TWO WHEELED DELIVERY VEHICLE

MOBILITY AND VEHICLE DESIGN PROJECT III

ALVIN P GOPAL
126390009

GUIDE
PROF. NISHANT SHARMA

INDUSTRIAL DESIGN CENTRE
INDIAN INSTTITUTE OF TECHNOLOGY
2014

Declaration

I declare that this report represents only my idea in my own words, and where others Ideas or words have been included, I have cited and referenced the original source. 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/sources in my report. I understand that any violation of the above will be cause for disciplinary action by the institute and can also invoke penal action from the sources from which proper permission has not been taken, or improperly cited.

Sign :

Name : Alvin P Gopal

Roll No : 126390009

Date : 10/06/2014

Approval sheet

This Mobility and Vehicle Design project report entitled "Two wheeled delivery vehicle", by Alvin P Gopal is approved in partial fulfilment of the requirements for Master of Design degree in Mobility and Vehicle Design.

Project guide :

Chairperson :

Internal examiner :

External examiner :

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1. Abstract

Increasing urbanization and changing lifestyles have introduced a lot of new trends in the Indian consumer market. E-Tailing and Home delivery of fast food are two of the most promising and challenging business areas. These areas are still at a nascent stage in India, but are growing at a very high pace. Considering these emerging businesses and their associated delivery systems, there is a huge demand for two wheeled delivery vehicles which enable fast, easy and safe delivery of cargo

Currently cargo/food delivery is primarily Urban Centric. In India, the major problem in urban areas is the traffic congestion. A two wheeler which cuts through traffic with ease can be extremely helpful in current urban scenario. These aforementioned factors motivated me to take this challenging topic in order to understand and solve the current problems faced by the delivery person.

The project was started with a market study followed by user study, which helped to understand the market trends as well as the user. User study consisted of questionnaire survey, activity analysis and a thorough observation of the users. From insights of the initial research, design brief was formulated. After that ideation was started on the basis of design brief. From the prepared sketches four concepts were selected and they have evaluated on the basis of few keywords viz. cargo handling, comfort, safety of cargo, comparison with existing and styling by the regular users. The concept which got the maximum preference was selected as the final one and made a 1: 3 scale clay model, as the final output.

2. Introduction

The project is mainly targeting the emerging e- Tailing and food delivery business in India. Currently e-Tailing is more popular among the urban population, but it is expanding to other places also. Similar to e-Tailing, food delivery also come under the same category. The two major reasons of the emergence of these trends are India's young population and the quality of urbanization. By 2020 the projected median age of an Indian would be 29 [1]. Such a young generation will be spending much more time on the internet and smart phone than any other medium. Internet accessibility and quality of urbanization will force people to search for convenience in all of their day to day activities. More over their busy life style will not let them spend time for the activities like spending time with family, shopping, cooking, health and entertainment. Alternatively people will look for some other convenient options for this. These situation will help to flourish more and more e-Tailing and food delivery business in India.

Now a days these two wheeled delivery vehicles are doing a good amount of delivery in urban areas than the four wheeled or three wheeled vehicles. But these vehicles need certain improvements to provide better user experience. Currently these vehicles are either cheaper or slightly modified version of some existing two wheelers. Here I am trying to design a two wheeled delivery vehicle for solving the existing problems faced by the delivery peoples.

Scope of the project

As mentioned before, the current delivery system relies heavily on standard market available two wheelers. In most cases companies insist on availability of these two wheelers as a criteria for employability of delivery person. These companies hence spend very little time studying the comfort and convenience of the users. This is in stark contrast to other countries where stringent standard is maintained in these areas.

Considering the growing e-Tailing and food delivery business in India, there is a huge scope for improvement in transportation. In this project I tried my best to find out the real problems faced by the delivery people during their working hours. These inputs helped me to come up with a new solution; a new “Two wheeled delivery vehicle”.

Process followed

My project has started with an initial research regarding e-Tailing as well as food delivery followed by a clear market study of Indian as well as global scenarios. Various factors of this business have been analysed. After getting a clear idea about various market trends, I did a user study to understand more about their actual needs and problems. Based on their requirement and convenience, a basic vehicle packaging have been chosen. According to the initial research, market study and user study, I have finalized a design brief, keeping all these results in mind. Based on the design brief initial ideation was done. The ideations are based on four different arrangements of cargo space. They are

1. Rear cargo
2. Rear and under seat cargo
3. Under seat cargo
4. Front cargo

From the prepared concepts , four of them were chosen by selecting one from each layout. The chosen concepts were converted in to renders and put for concept evaluation. 5 people were selected for concept evaluation. Each concepts were attributed with 5 design keywords, which were selected according to the user study and design brief. During user evaluation the users were advised to grade each concepts by giving certain points, out of 10 for each key words.

After user evaluation concept 1 with rear cargo has been selected as the final concept. Finally a 1:3 scale clay model has been made.

3. Initial research

These studies gave As a part of design process the various aspects of e-Tailing as well as food delivery were studied.

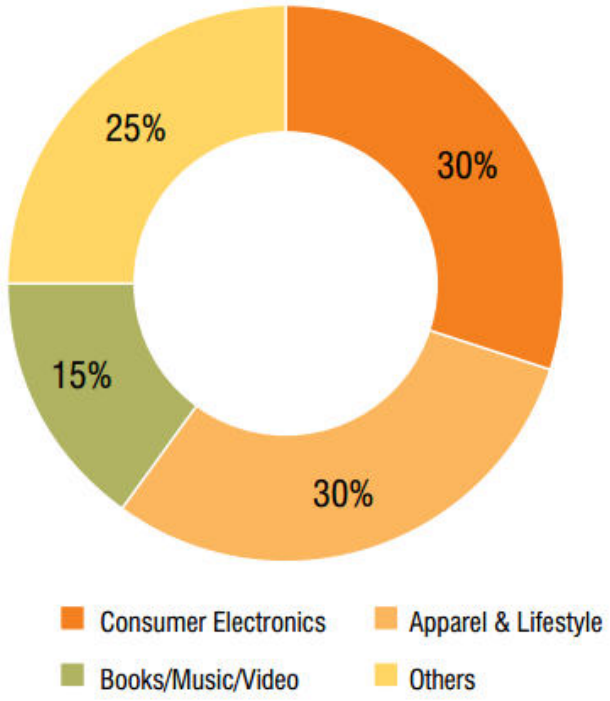
e - Tailing

e-Tailing Is the process of selling goods online. Here “e” stands for electronic, since all the business is happening through electronic media. e-Tailing has started by Dell in 1997 by making business through their online Website [2]. e-Tailing ensure that the products will reach the doorstep of customer. The various steps involved in e-Tailing are Customer visit, Choice of product, payment online and customer delivery. Through internet customer can access to the respective Website of the retailer, where they can see and select the particular item, from the given options. These websites are provided the details like price tag, details about the product, availability/deliverable time span and even customer reviews on the product.

After selecting the product, customer can make the payment either online or by cash on delivery method, which is one of the special features of Indian e-Tailing business. The selected items will be delivered to the customer according to their given contact details. ” Amazon” is the world’s largest e-Tailing

Currently ” Amazon” is the world’s largest e-Tailing company and in India “Flipkart” is the largest market holder. China, India and Indonesia are some of the rapidly developing e-Tailing markets. The Indian market is about 1 billion USD in 2013. According to “Technopak” forecasting It will grow up to 56 billion USD in 2023 [3]. But low Internet penetration and poor financial and transportation facilities are major drawbacks of India’s e-tailing market.

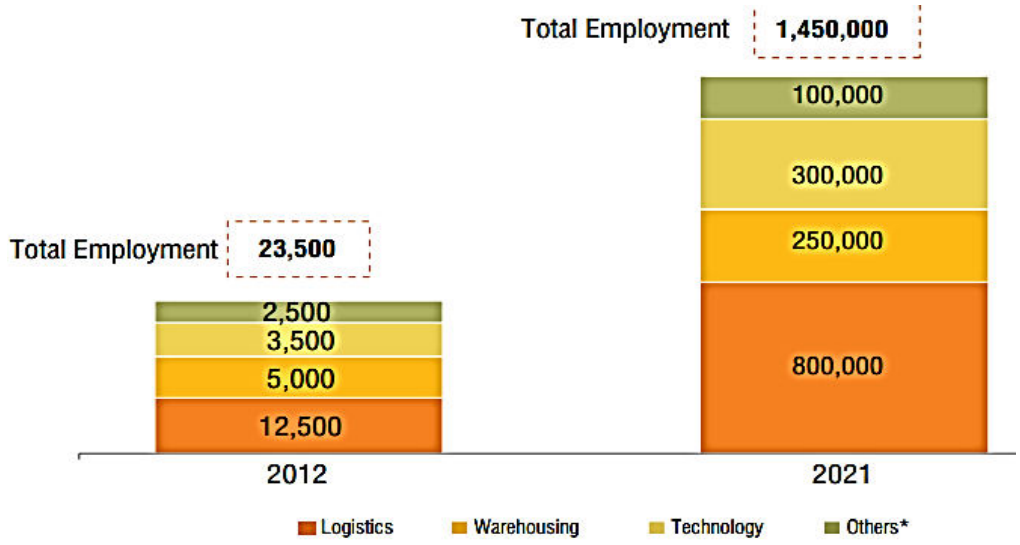
As far as the Indian e-Tailing business is concerned consumer electronics, apparels& lifestyle products are the most demanded ones. Books, music and video are also having good market in India. In future the e-Tailing business will be



IR 1

captured by 3 major category of competitors:

1. Some of the existing players will try to develop their business to meet the growing standards.
2. Many existing retailers will come to the e-Tailing business
3. Many consumer brands will start their own e-Tailing business [4].



IR 2

In India e-tailing has the potential to generate direct employment of about 1.45 million people by 2021. Out of 1.45 million around 800000 will be in logistics sector[5].

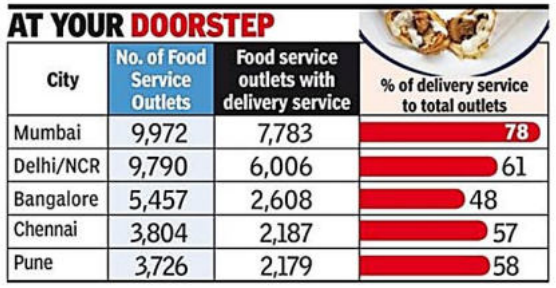
Food delivery

Is the Process of delivering readymade food items to the customers according to their order with in a limited amount of time. World food service industry is expected to reach almost $992 billion in 2014. Asia-Pacific holds almost 43% of the world foodservice industry market share [6].

As far as India is concerned, food delivery is getting more and more popular among the people, especially in urban areas. A report by National Restaurant Association of India (NRAI) and Technopak shows that the *size* of Indian food service market is estimated around 48 billion dollars in 2013 and which is projected to grow up to 78 billion dollars by 2018 [7]. Italian cuisine like Pizzas and pastas are the most favourite among Indians. Chinese cuisines are next to it. The Indian food delivery is largely nurtured by the young Indian population.

During early nineties the food service market in India was dominated by some unorganized parties and few brands. But this trend has been changed dramatically by the entry of some MNCs like Mc Donald's, Pizza Hut, Domino's Pizza, Subway etc. This revolution inspired lot Indian players to come to this industry. As mentioned before, technical advancements in communication sector and increasing urbanization triggered the introduction of lot of new trends in food industry like home delivery service. India have an urban population of 31.3% of total population (2011) with a rate of annual urbanization of 2.47%. [8]

Internet and smart phone usage are the two major reasons for the growth of food delivery business in India. Some reports are showing the young Indians are largely spending their time on the mobile applications and websites of these food delivery brands. Domino's Pizza had a million downloads of its delivery mobile application launched 24 months ago [9]. The following figure shows that most of the food service outlets in major Indian cities have home delivery options.



IR 3

Service providers

IR 4

These are the few service providers in India , in the field of e-Tailing as well as in food delivery.

4. Market study

As a part of design process I have done a market analysis, to understand the current market trends in India as well as abroad. Various two wheeled vehicles have been analysed and documented.

A. Abroad

These are some of the two wheeled delivery vehicles from various parts of the world.

“Peirspeed” Delivery scooter

IR 5

Peirspeed is US based company. This is a delivery scooter with a 150 litre rear

It has an automatic transmission for easy driving. The large cargo box provides enough space for branding. It has an optional large pizza size plug-in heated delivery bag.

Domino’s Pizza Delivery scooter

IR 6

This vehicle has been first implemented in a new farm store in Queensland, Australia. According to them, this electric scooter will make long term benefits for the environment and their business. Over the next three years Domino’s is planning to replace their current scooters with electric models.

Lit motor's "Kubo"

IR 7

It is an electric delivery scooter, designed and manufactured by Lit motors, San Francisco, California . It has a 22" square cargo space with 300 lb capacity. The cargo space have hooks, rails and loops to hold the cargo safely. This particular vehicle has a completely new cargo lay out having a complicated steering mechanism with mechanical linkages.

Pizzahut Delivery scooter

This delivery scooter is used by Pizza hut for their delivery business in Japan.

IR 8

It has a step through frame architecture, with a rear cargo box. The cargo box is used for the company branding.

E-Tropolis "Reload"

IR 9

This is an electric delivery scooter

manufactiured by “E-Tropolis” a German based company. It weighs 85Kg with out battery, and having a rear cargo space. It also have front baskets for carrying more items. It is a single seat vehicle.

The main features of these vehicles are.

1. Mostly two wheelers with step through frame design.
2. Prominent branding.
3. Specific colour scheme according to the brand for which it is used.
4. Bright and attractive body colour for grabbing attention as well as for better visibility from a distance.
5. Most of them are having rear cargo box.
6. All vehicles are single seated. This is for getting more cargo space as well as due to safety concerns and company policies.

B. India

Following are few Indian examples of two wheeled delivery in India. As of now India does not have an exclusive two wheeled delivery vehicle. As I mentioned earlier, we are using some cheaply modified bikes or scooters for delivery.

Hero RNT

IR 10

RNT is a hybrid turbo-diesel-electric motorcycle prototype launched y Hero Motocorp in Delhi Auto Expo 2014. It is an all-purpose utility vehicle, to carry

heavy loads safely and adapt to play a practical role, particularly in rural areas and the developing world [10].

Other two wheeled delivery vehicles

IR 11

IR 12

IR 13

IR 14

The Indian e-Tailing and food delivery companies are generally using some existing bikes or scooters, majorly bikes for their deliveries. They usually have a rear delivery box or a backpack type bag to carry the cargos. The main features of Indian two wheeled delivery vehicles are as follows.

1. Mostly bikes.
2. Have attached rear boxes or separate bags to carry the cargos.
3. Following certain colour scheme depending up on the brand.
4. Some new concepts are following step through frame design.
5. Difficult for female users.

5. User study

After having the market study, I tried to understand the users of the delivery vehicles to get enough design inputs from them. The users are categorised in to two as primary user and secondary user. Primary users are the people who use the vehicles regularly for delivering goods. Secondary users are the people belongs to the administration level, they usually don't ride the vehicles but they will always updated with the changing. market trends and trying to improve their business day by day.

The user study included a questionnaire The user study included a questionnaire survey, a detailed discussion with the users and thorough observation of them. 5 primary users were selected from different companies including e-Tailing as well as food deliver business. After that a detailed discussion with two secondary users from two different areas, viz. E-tailing as well as from food delivery.

A. Questionnaire survey- Primary user

The questionnaire survey consisted of 10 questions, which covered the quantitative as well as qualitative aspects. 5 primary users were selected from the two different areas viz., e-tailing and food delivery. Apart from the questionnaire survey detailed discussions were also happened with them. During this discussions they gave few comments, they are mentioned after the questionnaire survey.

User 1- Krishna Pedi
Field executive – e- Kart

User 2- Hemant Morge
Field executive – Amazon India

User 4- Anil
Field executive – Myntra

User 3- Romeo
Field executive - e-Kart

User 5- Vibhav
Delivery boy– Domino’s Pizza

Questionnaire survey table

Sl No	User survey questions	User 1	User 2	User 3	User 4	User 5
1	Types of shipments/cargos?	Electronic items, books, footwear, apparels	Electronics, footwear, cloths, perfumes	Books, electronics, apparels, footwear, CDs, DVDs	Electronics, books, footwear, cloths, music, video	Cloths, footwear, Music , Videos, Electronics
2	Average no of daily delivery?	30	35	40	40	45
3	Things carry, other than shipments?	POS machine, Money, Bills, Vehicle papers, Mobile	Helmet, Money, Other papers, Mobile.	Pen , Helmet, Money, POS machine, Papers	Helmet, POS device, Water bottle, Mobile, Money	1.Helmet, Money
4	Average daily travel distance?	35	40	35	30	30
5	Capacity of bag?	80 lit	80lit	80 lit	146 lit	80 lit
6	Advantages of bike delivery over 3 and 4 wheelers?	Fast, good for city traffic	Fast ,fuel efficiency, good for city use	Fast delivery, suitable for heavy traffic	Compact, fast, good for traffic	Fast, good for city traffic
7	Why do you prefer bike than scooter?	Style, mileage	Mileage, design	Mileage, design	Mileage, comfortable	Company providing
8	Are you 100% comfortable with the present delivery facilities?	No	No	No	No	No
9	Difficulties you are facing?	Weight of cargo bag, Balancing, safety of cargo.	Misbalancing, weight of cargo bag	Safety of cargo, weight of cargo bag, Lack of balanace with cargo	Weight and movement of cargo bag.	Don't have any problems
10	How many passengers are allowed during working time?	1	1	1	1	1

Common findings from questionnaire survey

1. Shipments includes books, small electronic items, footwear, cloths, DVDs etc.
2. Avg. number of daily shipments will be 30-40 numbers.
3. Apart from shipments they carry, helmet, POS machine, pouch, papers, water bottle etc.
4. Average daily travel distance is 40 kms
5. Working hours is almost 8 hours.
6. Two wheeler delivery is fast , good for city traffic, suitable for small shipments
7. Prefer bike because mileage, fast, style, easy handling and more manly
8. Almost all are not fully satisfied with their present facilities.
9. Misbalance, movement of bag, weight of bag, safety of the shipments are the major problem they are facing.
10. Only single passenger is allowed during working hours.

B. Activity analysis- Primary user

The second part of the user study included a thorough observation of the users especially the primary users. This study helped to understand their pattern of cargo handling and their unexpressed needs. This study also helped to get more details which have not covered in the questionnaire survey. Pictures and videos were taken for future reference and documentation. These studies were done during their working hours, which was helpful to understand their real time activities. Which include how they are handling the shipments, how they are interacting with the customers, how they are using the vehicle, what are their current problems etc. For the activity analysis I have selected two typical examples from both e-Tailing and Food delivery viz. e-kart logistics and Domino's Pizza delivery, since they are the leading market holders in their domains.

e- Tailing

1. Taking the shipments in order, at the godown.

3. Keeping the POS device in bag.

2. Arranging shipments in the cargo bag.

4. After packing the bag, start the journey for delivery.

Continued…

5. Before leaving the godown, wait for security check.

7. As per company policy, wear the helmet for safety.

6. Taking his own bike for going to the delivery of shipments.

8. After a final check, leaving the godown, to various delivery points.

Continued…

9. After reaching the destination, he will Keep the cargo bag down.

11. Calling the customer accordingly.

10. Checking the customer list for delivery.

12. Hand over the shipment to the customer, and make the payment.

Continued…

13. Keeping the money, pen, and customer list in his carrying pouch.

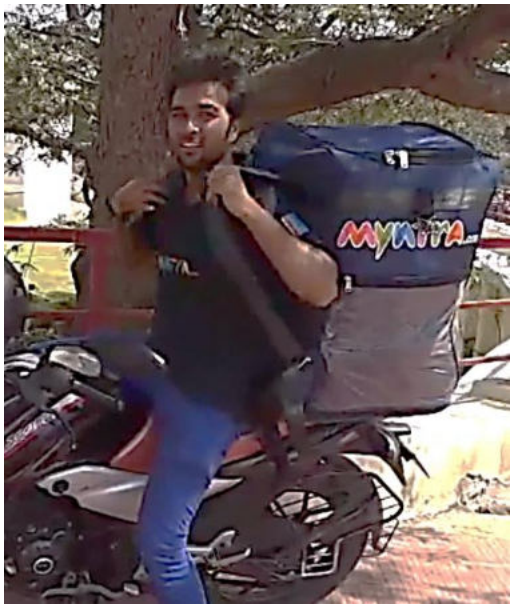
14. Delivery is over and get ready for the next destination.

15. Leaving to the next destination.

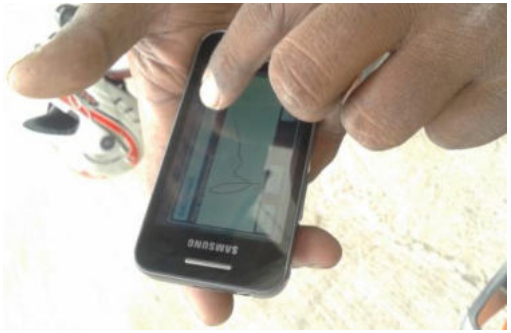
This is the activity cycle of a typical e-Tailing field executive. For this I selected e-Kart logistics. In case of food delivery those people didn't permit me .to take pictures and videos at their shop. The other activities are covered in the user observation part.

C. Observation- Primary user

1. All of them are carrying a big cargo bag, typically a backpack type, except food delivery, they usually have a fixed cargo box. These bags were looking so bulky and visually heavy.



2. They are carrying a POS device to enter the payment, except user 2 and user 5. The user 2 from Amazon India is using his own smart phone to enter the payment details. The Dominos guy didn't carry the POS machine since the company prefer online order and payment or direct money payment.



3. All of them are carrying a pouch to carry money, POS machine, pen, bills etc. Some of them are carrying on the waist like a belt and few of them were like normal bag. During rainy season protecting these pouches from rain water will be difficult since they are not water proof.

4. Some time they have to take the shipments out of the bag, since they are not arranged in an order. They usually spread the shipments on the ground, which increases the chances of theft.

5. Few of them have arranged the shipments orderly in the bags, enables easy visibility and access to them.

6. Every time they have to take the heavy and bulky bag up and down making so much difficulty for the user.

7. Climbing on to the bike with the back pack is so difficult. All the time they have to hold the bag while climbing to the seat, which creates lot of physical stress on the driver. This way of climbing is not at all ergonomic.

8. In case of food delivery, the fixed rear cargo box making it difficult to climb up and down from the bike.

9. The cargo bags or boxes are not looking as a part of the vehicle and visually creates a bigger volume over the vehicle or driver.

11. Due to the weight and movement of bags while driving, misbalancing of the vehicle will happen. This will leads to shoulder pain for the driver. At higher speeds the misbalancing might cause accidents.

12. No space to keep necessary papers and belongings

Due to the lack of enough inbuilt storage space in bikes, they are struggling to keep these items. This guy is keeping the papers inside the helmet.

13. Many flexible cargo bags are broken due to regular use and they are not water proof. Which points out the need for a more strong, safe and water proof cargo space.

14. Shipments are usually carried in cuboidal or rectangular boxes or pouches. Which makes the packing more easy, especially in cuboidal cargo boxes or bags.

15. All the companies have used the cargo bags or boxes for branding, and many of them are provided with prominent company logo and name and other details

16. In case of Domino's Pizza, they are using an "L" shaped cover for the cargo box, which enables easy access and visibility of the deliverables.

D. User study: secondary user

User 1

Boniface Mendoza (Hub in charge)
Company : e- Kart.

User 2

Avinash Savant (Dy. District manager)
Company : Domino's Pizza

User 1 : Comments

1. "Have three different kind of packaging small (mobile camera, books, perfumes etc.) medium(footwear, laptops etc.) and large(TV, Washing machines etc.)".

2. "Only small and medium will send through two wheelers. There sizes are given as (17cm x 12.5cm x 10.5cm), (33.5cm x 18cm x 12.5cm) and (35.5cm x 27cm x 12.5cm) respectively".

3. "Cargo bag size is 50cm x 45cm x 35 cm (80 lit approx.)".

4. "There are 30 delivery boys, with an avg. 25-40 shipments /day".

5. "They are using, their own bikes".

6. "Bikes are using for delivery, because of fast delivery, especially in cities".

7. "Delivery boys should not left the bag alone during working time, since that may lead to theft of shipments".

8. "They have to carry helmet, license and other papers etc. with them.

9. "Bags are not water proof".

10. "Fully loaded bag will weigh around 15-20 Kgs (On an average)".

11. " We need more bikes and vans, as company is planning to start same day delivery".

User 2 : Comments

1. “We are using a separate thermal insulating bag called Heat wave bag to carry pizzas with out loosing heat. 3Heat wave bags can be accommodated in the delivery box. Each bag can carry 2 pizzas”.

2. “Apart from pizzas, there will be some side dishes, soft drinks etc. Now we are carrying it separately”.

3. “Avg. distance travelled in one delivery will be 3-4km in one direction”.

4. “We have to deliver the order with in 30 minutes”.

5. “Now we are using petrol vehicles, Goregaon shop have tried an electric scooter for trial basis”.

6. “Capacity of the box is enough, about 80 litres, since more order can’t be accommodated with in 30 minutes”.

7. “Company prefer bike because of mileage”.

User study common takeaways

1. Should have easy cargo handling facility.

2. Should have enough storage space for cargos and other relevant things like money, POS machine, bills, papers etc.

3. The cargos should have enough safety while parking.

4. The storage space should be compatible for both e-Tailing and Food delivery.

5. Should have easy accessibility to the seat.

6. Comfort of the driver should be maintained.

7. There should be enough space for branding.

8. It should be a single seat vehicle.

9. The avg. daily travel distance is 40 Kms.

10. Design of vehicle should match with the current market trend.

11. Cargo boxes/ bags designs are not matching with the overall form of the vehicle.

E. Comparison study

In India many companies are using bikes for delivery and the main reason is mileage. But According to user study the users are facing lot of difficulties due to bikes, but they are forced to use it, other wise they will loose their job. Companies are not at all aware about the delivery people's problems. But, in more established and developed countries they are using scooters for delivery purpose and it has lot advantages over the bikes except mileage. Companies like Domino's Pizza have already introduced electric scooters for delivery in some of their shops in abroad. So before fixing the vehicle type I had to do a comparison study of these two different vehicles. For this purpose I have selected one of most popular and economical bike, Hero HF-Dawn and India's most selling scooter Honda Activa.

Bike: Hero HF-Dawn

IR 15

Specifications:

L 1965 mm x W 720 mm x H 1045 mm.	
Displacement	- 97.2 cc.
Wheelbase	- 1235 mm.
Ground Clearance	- 165 mm.
Saddle height	- 805 mm.
Fuel Tank Capacity	- 10.5 Ltrs.
Kerb Weight	- 109 Kgs.
Mileage	- 77 kmpl.
Ex-showroom Price	- 40,219 in Mumbai [11]

Scooter: Honda Activa

IR 16

Specifications:

L 1761mm x W 710mm x H 1147mm.

Displacement	- 109cc.
Wheelbase	- 1238mm.
Ground Clearance	- 153mm.
Saddle Height	- 765mm.
Fuel Tank Capacity	- 5.3 Litres.
Kerb Weight	- 111 Kg.
Mileage	- 60 kmpl.
Ex-showroom Price	- 48,517 to 51,665 In Mumbai [12].

Bike Vs Scooter

Bike pros

1. Better stability on higher speeds than scooters

2. More mileage than scooters.

3. More ground clearance than scooters, making it suitable for Indian roads.

4. The larger tires on a bike allow the vehicle to travel over potholes.

5. More fuel tank capacity than scooters, eliminates the frequent fuel filling.

Bike cons

1. Difficult for female users.

2. Higher seat height than scooters.

3. Less in built storage space.

4. Don’t have automatic transmission.

Scooter pros

1. Step through frame, enabling easy access.
2. More inbuilt storage space.
3. Automatic transmission.
4. Relaxed riding position.
5. Comfortable and wider seat than bikes.
6. Lower seat height than bikes,

Scooter cons.

1. Less mileage.
2. Low fuel tank capacity.
3. Low ground clearance than bikes.

In comparison of various features, the one with maximum positive features have selected for the vehicle packaging.

F. Benchmarking

After considering the user requirements, comfort, safety and the comparison study, Honda Activa is selected as the Benchmark for vehicle dimensions. According to SIAM, Honda Activa is the most selling two wheeler in India. In 2013 September. almost 144996 vehicles have sold, which was more than the sales of motor cycles [13].

The step through frame design will allow both male and females users to use the vehicle. Since the main service of delivery vehicles are in Urban area and considering the good road facilities there, 150 mm ground clearance will be good enough. The lower seat height enables comfortable seating for shorter people also. Comfortable riding position is an added advantage. There is enough scope for inbuilt storage space in scooters than bikes.

Few disadvantages are the lower fuel efficiency and low fuel tank capacity. But considering the environmental factors

and changing trends, an electric powered vehicle will be more suited for the future. Considering the environmental impacts causing by the Internal Combustion Engines (ICEs), the choice of electric powered vehicles can be justified. Apart from this, an electric powered vehicle have lot of other advantages over a ICE powered vehicle.

G. Why electric?

1. Electric vehicles (EVs) facilitates better vehicle packaging over IC engine vehicles. By providing hub motor, we can save spaces required for IC engine, fuel tank etc.

2. This concept is for future, and in future the source of power is going to change from petroleum fuels to another sources like electricity.

3. In delivery companies they will get enough time to recharge their vehicles after the working hours to the next day morning or in between consecutive deliveries.

4. Companies can maintain certain standards of control in energy(fuel) expenditure.

5. Environmental concerns- EVs causes less or no air pollutants.

6. They can be finely controlled and provide high torque from rest, which is helpful for easy acceleration .

7. EVs operates very smoothly and not causes sound pollution.

8. They are mechanically very simple, so easy maintenance is possible, which help to reduce time for maintenance.

9. In future the EVs can be connected to the “Smart grids” to cope up with the energy demands [14].

10. Electric motors can be combined with regenerative breaking system.

6. Design brief

Vehicle packaging

A single seat two wheeled vehicle with enough storage space(Min 80 lit), compatible for e-Tailing as well as Food delivery requirements. Safety of shipments is an important factor of design. Comfort of the driver should be taken care.

Dimensional specification

1	Wheelbase	1238mm
2	Seat Height	765mm
3	Ground Clearance	153mm
4	Length	1761mm
5	Width	710mm
6	Height	1147mm

Aesthetics

The styling of the vehicle should match with the current market trends with enough scope for branding. The design should be unisex and compliment the brand identity.

Power source

Electric powered, with hub motor, using Lithium Polymer battery pack, due to high efficiency and flexibility in shape.

7. Packaging design

As per the questionnaire survey conducted, the items that a delivery person carry, can be broadly classified in to two 1. Shipments 2. Other belongings. The shipment or cargo carrying capacity should be 80 litres min. and the vehicle should have enough storage space for the other belongings like POS machine, money, papers, bills etc. According to the placement of cargo space 4different concepts or layout are made, they are given as follows. The following colours represents various parts.

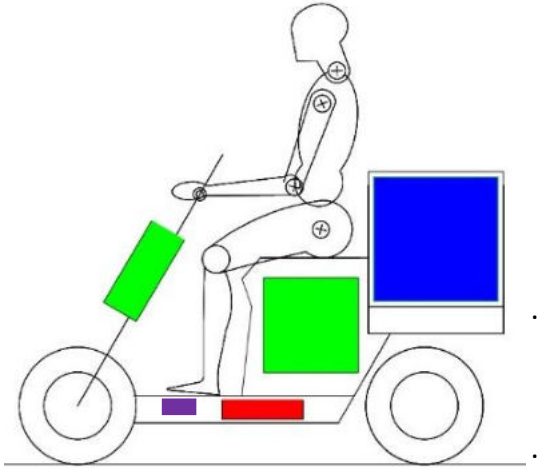
Cargo space

Other belongings

Battery pack

Control unit

Concept 1



Rear cargo

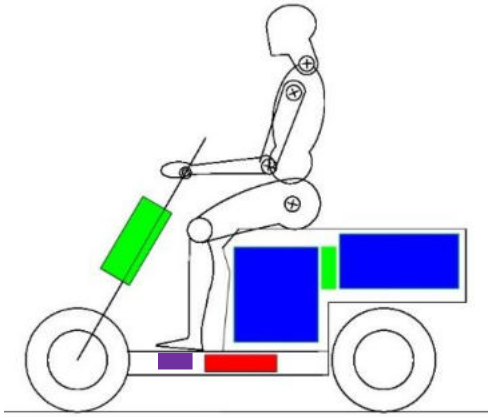
Pros

- More cargo space approx.120 lit.
- Easy access to the seat.
- Back support for the driver.
- More scope for branding.

Cons

- Look like a separate box.
- High CG due to higher cargo position.
- conventional.

Concept 2



Rear with under seat cargo

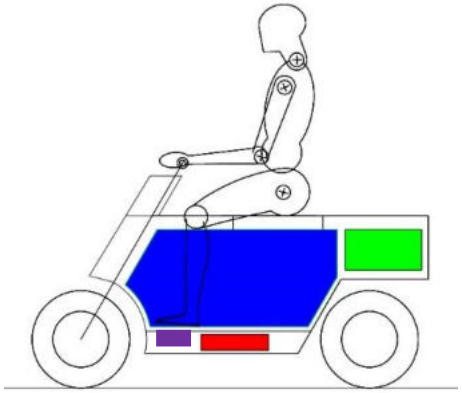
Pros

- No separate box is visible
- More integrated form.
- Lower CG hence more stability.
- More scope for branding.
- Easy access to the seats

Cons

- Effective cargo space is less than the first one. Approx. 90 lit
- Partially conventional

Concept 3



Under seat cargo

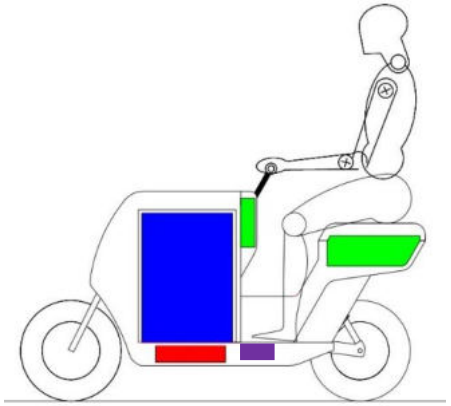
Pros

- More integrated form.
- Even distribution of load.
- Low CG, hence more stability.
- More Compact
- Non conventional.
- More scope for branding.

Cons

- Less cargo space, approx. 70 lit. only
- Can not utilize the step through frame.
- Less additional storage space

Concept 4



Front cargo

Pros

- Unconventional
- More luggage space approx. 110 lit.
- More space for driver's belongings
- Easy access to the seats
- More space for branding

Cons

- Steering mechanism is complicated
- More bulky in the front.

Seat design

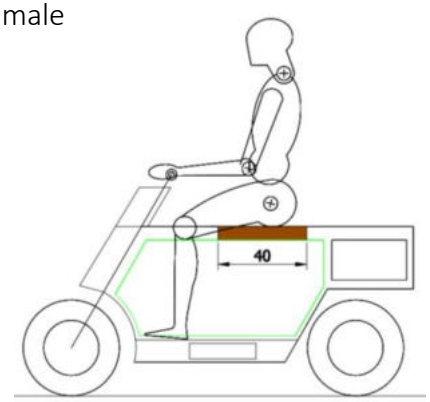
In case of seat design the concepts 1,2 and 4 can be considered to be of same category , since they are following a step through frame layout and concept 3 follows a bike kind of layout. One common thing in theses two layouts are the need for single passenger. To get the seat width, I physically measured the seat width of a Scooter(Honda Activa) for concepts 1,2, 4 and that of few bikes for concept 3. Then I had to find out the most comfortable seat length keeping all the other parameters unchanged.

As I mentioned earlier the seat height is fixed as *76.5 cm which is equal to the Crotch height of 50th %le Indian man [15].* For getting a comfortable seat length, I had to consider the ergonomics ie the *buttock popliteal length of a 95th %le Indian man since he need more space for sitting and this value is around 51.2 cm [16].* Since it is a two wheeler seat, full buttock popliteal length is not needed and a value of 35cm was found to be comfortable from the given figure.

For concepts 1,2,and 4 with 95th %le Indian male

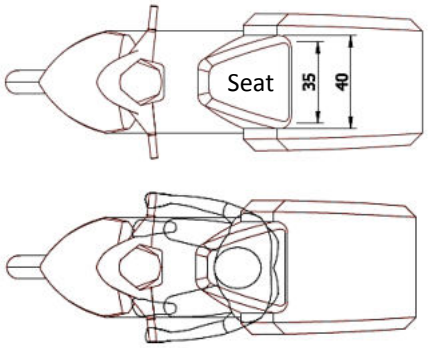
Dimension is in cm

For concepts 3 with 95th %le Indian male



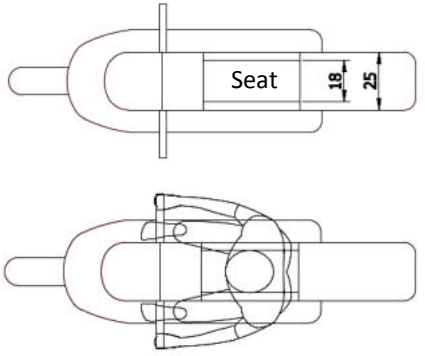
Dimension is in cm

For concepts 1,2 and 4 plan view with 95th %le Indian male for seat width.



Dimensions are in cm

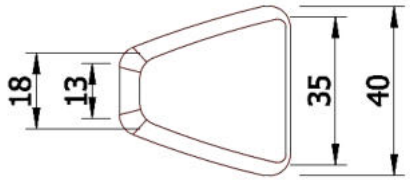
oncept 3 plan view with 95th %le Indian male for seat width.



Dimensions are in cm

6

For concepts 1,2,and 4, seat design



Pan view
All dimensions are in cm

Side view

3 Quarter view

For concept 3, seat design.

Pan view
All dimensions are in cm

Side view

3 Quarter view

Mood board for styling

Fast

IR 17. References are given at the end, from top left image in clock wise direction.

8. Ideation

Before starting the ideation process, I have made a mood board for the styling. The key word of the mood board is “Fast”, The two wheelers helps for the fast movement in city traffic and also the process of cargo delivery needs more fast operation, so this particular word has selected as my key word for the design process. For making the mood board, I have selected few living as well as non living objects, they attributes the emotion of speed. I tried to assimilate the various features of these objects, which gives the feel of speed to them. The features are given as follows.

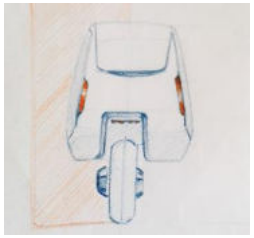
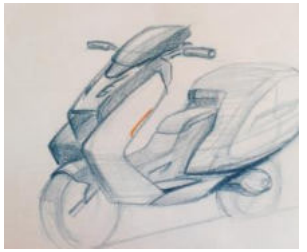
1. Pointed towards the direction of movement, which gives more aerodynamic features.
2. No body lines are parallel or perpendicular, but they are intersecting at acute angles or not moving in parallel.
3. Most of them have sharp edges.
4. Most of them have contrasting colour scheme.
5. Fluidic body curves.
6. Absence of pure geometric shapes.

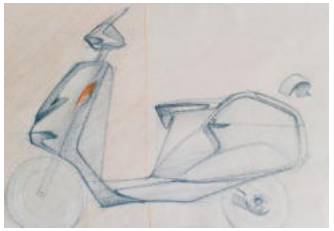
After creating mood board, I have started making basic line sketches of four different layouts, by keeping the basic features from mood board. For maintaining the proportions, the various layout figures were kept as reference. A quite few number of sketches were made for each of these layouts. During my ideation I tried to make the cargo space as an integral part of the overall vehicle design. For this, the various character lines or features on the body as well as on the cargo area were made with some relation between them. Certain features were extended or replicated at various parts.

Ideation sketches





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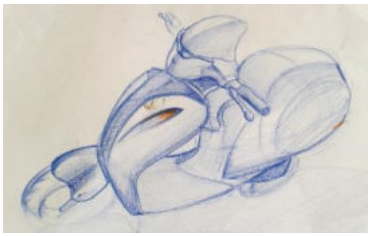
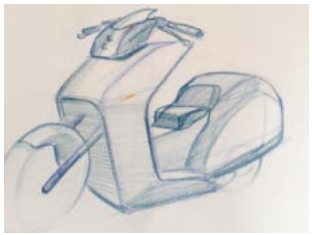

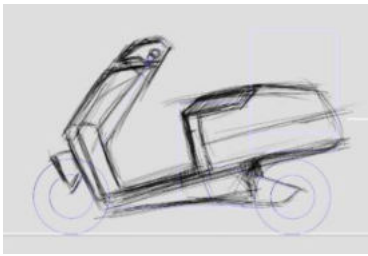



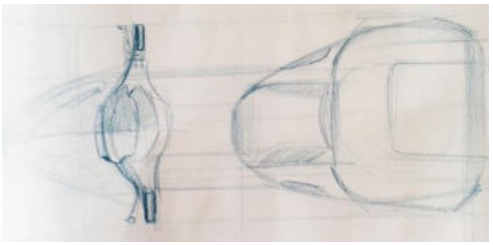

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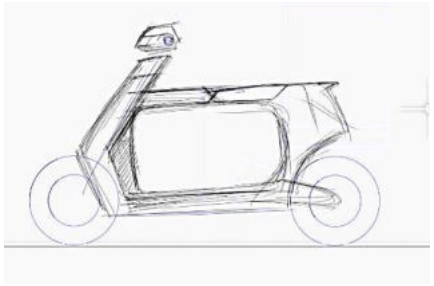
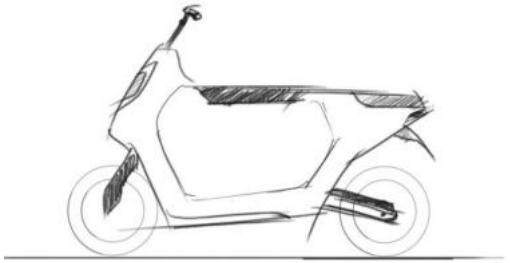
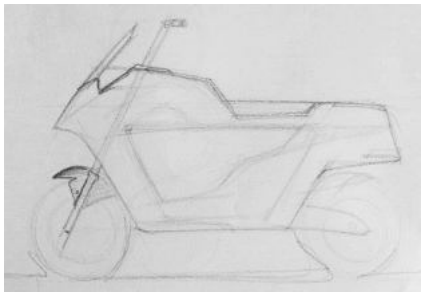
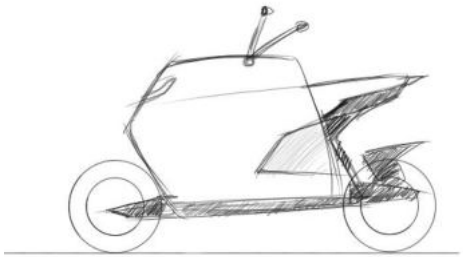
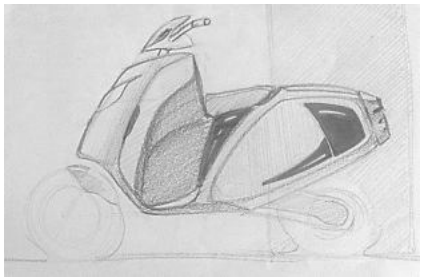
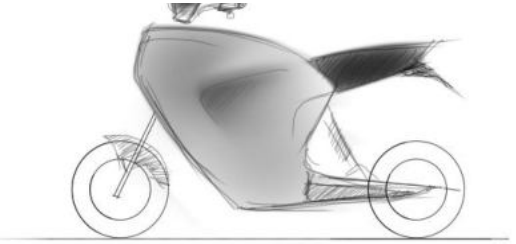






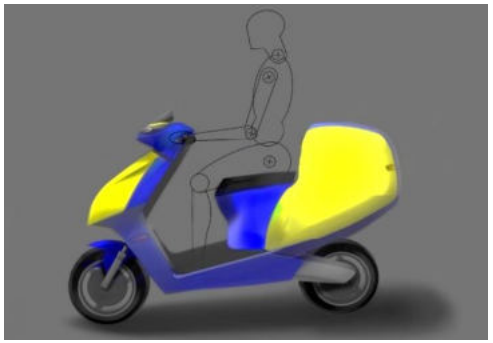


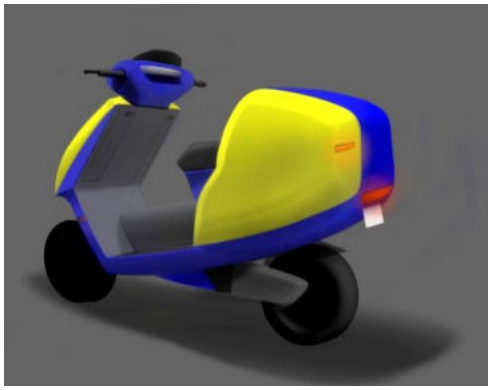




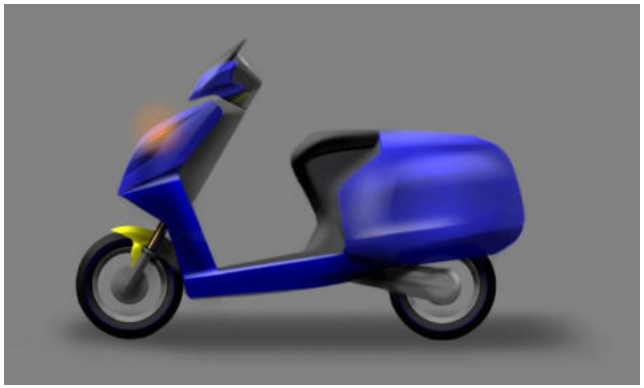
9. Concept renderings

Layout 1 – rear cargo

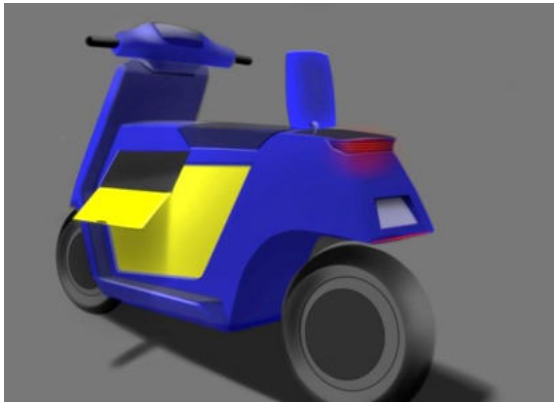




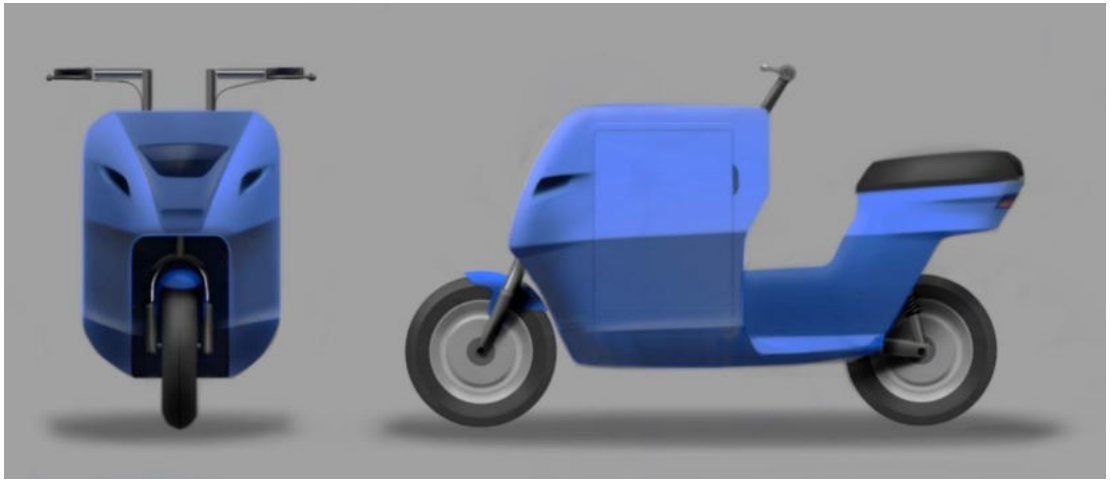
Layout 2 – Rear and under seat cargo

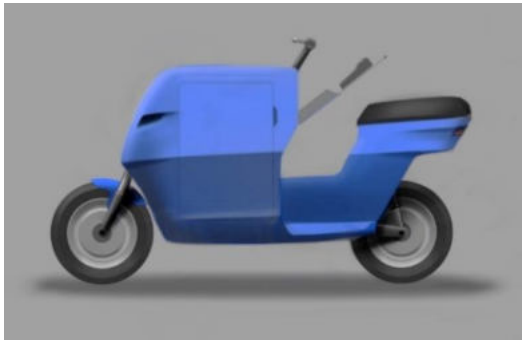


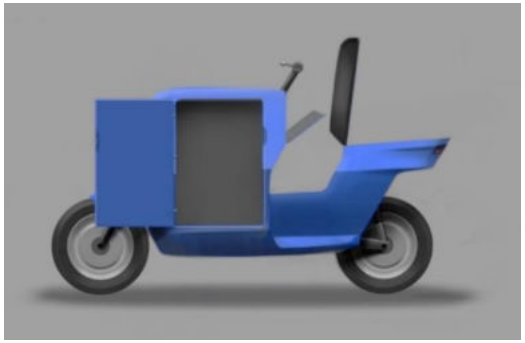
Layout 3 – Under seat cargo



Layout 4 - Front cargo







10. Concept evaluation

For selecting the best concept, the four shortlisted concepts have been evaluated by the end users belongs to the e-Tailing as well as Food delivery industry. The primary and secondary users were there for evaluation of concepts, so that I could cover the needs of both the management and workers. The users were provided with 5 different key words, they are

1. Cargo handling
2. Comfort
3. Safety of cargo
4. Comparison with existing
5. Styling

These key words were selected according to the user needs, which they have mentioned during the user study, at various stages. These key words helped to evaluate each concepts both qualitatively and quantitatively.

Cargo handling

This key word examines the ease of cargo handling in the shortlisted concepts.

Comfort

This feature evaluates the visual comfort of various concepts perceived by different users, from the comparison of their previous experience with the new concepts.

Safety of cargo

This key word helped the users to check the safety of cargo as well as himself in terms of location, visibility and theft.

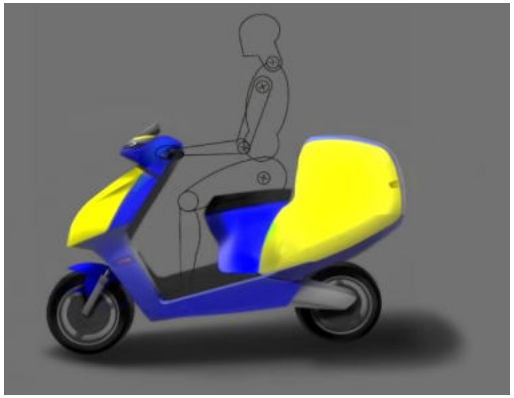
Comparison with existing

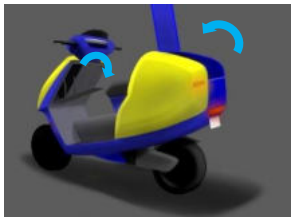
Through this, the users could make a comparison of new concepts with the existing concepts in various other factors which were not covered in this analysis.

Styling

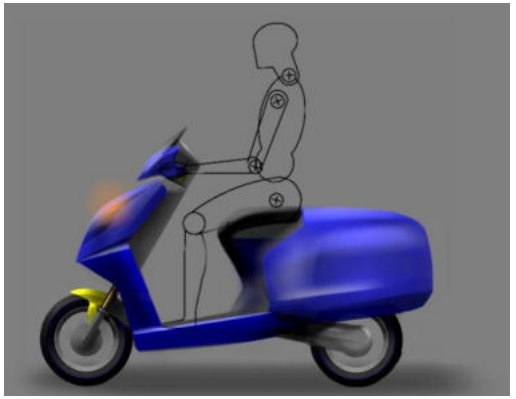
This key word helped to evaluate the overall design and aesthetic aspects of various concepts. design and

Concept 1





Concept 2



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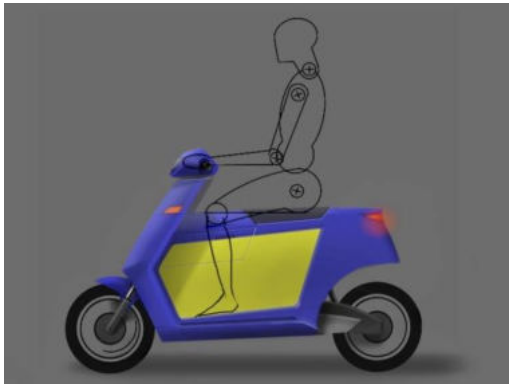
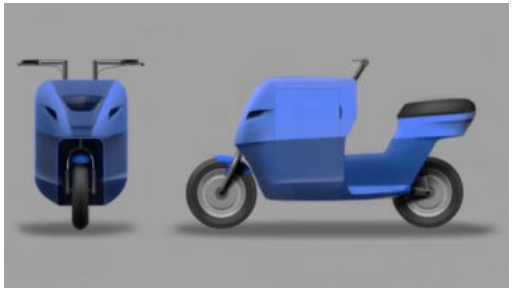
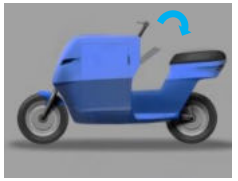
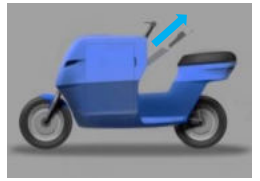
Concept 3

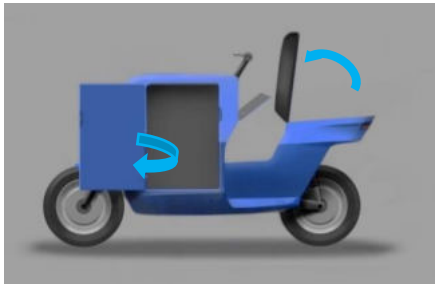


Concept 4









Concept evaluation tables

As I mentioned earlier, 5 different users have evaluated each concepts according to the given key words, by providing each concept some points out of 10. Each key word was assigned with certain weightage according to their relevance in the user study. The following tables are a compact form of the concept evaluation, which shows how the users given points to each concepts. The first 3 users are from e-Tailing And the remaining two are from food delivery industry.

Sl No	Parameter	User 1				User 2				User 3				User 4				User 5			
		C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
1	Cargo handling	10	8	9	5	9	7	6	8	10	7	7	6	10	8	6	6	10	9	8	8
2	Comfort	10	8	8	5	9	7	7	6	8	9	6	6	9	6	6	6	10	9	7	8
3	Safety	9	8	8	6	8	8	8	8	10	7	7	7	8	8	8	4	9	9	8	8
4	Comparison with existing	10	9	5	5	9	7	7	8	9	9	6	6	10	8	6	6	9	8	7	7
5	Styling	9	7	4	4	8	9	8	9	9	7	5	4	8	6	6	8	9	7	8	7
Total		48	40	34	25	43	38	36	39	46	39	31	29	45	36	32	30	47	42	38	38

Sl No	Parameter	Weightage out of 10	Indivudual poit x Weightage			
			C1	C2	C3	C4
1	Cargo handling	3	147	117	108	99
2	Comfort	2	92	78	68	62
3	Safety	2	88	80	78	66
4	Comparison with existing	1.5	70.5	61.5	46.5	48
5	Styling	1.5	64.5	54	46.5	48
Total			**462**	**390.5**	**347**	**323**

The given tables shows the points obtained for each concepts during concept evaluation. According to the tables the concept 1 with rear cargo came in the first position. According to the users this concept satisfies almost all the given key words effectively. Following are some of the comments made by the users during concept evaluation, which include some suggestions as well as appreciations. Some suggestions were taken in to consideration in my final concept layout.

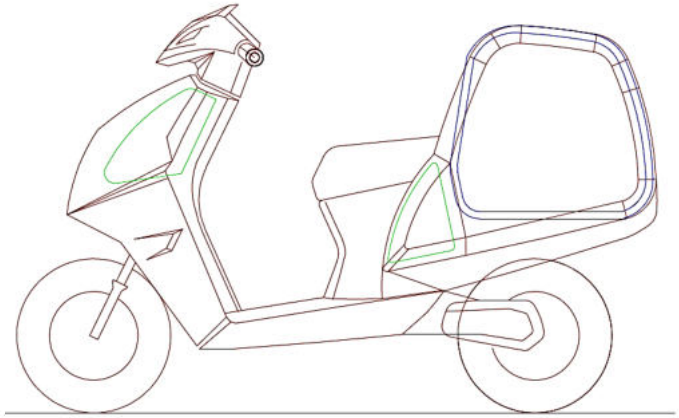
1. "I like the lockable cargo area, since currently we don't have this facility, hence theft happened many times" (Sashi Singh – Domino's Pizza

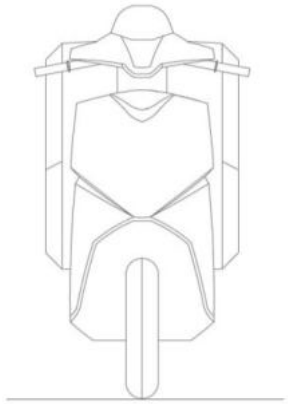
2. "I like concept 1 the more, because it has space for everything and feels more comfort for the drivers" (Avinash Savant – Domino's Pizza).

3. The concept 1 is a "Wonderful design, a must delivery vehicle for all" (Boniface Mendosa- Hub in charge- e-Kart logistics).

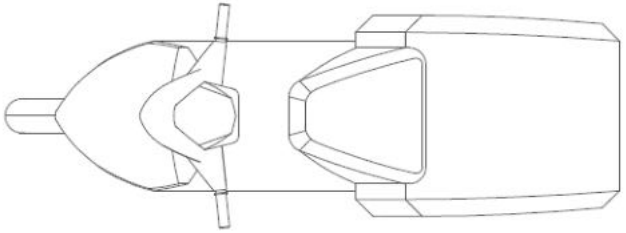
4. "Need some storage facility some where out side the cargo box, to keep small shipments" (Romeo- e-Kart logistics).

11. Final concept

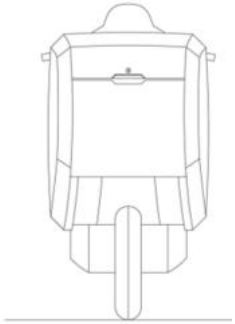




Front view



Top view



Rear view

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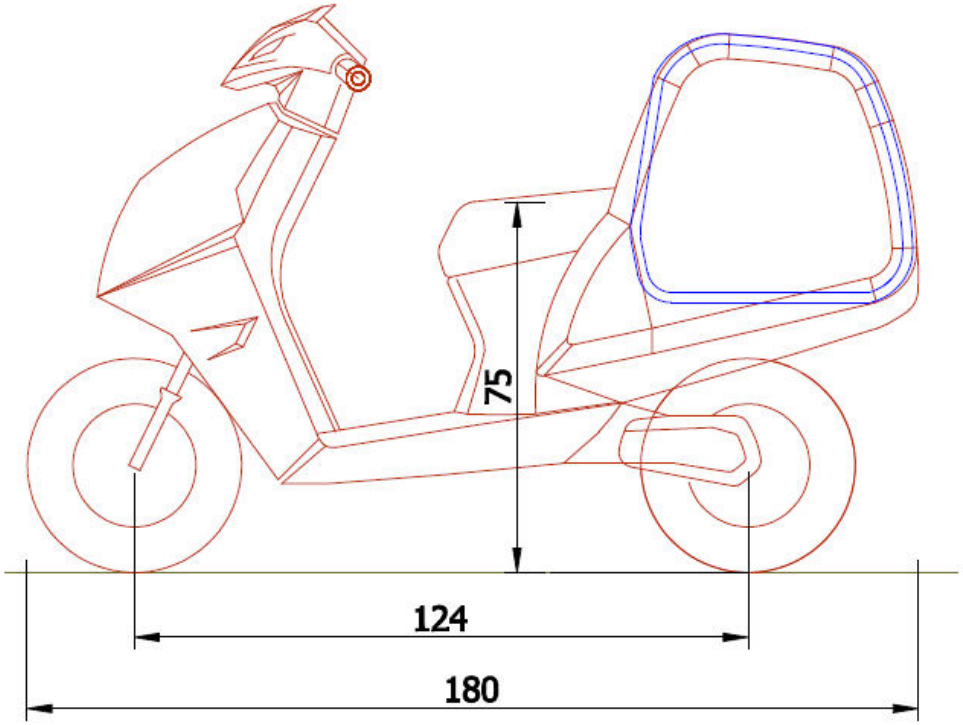

Dimensions All dimensions are in cms

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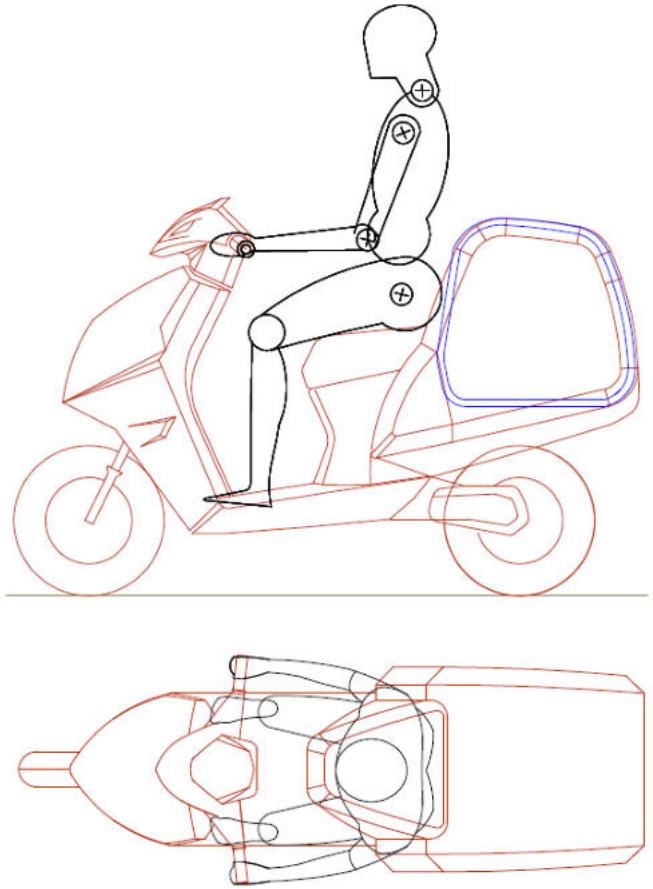
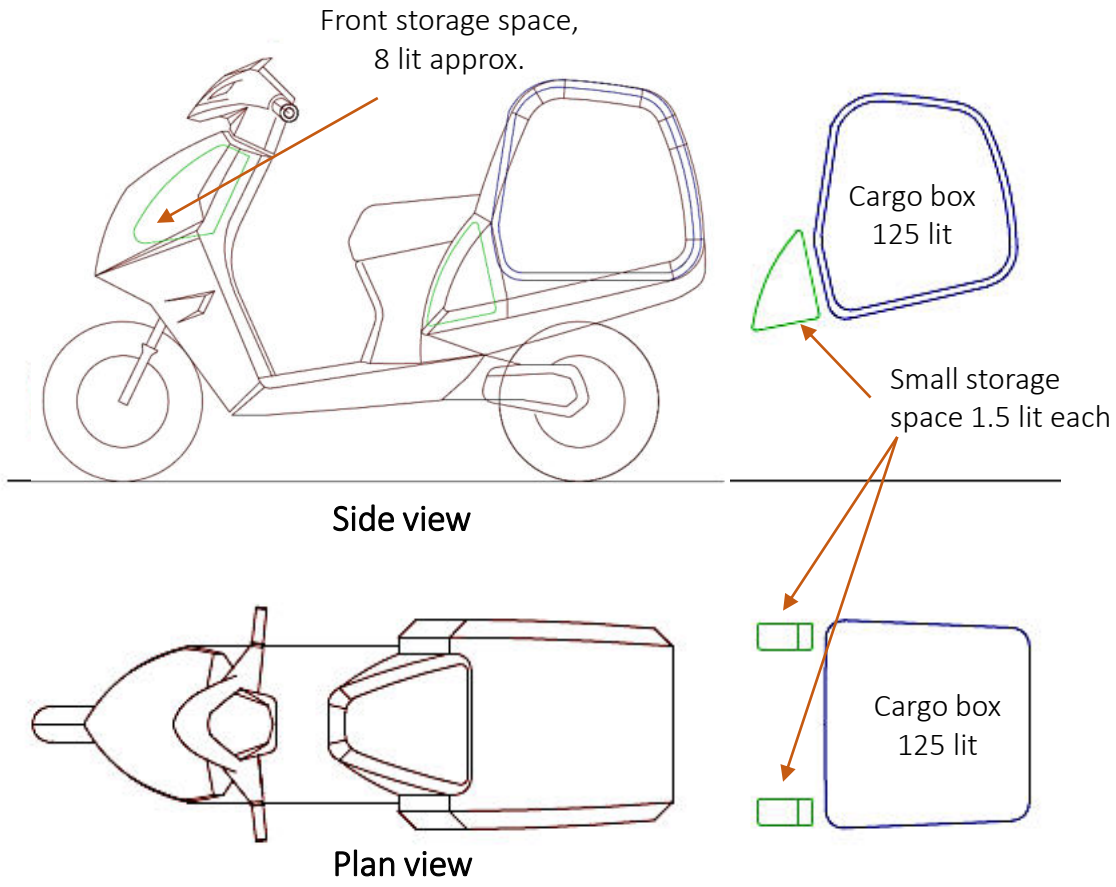
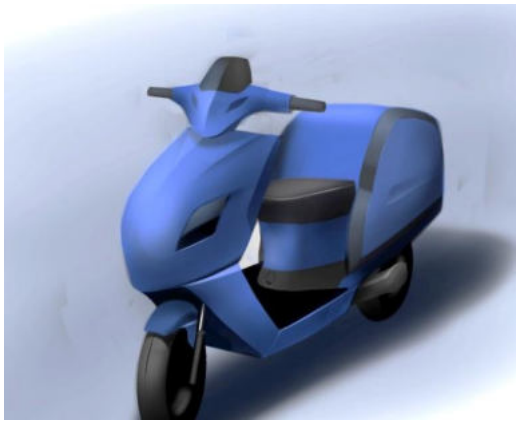


Final concept – Cargo space layout

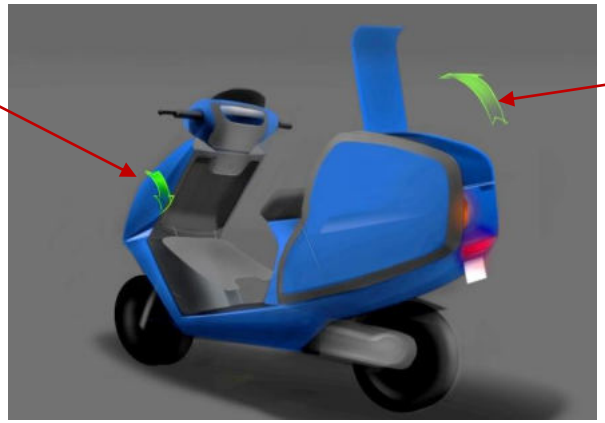


Final concept – Renderings

Continued…



Front storage space opening



Rear cargo space opening

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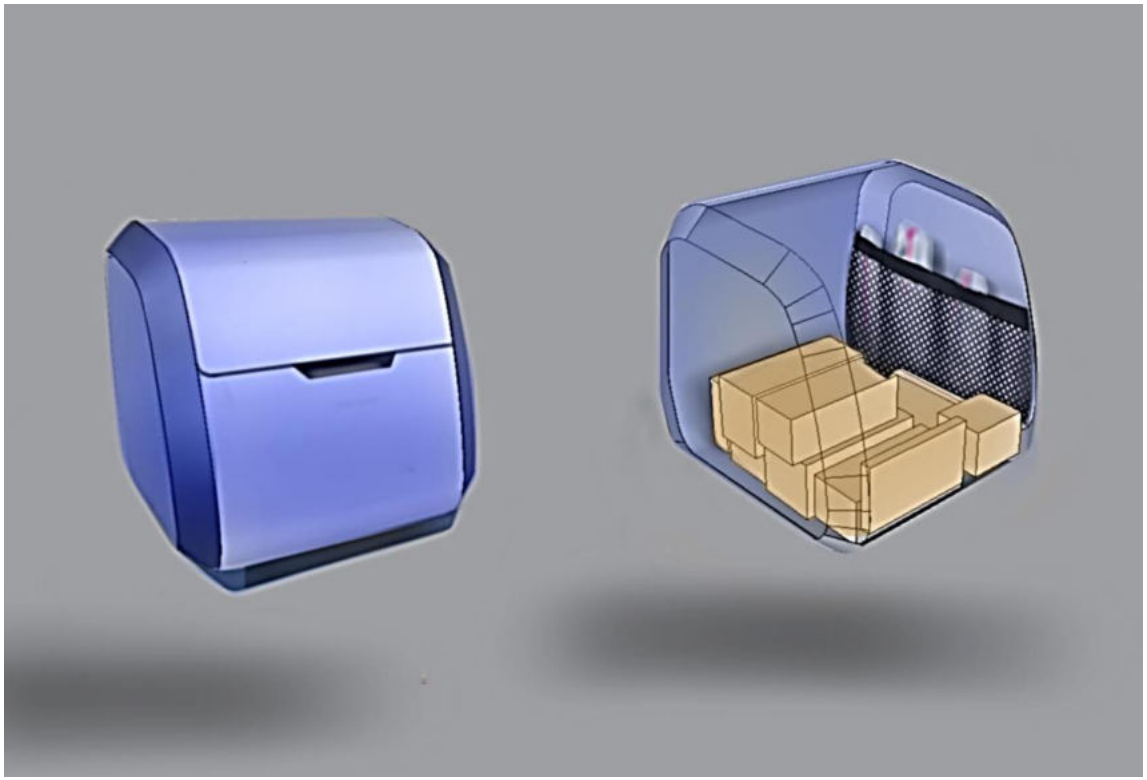
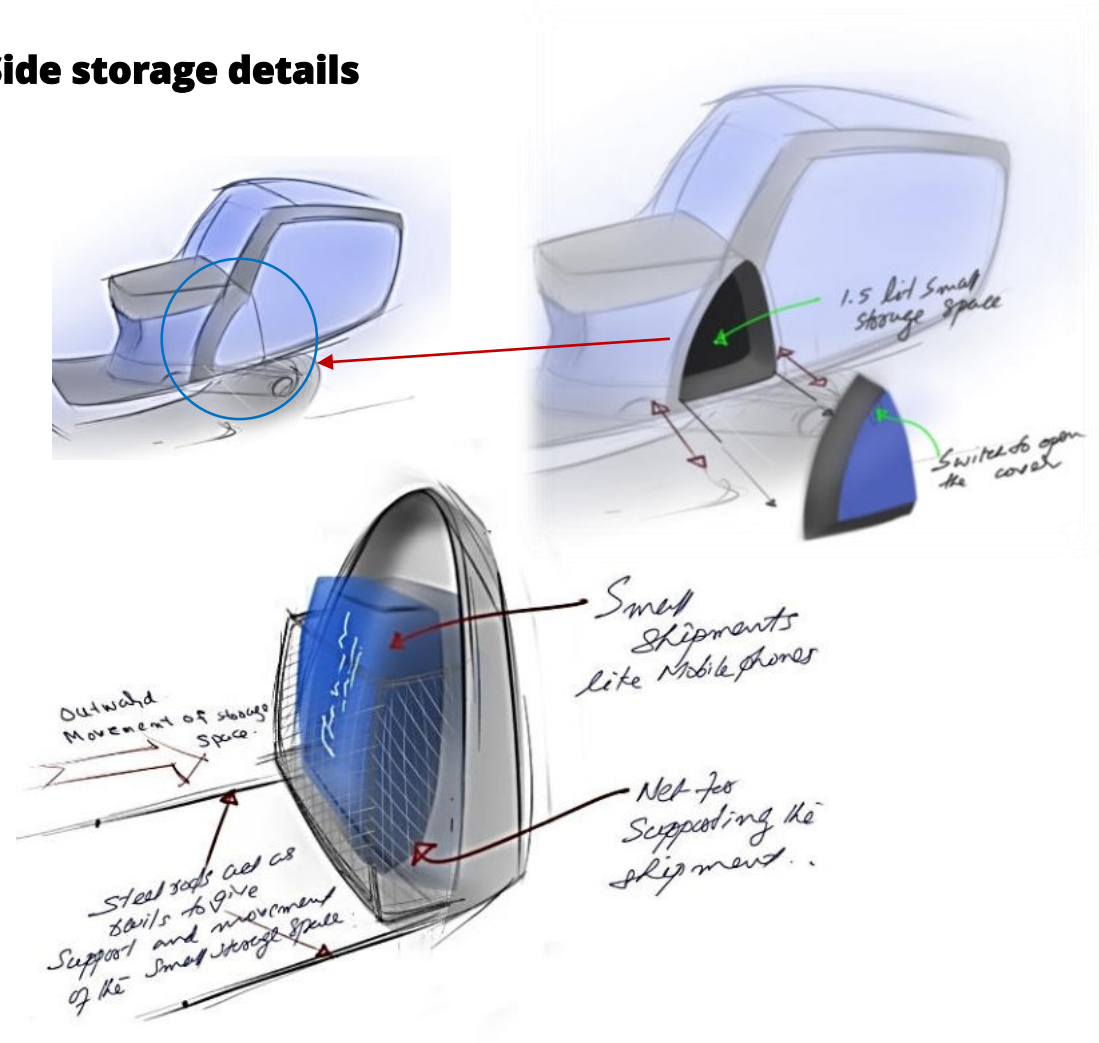


Side storage details



12. Model making

Continued...

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