitude to Prof. Nishant Sharma, associate professor IDC IIT Bombay, for his constant guidance and invaluable instructions given to me to be in a proper direction for accomplishing the target. Special thanks to all who have constantly been helping me and encouraging me throughout the project, prof. Sughand Malhotra and my colleagues. Also, the IDC staff who helped me in my project and all the individuals who helped me during my initial research. I also thank my family and friends for their support and guidance.

Tekhengutso Therieh

216390014

## APPROVAL SHEET|

This Mobility & Vehicle Design Project II titled 'Compact Cargo bike for Indian market' by Tekhengutso Therieh is approved in partial fulfillment of the requirements for Master of Design Degree in Mobility & Vehicle Design, IIT Bombay.

Project Guide:



Chair person:



Internal Examiner:



External Examiner:





## Table of contents |

### 1. Introduction:

|                  |    |
|------------------|----|
| 1.1 Introduction | 1  |
| 1.2 Aim          | .2 |

### 2. Research

|                             |    |
|-----------------------------|----|
| 2.1 Secondary research      | 3  |
| 2.2 User Study              | 9  |
| 2.3 User story              | 15 |
| 2.4 Insights                | 18 |
| 2.5 Technical Specification | 21 |
| 2.6 Benchmarking            | 27 |
| 2.7 User persona            | 32 |

### 3. Design Brief 33

|                               |           |
|-------------------------------|-----------|
| <b>4. User Case</b>           | <b>35</b> |
| <b>5: Concept Generation</b>  | <b>39</b> |
| <b>6. Concept Development</b> | <b>51</b> |
| <b>7. Concept Mock Up</b>     | <b>57</b> |
| <b>8. Final Concept</b>       | <b>60</b> |
| <b>9. 3D Modeling</b>         | <b>62</b> |
| <b>10. 1:5 Mock Up model</b>  | <b>72</b> |
| <b>11. Reference</b>          | <b>73</b> |

## Introduction |

Most of the cargo bicycles or tricycles that exist in the Indian market are for commercial purpose (or are viewed to be for commercial use) , with the increase in the environment and health concern many individuals started cycling, cycling for running errands or going to work has now become more prevalent. Here is where the need of a cycle that is practical enough to carry an individual and their belongings with ease is needed.

This project is not only limited to the bicycle segment, but also at the tricycle segment. And will try to solve the issue with a novel solution with respect to the Indian consumers.

## Aim |

Human powered vehicle today play a very important role in this world where environmental and health concerns are the main priority. HPV help us to not only move from a place to another but also do it by keeping us fit and contributing to the reduction of carbon footprint. It is also found to be one of the most efficient and cheap way to move around. This project aims to design a practical HPV, that can help an individual to commute from one place to another with the added benefits of carrying goods or cargo, this will help and encourage individuals to run errands and use it for their daily commute. It aims to identify the needs of the current bicycle or HPV users and come up with a solution that can help them with their daily commute.

## Research |

### Benefits of pedal driven personal vehicle

The long term benefits of cycling to health, the economy, and the environment far exceed the short term cost of investment in cycling. we can also see that these benefits can be vastly divided into two parts, direct benefits, which accrue to individuals, and indirect benefits, which are realized by society on account of increased cycling and reduced use of motorized transport.

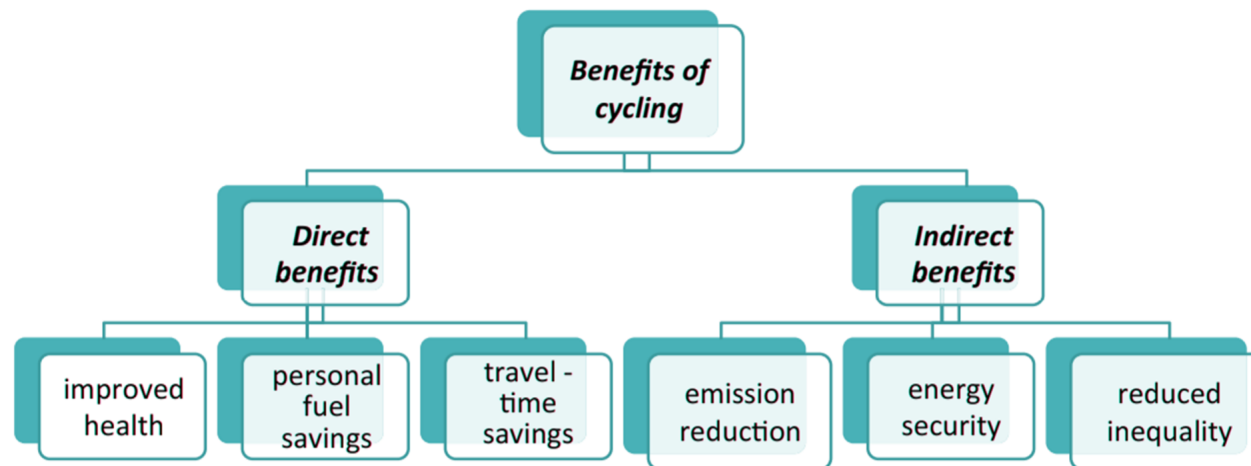


Figure 2 Estimated Direct and Indirect Benefits of Cycling

## Direct benefits

The benefits that directly accrue to individuals due to the uptake of cycling are defined as direct benefits. In the study, personal fuel savings, health benefits due to increased physical activity, reduced air pollution, and travel-time savings by marginal unskilled workers are quantified

**Table 0.1** Estimated Direct Benefits of Increased Cycling

| Benefits                                                                                      | Trips Substituted by Bicycle                                                              | Methodology                            | Value of the Benefits (INR Billion) |
|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------|-------------------------------------|
| Personal fuel savings                                                                         | 50% substitution of two-wheeler and four-wheeler trips under the average distance of 8 km | TERI Transport Model                   | 27                                  |
| <b>Health benefits due to:</b>                                                                |                                                                                           |                                        |                                     |
| 2a) Increased physical activity (net present value of the accumulated benefits over 15 years) | 50% substitution of two-wheeler and four-wheeler trips under the average distance of 5 km | WHO HEAT                               | 1435                                |
| 2b) Reduced air pollution                                                                     | 50% substitution of two-wheeler and four-wheeler trips under the average distance of 8 km | TERI's Air Quality Modelling Framework | 241                                 |
| Travel-time savings                                                                           | 50% substitution of walking trips above the average distance of 3.5 km                    | Wage Rate Model                        | 112                                 |
| <b>Total direct benefits</b>                                                                  |                                                                                           |                                        | <b>1815</b>                         |

Source: TERI Analysis

## Indirect benefits

The benefits that accrue to society due to a modal shift towards cycling are defined as indirect benefits. In the study, energy savings (toe) and reduced CO<sub>2</sub> emissions have been estimated

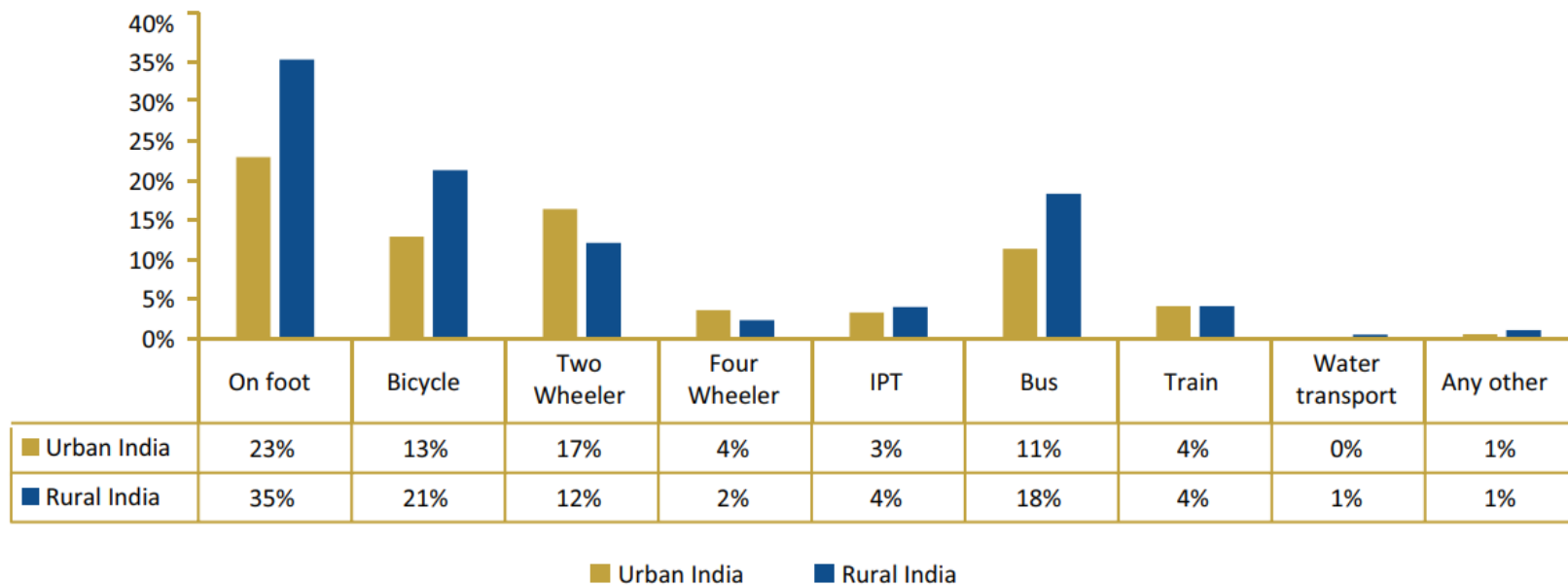
**Table 0.2** Estimated Indirect Benefits of Increased Cycling

| Benefits                           | Trips Substituted by Bicycle                                                              | Methodology          | Quantum of Savings (Million Tonnes) |
|------------------------------------|-------------------------------------------------------------------------------------------|----------------------|-------------------------------------|
| Energy savings (oil equivalent)    | 50% substitution of two-wheeler and four-wheeler trips under the average distance of 8 km | TERI Transport Model | 0.35                                |
| CO <sub>2</sub> emission reduction | 50% substitution of two-wheeler and four-wheeler trips under the average distance of 8 km | TERI Transport Model | 1                                   |

Source: TERI Analysis

## Work Trips in India

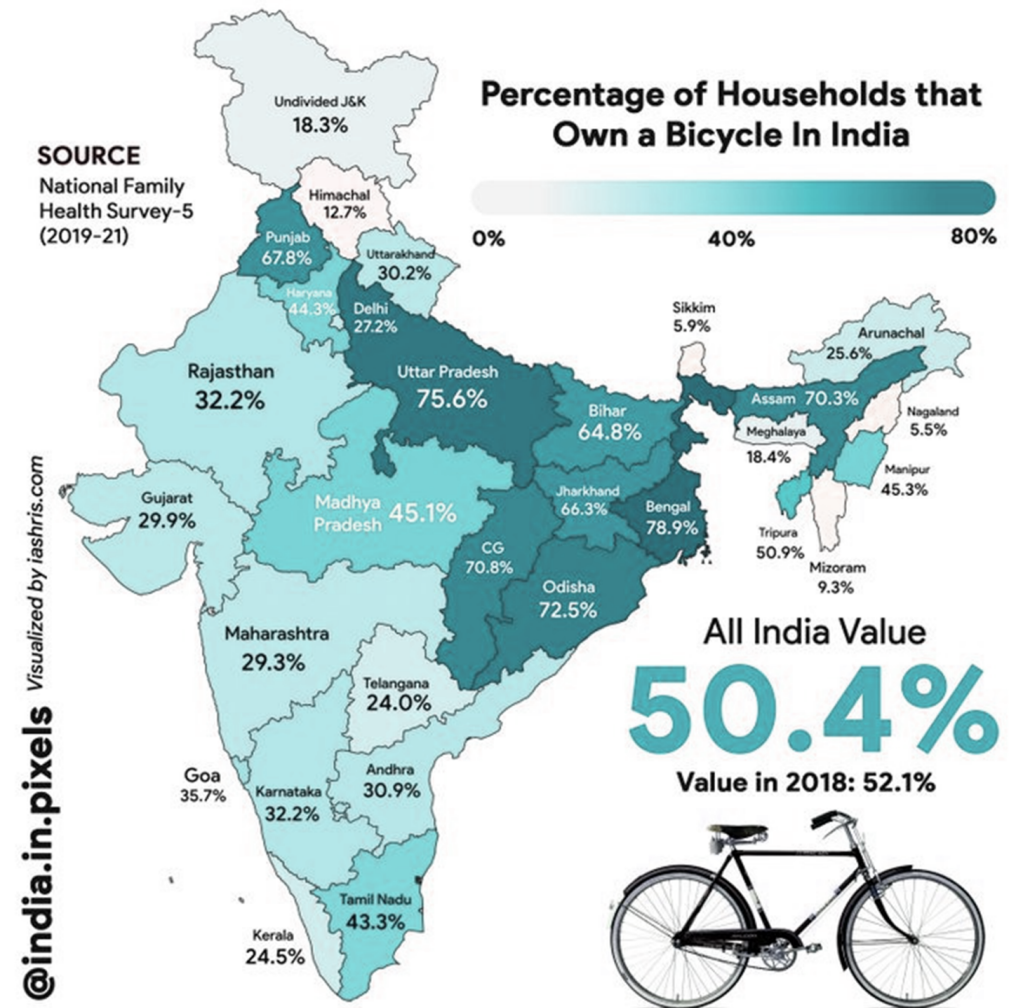
In urban and rural India, on-foot trips account for the highest share of work trips with the share being 12% higher in rural areas. In terms of bicycle use, urban and rural areas exhibit different travel patterns. In rural areas, for meeting the daily travel requirements, workers are most dependent on cycling after walking. It is estimated that 21% of the work trips in rural India 1 Cars, jeeps, and vans are categorized as four-wheelers. Tempos, autos, and taxis are categorized as intermediate public transport (IPT). are undertaken by bicycles. However, in urban areas, after walking workers are most dependent on two-wheelers. The latter accounts for 17% of the total work trips followed by cycling (13%) (Figure 4).



**Figure 4** Share of Work Trips by Mode in Urban and Rural India (2016)  
*Source:* TERI Analysis

## Types of users

Bicycle users in India are either **captive** or **choice users**. Captive users, who belong to low-income households, are dependent on cycling as their primary means of mobility. Among these individuals, bicycle ownership has remained stagnant due to the lack of the requisite financing options and the high price of bicycles. For choice users, the absence of adequate safe cycling infrastructure has curtailed the use of bicycles.





### **Why look for Human powered solution?**

To come with a sustainable mode of transportation, a transportation that has zero dependency on fossil fuel, has zero emissions and pollution, has health benefits in the form of physical activity, and also being a affordable means of transportation.

### **Why do we need a cargo vehicle?**

Cargo bikes or vehicle is not a new concept, but rather a concept that is having a revival, cargo vehicle is the most practical and sustainable mode of transportation, it gives the user the ease of carrying more, while being a sustainable way of transporting, taking up less space and also helping the user get some physical exercise, we can also see that economical it makes a huge difference as compared to getting a motorized vehicle (in both initial investment and running cost).

### **What will be the use of this vehicle?**

This vehicle can be used for various kinds of activities. Activities ranging from transport of goods, humans, running errands, shopping, commuting, going to work, as a leisure, a recreation or an exercise. This vehicle can also be used to solve the issue of last mile mobility.

### **Who is this vehicle for?**

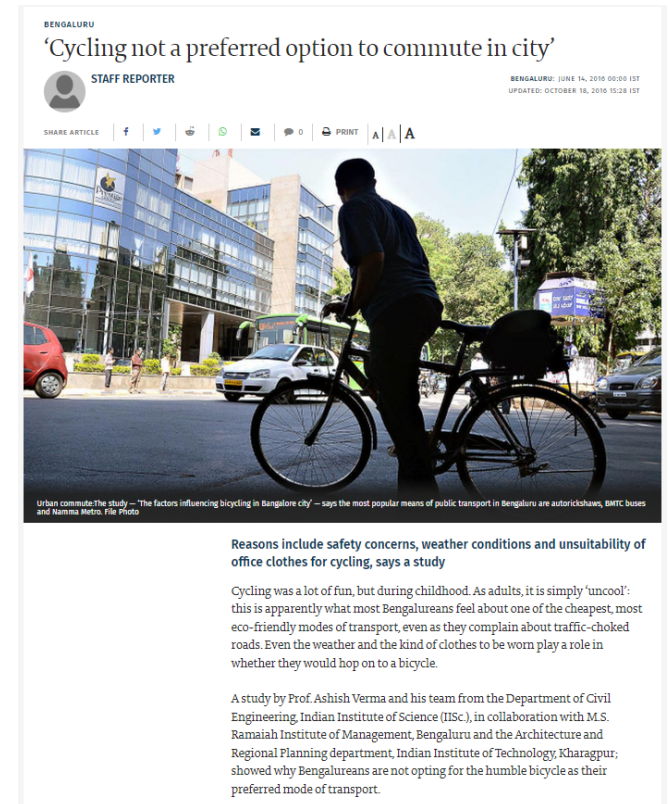
This vehicle has a vast profile of users, this can be used by users of any gender, a teen, an adult. This vehicle can be for an individual or a family. For commercial as well as individual use.

## Challenges of cycling

## Highlights of the study

- During childhood, people had a more positive perception about cycling. As they grew up, their disposition towards motorized modes increased and they started finding cycling an uncool option.
- People thought it is a natural process to shift to motorized vehicles as they grew up. There is a perception that shifting to motorized vehicles is a sign of prosperity.
- People are more particular about inconveniences such as travel time, weather conditions and clothes worn.
- Currently, people are more concerned about safety due to lack of separate lanes and signals, and skeptical about the existing parking facilities for bicycle riders

The perception of the bicycle as the poor person's mode of mobility and an unsafe mode of transport. Bicycle is a sustainable, eco-friendly and affordable means of transport and presently requires national level intervention for its successful promotion. Although less, there have been a few initiatives by city planners to plan for equitable, efficient and environment-friendly transport systems. City planners have now started viewing transport beyond the traditional concept of just physical mobility to a broader concept of accessibility i.e. people's ability to obtain desired goods and services



**User research:**

The objective of this exercise was to identify the problems encountered by the users, and to understand their point of view.

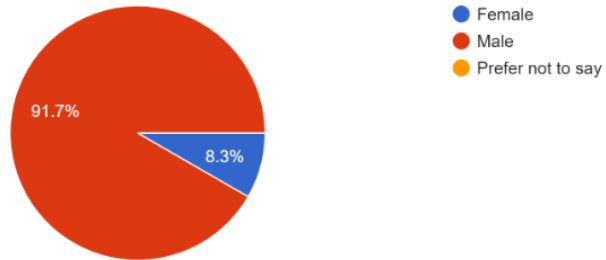
**Target audience:**

The interview and the questioner were answered by the individuals who practice bicycling in their day to day activities, this was also to understand their say on the problem they face.

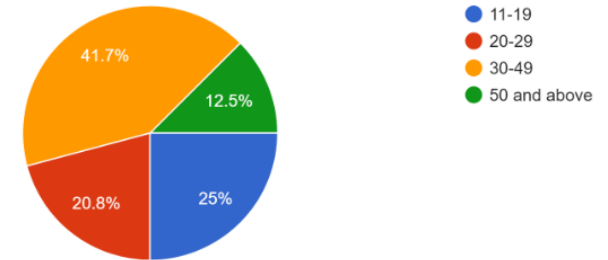
**Questionnaire:**

1. Gender and Age?
2. How often do you ride your bicycle?-
3. What do you use your bicycle for?
4. Do you ride your bicycle to Work / School?
5. How far is your workspace/ School from home?
6. How do you carry your stuffs? (If yes)
7. What are the stuffs you would carry? (If yes)
8. Do you use your bicycle to go shopping?
9. What are products that you would use your bicycle for shopping? (If yes)
10. Do any of these factors stop you taking your bicycle out?
11. Do you face any other issues while commuting or running errands in your bicycle?
12. Have you added any extra accessories to assist in your commuting? If yes what is it?
13. Do you enjoy cycling?

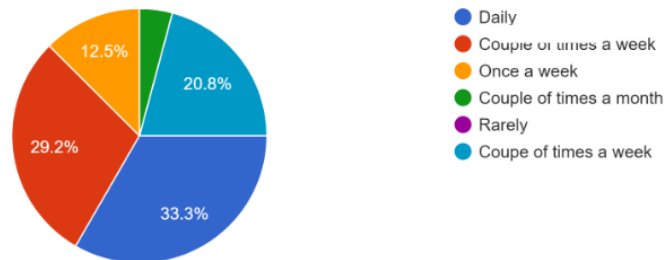
Gender



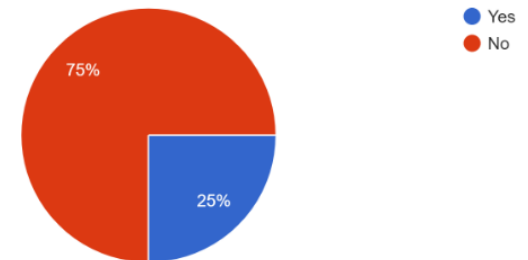
Age



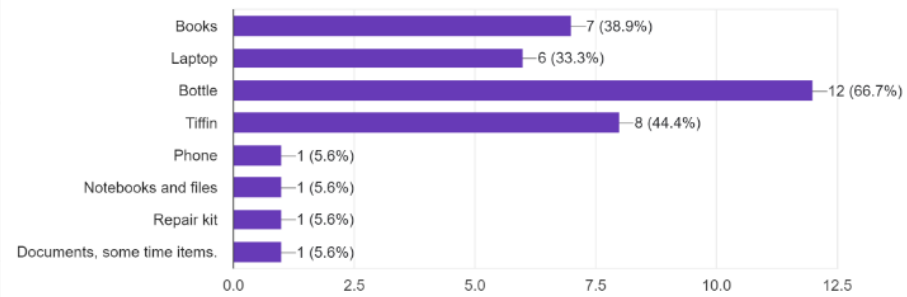
How often do you ride your bicycle?



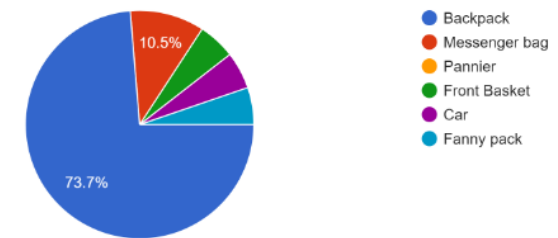
Do you ride your bicycle to Work / School?



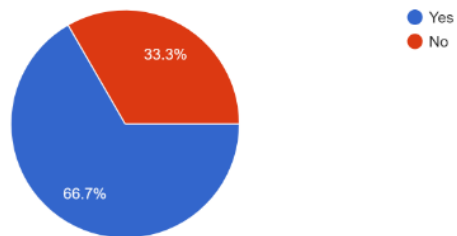
What are the stuffs you would carry? (If yes)



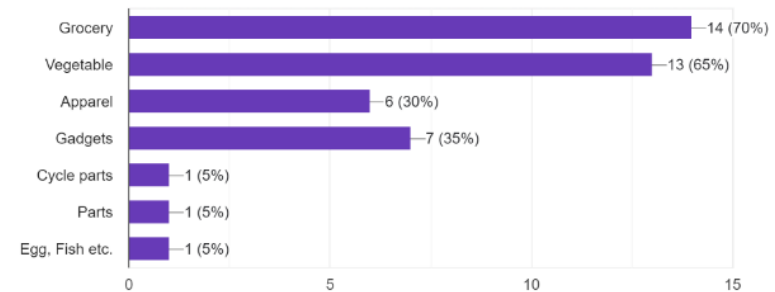
How do you carry your stuffs? (If yes)



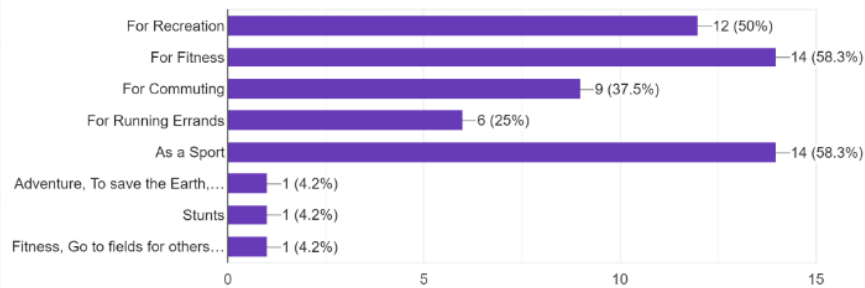
Do you use your bicycle to go shopping?



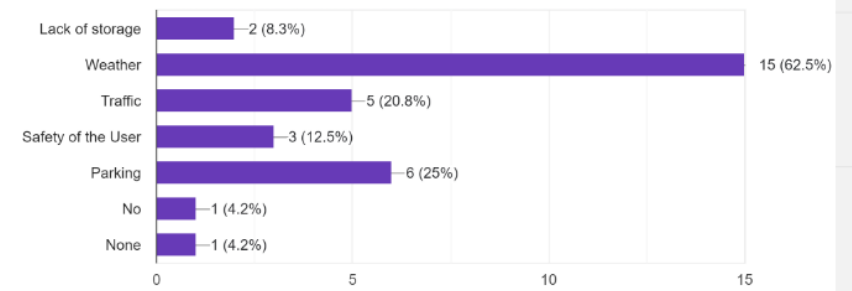
What are products that you would use your bicycle for shopping? (If yes)



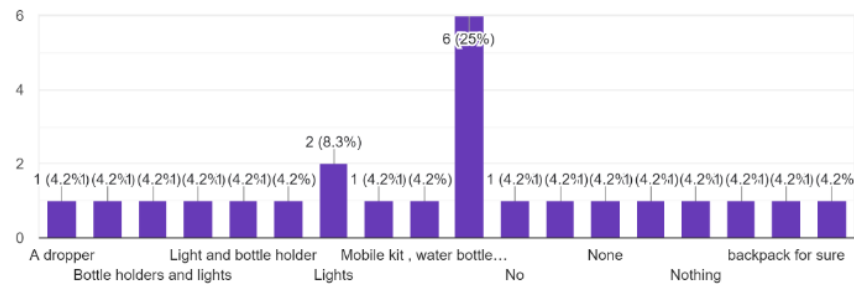
What do you use your bicycle for?



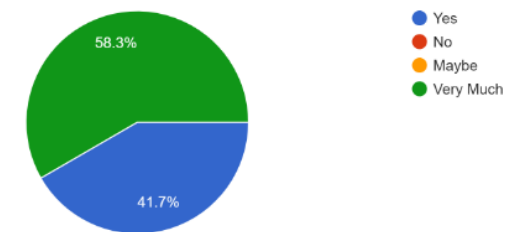
Do you any of these factor stop you taking your bicycle out?



Have you added any extra accessories to assist in your commuting? If yes what is it?



Do you enjoy cycling?



### **Problems faced by cyclist :**

1. Reckless driving. Causing a risk to cyclists.
2. Crazy vehicular traffic, no cycle lanes.
3. Lack of awareness on traffic rules on the part of commuters or motorized vehicle owners.
4. Weather causes issues.
5. Rain is an issue in 2 wheelers.
6. Parking of the bicycle gets tricky.
7. Lack of storage.
8. Irregular terrain adds to Effort to climb hills.
9. Traffic, road conditions.
10. There is an uphill section on the way to work and I don't want to be sweating and that's the reason I do not ride to work.
11. There is no respect towards cyclists.
12. Less respect from other commuters.
13. Ignorant people who think roads are built only for cars.
14. Hostile non cyclists disturb us, don't cooperate.
15. Bicycle accidents like OTB, Skid etc.
16. Lack of proper equipment to perform tasks.

## Observations from the study

1. Predominant of the participants were male.
2. Over 50% of the people are above the age of 30 years
3. 2/3rd of the participants ride their bicycle in a daily or regular basis.
4. 1/4th of the participants use their bicycle for commuting to work and classes.
5. The stuffs that they carry are bottle, books, laptop and tiffin.
6. Many use backpack to carry their stuffs followed by a messenger bag.
7. 2/3rd of the participants use their bicycle for shopping or running errands
8. Some of the products that they would go for shopping are grocery, vegetable, followed by gadget and then apparel.
9. Many cycle for the fitness and sport, followed by recreation then for commuting.
10. Weather is a major concern, followed by parking of the bicycle with respect to the safety of the bicycle.
11. Traffic and safety of the user is also found to be of concern.
12. 65% of the participants kept their bicycle stock
13. Lack of awareness among the motorized vehicle user were also pointed out.
14. Lack of proper infrastructures and system were also reported
15. The participants travel in and around 3-7 km for commute to their work place
16. Many participants were concern about the environment, and to create lesser carbon footprint by their actions.



## User story:

### User 1

Gender: Male

Age: 24

I ride my bicycle in college now, I use it to go to my class which is around 3 km away, during weekends I go out on longer rides. I do use my bicycle for running errands, like shopping for groceries and stationery. well **rain is an issue**, but I would usually carry a **raincoat** around. I have been cycling for over 7 years now. For a longer ride I have a **larger saddle bag** to carry my stuff, like rain coat, food, clothes etc., and also I have attached **2 bottle holders**.

### User 2

Gender: Male

Age: 48

I resumed cycling very latter in my life, during the lockdown, I felt the need for some **physical exercise** so I took up cycling, since that I have always been cycling in all possible opportunity, I occasionally take my bicycle for work, parking in office is not much of an issues as its in a **closed compound**, but I mostly ride during the week ends with other club members. I carry a **backpack** whenever I go to the office which contains my laptop therefore I only take my bicycle **out on good weather days**. My office is 4 km away from my home.

### User 3

Gender: Male

Age: 51

Cycling for me has always been a motivation for me to move forward, it makes me feel I am still young. Me taking my bike to work has definitely **encouraged my fellow colleagues** to ride bicycles too. Well I have added a **pannier rack**, and I do carry a pannier around if I need any extra storage. Weather is definitely a concern when it comes to cycling, but its definitely not a stopping point. I cycle because I want to **contribute to society** and cause **less pollution**. I encourage everyone to ride bicycles.

### User 4

Gender: Male

Age: 32

I do consider myself a cycling enthusiast. I have a Canyon Road bike, which I use everywhere. During weekdays I use it for short rides and for going to the office sometimes, while on weekends I go for longer rides. Cycling has helped me get InTouch with new people, **explore different cultures and places**. I do carry backpacks if needed but it sometimes becomes quite **sweaty and uncomfortable**. I try to avoid backpacks. Well, the idea of having a cargo bike is definitely interesting and I would love to try it.

### User 5

Gender: Male

Age: 23

I ride my bicycle daily, I try to ride my bicycle daily. I ride to my classes, shopping and for my regular commute. I use a **backpack** while going for classes, but when I go shopping I would use a **pp woven carry bag**. yes it does get **uncomfortable** at times, but I just go along with it. As far as parking is of concern I don't have any issues. I would **love to have more storage** in my bike, like a basket or a pannier which I can use for running my errands.

### User 6

Gender: Male

Age: 36

I am a regular cyclist, I am into endurance cycling, I have a bike which I use for all purposes such as commuting, racing and events, office work etc. As for storage I always use a **backpack**, I **don't have any sort of pannier or attachments** to my bike, I **don't want to add** any extra weight to my bike. I find the idea of having a cargo **commuter bike interesting**, but the major concern would be the **cost**, but, yes India sure is a high **potential** place for such bikes.

## Insights:

1. Backpack is the common way to carry stuffs while cycling
2. People who owned a single bike preferred not to run errands with their bikes, especially with people using higher end bikes.
3. For many the motivation for cycling was fitness and sport
4. Conflict between cyclists and motorized vehicles is a common incident.
5. Policies and traffic system is not cycling friendly
6. Lack of infrastructure, demotivates people from taking up cycling
7. Many people keep their bicycle stock
8. The most common add on on a bicycle is a bottle holder
9. Difference in terrain and road condition affect the decision to ride a bicycle
10. Rain not only affects the rider but also the bicycle
11. Weather plays an important role in decision to ride a bicycle
12. Rain is the major weather issue
13. More than 2/3rd of the cyclist use their bikes for running errands
14. Many feel the need for more storage, but they just accept the situation and adjust without it
15. Many of the cyclists believe that cycling helps them give back to the environment, by helping reduce carbon emission.
16. 2/3rd of the participants ride their bike regularly.
17. Backpack was a burden to carry for some, while some didn't like using the same backpack for commuting to work and for shopping
18. Over 50% of the participants are above the age of 30, which is the age group for the working professionals.
19. 1/4th of the users used their bicycle for commuting to work or classes.

### **Who are the targeted users?**

The targeted users are the **enthusiasts** or the **individuals who already own a HPV** and use it. The target user group are from the urban area, where bicycling systems like bicycle lanes, and policies are being implemented.

### **Why is this project needed?**

Since we are catering to the user group who are already introduced to the world of HPVs, we need to understand the problems they encounter in their day to day activities performed on their HPVs , and design to make their interaction with the vehicle more desirable, especially related to their commuting purpose.

### **What is the problem in hand?**

1. While running errands the users face the issue of storage.
2. While parking the vehicle the user is concerned over its safety.
3. Weather is also an issue faced by the user.
4. Irregular terrain creates a stumbling block.
5. Maneuverability in traffic situations.

### **What is the end result?**

The end result is a product that will directly or indirectly assist the user in commuting, and solve the issue they are now facing of storage, parking and safety. The product can be in any form as a vehicle itself or an add-on to their current vehicle.

### **What is the intent of this project?**

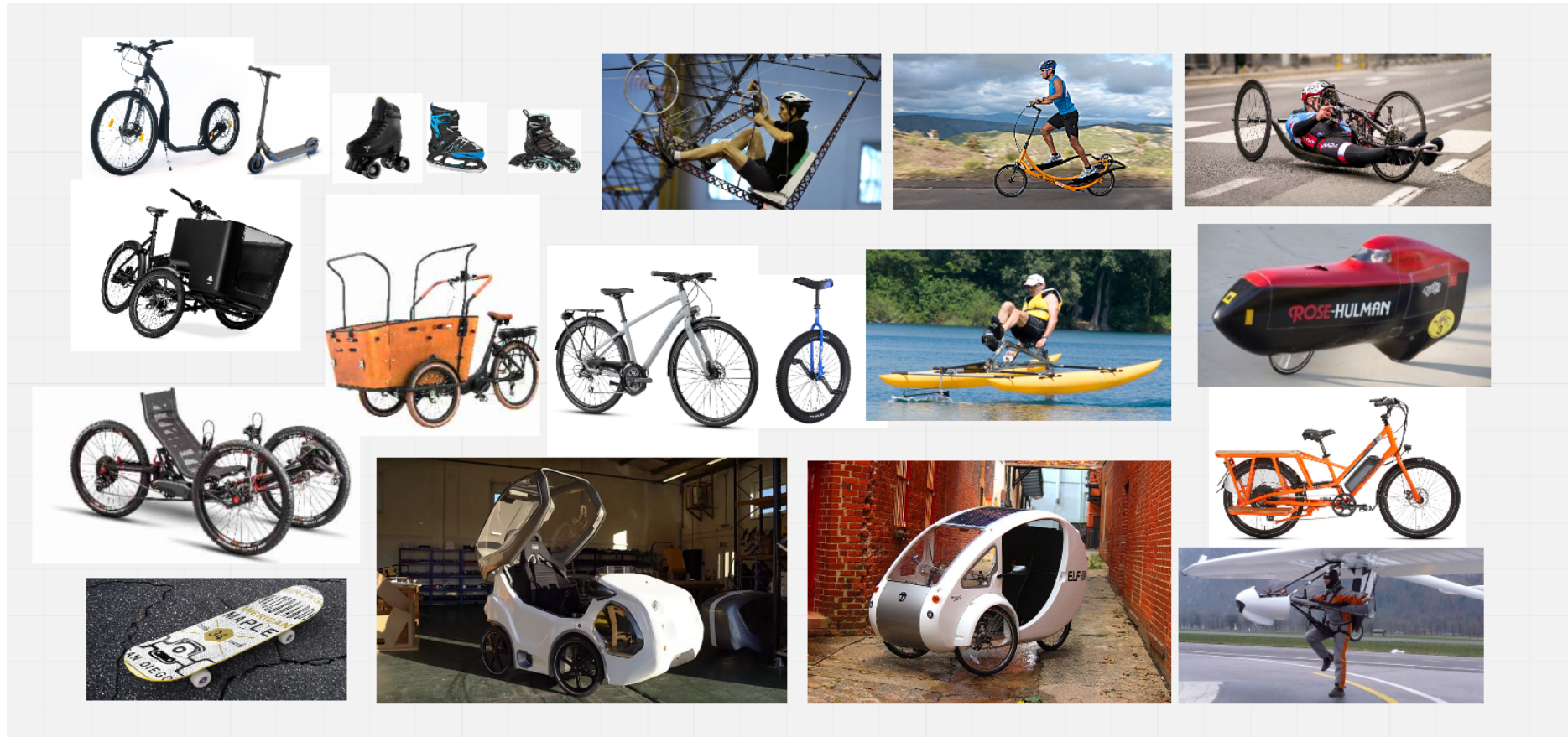
1. To promote environment friendly transportation solutions.
2. To encourage the user to continue using HPVs for their day to day task.
3. To cater to the needs such as storage, safety in the HPVs for commuting purposes.

### **How will the project be done?**

1. Identify the problems faced by the users and come up with suitable design solutions.
2. Understanding the issues in hand, by conducting primary and secondary research.
3. Coming up with novel solutions for a HPV, which can be used as an alternative to their current vehicle.

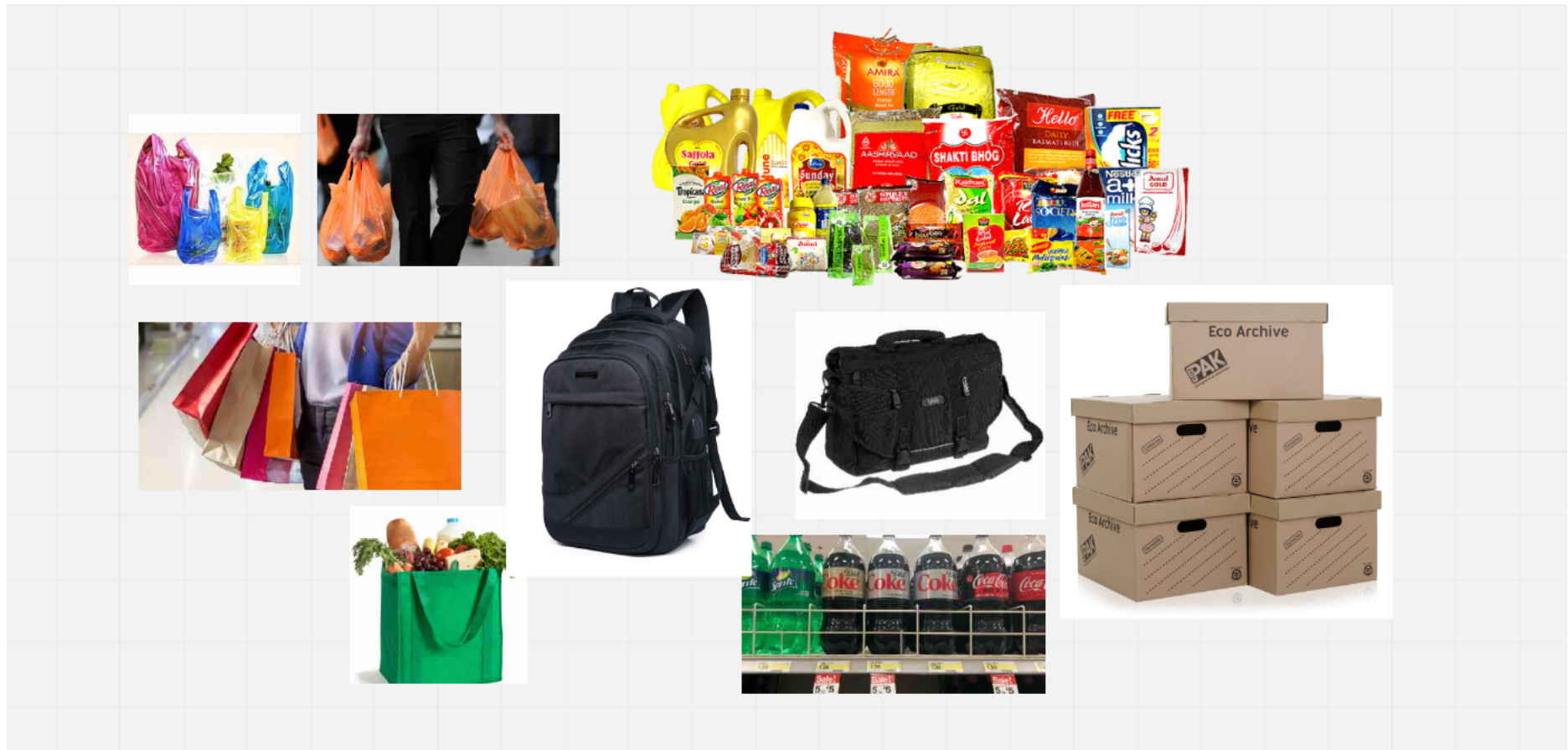
"Cargo bikes connect people with their community, their family and their surroundings. It brings life to daily activities that could otherwise be mundane."

## Types of human powered vehicle





## Types of goods





## Steering System



Hub center Steering



Cable Steering



Linkage Steering

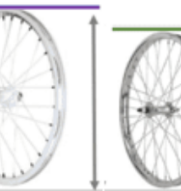
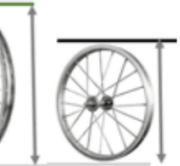


Direct Pivot Steering



Hydraulic Steering

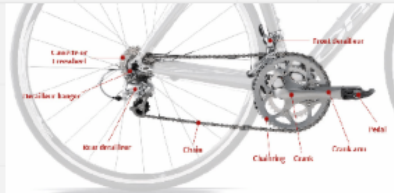
## Wheel Size

|                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |
| 28"/29er/700C                                                                     | 27"/27.5"/650                                                                     | 26"/650C                                                                           | 24"                                                                                 | 20" (old)                                                                           | 20"                                                                                 | 16"                                                                                 |
| Road Bike<br>Hybrid<br>Fixie<br>City bikes                                        | New MTBs<br>Hybrid                                                                | Older MTBs<br>Regular single<br>speed bikes                                        | Recumbents<br>Tricycle                                                              | BMXs<br>Shopper Bikes                                                               | Folding bikes<br>Dahon                                                              | Brompton                                                                            |

Rim size combination, F20 R24, F20 R26, F24 R26,



## Drive Train:



Legs Powered drivetrain



Arm Powered drivetrain



Legs Powered drivetrain  
+  
Arm Powered drivetrain



**Mid-drive** ebike motors, as the name may have already suggested, are ebike motors that are placed right in the center of an ebike. Their prime purpose is to supplement your pedal input in order to take the strain off your legs & feet. Their unique positioning ensures perfect weight balancing of an ebike and at the same time, the center of gravity is also optimized.



**Direct-hub motors** are the most common type of ebike motors, and they are placed directly into the hub of the rear wheel. Such a motor's shaft essentially becomes the rear axle and instead of delivering power through the chain, it instantly & directly propels the wheel, thus eliminating the need to carve out a designated area for the motor in the middle of an ebike.



**Geared Hub Motors** are essentially a complex version of direct hub motors since they are fitted with a series of gears that tone down the high revolutionary motion generated by the powerful motor and then transfer it to the wheel hub. Such motors are noticeably smaller than direct-hub motors, but it is the gears that make them look wider than their competitors.

For the power delivery :

The main difference is, **pedal-assist** offers motor assistance up to a certain max speed while you're pedaling. On the other hand, the **throttle** offers full motor assistance up to a max speed without the use of the pedals.



## Belt Driven

### Pros

- Belt driven are practically maintenance free.
- Belt driven last longer than that of the chain drive
- Belt driven are cleaner as they require no lubrication.
- belt drive operates silently.
- Belt drives are corrosion free and last longer over time.
- The driveline is always straight, and its more efficient at higher power outputs.

### Cons

- Belts are only compatible with an internal gear hub, pinion gearbox or a single speed.
- The frame must be compatible, as the belt is a continuous loop, so there has to be a split in the frame.
- Belt drives cost more than a chain drive
- Spare parts are harder to find.
- Belts are not compatible with full suspension bikes
- Belt drive creates more tension on the BB and hubs, making them to wear out faster.



## Chain Driven

### Pros

- Chain drive are **compatible** with every bike frame.
- Chain drive are cheaper.
- Chain drive are compatible with derailleurs which is the most simple, common and cheap bike gear system.
- Chains are easier to adjust and service, as well as easy to replace them.
- Spare parts are easier to find.
- Chains are compatible with full suspension setup.

### Cons

- Chain drive requires more maintenance.
- Chain drive don't last for long, and lose efficiency over time.
- Chain drive can be dirtier as the lube can attract dust and dirt.
- Chain drive are heavier than belt drive.
- Chain drive are louder, and makes noise while shifting and while running the metal chain against the clogs.
- Chains tend to corrode easily.



## Cargo Bikes



1. Mongoose Envoy Cargo



2. Yuba Kombi Step-Through



3. Benno Carry On 27D Utility Bike



4. Benno Carry On 30D



5. Yuba Mundo Lux Cargo Bike



6. Surlly Big Dummy



7. Salsa Blackborow GX Eagle



8. Rad Power Bikes RadWagon 4



9. Urban Arrow Shorty Performance



10. Tern GSD S10



11. Yuba Mundo Cargo Electric Bike



12. Yuba Spicy Curry V3



13. Momentum 22 PakYak E+



14. Benno Boost E 10D



15. Urban Arrow Family Cargo Bike



16. Yuba Kombi E5



**Longtail bikes:** These allow you to carry children and different cargo on an prolonged rear rack that sits over the back wheel. They're well-liked with families who have more than one child. Youngsters can ride in child seats which are mounted on that rack or sit on a bench on the rear rack.



**Mid-tail bikes:** These compact utility bikes are shorter than longtails. Some are about the identical length of an ordinary bike however with higher hauling capacity. They're simpler to store, transport and maneuver; some fold up. They are probably not able to deal with multiple youngsters so is probably not as versatile for bigger families.



**Front-loading cargo bikes** (generally called bakfiets, Dutch for "box bike") allow you to carry your cargo in a box or container that sits low in the area between the handlebars and the entrance wheel. Households get pleasure from these bikes because they'll carry kids and pets within the entrance the place they'll keep an eye on them, and conversations are usually easier. Using them takes some apply, but they're surprisingly simple to maneuver.





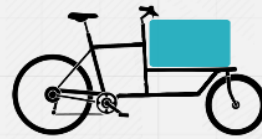
## Load position



Front loading bicycle are usually found in cargo bikes, they usually have smaller wheels in front to accommodate the cargo space.



Rear loading bikes are found with regular wheel setup, where usually both the wheels are of the same size.



Front loading cargo bike, in this type of bike the front wheel is extended and the space between the head tube and front wheel is used for storage.



This setup has loading capability in both front and rear, and it comes in various forms of wheel configurations.

## Tire configuration



This is the configuration in which both the wheels used are small sized to increase the space for storage and lowering the cg.. Eg. F 20" R 20"

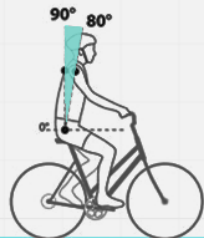


This is the configuration in which There is combination of 2 size, where usually the front wheel is smaller than the rear. Eg. F 10" R 16"

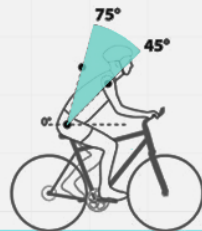


This is the regular configuration in which both the wheels come in the same standard size. Eg. F 26" R 26"

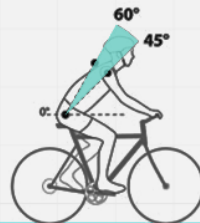
## Rider Position



This position are found in commuter or city bikes, these have a upright posture which is on of the most combatable position to ride a bike



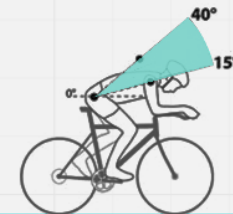
This position are found in regular single speed bikes, and hybrids which are more oriented towards regular use, and hence they are less sporty.



This position are found in MTBs are hardtails this is more inclined towards MTB race formats and are more aggressive but still comfortable in rough terrains.



This position are found in Road bikes, these are designed for performance on road, they are much more aggressive and less comfortable.



This position are found in TT bikes, these are some of the most aggressive position bikes, they are designed to be aerodynamic.



## Benchmarking

| Tern GSD S10                                                                      | Riese and Muller load                                                             | Streak Ecargo                                                                     | CERO ONE                                                                           | Urban Arrow Family Cargo Bike                                                       | Hero Lectro Winn                                                                    | Aurita INFINITY 2.0                                                                 |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |
| <b>Size:</b><br>176 × 40.5 × 83 cm                                                | <b>Size:</b><br>264.5 cm                                                          | <b>Size:</b><br>189 x 590 x 970 cm                                                | <b>Size:</b><br>173.6 cm                                                           | <b>Size:</b><br>274 × 70 × 110 cm                                                   | <b>Size:</b><br>183 cm                                                              | <b>Size:</b><br>182 cm                                                              |
| <b>Wheel:</b><br>F 20" R 20"                                                      | <b>Wheel:</b><br>F 20" R 26"                                                      | <b>Wheel:</b><br>F 18" R 20"                                                      | <b>Wheel:</b><br>F 20" R 26"                                                       | <b>Wheel:</b><br>F 20" R 26"                                                        | <b>Wheel:</b><br>F 24" R 24"                                                        | <b>Wheel:</b><br>F 20" R 20"                                                        |
| <b>Capacity:</b><br>200 Kg (Including rider)                                      | <b>Capacity:</b><br>-                                                             | <b>Capacity:</b><br>60 Kg (Including rider)                                       | <b>Capacity:</b>                                                                   | <b>Capacity:</b><br>125 kg                                                          | <b>Capacity:</b><br>200 Kg (Including rider)                                        | <b>Capacity:</b><br>130 Kg                                                          |
| <b>Drive:</b><br>Bosh Cargo line                                                  | <b>Drive:</b><br>Bosch PowerPack 500 Performance.                                 | <b>Drive:</b><br>DC36V/250W                                                       | <b>Drive:</b><br>Shimano STEPS 6100 pedal-assist                                   | <b>Drive:</b><br>Bosh Cargo line                                                    | <b>Drive:</b><br>250 w, BLDC motor                                                  | <b>Drive:</b><br>250 w BLDC hub motor                                               |
| <b>Cost:</b><br>₹ 465306.25                                                       | <b>Cost:</b><br>₹ 721824.80                                                       | <b>Cost:</b><br>₹ 2256320.00                                                      | <b>Cost:</b><br>₹ 313790.18                                                        | <b>Cost:</b><br>₹ 538890.20                                                         | <b>Cost:</b><br>₹ 49,999                                                            | <b>Cost:</b><br>₹ 39,999                                                            |



## The user



**Age:** 34

**Address :** Bangalore

**Profession:** Graphic Designer

**Status:** Married

Akshay is a **fitness enthusiast**, he got into cycling because of its **health** and **environmental benefits**. He would cycle regularly, for going to the gym, for **commuting to work** and also for running quick errands. Akshay also sometimes uses his bike to commute to his work, he currently **works** as a graphic designer in a studio, he is **dedicated** to his work as well his family. He recently got **married**.

Akshay has a very **active lifestyle** so does his wife, they would together go on weekend trips, also go on bike **rides and trek** together.



- To live a healthy and active lifestyle.
- To find sustainable transportation solution.
- To continue to find the work life balance.

## Design Brief |

"To design a compact Cargo Bikes that can help an individual to carry out their basic task of carrying **medium size** goods and assets. This vehicle should be **adaptable** to be used for their daily commute and perform their other daily chores of running errands, this vehicle has to be designed with the context of the Indian conditions."

- A product that has enough **storage space** so that the user doesn't have to carry their backpack or such additional bags while commuting and running errands.
- A product that can be used for **commuting**
- A product that is **exciting** and creates a **new experience**,
- A product that is **portable** and **adaptable** to its requirements.
- The product should have the **flexibility** to be used both for **commuting and cargo**.

\*medium size = 25" trolley i.e. 125 Ltr

### Design Intend:

- Accessible for the user
- Be more practical with more storage space.
- Safe and secure
- Compact and economical

### A Portable **compact cargo bike**

A 2 wheel format compact cargo bike that is suitable to carry small goods, backpacks, packages, and shopping bags. The vehicle has to be compact and portable. With added adaptability features like folding tray or baskets and trolley, pannier friendly.

#### **Dimensions:**

Length: 1650 mm

Width: 600 mm

**No.of wheels:** 2

**Wheel size:** F 16" R 24"

## USER CASE:

### CASE 1

**Name:** Suresh

**Age:** 36

**Occupation:** Employed

**Status:** Married

Suresh has 2 kids, he usually use the cargo bike for taking his kids out in the evening for some short rides, and also sometimes uses it to drop them off to schools when there is good weather.



## CASE 2

**Name:** Raj

**Age:** 27

**Occupation:** Musician

**Status:** Unmarried

Raj is a musician, he plays in the local cafes and as well as busk in the streets, he is in a band too. Raj uses his cargo bike for carrying his equipment, such as guitar, speaker, mic etc.



### CASE 3

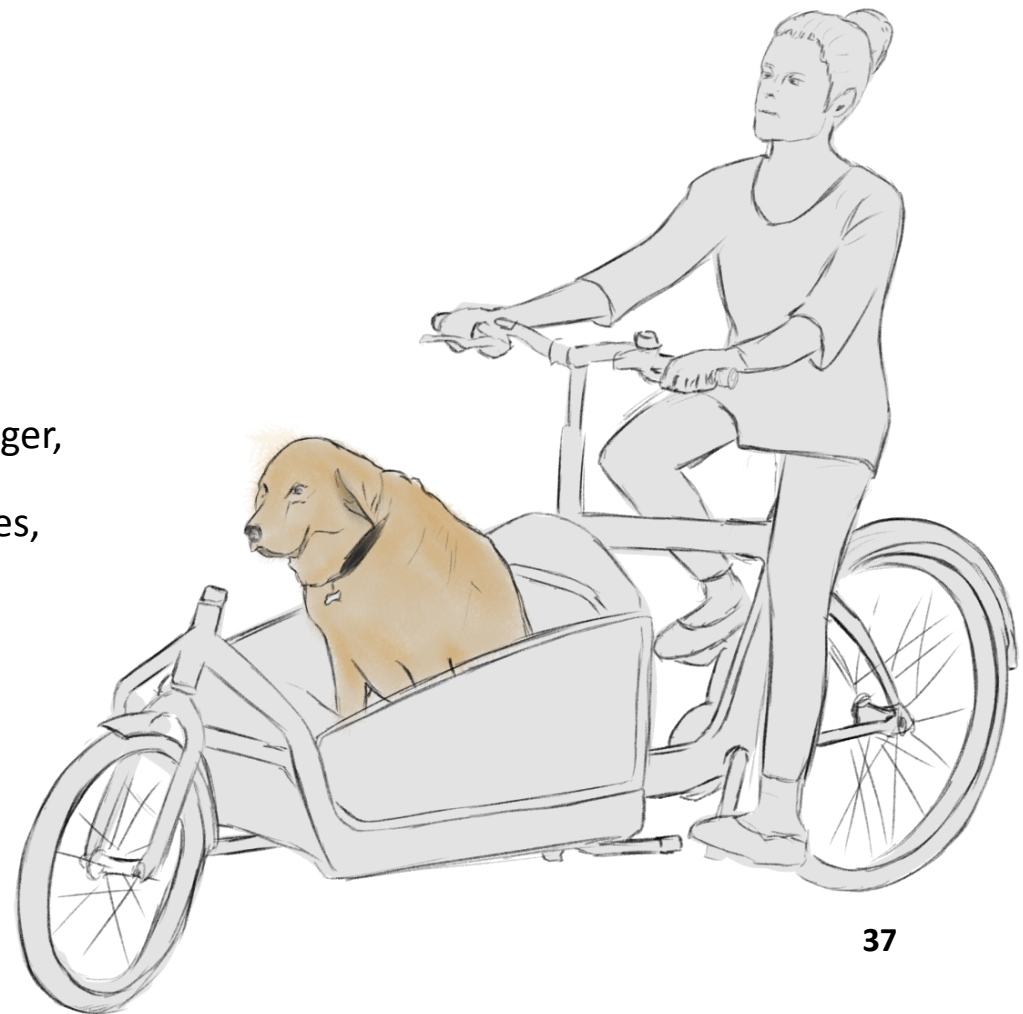
**Name:** Rekha

**Age:** 26

**Occupation:** employed

**Status:** Unmarried

Rekha works in a company, she has a pet dog Roger, Rekha uses her cargo bike to take Roger out on rides, she rides with Roger around the locality and also goes to the dog park.





## CASE 4

**Name:** Anvi

**Age:** 28

**Occupation:** Freelancer

**Status:** Unmarried

Anvi works as a freelance, his job requires him to work only on specific seasons. Therefore during this off season he also works as a part time delivery person, he uses his cargo bike to deliver the packages.

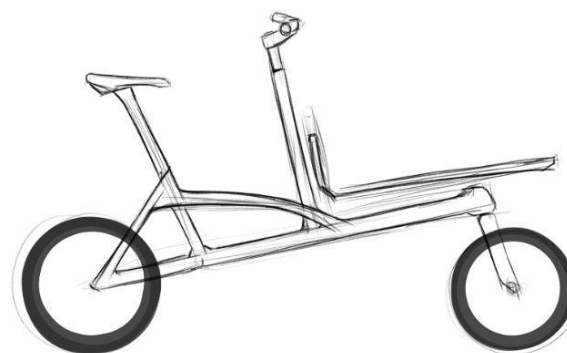
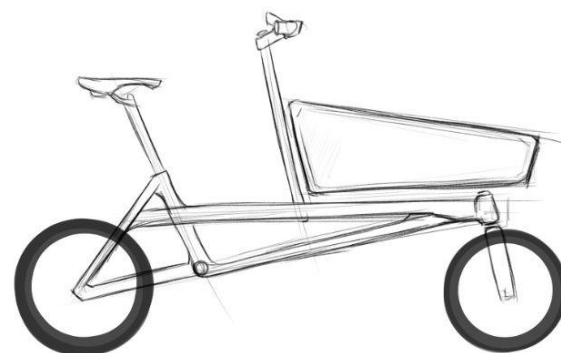
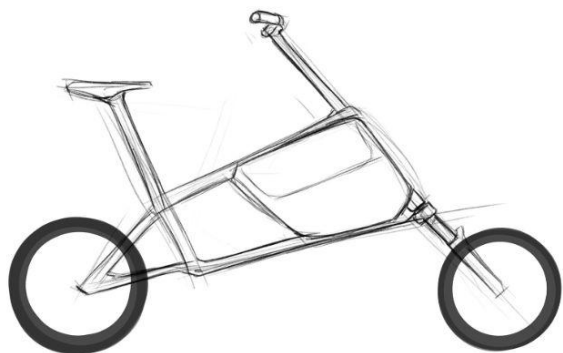


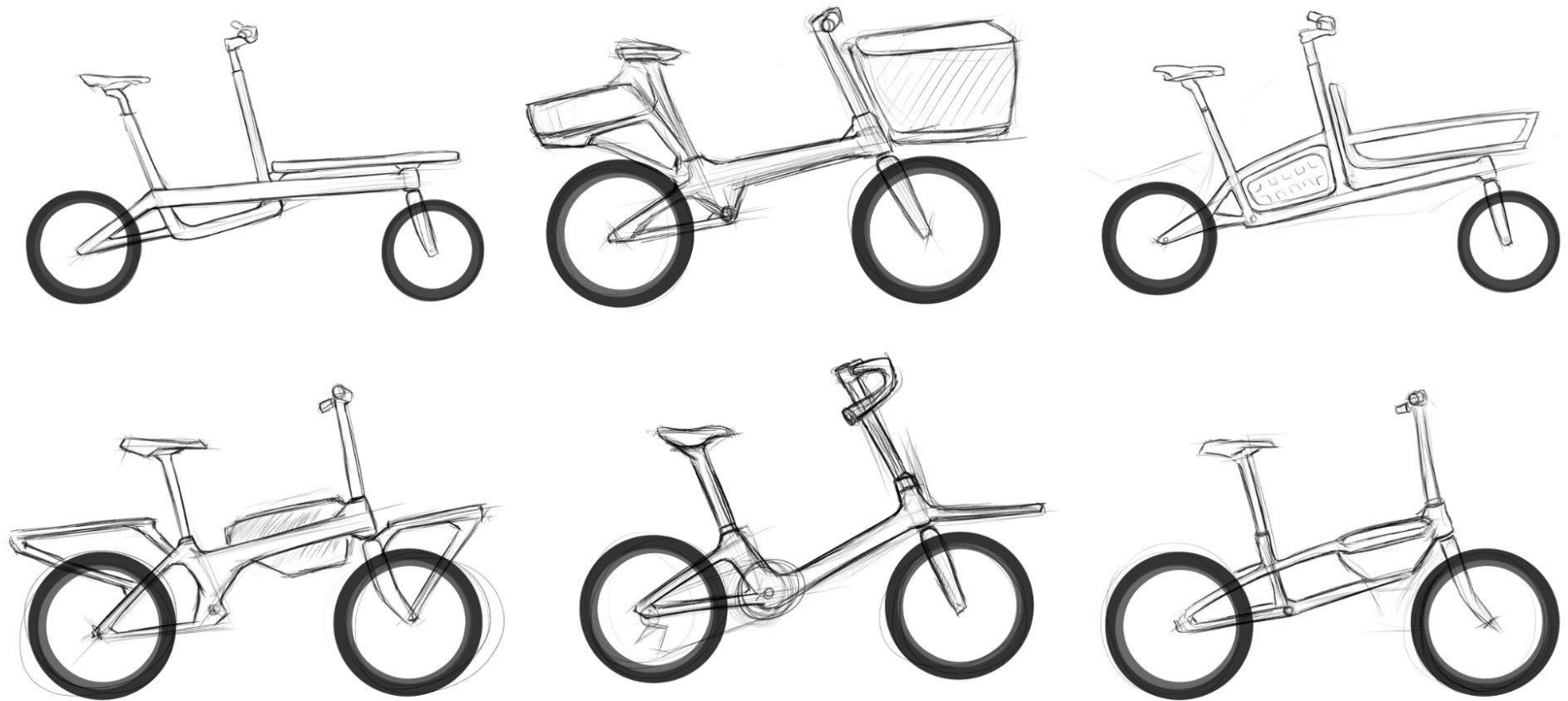


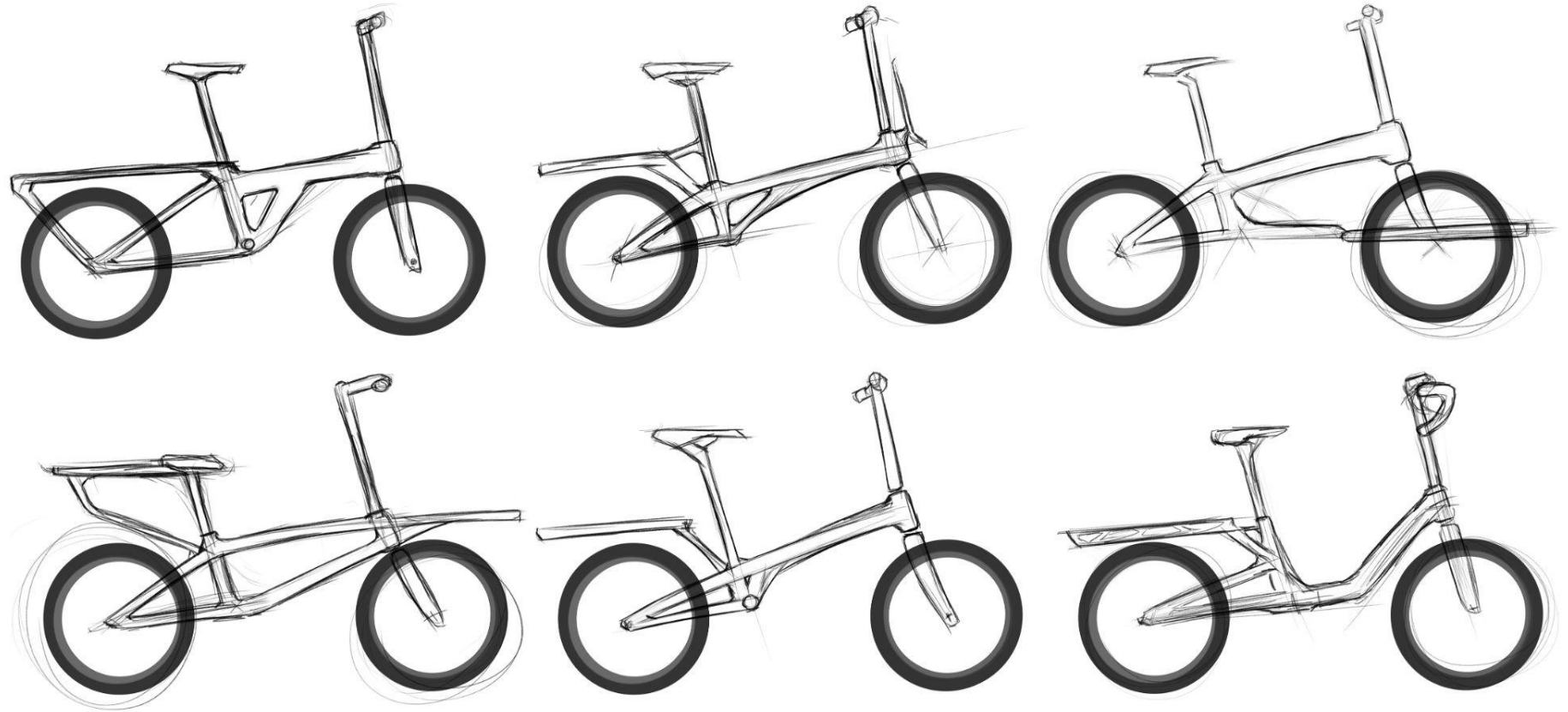
**Concept generation:**



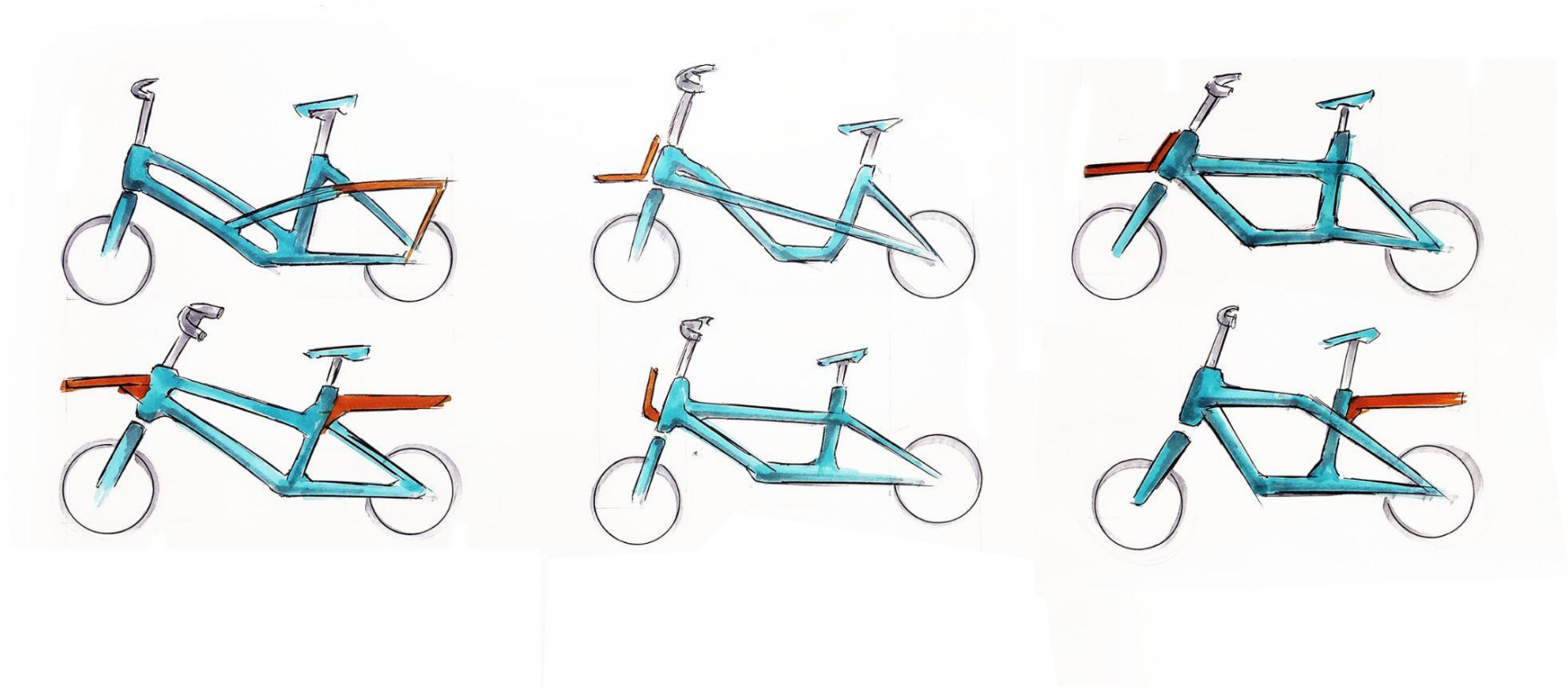


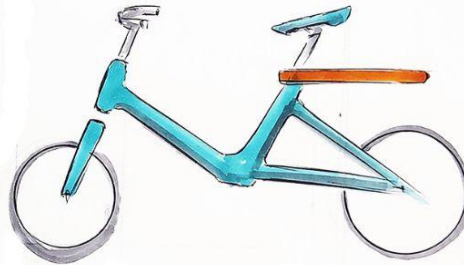
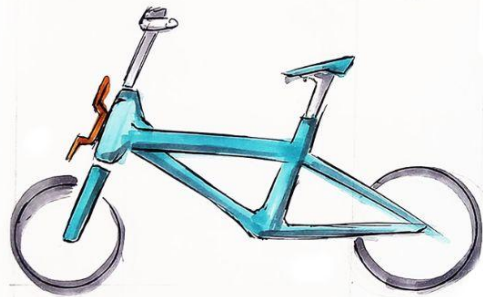
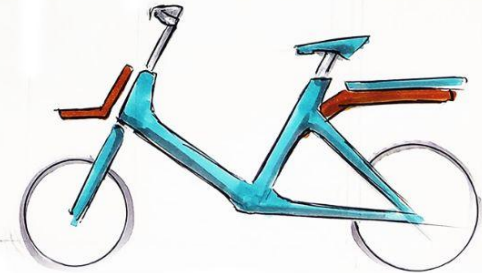
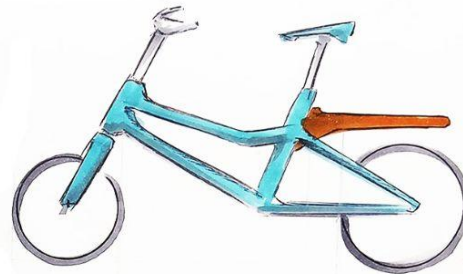








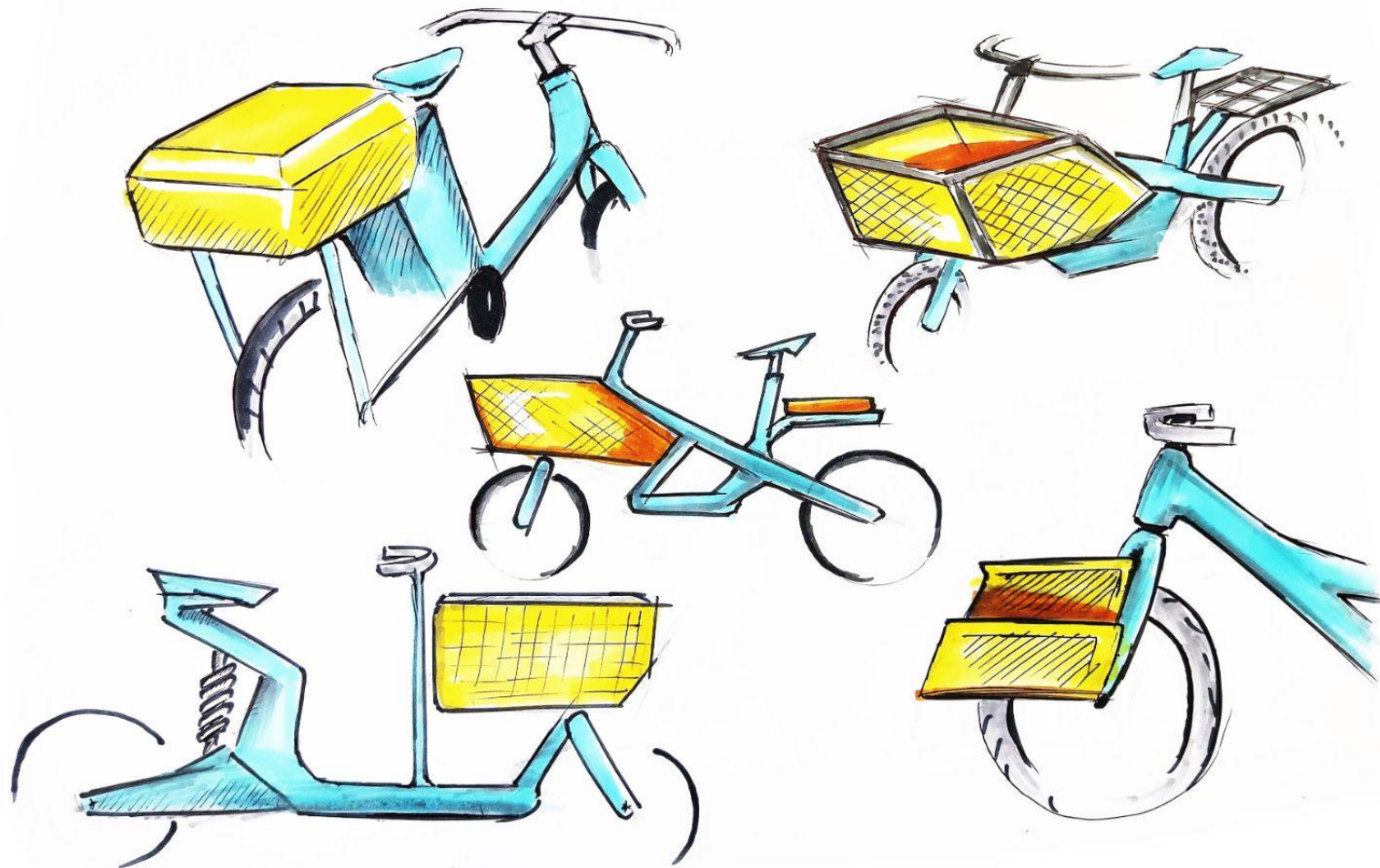


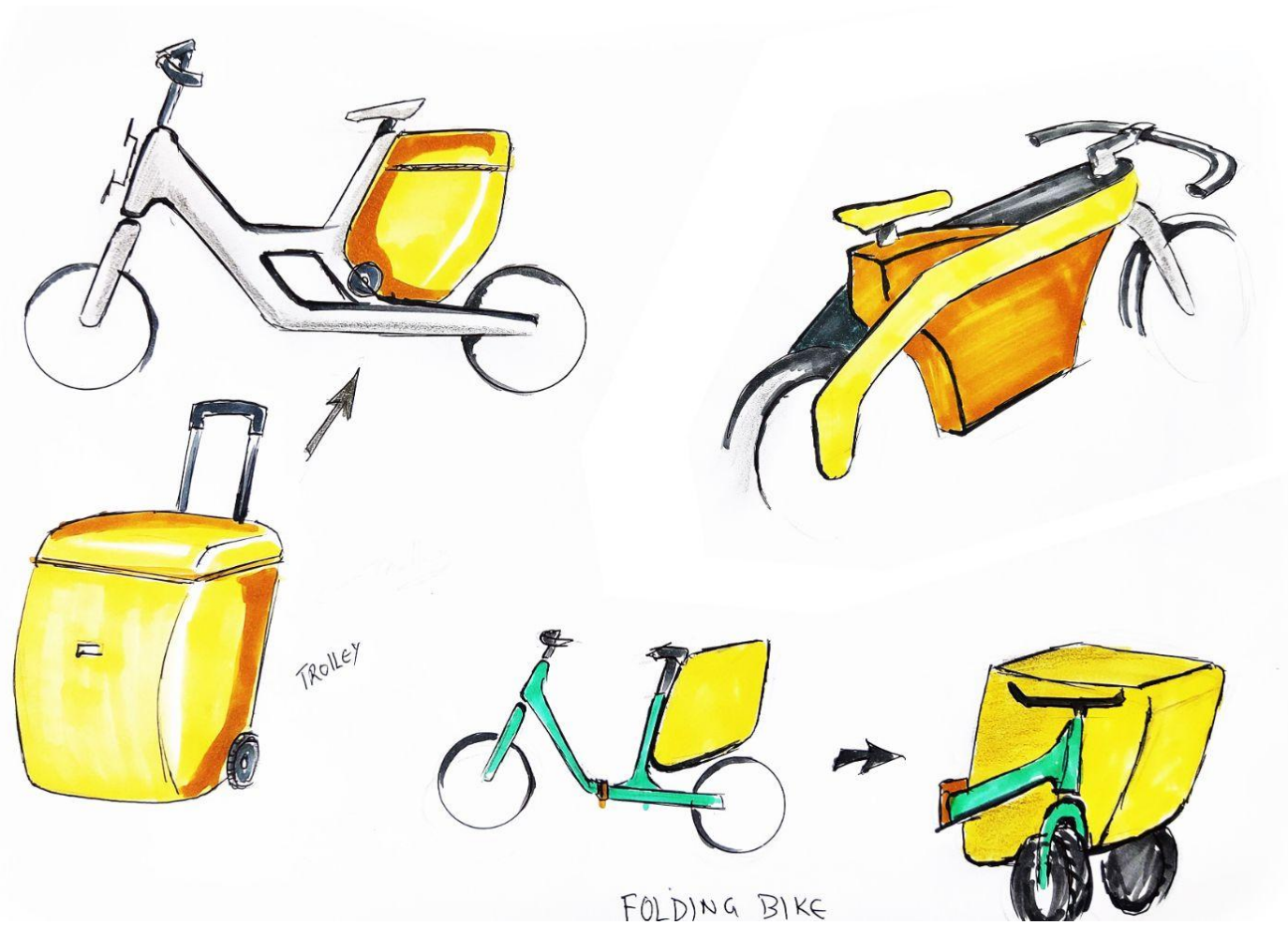




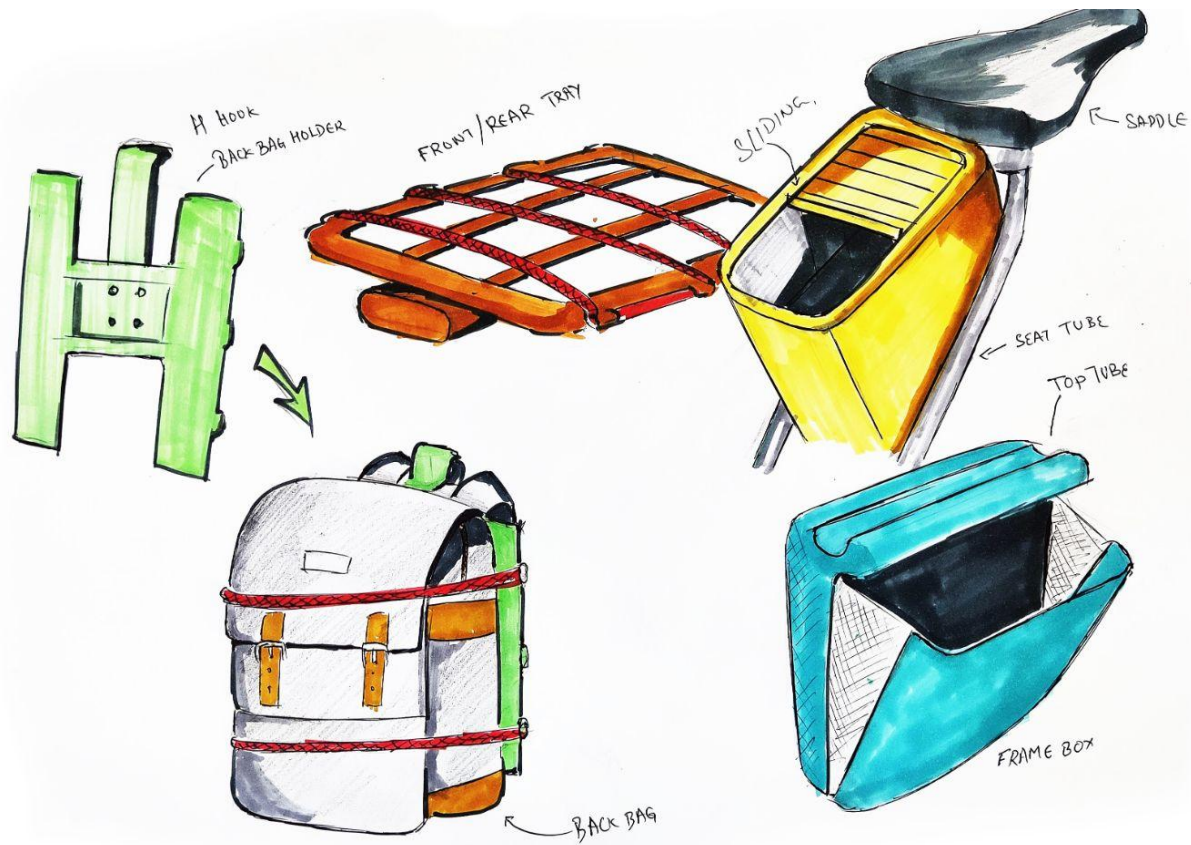




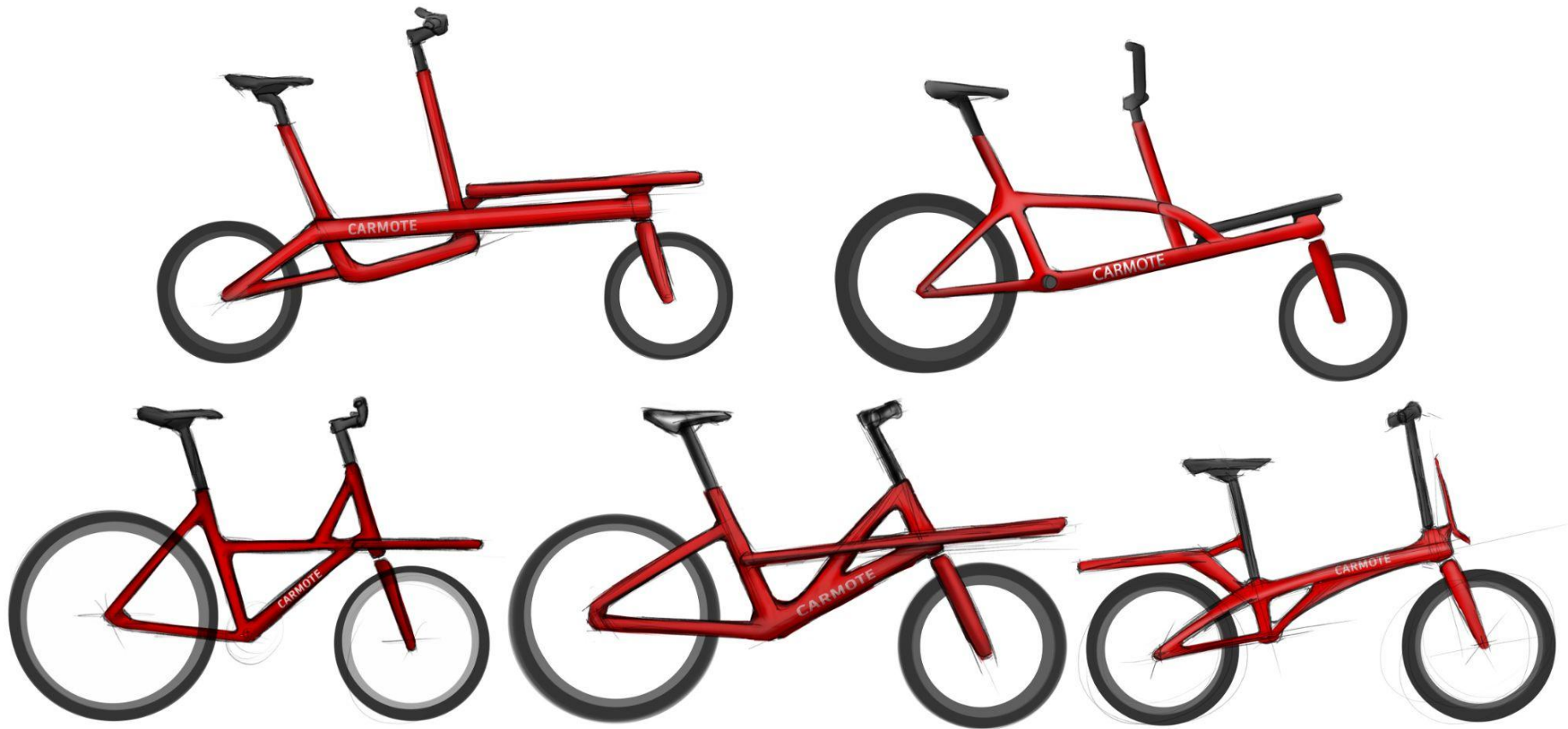








## Concept Development:







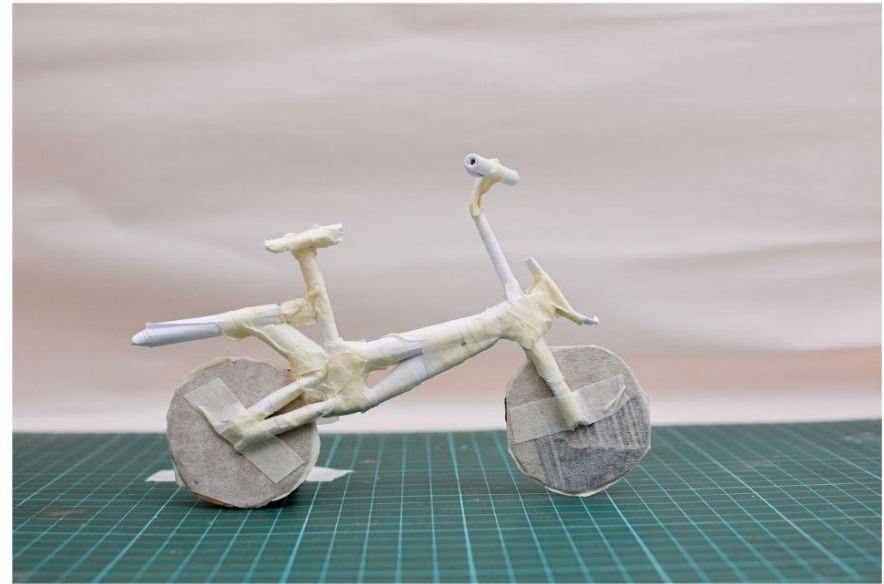
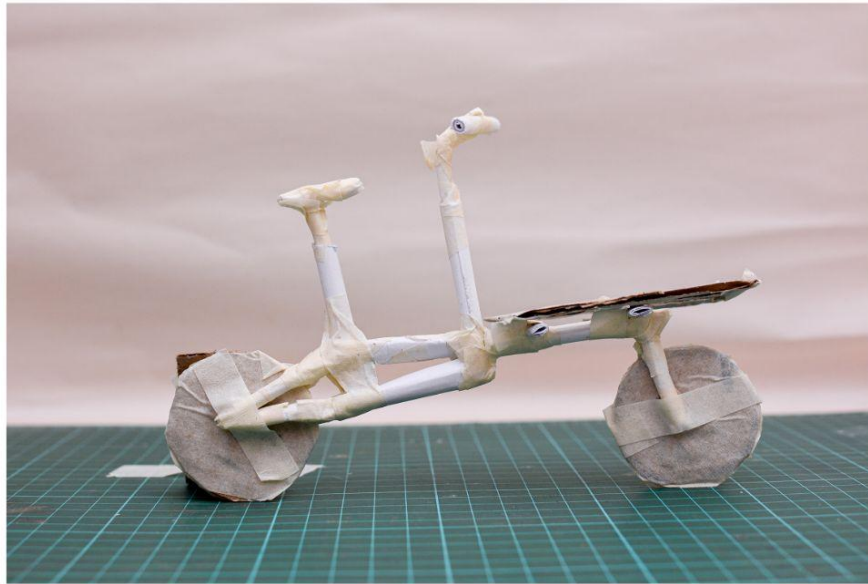








## Concept Mock Up:t



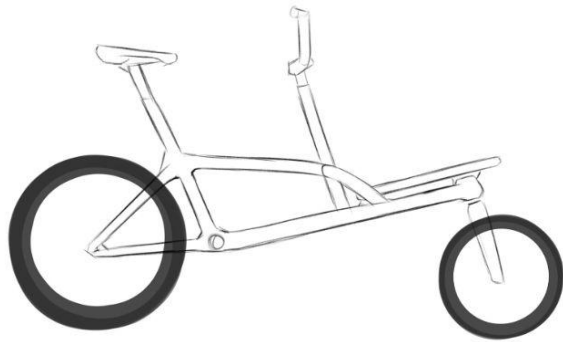








## Final Concept:





## 3D Modeling:

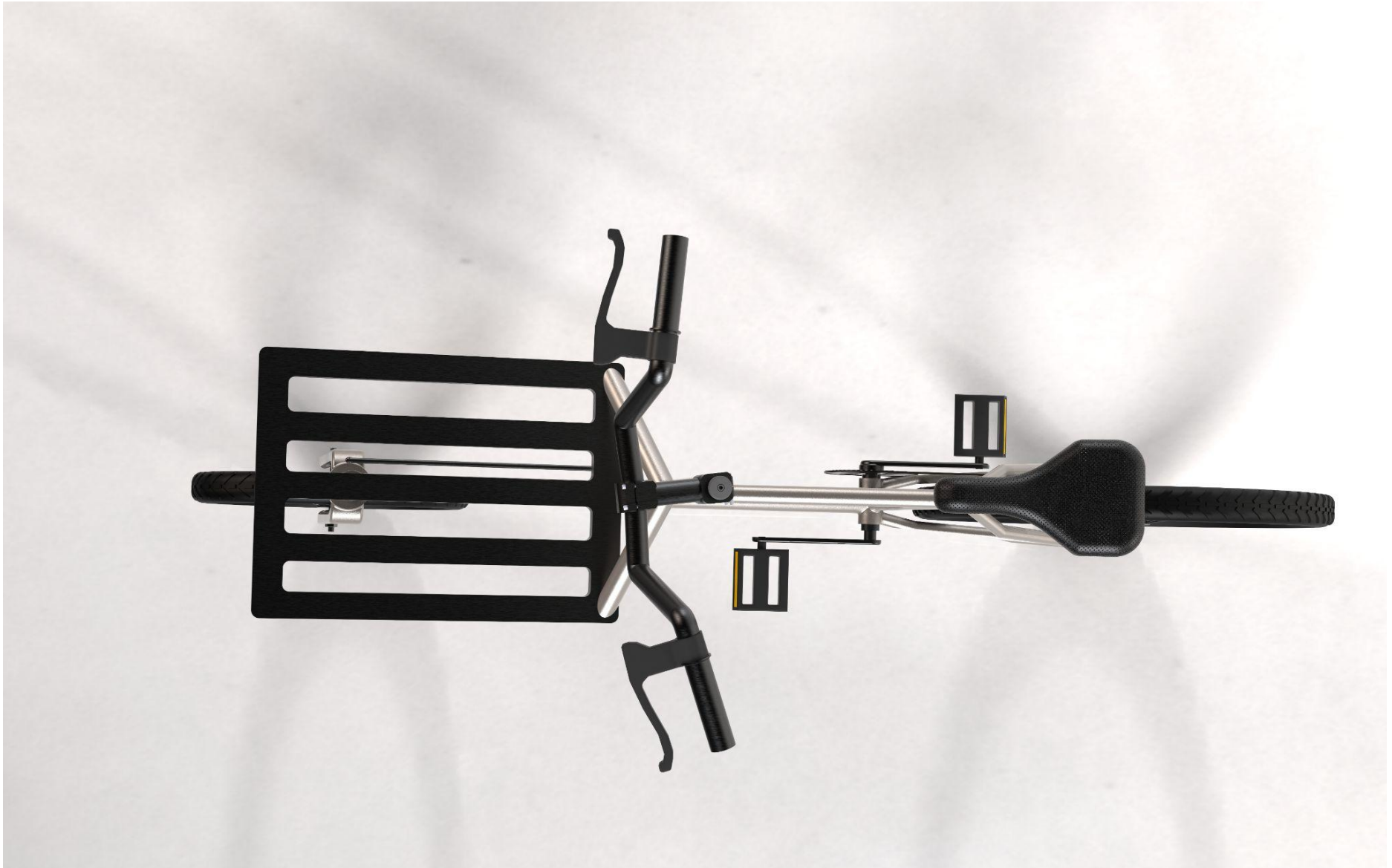


























**1:5 Mock up model:**





## Reference:

<https://dhsprogram.com/pubs/pdf/FR375/FR375.pdf>

<https://assets.kpmg/content/dam/kpmg/in/pdf/2021/06/world-bicycle-day-e-bikes.pdf>

<https://www.teriin.org/sites/default/files/2020-06/benefits-cycling-report.pdf>

<http://aicma.org/wp-content/uploads/2020/08/FINAL-NITI-REPORT-170-gsm-rept-FB-8-set-1-1.pdf>

<https://www.guwahatiplus.com/opinion/opinion/vehicular-emissions-and-its-role-in-driving-global-climate-change>

<https://www.thehindu.com/news/cities/bangalore/%E2%80%98Cycling-not-a-preferred-option-to-commute-in-city%E2%80%99/article14422073.ece>

<https://www.thehindu.com/business/Industry/cycle-sales-jump-twofold-in-five-months/article32856371.ece>

<https://www.thehindubusinessline.com/opinion/why-has-cycle-industry-not-pedalled-forward/article33272230.ece>

<https://auritabikes.com/>

<https://www.herolectro.com/winn-SHLE24GYGY01HM.html>

