Luggage Design for a Middle Class Family

Industrial Design Project II

Project Guide
Prof. V.P. Bapat

Submitted by
Sanjay B Nair
08613002

Industrial Design Centre
IIT Bombay

Approval sheet

The Industrial Design project titled

"Luggage Design for a Middle Class Family"

by Sanjay B Nair (08613002)

is approved for the partial fulfilment of the requirement for the post graduate degree in Industrial Design.

PROJECT GUIDE:

EXTERNAL EXAMINER:

INTERNAL EXAMINER:

CHAIRPERSON:

Declaration sheet

I 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 or falsifi ed 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 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.

Signature

Name of the student

Roll No.

Date:

Contents

Acknowledgment iv

1. Abstract 1

2. Need for design 2

3. Design Process 3

4. Luggage Classification 4
    4.1. Luggage materials 5
    4.2. Luggage components 6

5. User Study 8
    5.1. Measuring the size of ironed garments 9
    5.2. Details of a family going on vaction 10
    5.3. Observations and analysis of people interacting with luggage 11
    5.4. Visit to VIP Factory at Nashik 18

6. Ideation 19
    6.1. Imageboard 20
    6.2. Ideation sketches 21

7. Selection of ideas for validation 30
    7.1 Validation of ideation 2 31
    7.2 Validation of ideation 9 33
    7.3. Final ideation and validation 38

8. Product features 44

9. Concept generation 45
    9.1. Block models of thermocol to understand construction 46

10. Imageboard 47
    10.1 Inferences from Imageboard 48

11. Moodboard 49
    11.1 Inferences from moodboard 50

12. Form generation 51

13. Final form 55
13.1 Outside details 56
13.2 Inside details 57
13.3.Handles 58

14. Rig construction 59

15. Final concept 60

17. Web references 64

Acknowledgement

I express my deepest gratitude to Prof. Bapat for providing his guidance throughout the project and helping me out whenever I was facing difficulties.

I thank Prof. Ramachandran, Prof. Athvankar and Prof. Nishant Sharma for their time and suggestions on my project.

My sincerest thanks to Mr.Satyajit Vetoskar of VIP Industries for providing valuable inputs and access to company resources.

Lastly, a special thanks to all my faculty,friends, library and workshop staff at IDC for the help they provided me to make my luggage!

1. Abstract

Small families travelling longer distances by train generally use multiple luggage of smaller size (less than 22"). This has advantages like ease of handling and separate space for each individual. Large size luggage (between 28"- 32") is mostly used for air travel, due to restrictions on the total weight of individual luggage and the number of bags an individual can carry.

Family trips generally tend to be of short duration (4-7 days) due to which the packed items are not completely removed from the luggage during the trip. Luggage is accessed intermittently during this period whenever something is required to be taken out. Organizing and accessing items becomes difficult when many members of a family use a common large luggage. Similar situation is faced by business travellers hopping from one place to the other. They literally have to "**Live Out of the Box"**.

Many innovations are taking place in luggage design w.r.t. the materials, colour, texture and wheels. But even today, a luggage continues to have one/two major compartments into which we pack our belongings.

This project aims at designing a luggage for small family of 3-4 members travelling by air (for 4-7 days), which will allow individual members to organize and access their luggage contents easily during travel.

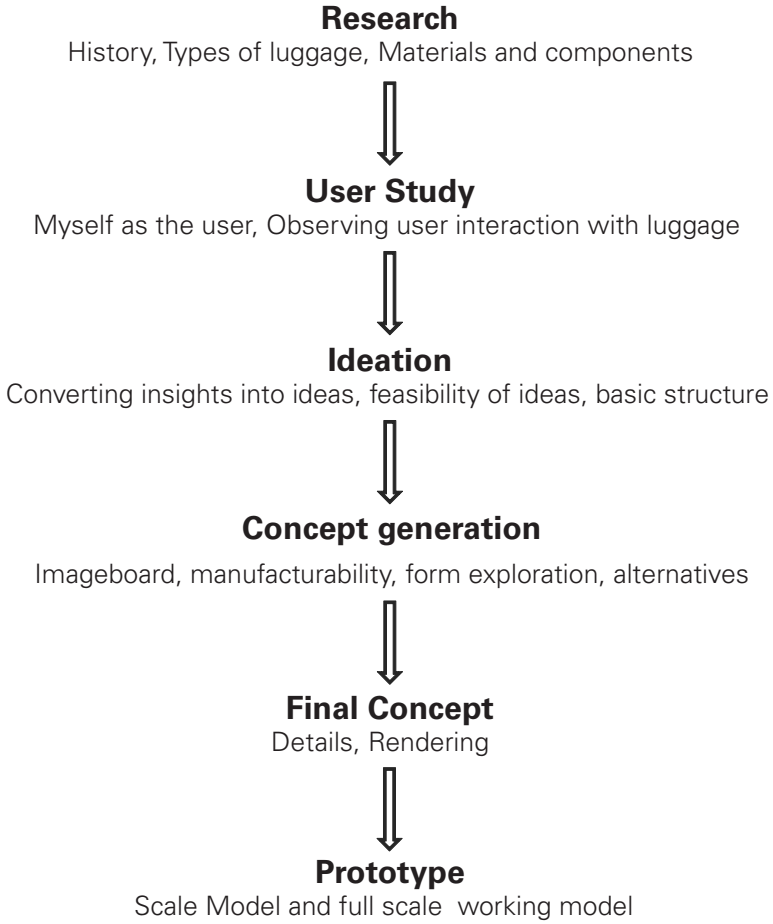
2. Need for the design

A luggage is primarily designed to provide safety of contents and make the process of carrying it around convenient. This means that the parameters by which we judge a luggage today are better wheels, lighter and stronger material.

The time and cost required to travel to a particular place today has been cut down drastically due to the affordability of travelling by air. This also means that we spend lesser time handling the luggage during travel. In such a context, the time we spend packing a luggage is almost equal to the time that we spend travelling.

There is a need for making the task organizing and accessing the contents easier and faster, especially when many members of a family are travelling together and using a common luggage. The luggage available today does not address these issues.

3. Design Process



The design approach followed was to observe and understand how people interact with existing luggage and get knowledge about their actions through informal discussions. The ideations were based on the insights got by the analysis of these observations. The most feasible idea was taken for concept generation.

4. Luggage Classification

a b c

Fig. 1 Hard Luggage

a b

Fig. 2 Soft Luggage

a b

Fig. 3 Hybrid Luggage

— By material

Hard luggage (fig 1)is luggage manufactured by industrial process of injection moulding or vacuum forming.

Soft luggage (fig 2) is the luggage which is stitched together using various soft materials.

Hybrid luggage (fig 3) is blend of hard & soft luggage, where soft material is stitched over hard skeleton or base. Some times bottom shell is hard and front shell is soft in hybrid type of luggage.

— Number of wheels

Spinner luggage (fig 1a, 1c, 2b, 3a) Luggage having 4 wheels are called spinner luggage. Spinner luggage are very convenient to maneuver as they require very little effort to use

Inline skate wheels luggage (fig 1b, 2a, 3b) Also called as the rolling wheel luggage is the most commonly used luggage.

4.1. Luggage Materials

a

Polypropelene (fig a)

- made by injection moulding
- matte surface
- colour variations possible
- Lip to lip closing
- local texture can be applied at surfaces
- Suitable for mass production
- Cheaper compared to PC/ABS

b

ABS (fig b)

- made by vacuum forming
- matte surface
- colour variations possible
- zipper/framed closing
- texutre applied uniformly
- Suitable for low volume production
- Expensive

c

Polycarbonate (fig c)

- made by vacuum forming
- glossy surface
- colour variations possible
- zipper closing
- texture applied uniformly
- Suitable for low volume production
- Expensive

d

Nylon (400-600D) (fig d)

- D means denier, higher denier means stronger fabric
- fabric stitched on frame
- colour variations possible
- zipper closing
- texture applied uniformly
- Suitable for mass production
- Cheaper compared to hard luggage

4.2. Luggage Components

Fig. 4 Telescopic Handles

Fig. 5 Wheels

Handles Metal or metal-reinforced bases with a number of rivets, screws, or prongs attached to the frame of the case itself --increases the load-bearing area. Handle systems housed inside a bag are least likely to sustain damage. Recessed handle systems that include single-handed push button release and a recessed handle cup that reduces the possibility of damage. Fig 4 shows the different types of handles

Wheels Materials: PP and PVC used for mobility & to reduce the damage to the bottom of the case.Wheels are sometimes retractable or removable. Fig 5 shows the two most commonly used wheesl i.e. inline and caster wheels.

Fig. 6 Locks

Locks Built-in combination locks are most often found on hard-sided luggage. Padlocks and key locks that attach to zipper pulls are used on soft and semi-soft constructions. Fig 6 shows the different types of locks

Zipper Polyester coils--Made by weaving or sewing the nylon coil to the tape. These zippers do not have individual teeth and can take a great deal of pressure. If they do pop open, they can be rezoned and "healed."
Invisible zippers' teeth are behind the tape. The tape's color matches the garment's, as does the slider, so that, except the slider, the zipper is "invisible". Fig 7 shows the two types of zippers.

Fig. 7 Component_No_2

5. User Study

Following approach was followed for user study:

- Understand the various usability aspects of a luggage by using it myself.
- Observe the way people interact with luggage at various places like homes, railway stations, airports etc.
- Visit to luggage dealers at crawford market to understand the luggage business.
- Visit to VIP factory to understand the manufacturability aspect

Looking at the whole process carefully gave me insights and direction to my project. All these studies helped me to develop a holistic view of the luggage.

5.1. Measuring the size of ironed garments

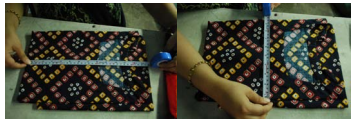
Type of garment	**Overall size** L × B inches
Formal shirt 	16 × 9
Saree 	12 × 7.5
Kameez 	14 × 10
Salwar 	14 × 12
Formal Pant 	15 × 11
Dupatta 	14 × 9

Table. 1 Dimensions of garments in ironed condition

To decide the dimensions of the luggage, it was essential to understand the dimensions of various garments in ironed condition. The data is tabulated here.

5.2. Details of a family going on vacation

Type of luggage	Size (in)	Contents	Approx wt.(kg)
Strolley, hybrid, cabin 	19 × 14 × 8	Salwar kameez (7–8) Tops (2) Jeans (1) Children clothes (8–10) Undergarments (6–7 pairs)	5–6
Suitcase, hardside, check-in 	21.5 × 16 × 7.5	Formal shirts (3) Casual Pants (2) Jeans (1) T-shirts (3) Lungi (2) Undergarments (5 pairs) Liquor bottle (750 ml) Foodgrain (2–3 kg)	10–12
Duffel, softside, cabin 	20 × 9.5 × 11	Packed food items Slippers (3 pairs) Baby diapers Diary/notebook Toiletries	4–5

Table. 2 Details of family going on vacation

To understand the typical things that a family carries on a vacation, a visit was made to the home preparing to go for a vacation. Table 2 shows the details of items held in each luggage
No. of members: 4 (2 adults and 2 children)
Purpose of visit : Meet Parents
Duration of visit: 7 days
Mode of transport: Air/Taxi (Meru Cab)

5.3. Observations and analysis of people interacting with luggage

The following chapter discusses the observation and analysis of users including myself interacting with luggage at various places like homes, railway station etc. More emphasis is laid on observing the process of packing. The observation has been highlighted in bold and the analysis mentioned below it.

Fig 8: Luggage kept on floor for packing

— bottom surface has dust/is dirty
— needs to be cleaned if it is to be kept on bed
— clothes are placed on bed before packing for easy access
— user finds it convenient to squat and pack

Fig 9: Glass bottle packed with soft cloth

— provides additional cushioning
— is packed in hard luggage to minimize the chance of breakage

Fig 10: Ironed shirts folded and packed, pants are not

— folded shirts don't occupy as much space compared to pants when folded

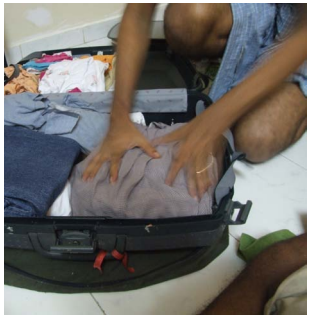


Fig 11: Luggage opened again and rearranged

— compartment space adjusted by rearranging items to minimize interference and make closing easier
— Slight gap still remains

Fig 12: Difficult to close the luggage

— excess luggage
— locking is done only at 3 points unlike zipper which is continuous
— more effort required to lock due to this reason

Fig 13: Luggage covered with cloth

— to cover the gap
— to prevent bottom surfaces from getting dirty
— to help identify the luggage

Fig 14: Woman keeps luggage on side table/bed

— doesn't prefer to bend too much and pack
—keeps all the clothes on bed before packing

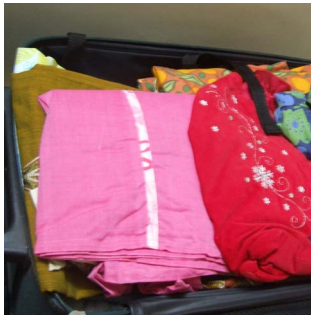


Fig 15: Difficult to access packed items

— items stacked one over the other
— only top items visible
— bottom items sometims end up being unused

Fig 16: Frequently accessed items kept on top of the luggage

— e.g. baby diapers, person doesn't want to waste time searching
— other items which are inside, not visible

Fig 17: Luggage lifted by man

— heavy luggage is not lifted by woman
— luggage lifted from table and kept on ground

Fig 18: Packing is not done continuously

— person gets up in between for taking out things he/she forgot
— packing starts days in advance,when going on a long trip as more things are packed

Fig 19: People compartmentalize their luggage

— no physical dividers, compartments are created by stacking clothes and other items of same size together
— still only top items are visible

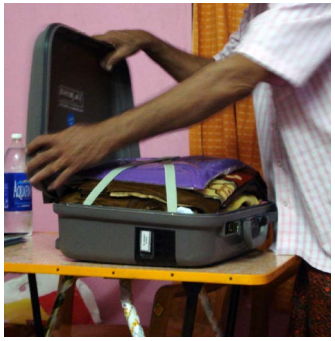


Fig 20: Elderly keep luggage on table and pack

— elderly people find it difficult to bend and pack
— they lift the luggage and keep it on table to pack

Fig 21: Hard luggage used for fragile items

— main compartment divided by the packed items
— items like pickle bottle, food containers etc. kept in hard luggage to minimize chances of breakage

Fig 22: Luggage kept on floor during visit

— kept at a place convenient to access
— required items is taken whenever required
— difficulty in bending and accessing for elderly

Fig 23: Porters help at railway stations

— no customer trolley at railway station
— difficult to climb stairs with luggage

Fig 24: Ironed clothes get creased in transit

— packing is done in horizontal position and the luggage is carrried in the vertical position.
— ironed clothes get creased as they are not held securely

Fig 25: No combination lock on local luggage

— people forget the combination, lock has to be broken in this case
— but zippers having conventional locks can be hacked very easily

Fig 26: Luggage covered with cloth

— absence of lugs on the surface of luggage, surface might get spoilt
— other luggage kept on top of it, surface of lower luggage doesn't get spoilt due to cover

5.4. Visit to VIP Factory at Nashik

Apart from observing the manufacturing process of hard luggage in detail I came to know about additional aspects of hard luggage after interaction with executives at VIP Industries:

- PC luggage not popular because of zip, doesn't look secure
- people buying hard luggage looking for security,especially airport travel
- hard luggage cannot be tampered easily compared to softside luggage
- hard luggage is givenn as gift during marriages
- hard luggage market is stagnant, soft luggage growing rapidly
- soft luggage more stylish, looks visually light because of the fabric
- vacuum forming more expensive, lot of operations and material wastage
- better texture achievable in vacuum forming
- difficult to injection mould polycarbonate

6. Ideation

The approach was to think without constraints,focus on the task of organizing the luggage and provide solutions to the problems that were observed.The luggage was imagined as a compartment that is to be reconfigured to make the process of packing and accessing items easier.
Then, a study was conducted of the existing objects that are modular, saves space, and makes organizing and accessing things easier and the attempt was to apply direct/indirect analogy in my ideas. The next page shows the image board that was created for ideation. The insight obtained is mentioned against each product in brackets.

6.1. Imageboard

Tool box (organizing)

Swinging wall unit (space saving)

Drawers (organizing)

Tool box
(organizing)

Vertical shelves (space saving)

Lego Blocks
(modular)

Telescopic shelves
(organizing)

Adjustable shoe rack
(organizing)

Multi-rack storage box
(organizing)

Foldable furniture (space saving)

Multi tray organizer
(organizing)

Camera bag divider
(organizing)

6.2.1. Ideation1

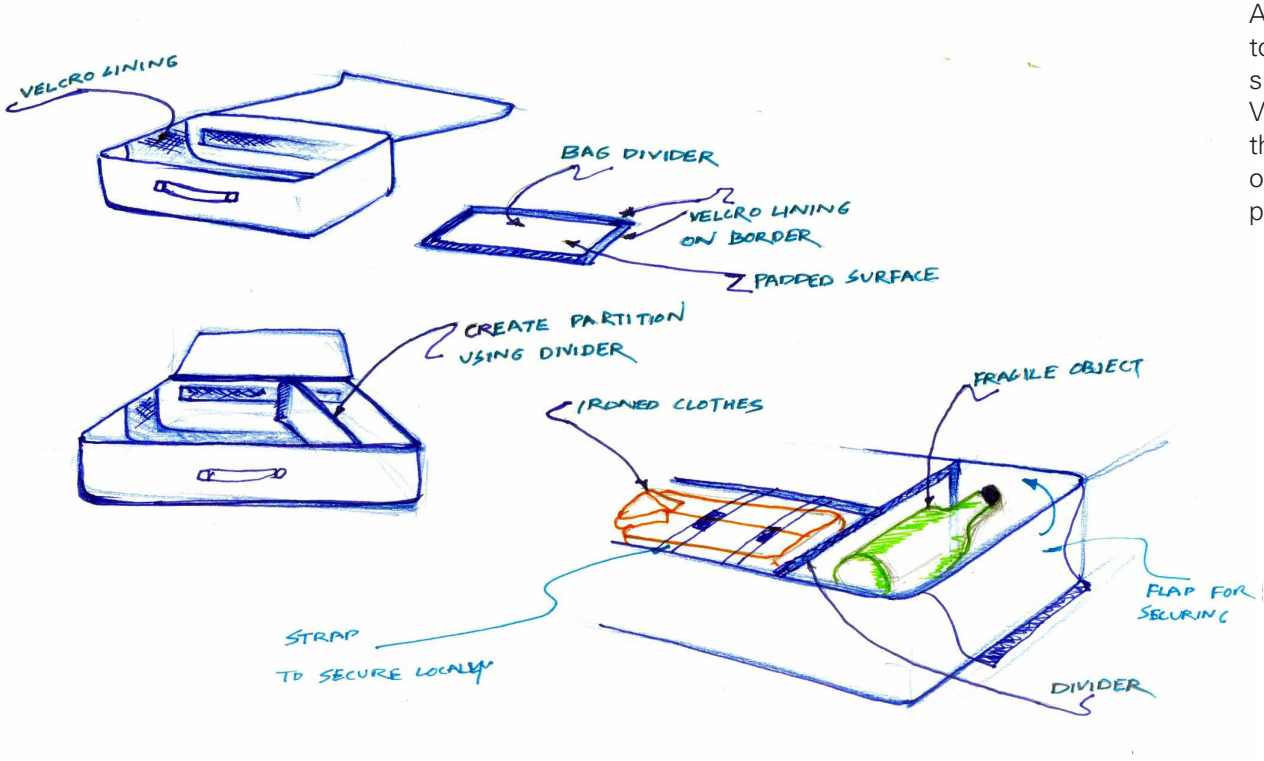


Fig. 27 Ideation 1

Analogy of camera bag dividers and tool box (fig 28) was taken.Fig 27 shows use of bag dividers lined with Velcro that helps to compartmentalize the luggage as per need. Fragile objects and ironed clothes can be packed secured separately

Fig. 28 Camera bag/Tool box with compartments

6.2.2. Ideation 2

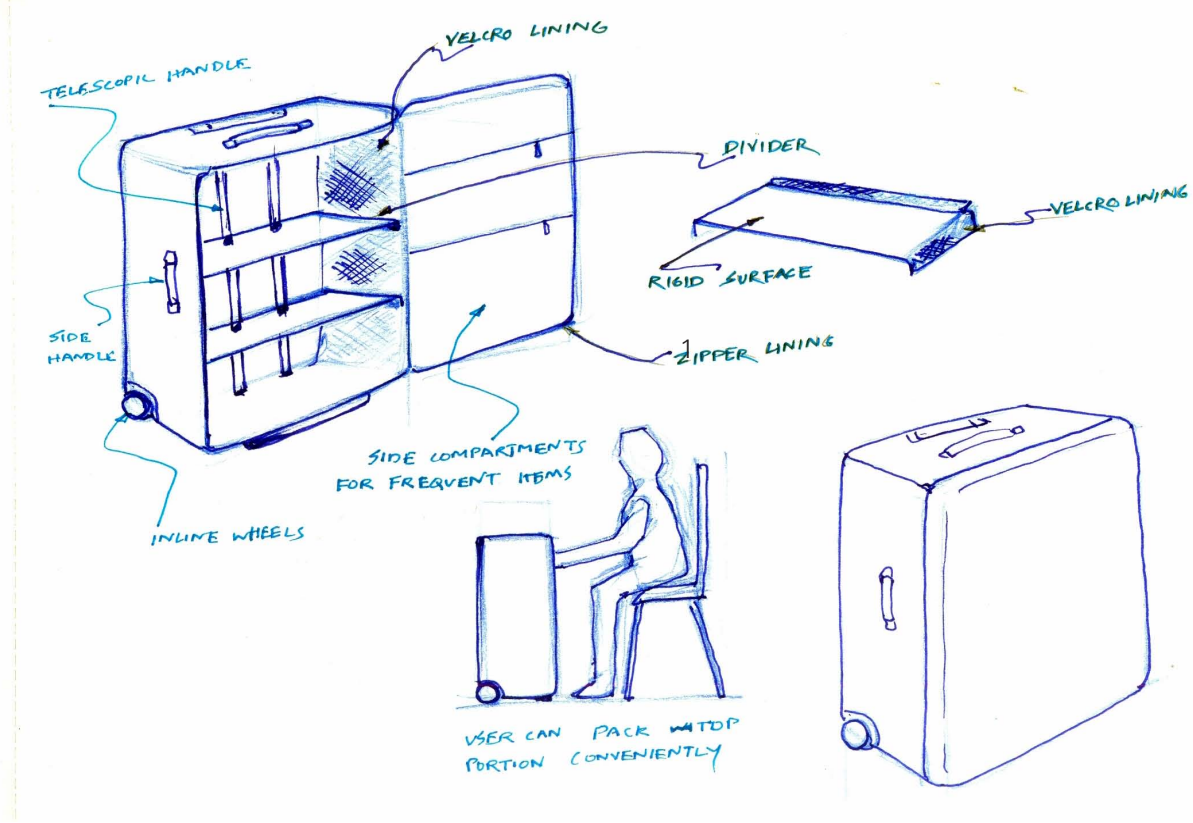


Fig. 29 Ideation 2

Fig 29 shows the use of luggage in vertical position for packing. The analogy applied here was a adjustable shoe rack (fig 30).The height of the compartment can be adjusted by velcro lined rigid dividers. Upper compartment can be accessed conveniently by sitting on chair.

Fig. 30 Adjustable shoe rack

6.2.3. Ideation 3

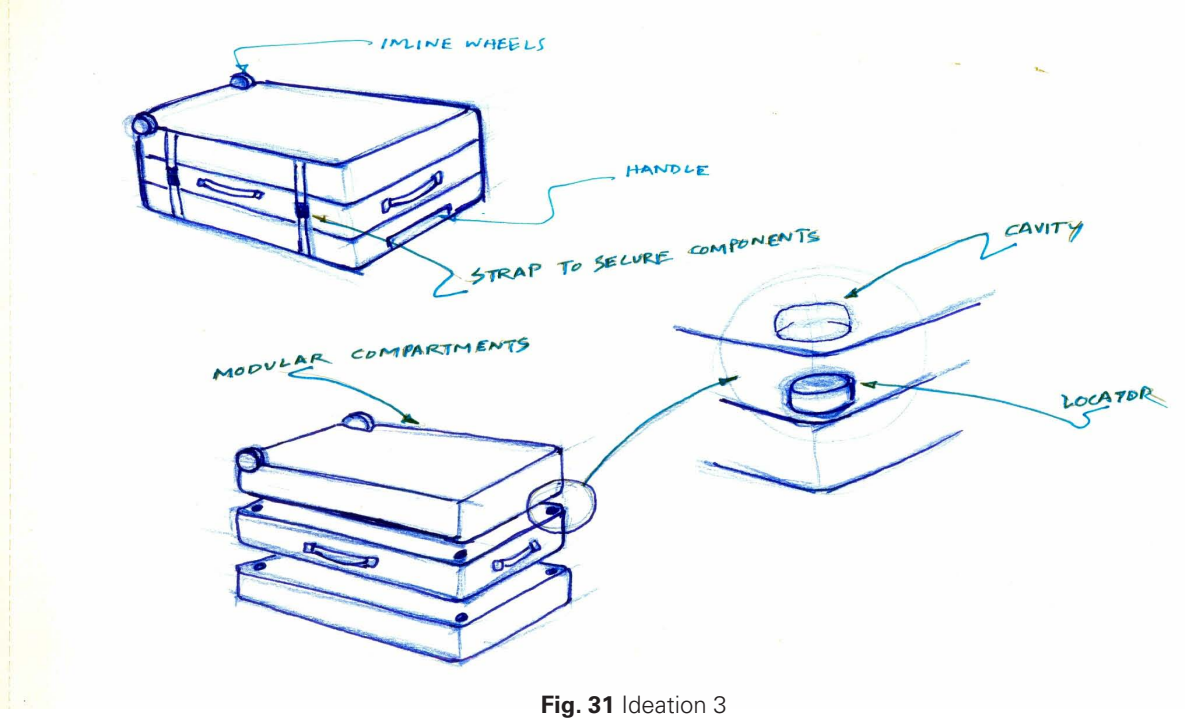


Fig. 31 Ideation 3

Fig 31 shows the use of modular compartments to divide volume into smaller parts. Analogy applied in this case is the lego toy (fig 32). Packing is done separately for each compartment and joined together to form single unit. Each member of family can have individual space for packing.

Fig. 32 Modular blocks in lego toys

6.2.4. Ideation 4

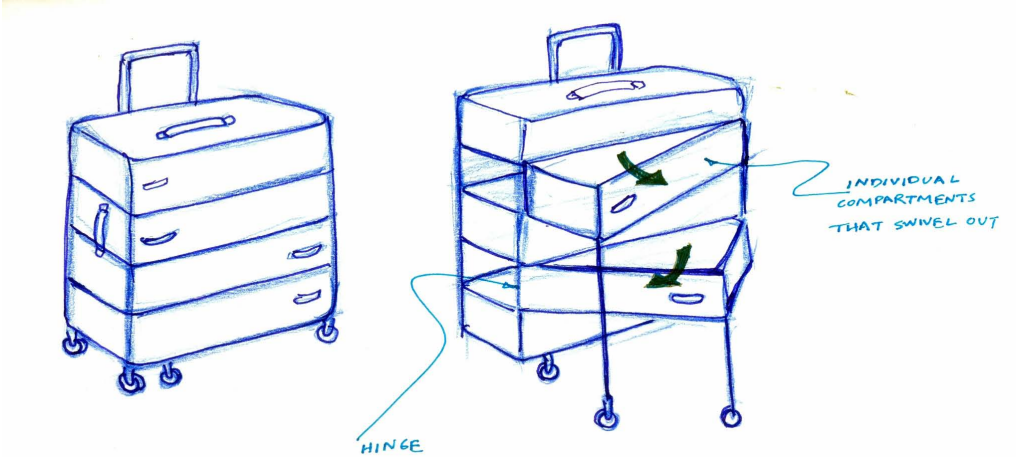


Fig. 33 Ideation 4

Fig 33 shows a modular luggage with multiple compartments in which each compartment can be accessed independently. An analogy of telescopic shelves (fig 34) is taken. Each compartment swivels out making it easier to categorize items and place it on top or bottom according to priority.

Fig. 34 Telescopic shelves

6.2.5. Ideation 5

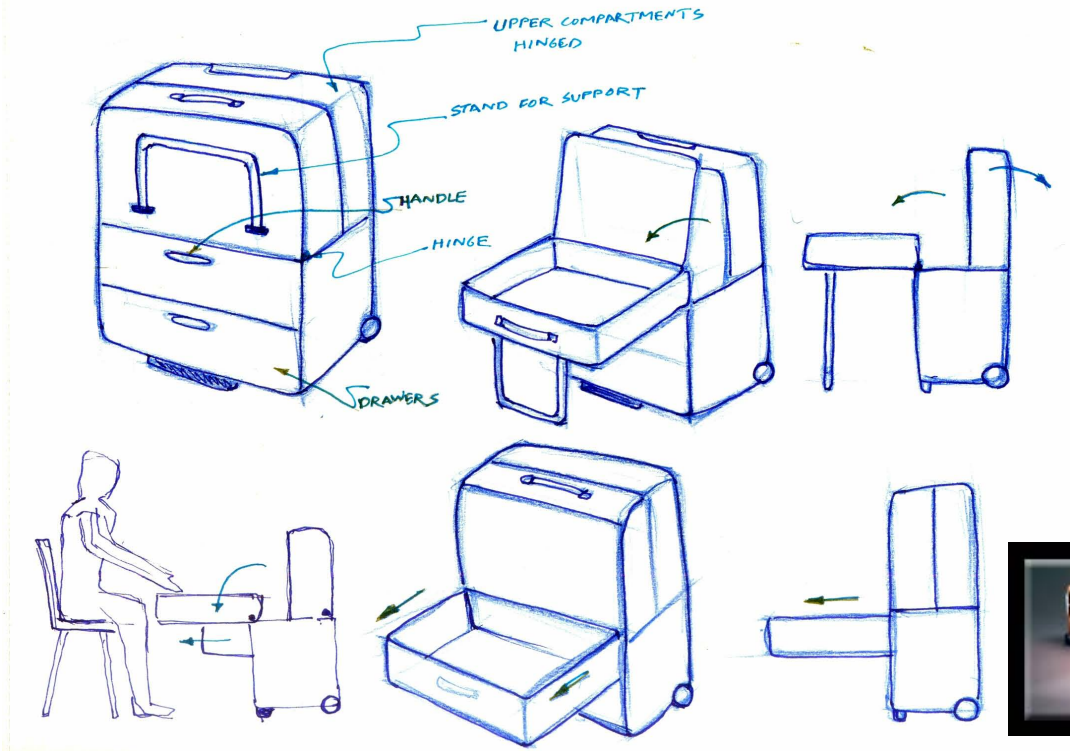


Fig. 35 Ideation 5

Fig 35 shows the use of hinged compartment in the top part and drawers at the bottom part. Analogy of foldable furniture (fig 36) is used in this case.Frequently used items can be kept in top compartments and accessed conveniently. Bottom compartments are drawn and accessed as per need.Better organization and easier access of items possible due to more compartments.

Fig. 36 Foldable furniture

6.2.6. Ideation 6

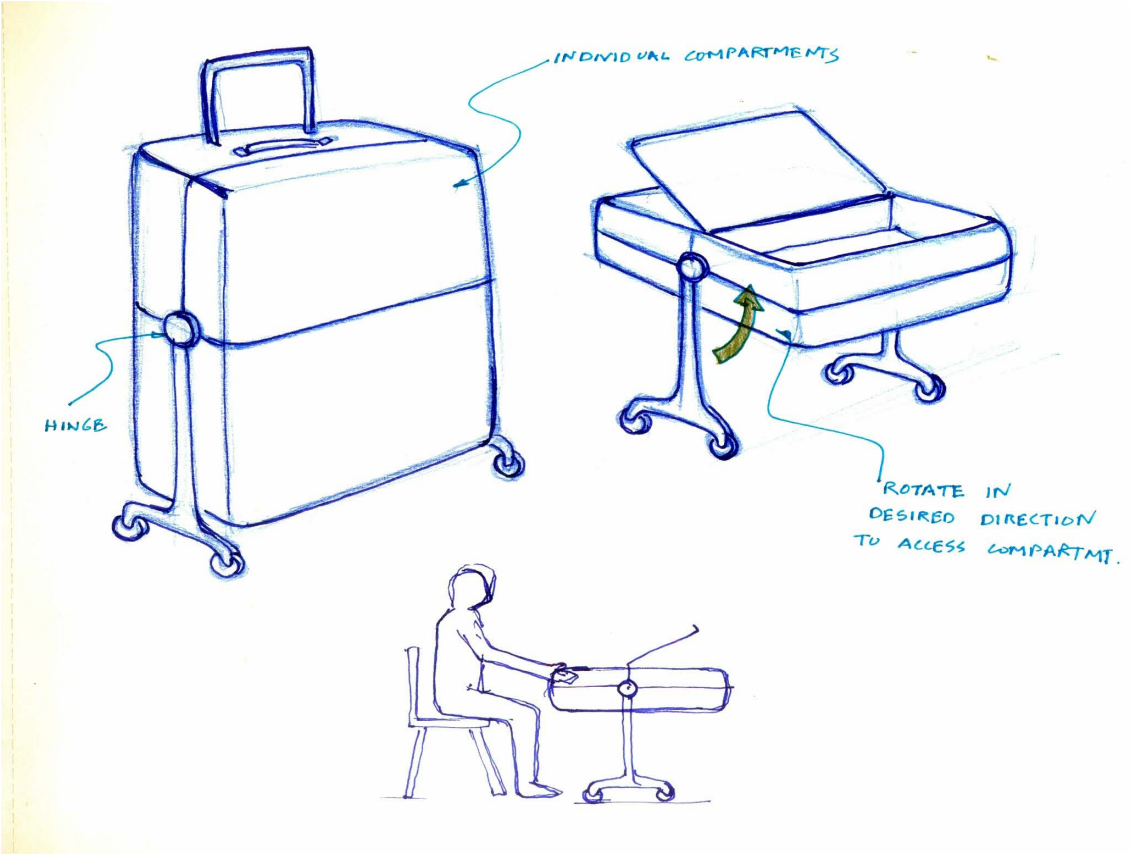


Fig. 37 Ideation 6

Fig 37 shows the main luggage is divided into 4 compartments. The entire luggage swivels about the central hinge. A swinging wall unit (fig 38) is used for analogy. The luggage in vertical position is can be locked at 90 degrees in each direction to access the desired compartment. The compartment can thus be made horizontal without having to keep on table/bed etc making it convenient to access.

Fig. 38 Swinging wall unit

6.2.7. Ideation 7

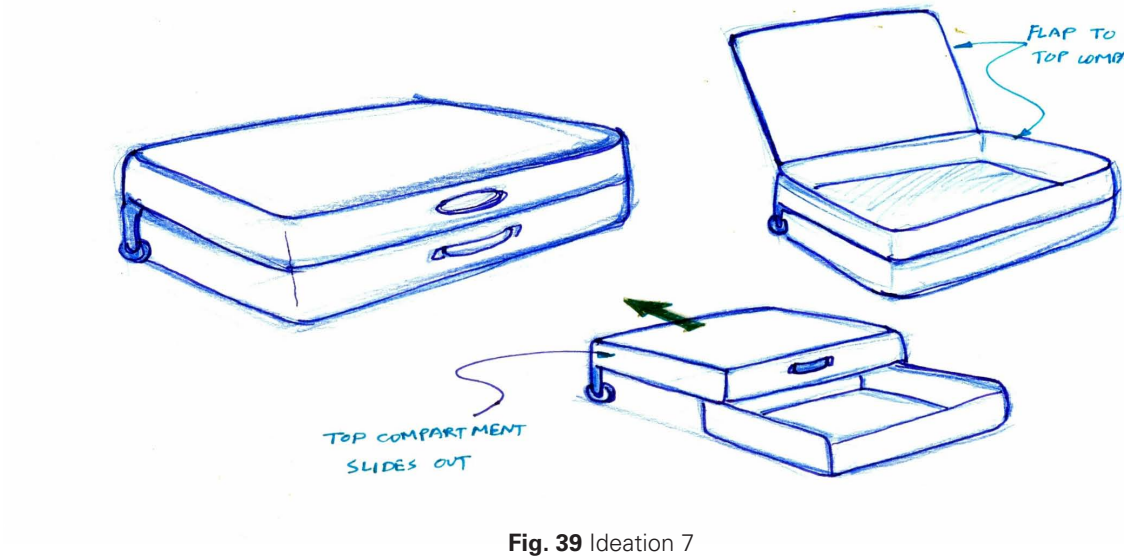


Fig. 39 Ideation 7

Fig 39 shows use of sliding mechanism to create compartments. The lower compartment can be accessed by sliding the upper one. Analogy of sliding drawers (fig 40) is applied in this case. Both compartments become equally accessible. No need to reach out inconveniently to the other compartment like in traditional hinged luggage.

Fig. 40 Draws in table

6.2.8. Ideation 8

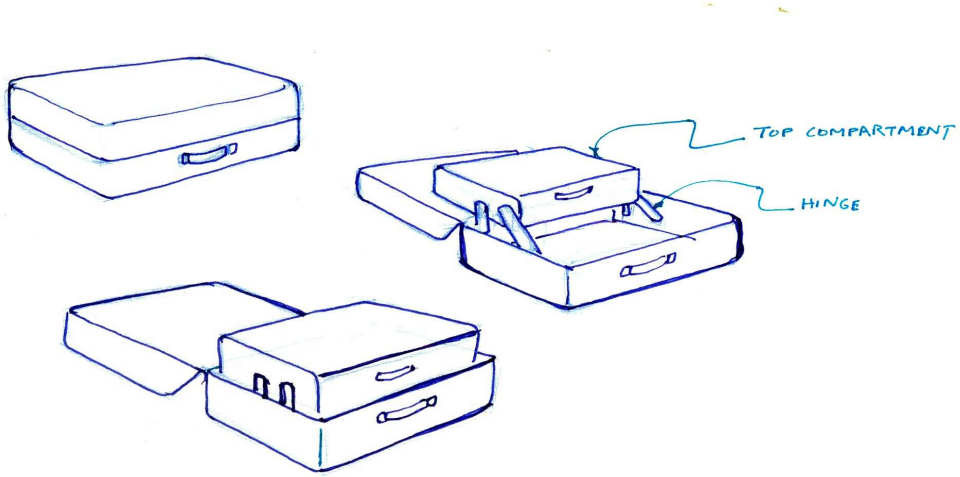


Fig. 41 Ideation 8

Direct analogy is taken from the multi rack organizer (fig 42). Fig 41 shows the top compartment hinged on the lower one. When the lower compartment is to be accessed the top one is swung behind.
Like in previous case, there is no need to reach out far to the top compartment like in hinge luggage making it easier to access.

Fig. 42 Multi rack organizer

6.2.9. Ideation 9

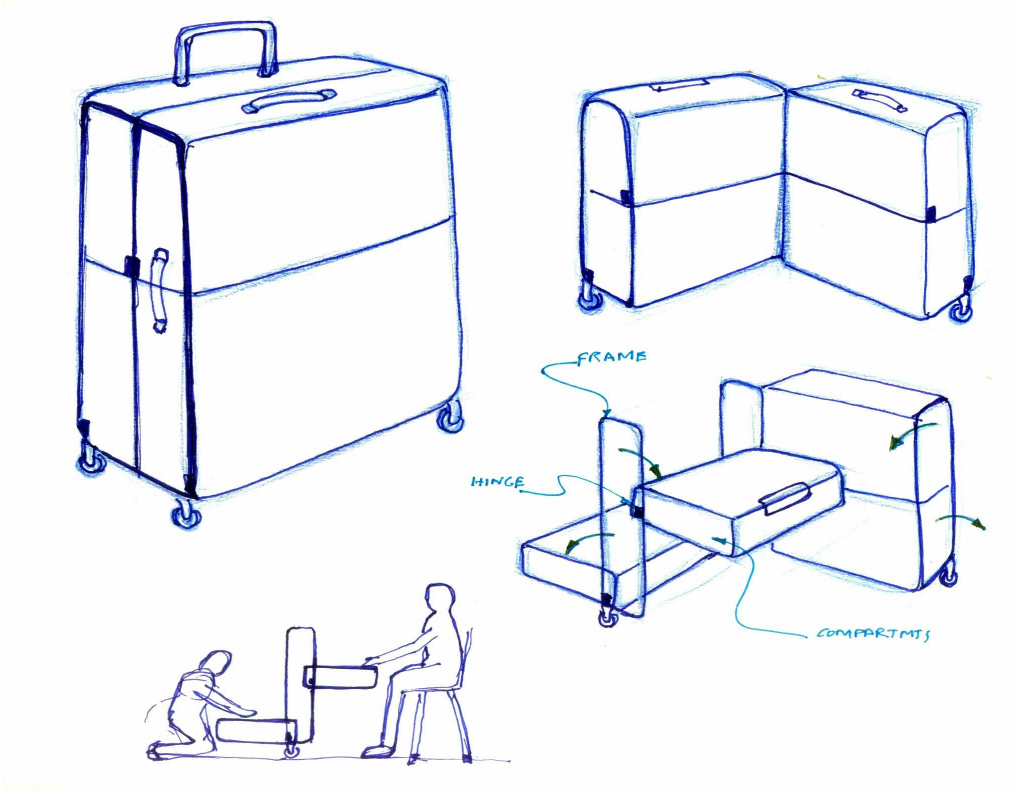


Fig. 43 Ideation 9

Analogy is taken from vertical shelves in which the hinge allows it to be locked at 90 (fig 44). Fig 43 shows the luggage is divided into 4 compartments. Upper and lower compartments are hinged and open in opposite directions allowing two people to access the luggage simultaneously.

Fig. 44 Vertical shelves with hinges

7. Selection of ideas for validation

Conventionally packing is done by keeping the luggage in horizontal position and then it is orientation is changed to vertical position for transportation (vice-versa for accessing packed items). If packing is done in vertical position then the step of re-orienting it can be eliminated. The ideas proposing vertical storage (fig 29 and 43) were taken ahead for validation.

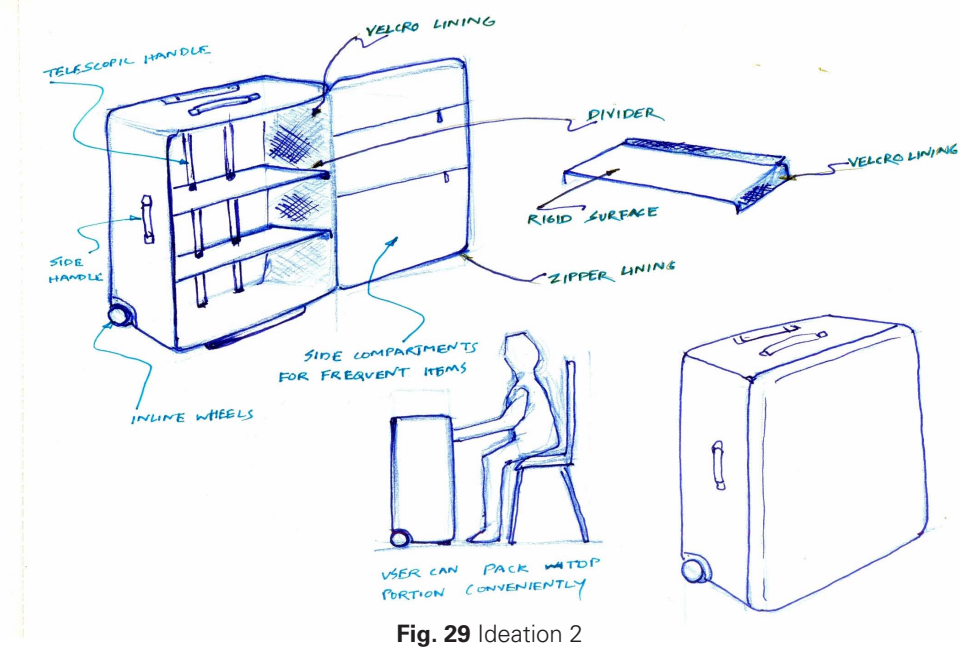


Fig. 29 Ideation 2

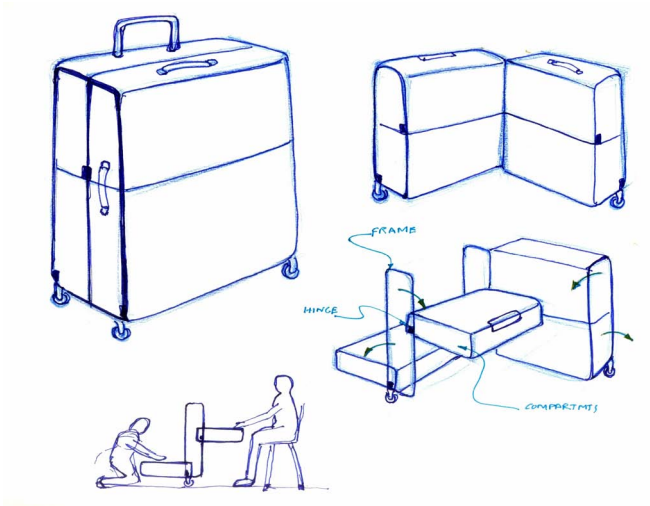


Fig. 43 Ideation 9

7.1. Validation of ideation 2

To try out this idea, a second hand luggage (24"x 18"x 8") was used and the side faces were stitched with velcro lining. A compartment of nylon fabric(19" X 7") also lined with velcro was made that would form the adjustable compartment. The purpose was to test the feasability of using adjustable compartments for packing. Also, the idea of rolling and packing instead of the conventional folding and packing was experimented with.

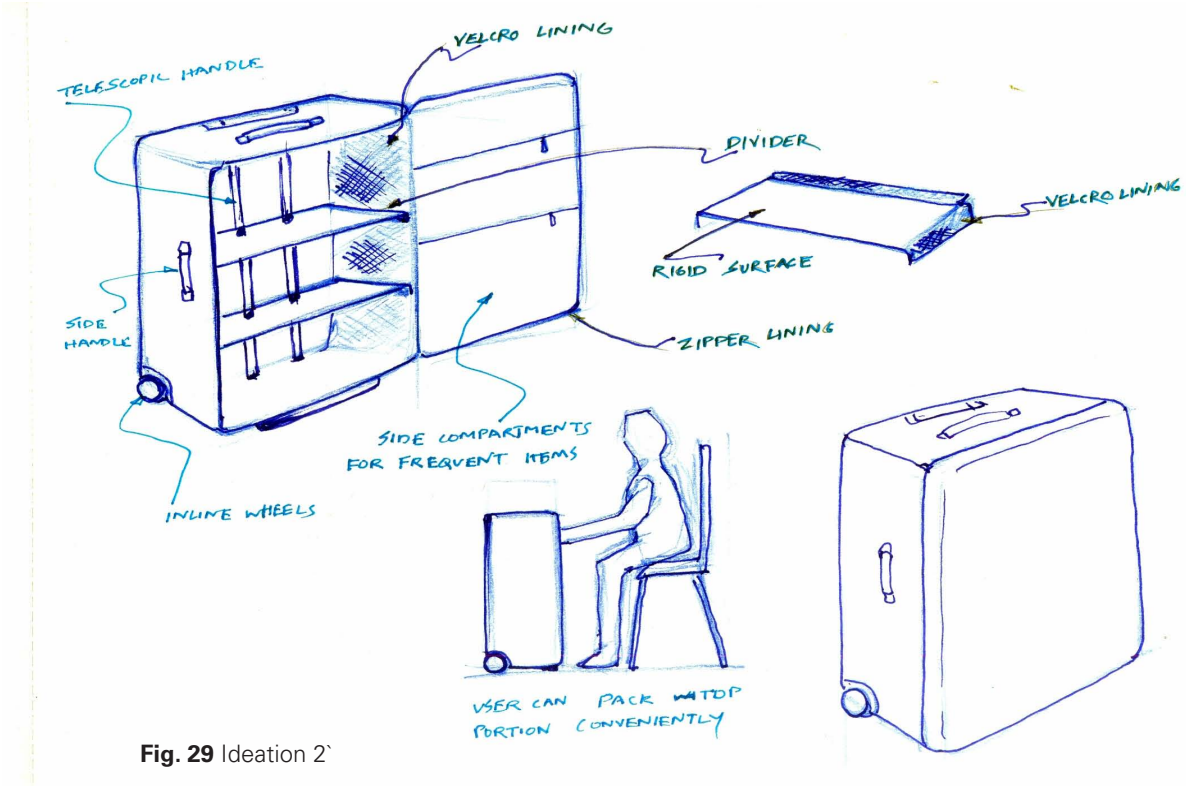


Fig. 29 Ideation 2`

Fig. 44 Velcro stiched on the side faces

7.1.1. Analysis

Rolling and packing saves space | Packing | Apply velcro sheet | Better visibility of items, easy to access | Testing strength | Closing

Fig.45 Stages of packing`

Though this idea had the advantages like allowing the user to compartmentalize the volume as per his need and easy access of packed items, there were many disadvantages in this idea

- though rolling and packing has advantages it was less likely to be accepted by people as they were used to conventional folding and packing
- Velcro can spoil the garment
- Ironed clothes would not fit into the compartment
- Difficult to close the zip as the lower portion is not visible.
- The structure is less stable in vertical position due to lesser depth (8")

7.2. Validation of ideation 9

The overall dimension of luggage was decided by calculating the volume a family needs to keep their belongings for 5—7 days. The standard size of 29″ × 19″ × 12″ satisfied this requirement. The size of the lower compartment was kept 15″ × 19″ × 6″ and upper compartment to 14″ × 19″ × 6″. The feasibility of this idea was tested by making block model in thermocol to understand the mechanism and full scale trial in cardboard to give an estimate of actual size.

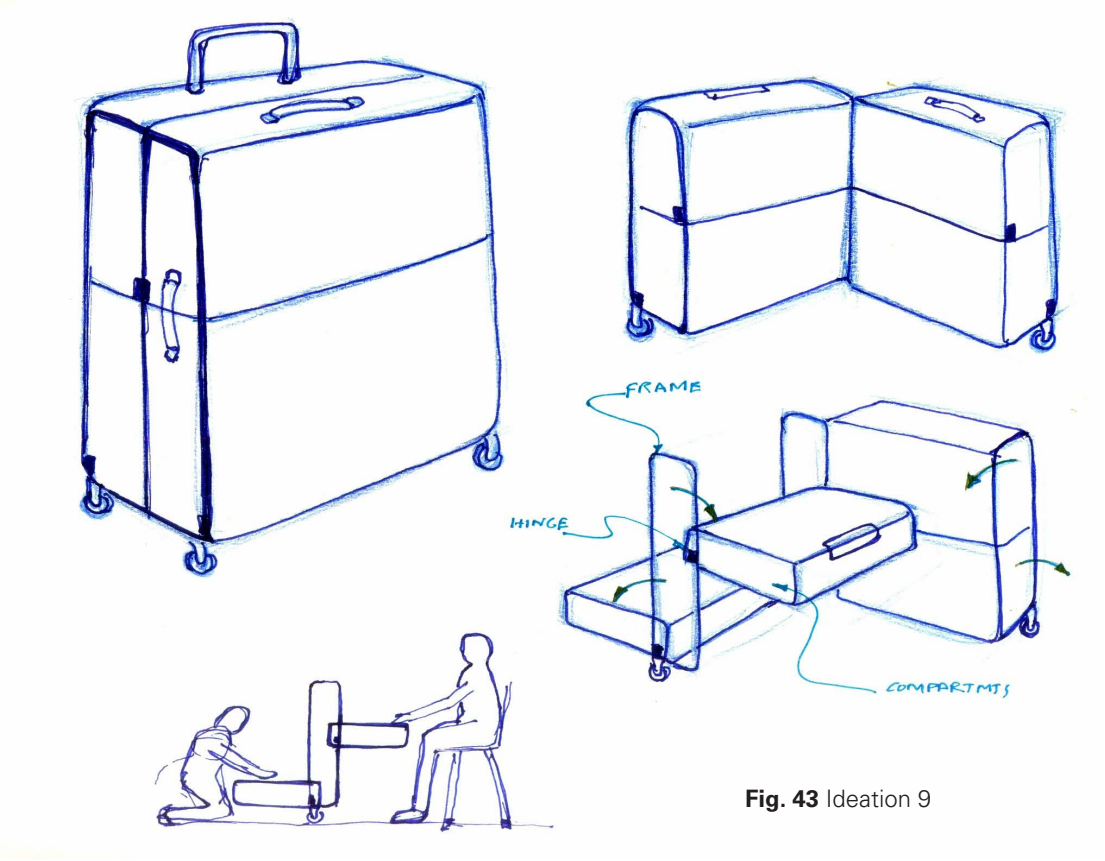


Fig. 43 Ideation 9

7.2.1. Scaled Block model(1:5)

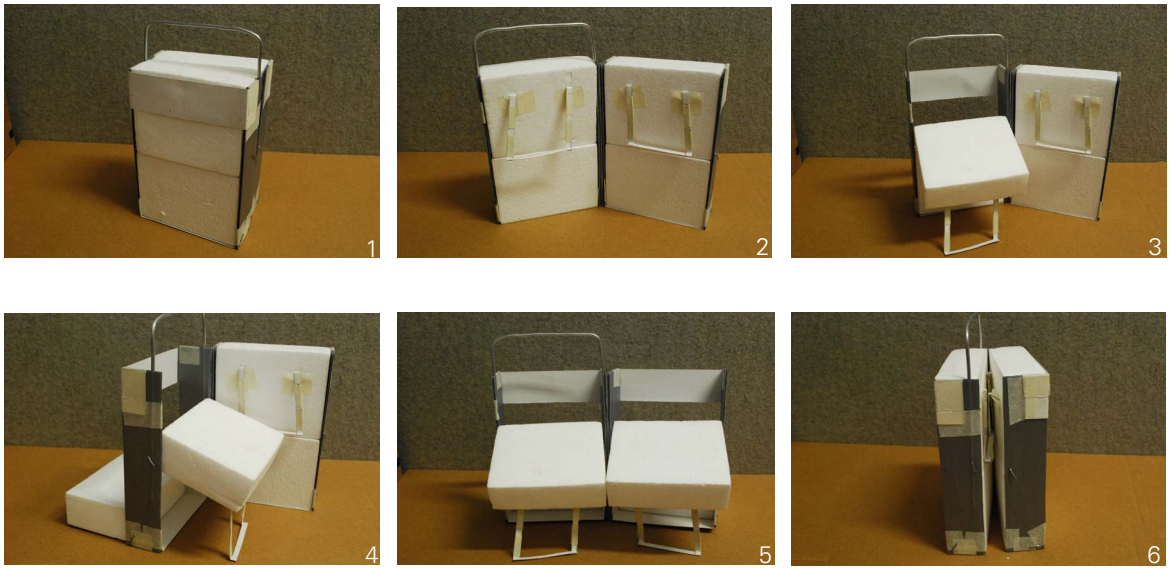


Fig. 46 Ideation 2: Sequence of operation

Initially a 1:5 scale model was made to understand the basic working mechanism. Fig 46(1-6) shows the sequence in which the luggage would operate. The stand on the top compartment would give it stability when hinged. But this stand also looked unaesthetic and increase the weight of the luggage. The model was refined further.

7.2.2. Scaled Block model (1:4)

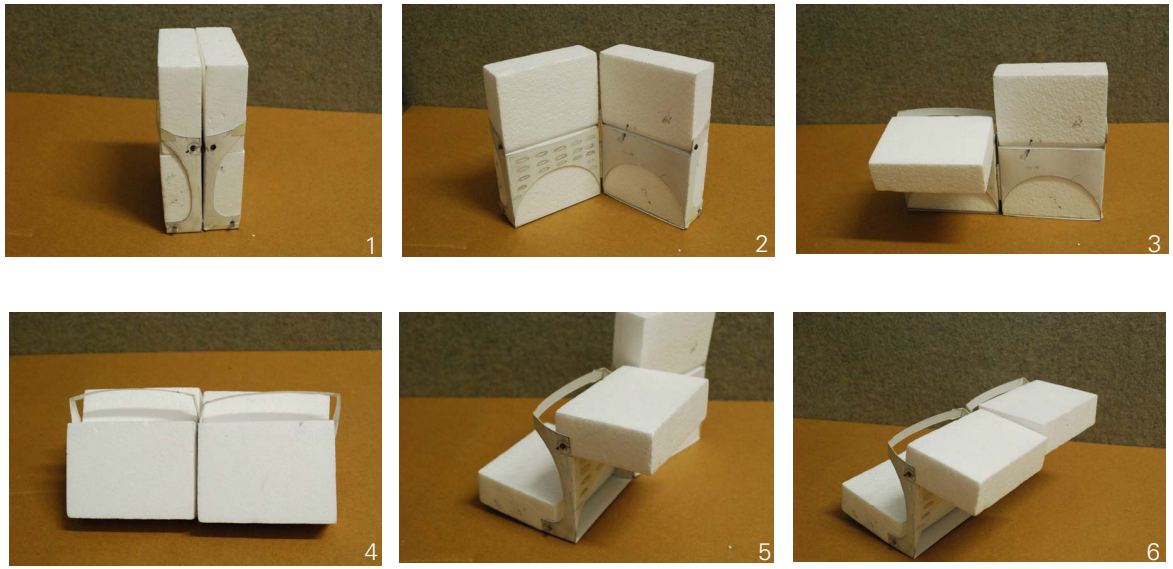


Fig. 47 Ideation 2: Refined model

A refined model of scale 1:4 was made to explore the idea further. The frame was more minimal, providing the function of supporting the contents. The sequence of operating the luggage is shown in the fig 47 (1-6). An observation is that the unit tends to topple when the compartment is 180 deg open and the top compartments are pulled out (fig 29(4)). Also in order to access the lower compartment the top compartment has to be pushed out.

7.2.3. Full Scale Card Board trial

Fig. 48 Card board trial in actual size

A full scale cardboard model of the 4 compartments was made and given to people to simulate packing. Fig 30(1) shows the height at which user will be accessing the top compartment. Fig 48 (2-4) gave an idea about the no. of clothes that would fit easily into a compartment and if the space was sufficient or not.

7.2.4. Analysis

This idea has the advantage that the top compartment can be accessed conveniently by a person. One doesn't have to lift the luggage from ground and place it at a higher level to access the items. Also four compartments allows the person to organize the luggage in the way he/she wants to. For example, there can be a separate compartment for soiled clothes/ironed clothes/ children clothes etc.
However this idea had many problems which were to be sorted out.

- The footprint of the luggage was very large, middle class homes were not likely to have this much space
- Additional faces would add to the weight
- Eight hinges would have to be used for the construction, which would mean the frame would have to be stronger, adding to weight.
- It was necessary for the compartments to be securely held to each other, or else there would be problem to carry it around.
- There was a tendency of the unit to topple when the luggage is 180 deg open and the top compartments are pulled out.
- Top and bottom compartments need to be packed together to avoid toppling
- The frame in the model looks visually very weak.

Due to all these factors there was a need to come up with a new idea that would resolve these problems. The need was to design a solution that would be simple in construction thus easier to manufacture.

7.3. Final ideation and validation

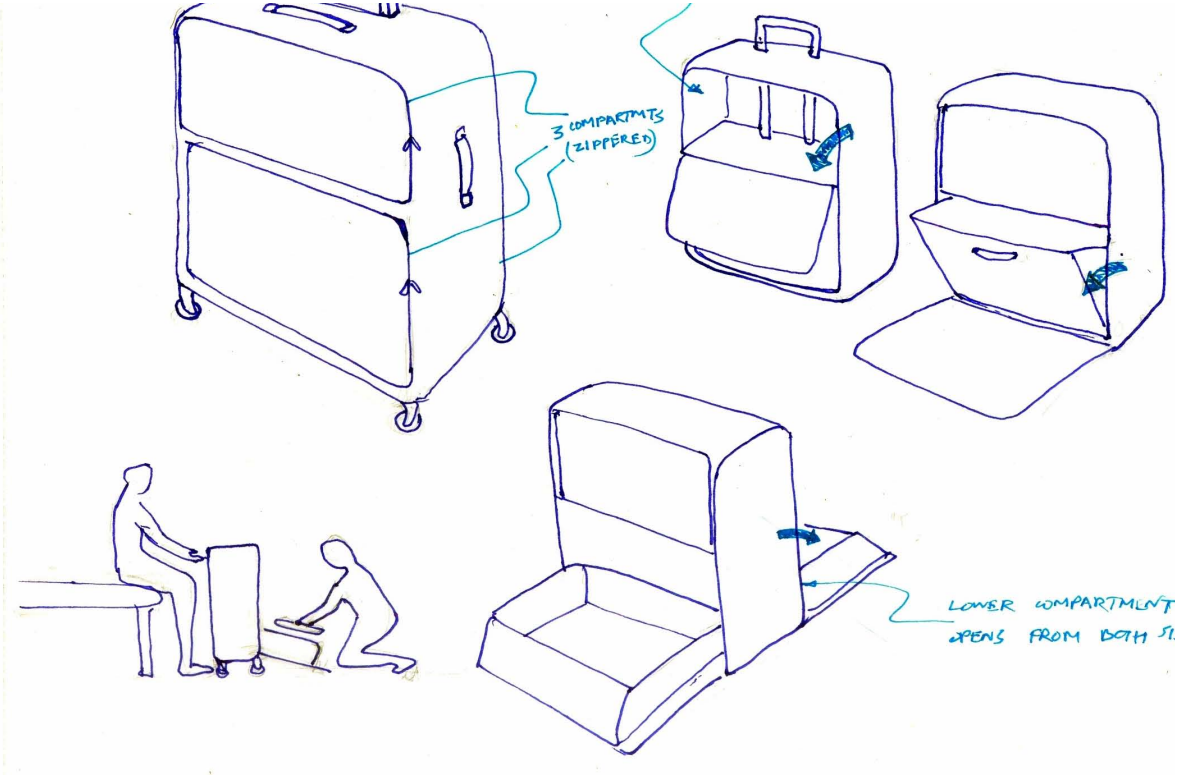


Fig 49 shows the idea which is a combination of idea2 and idea 9. The positive features were combined to generate the new idea. .The top part is a single compartment and the lower part is divided into two compartments and opens from both the sides. The next step was to find out the feasibility of this idea

Fig. 49 Ideation 10

7.3.1. Full Scale Card Board trial

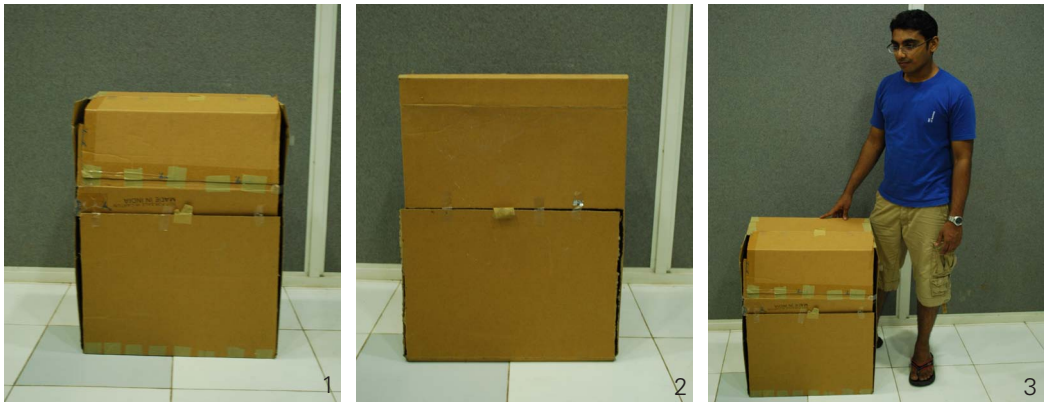


Fig. 50 Card board trial in actual size

A full scale cardboard trial model of size 28"X 21"X13" was made. Fig 50(1 and 2) show the front and back of the luggage respectively and fig 32(3) shows the size of luggage w.r.t. a person.

7.3.2. Observations and analysis of user interacting with model

Fig. 51 Using the upper compartment

Fig 51 (1-6) shows the user interacting with the top compartment of the luggage. A scenario of a person sitting on bed and accessing the luggage is simulated here. Fig 32(2) shows the difficulty in opening the flap of the top compartment. Fig 32(4) shows its possible to keep two ironed clothes side by side conveniently. Fig 32(5) there is empty space along the depth, so this dimension can be reduced. Fig 32(6) shows that clothes can be easily accessed from the compartment when required.

Fig. 52 Using the lower compartment

Fig 52 (1-6) shows the user interacting with the lower compartment . This situation simulates the scenario of user keeping the clothes on a bed and squatting on the floor to pack. Fig 34(3) shows an additional step of removing the box after opening the lower flap which can be eliminated by integrating box with flap. This will also reduce the no. of faces.

Fig. 53 Using lower compartments from both sides

Fig 53 (1-2) shows the users interacting with lower compartment from both sides. This is an improvement from ideation 9 in terms of the footprint it occupies and the stability in structure.

7.3.3. Analysis

Ideation 10 is an improvement over the previous ideas. The main useful features of this idea are

- 3 points of access allowing better organization and easier access of items
- Lower footprint area compared to idea 9
- Top compartment can be accessed conveniently
- Ironed garments can be kept securely in top compartment
- more than one user can access luggage at a time
- Lesser no. of faces compared to idea 9, therefore lighter in weight

Due to these reasons ideation 10 is taken ahead for concept generation

8. Product Features

- Overall Dimensions : 28”X 20”X 12”
- Upright spinner luggage with 4 wheels
- Used for air travel as check in luggage
- Can store contents of 3-4 members of family for 4-7 days
- Has 3 compartments, one at top and 2 at bottom for ease of organization and acccess
- Ironed clothes can be kept securely without getting creased
- Has provision for easy access of items used frequently

9. Concept Generation

Following approach is planned fo make the final concept:

- to understand the basic construction of the luggage by making block models of thermocol
- Make an imageboard to understand the attributes the product must have.
- Decide on the material that is to be used
- Make moodboard for form generation
- Generate alternatives of form
- Evaluate and select the final form for prototyping
- Detail the final design

9.1. Block models of thermocol to understand construction

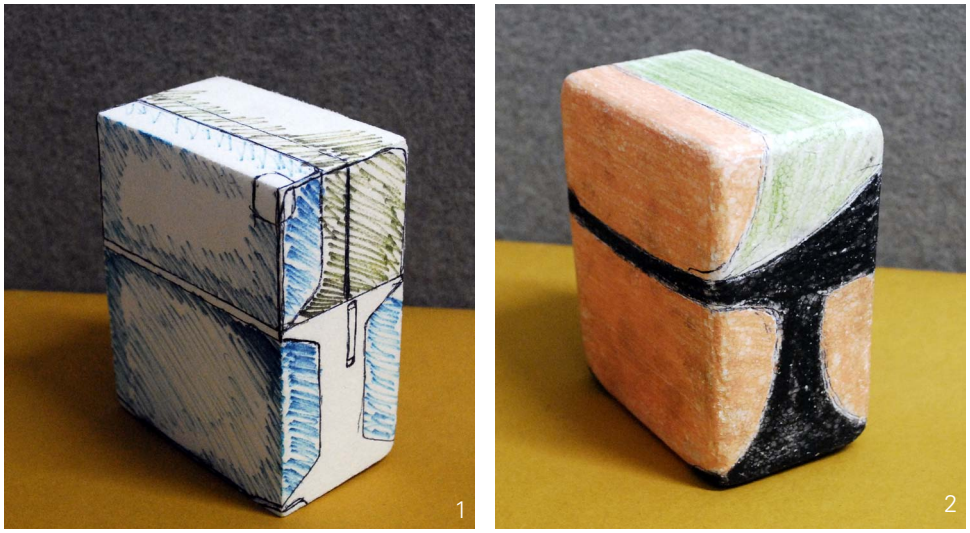


Fig. 54 Block models showiing tentative construsction

Fig 54 shows the block models that were made to understand the construction aspects of the luggage.

Since there are 3 points of access the product should have a strong frame which provides overall strength and rigidity. Fig 36(2) shows the frame painted in black. Frame can be manufactured by injection moulding or vacuum forming .

The frame should also cover the top region painted in green as shown in fig 36(2) as the top portion houses the handle, and hence must be strong.

10. Imageboard


1

2


3

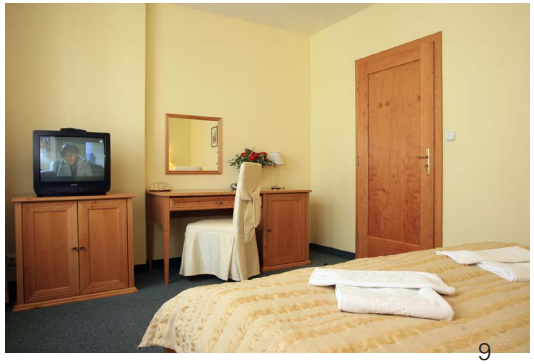
4


5


6


7


8


9


10


11

Fig. 55 Imageboard

10.1. Inferences from Imageboard

The luggage should look visually strong and rugged as it is check in luggage and will be handled roughly, but it shouldn't look bulky. It should look informal and elegant enough to be taken inside airports, railway stations or home environments.

11. Moodboard

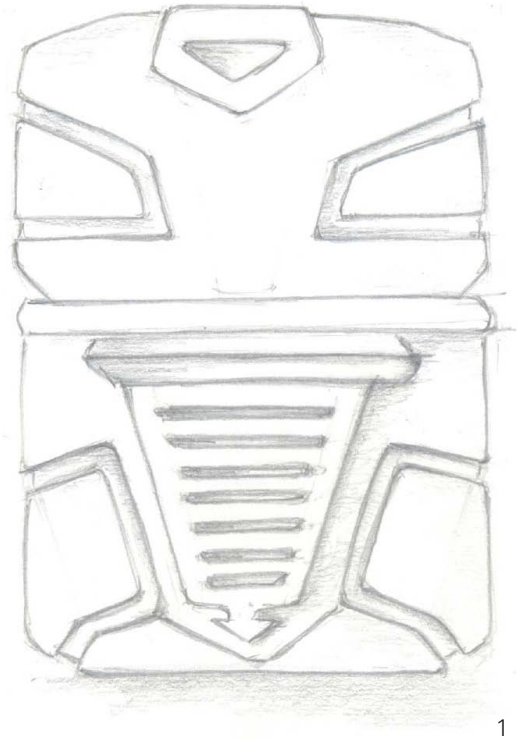
Fig. 56 Moodboard

11.1. Interpreting the moodboard

The above moodboard is a collection of objects that show attributes such as strong, rugged, soft and light.
Fig 56(1) shows Renault Radiance truck which looks strong due to the large fillets, use of bright colour and curve with bulge that flows continuously.
Fig 56(2) shows a transformer in which the central portion having grills and tyres looks rugged due to the sharp grooves running through the surface
The bald eagle shown in fig 56(4),(5) and (6) looks strong due to its stance. The sharp beak with a downward curve adds to its power.
Fig 56(7) conveys ruggedness through its texture and strength through the continuous flow lines and round shape.
Fig 56(8) is a hard disk which looks rugged due to the grooves breaking at regular intervals and the surfaces having different colour.
Fig 56(9) shows a vacuum cleaner which looks inviting due to its soft colour and the matte texture.
Fig 56(10) conveys feeling of the speaker being light due to the radii at the bottom.

The theme of transformer was taken forward as one gets the feeling of this luggage getting transformed by opening from multiple places

12. Form Generation

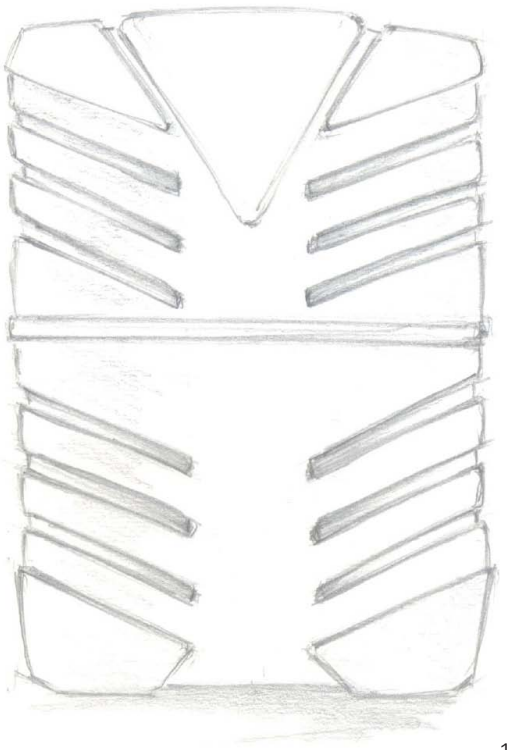


1

3

Fig. 57 Form 1

This form is inspired from the front grill of the transformer and its logo. The form looks interesting but is complicated with many elements. Also the elements don't provide a functional use.

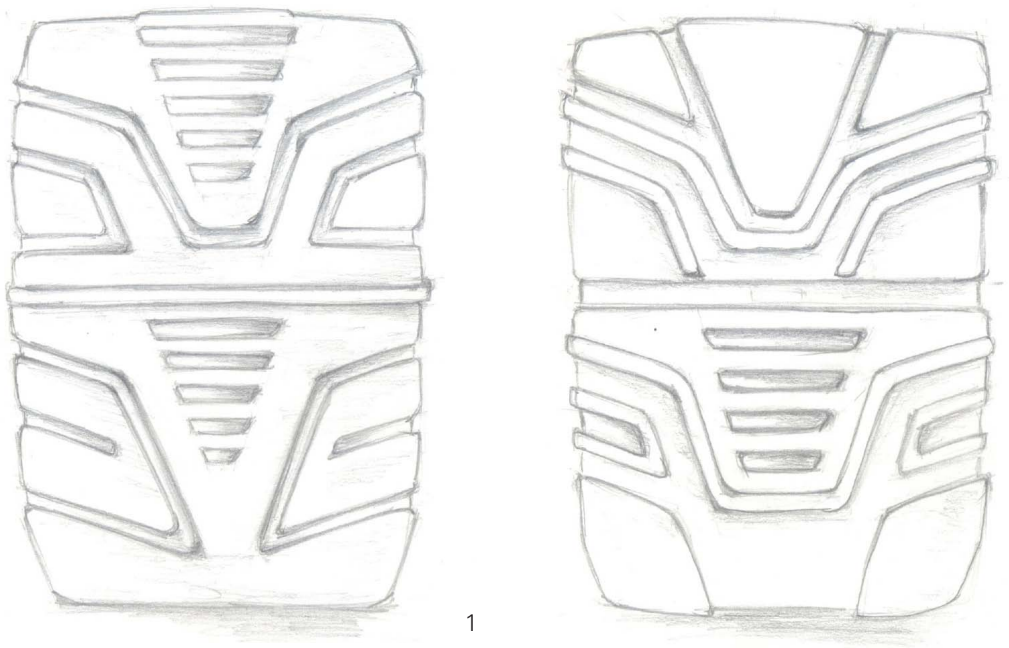


1

2

Fig. 58 Form 2

In this form the transformer elements were combined with the stance of a eagle which gives a feeling of flight to it. The grooves add strength to the luggage but overall the form looks more rugged due to the discontinuity of the grooves. Also the groove width is small in relation to the overall proportion which makes the form look weak.



1

Fig. 59 Form 3 & 4

Fig 59(1) & (2) are further variations in which the groove width is increased and the flow is made continuous. The bottom is given radius to make it look less bulky. But even in these the overall expression is rugged than strong. The next step was to reduce the no. of elements and keep the flow of grooves continuous to give the form more strength.

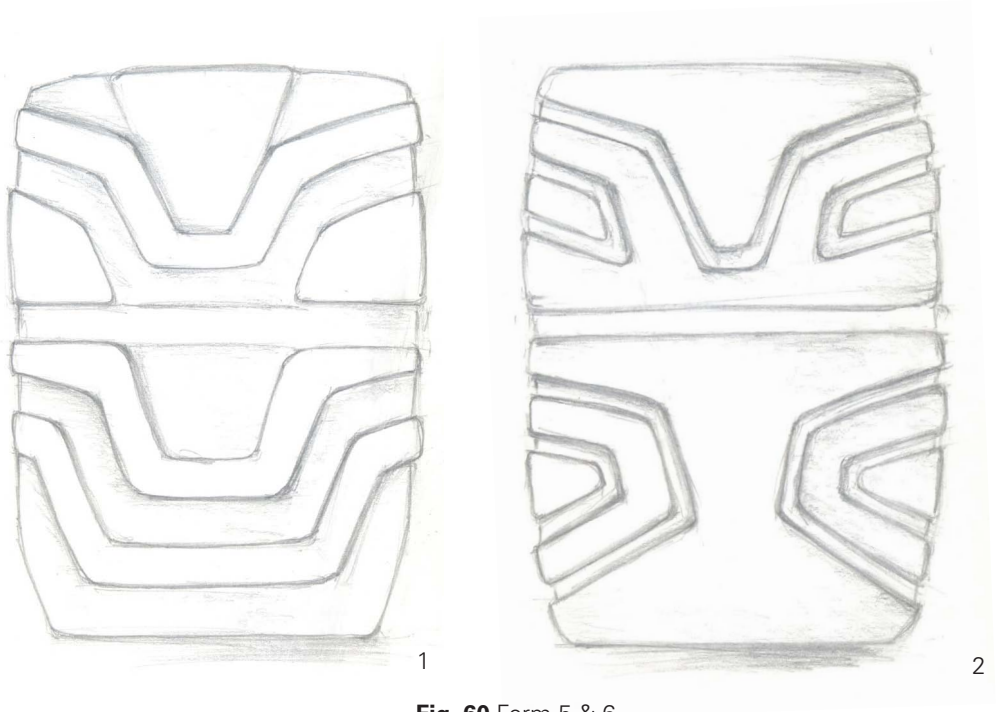


Fig. 60 Form 5 & 6

Fig 60(1) shows a variation in which the groove width is further increased. The flow lines are continuous in this form which makes the form look strong but more bulky due to the higher width.In fig 60(2) the groove width is kept optimum and the continuity of lines maintained. The top half and bottom half are in harmony with each other in this case. This form is taken ahead for concept generation.

13. Final Form

Fig. 61 Final Form

Fig 61 shows the luggage is visualized as a whole. The next step is to add the details on to the form.

13.1 Outside details

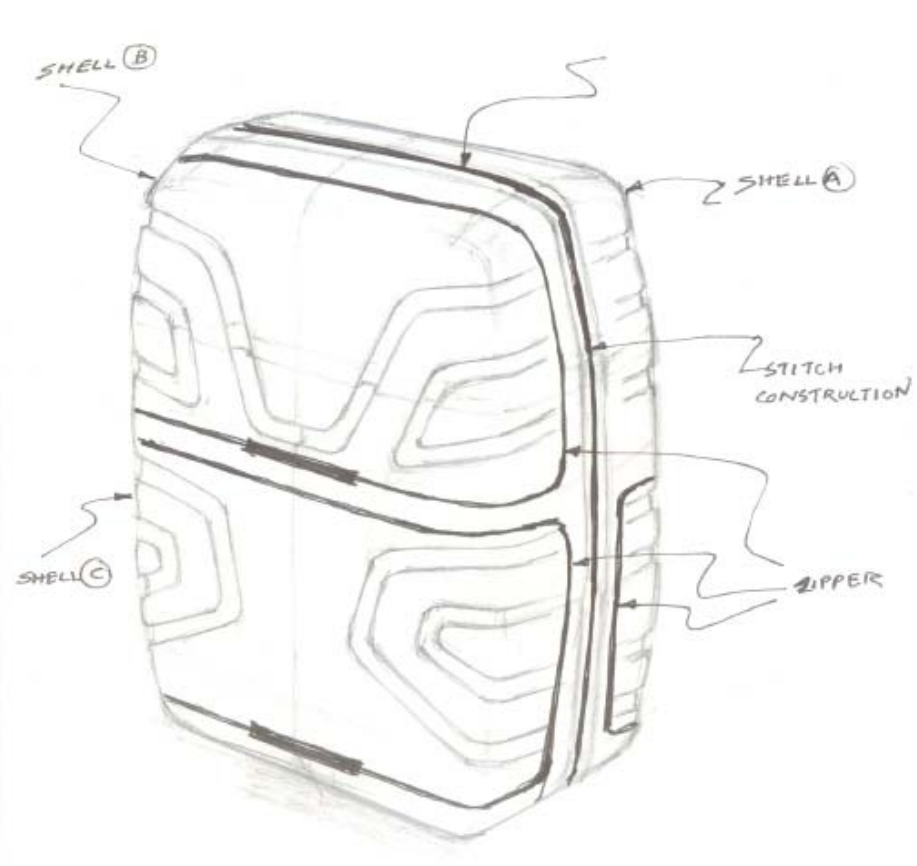
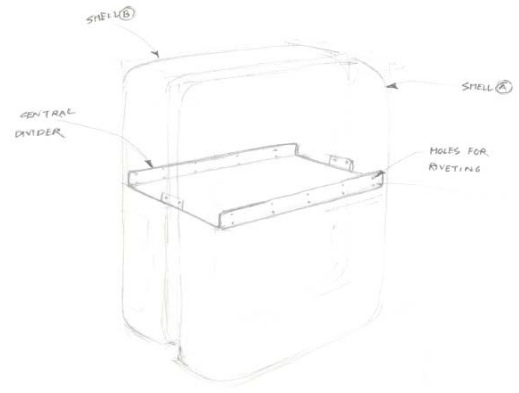


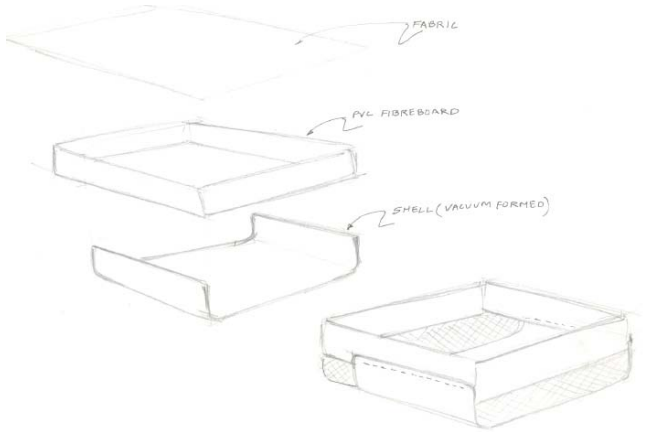
Fig. 62 Outside Details

Fig 62 shows the outside construction of the luggage. The process used for manufacturing will be vacuum forming ABS. Shell A will be vacuum formed and cut out at top and bottom for front face and only at bottom for back face. Shell B & C will also be vacuum formed and stitched with zipper. There will be 3 compartments that will have a zipper construction and soft hinge. Shell A is stitched with its opposite permanently and cannot be opened, thus it provides a strong central frame.

13.2 Inside details



1



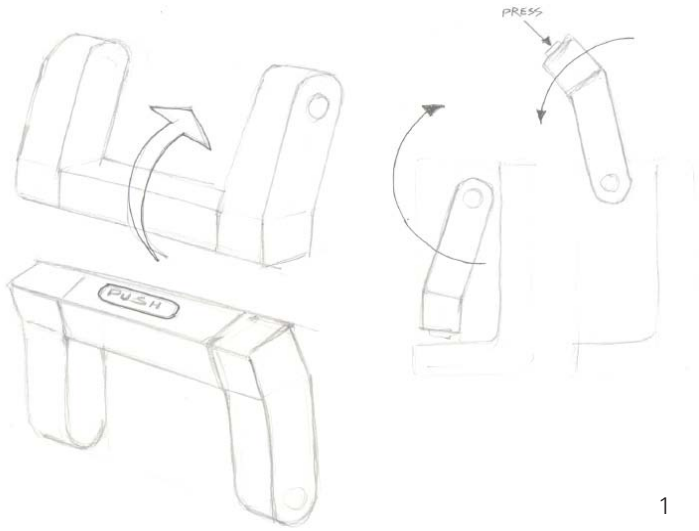
2

Fig. 63 Inside Details

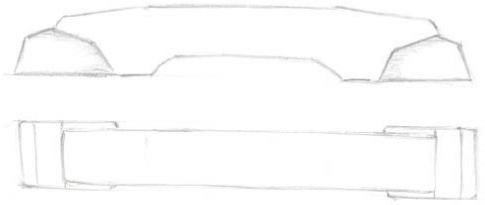
Fig 63(1) shows the inside divider which is vacuum formed ABS and is riveted on shell A and B at the points shown. The rivets are covered by the rubber beading that runs along the zipper.

Fig 63(2) shows the lower part consists of corrugated fibreboard which is struck onto the shell and covered with fabric to seal the gap. This construction will help reduce the weight and save space for packing.

13.3 Handles



1



2

Fig. 64 Handles

Fig 64(1) shows the handle which is proposed in place of the normal retractable telescopic handle. As the overall height of the luggage comes to around 30"a shorter retractable handle would suffice the purpose.
The passive position is as shown in fig. When required it is lifted, and it locks itself in the 2nd position. When not required the button is pressed and it retracts itself to its original position.

Fig 64(2) shows the views for side and the top handle. The handle will be standard having a spring enclosed which will make the handle flat when not in use.

14. Rig Construction

Fig. 65 Full Scale Rig Model

Fig 65 shows the rig which is under construction. Fig 65(1) & (2) shows how a person would carry this luggage. Fig 65(3) shows the top view. Fig 65 (4),(5) & (6) shows the compartments open in various positions.

15. Final concept

Fig. 66 Rendered concept

Fig 66 shows the rendered image of the luggage that is proposed. The colours were selected to give it a soft inviting look. The badge at the centre gives scope for branding the product. The next page figs (shows the various product features. back view, handle and the surface texture.

Fig. 67 Product Features

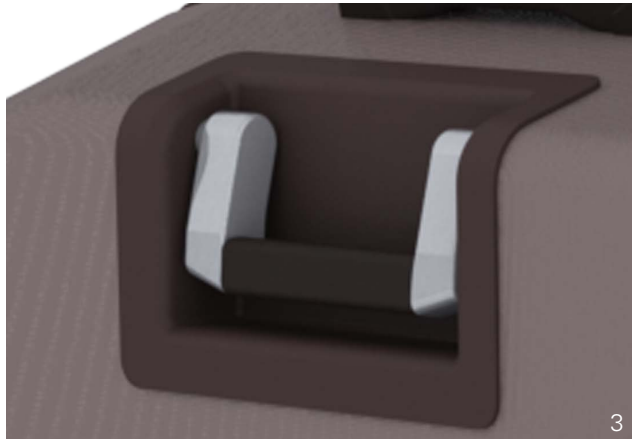


Fig. 68 Alternate views

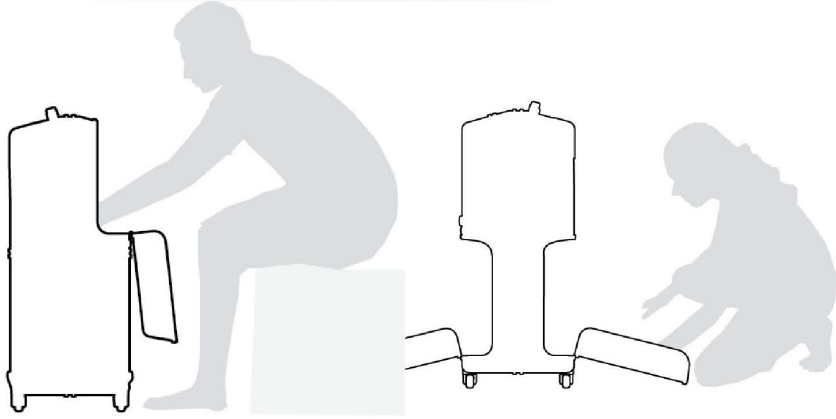


Fig. 66 Product in use

17. Web references

http://www.luggageguides.com/ (29/07/09)
http://www.overstock.com/guides/how-to-pack-in-one-bag (15/07/09)
http://shop.heys.ca/ (10/09/09)
http://www.luggage-parts.com (12/09/09)
http://pddtoolbox.org/pddtoolbox/media/ToolboxMenu.jpg (03/08/09)
http://www.gorenje-no.si/en/imagelib/magnified/products/interior/kitchens/kitchens_marles/details/telescopic-shelves-for-easy-access.jpg (03/08/09)
http://www.sz-wholesale.com/uploadFiles/upimg7/Multi-Tray-Desk-Organizer-Set-40227.JPG (03/08/09))
http://www.designer-daily.com/wp-content/uploads/2007/11/work-play_combo.jpg (03/08/09)
http://www.cutecamcase.com/images/srl-camcorder-bag-5.jpg (05/09/09)
https://www.toolsunlimited.com.au/shop/images/stanley192748.jpg (07/09/09)
http://www.mmocrunch.com/wp-content/uploads/2008/01/lego.jpg (08/10/09)
http://www.apartmenttherapy.com/uimages/la/shelving_atla013108-07.jpg (09/1009)
https://www.saddler.co.uk/prodpics/ready/delseyseascapesuitcasewheel_3_large.jpg (12/10/09)