Water fetching aid for rural women

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Content

Current Scenario

- No direct water supply at homes.
- Most households have women fetch water daily.
- Neighbouring women go together in a group
- A woman brings approximately 50 litres of potable water for a family.
- For this, she must make 3-4 trips to the well/tap.
- Often she has a baby that she must carry along with her.

- Per trip: 20 litres of water.
- Weight of this water: 20 Kg.
- Total distance walked: 10 Km.

NEED

- Socio-economic problems
- Heavy weight
- Physiological problems
- Neck pain, poor muscular strength
- Problems from young age
- Safety issues
- Lack of time
- Loss of valuable time for education

Design Objective

To reduce the effort and minimize the difficulties associated with fetching water by rural women.

Secondary Research

Modes of carrying water filled matkas

Fig 1: Head mode

Fig 2: Hip mode

Fig 3: Head and hip

Fig 4: Hand and hip

Fig 5: Shoulder mode

Parallel product study

		Problems
 Fig 6: Q drum	- Volume: 50-80 litres - Cost: Rs. 4500/- - Can be rolled on flat ground	- Drinking water rolled on ground - Rough terrain - Up-slope - Cleaning
 Fig 7: Wello Water wheel		
 Fig 8: H_2O water packs	- Volume: 20 litres - Cost: Rs.1500/- - Carried on the back or slung on the side	- Very large load only for back - Difficult to fill, clean
 Fig 9: Load carrier for labour	- Load carried 3 ways for ease - Caster wheels for trolley like function - Bamboo frame	- Rigid structure, difficult to move head - Adjustments to change orientations - Caster wheels would not work in rough terrain

Learnings from secondary research

- Should be applicable on different terrains
- Should suit different houses
- The whole process from home to the well and back has to be considered
- Minimum quantity of water that the product allows to carry must be 18 litres.
- It must be cost effective
- It has to be acceptable to the users

Field Study

Village : Dengachimat, Jawhar

Primary occupation : Subsistence farming, temporary labour work

Primary users:

Women, age group - 30 to 45

Family of 5-6.

Occupation : Farming, labourers

No. of trips made : 3-4

Total time : 40 mins - 1 hour

Discomfort or pain : temporary sore-ness in the back and neck.

They say they are used to it, so don't mind.

Terrain

- Slope: 15° - 20°
- Rough terrain
- Stones, bushes
- Narrow path to walk on

Activity analysis










Inferences from field study

- Volume of water for a family of 5: 45 litres
- No. of trips made per day: 3-4 (for a family of 5)
- Terrain: Rough, narrow with stones and bushes

About Process:

- They carry an additional sieve and jerrycan attached to a rope.
- Loading of water is the toughest task.
- Keeping the matkas on the well wall first since lifting up the filled matkas is most difficult.
- Unloading of water is done with help from family members
- Usage of water at home must be considered.

Physiological problems:

- Pain
- Balance and position the matkas – restriction in movement
- Strain in neck muscles while walking with the water.
- Pregnant women carry large quantities of water throughout the pregnancy.

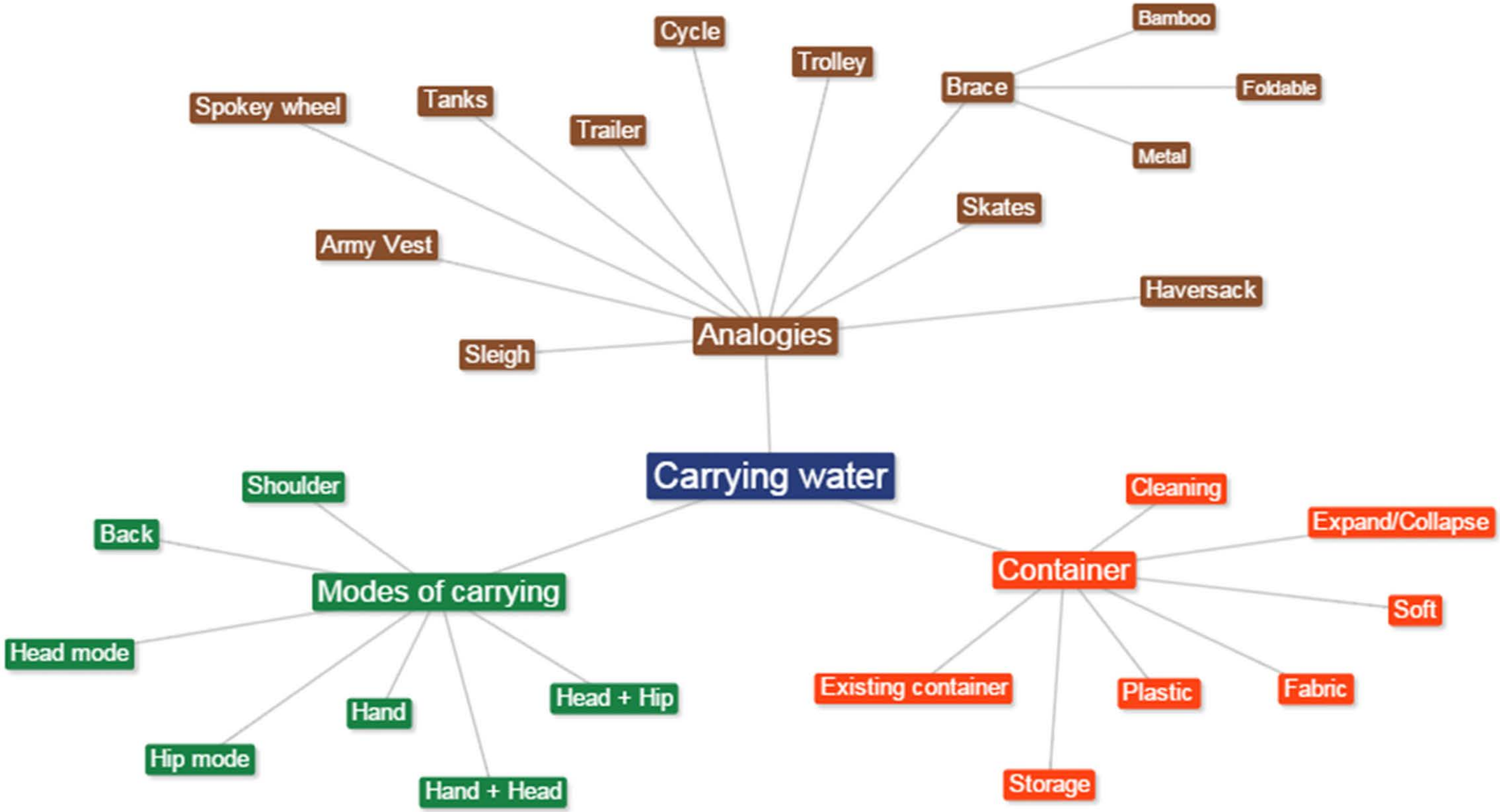
- Durability
- Cost

Design Brief

To design an aid for rural women, to increase efficiency of fetching water

1. Should allow to carry 45 litres of water in 2-3 trips
2. Should reduce the effort required to fetch equal amount of water.
3. Should be carried ergonomically by one woman
4. Should allow easy loading and unloading of water
5. Should store water in a hygienic manner
6. Should minimize wastage of water on commute
7. Should be usable over different terrains of different villages.
8. Should allow easy pouring/transfer of water.
9. Easy to clean and maintain

Mind Map


Carrying water
Analogies
Cycle
Trolley
Tanks
Trailer
Spokey wheel
Army Vest
Sleigh
Brace
Bamboo
Foldable
Metal
Skates
Haversack
Modes of carrying
Shoulder
Back
Head mode
Hip mode
Hand
Hand + Head
Head + Hip
Container
Cleaning
Expand/Collapse
Soft
Fabric
Plastic
Existing container
Storage

Ideation:
Concept clusters

Individual - Wearable

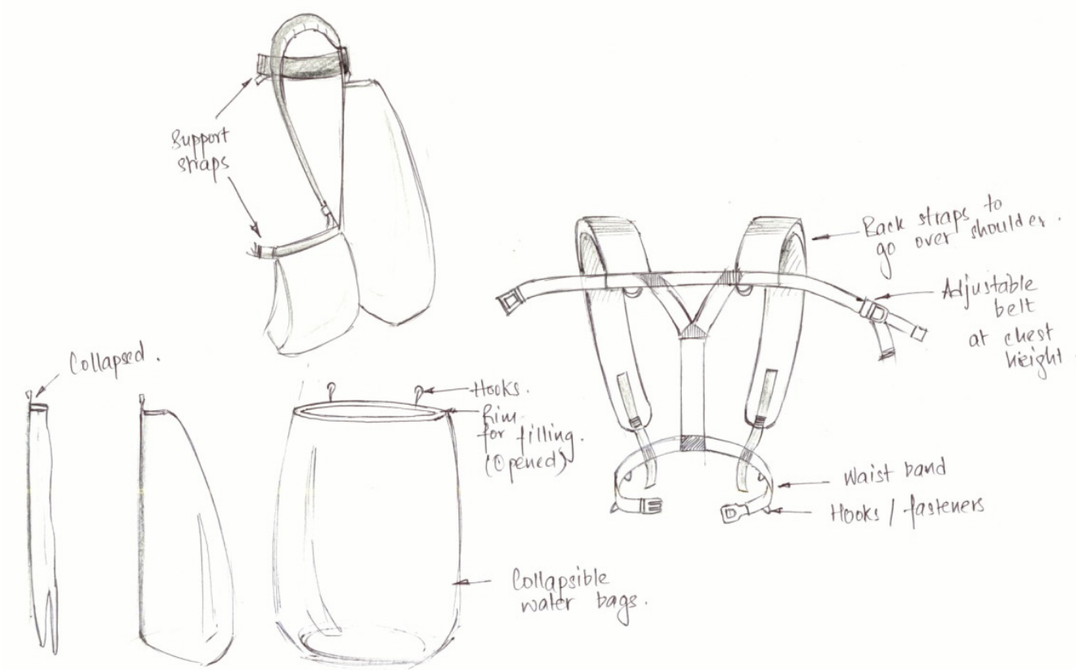


Fig 1: Vest design for water bags

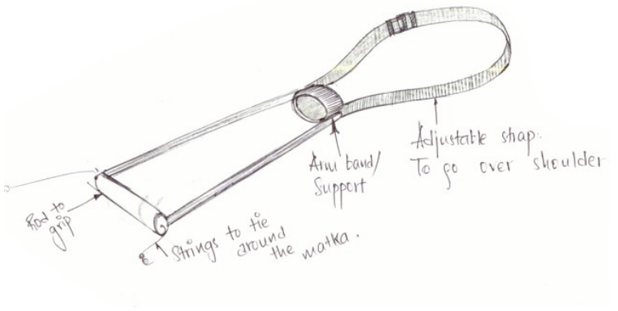


Fig 2: Hand held

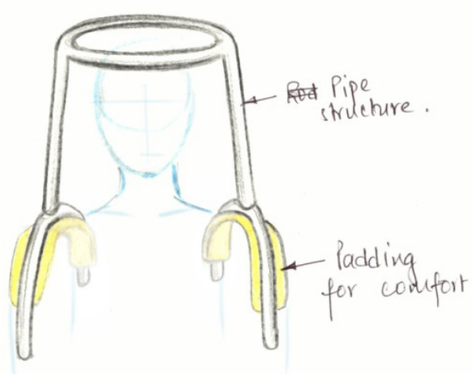
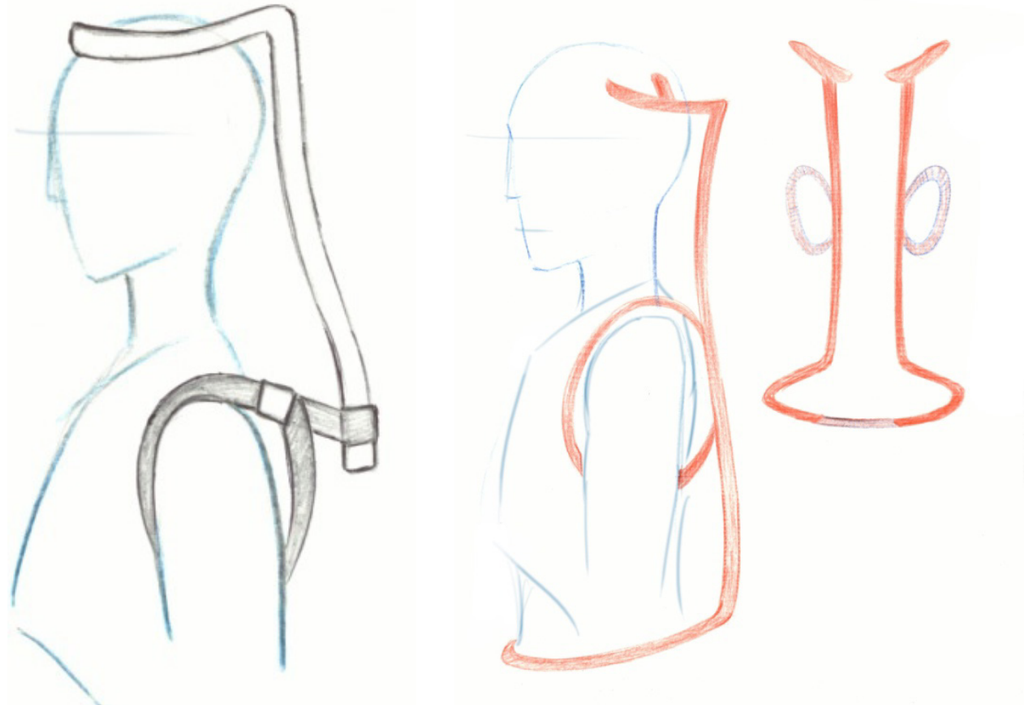


Fig 3: Shoulder brace



Individual - Ground supported

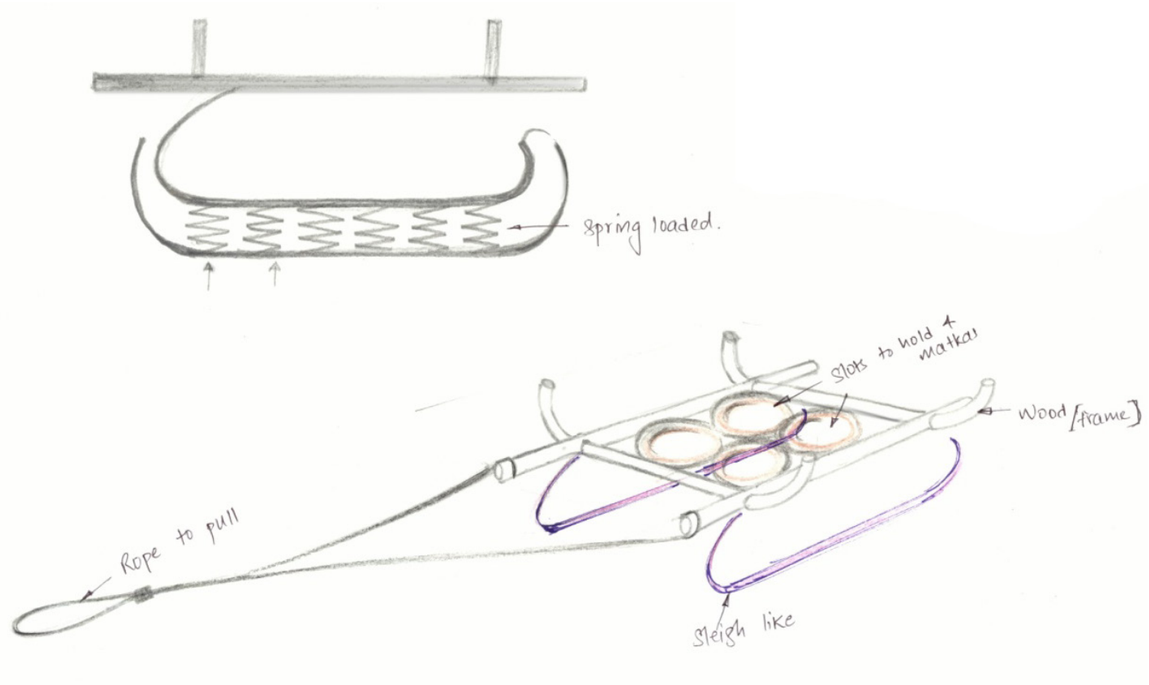


Fig 4: Spring loaded sled

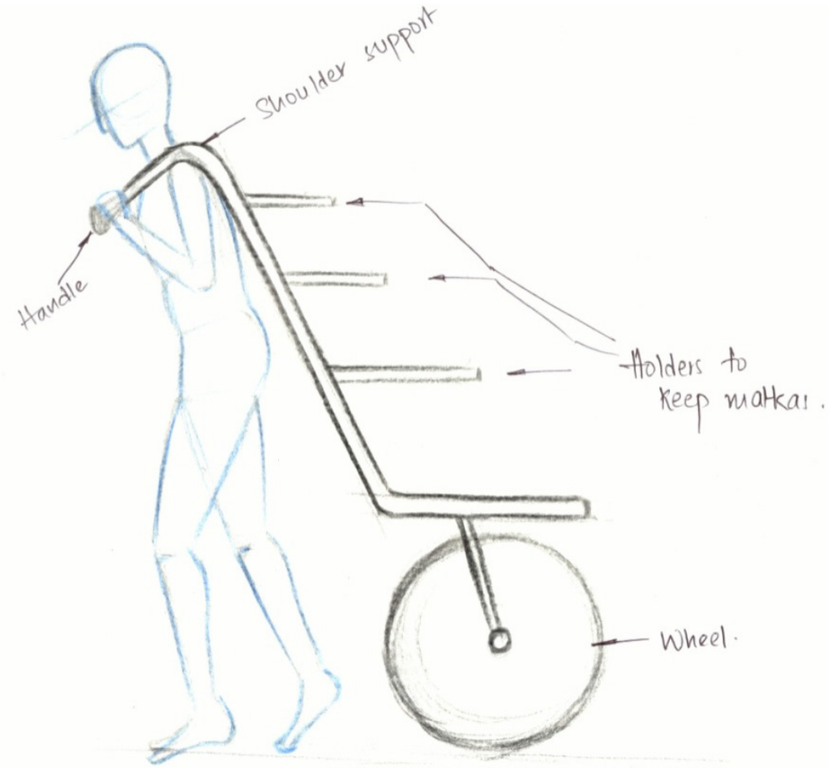
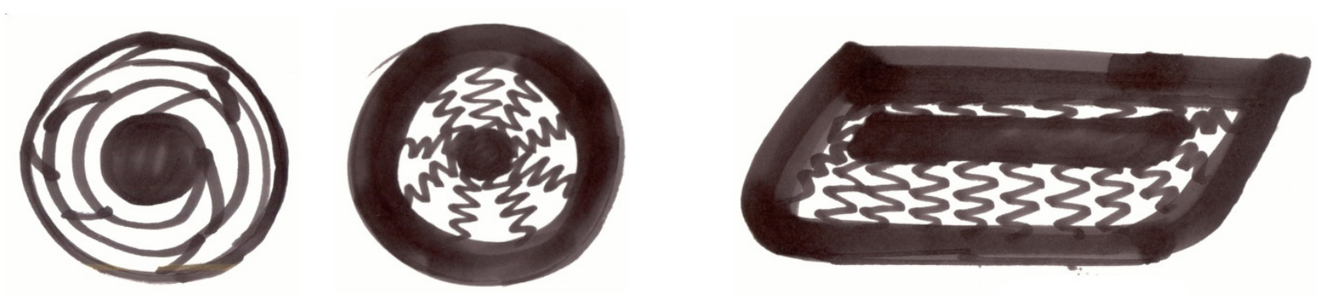


Fig 5: Back load with wheel



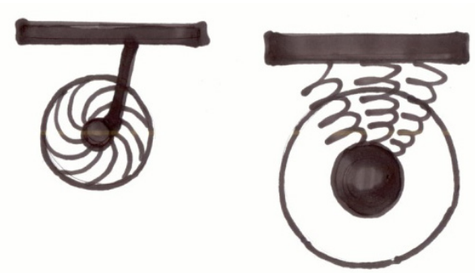
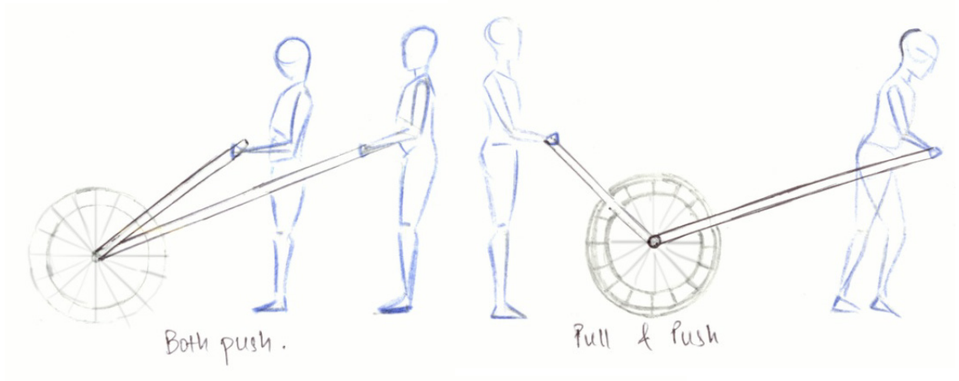


Fig 6: Flexi-wheels



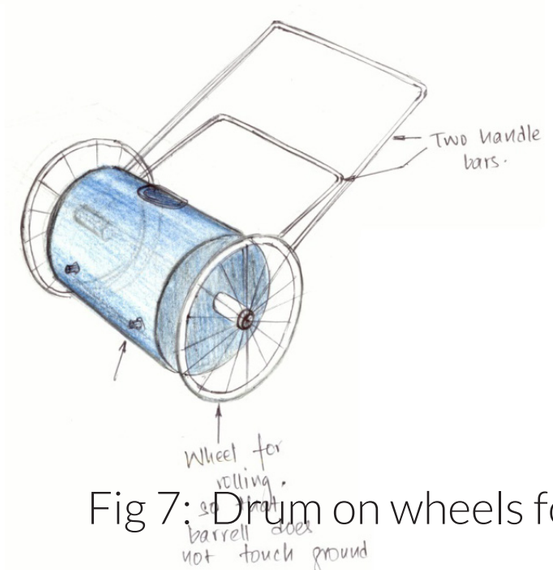


Fig 7: Drum on wheels for two people

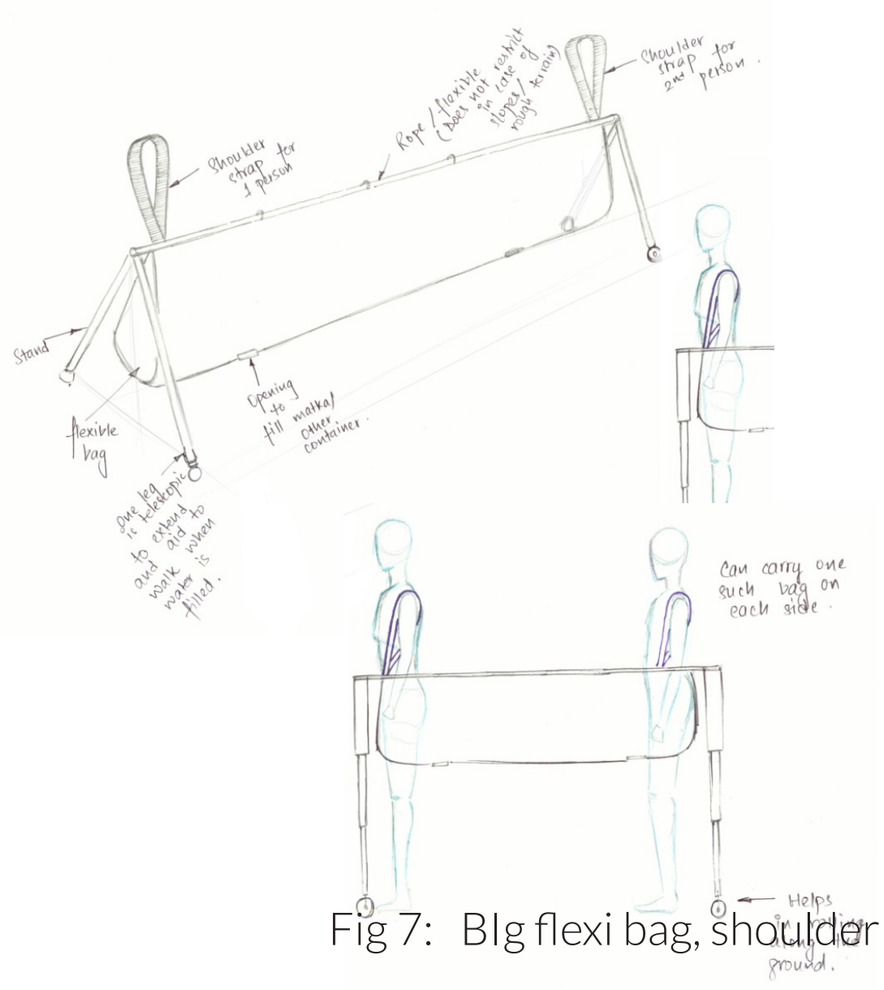


Fig 7: BIg flexi bag, shoulder strapped

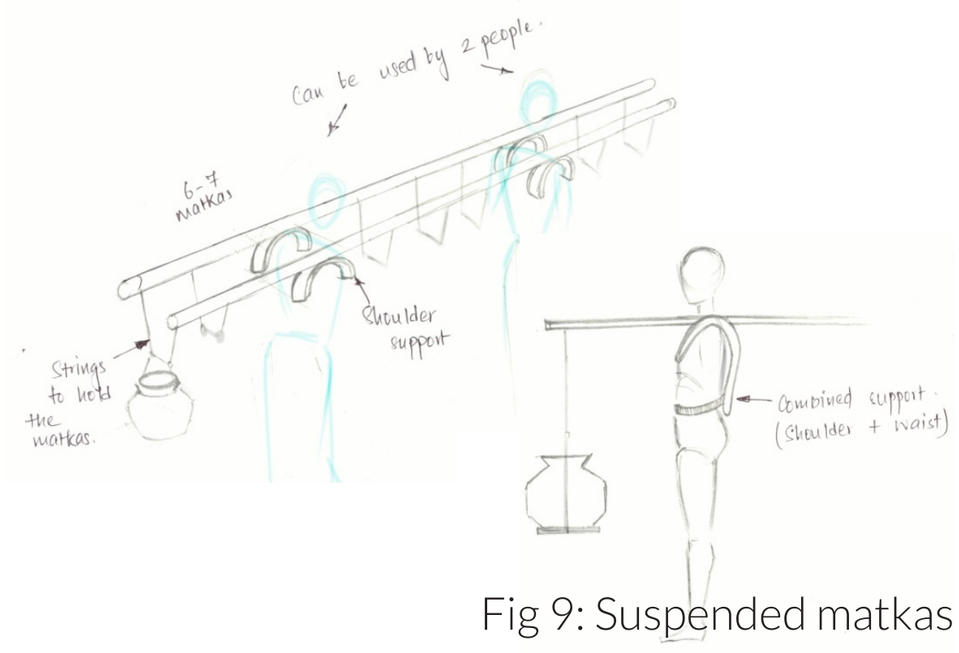


Fig 9: Suspended matkas

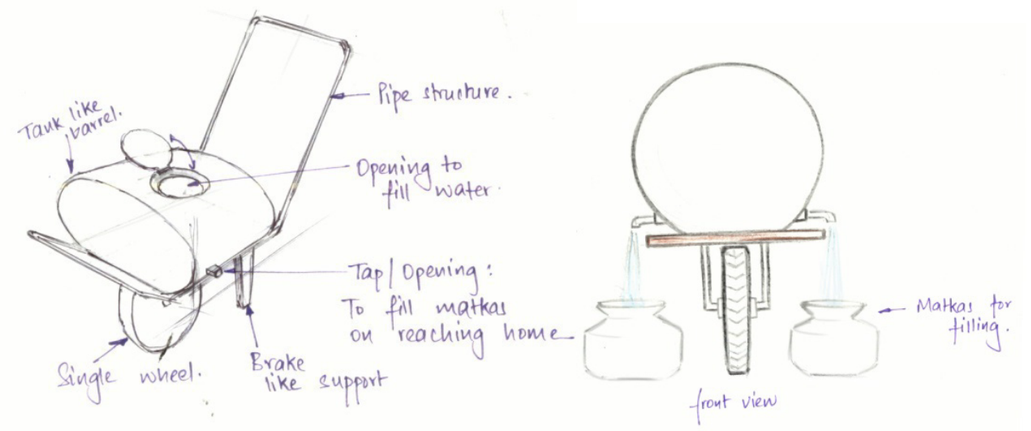
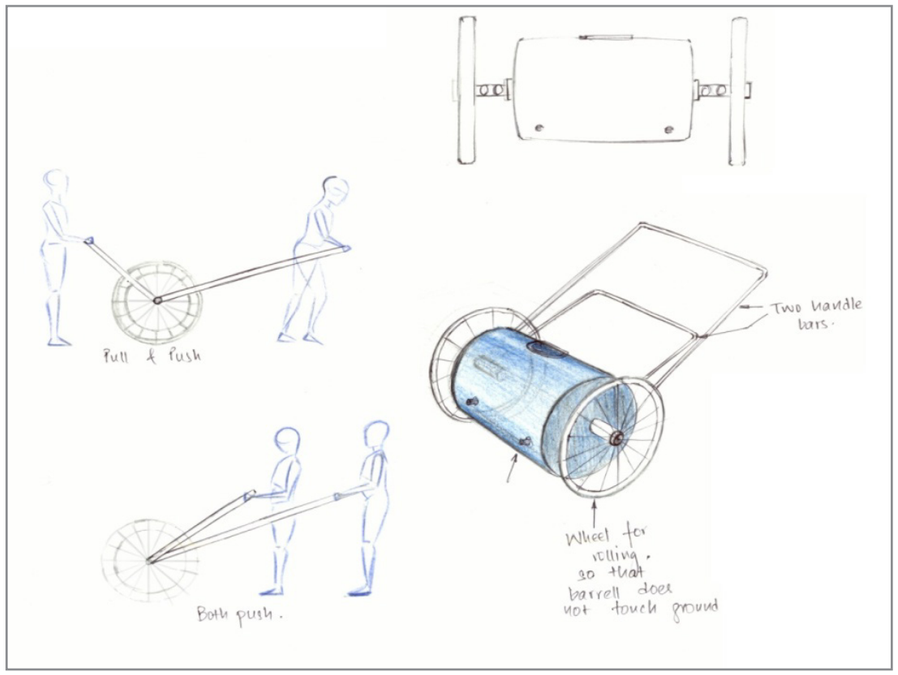


Fig 10: Drum on trolley

Going back to the field…

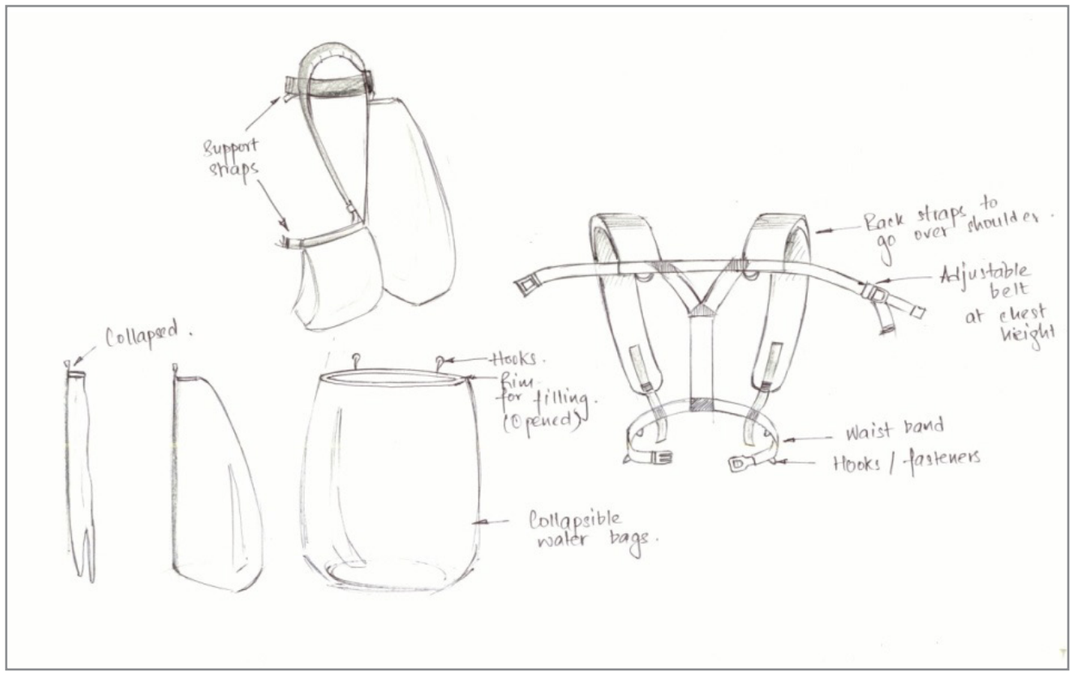


Likes :

- Volume
- 2 persons

Dislikes :

- Wheels will wear off
- Atleast two persons will be needed
- Too heavy
- Added work of transferring water



Likes :

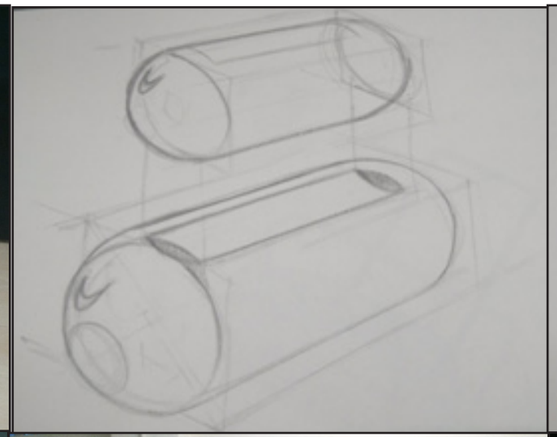
- Safety straps
- Looks more comfortable
- Will avoid neck strains
- Something new to use

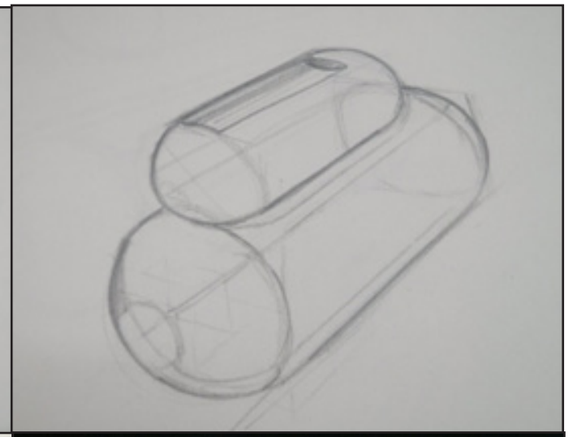
Dislikes :

- Cannot carry a large volume of water

like in the drum

Further explorations





- Stackable drums
- Weight testing
- Flexible bag

Concept evaluation

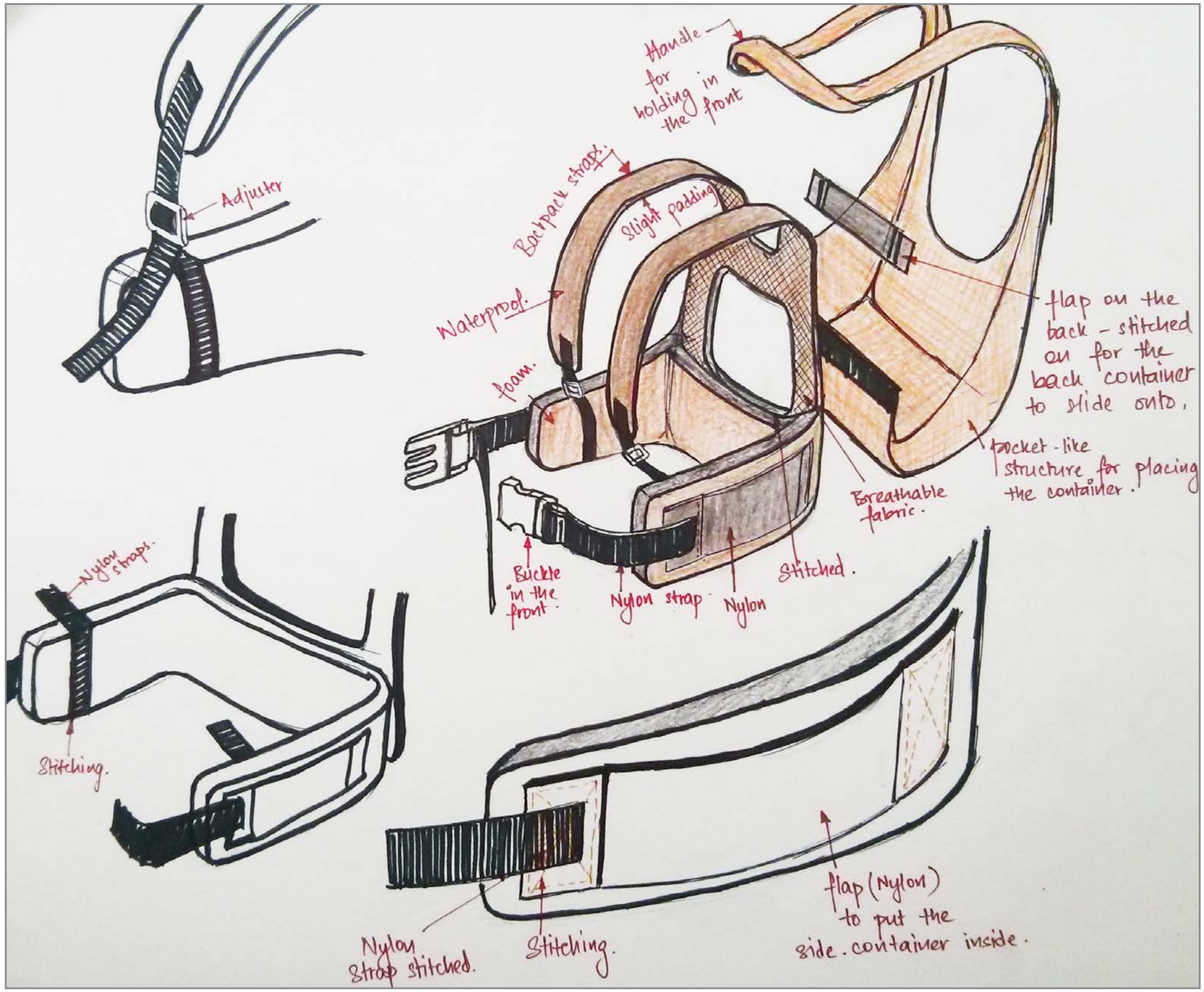
Criteria	Priority
Reduction in effort	1st
Ease of loading, unloading	2nd
Volume of water per trip	3rd
Ease of use	4th
Easy transferring	5th
Ease of cleaning	
Level of acceptance	

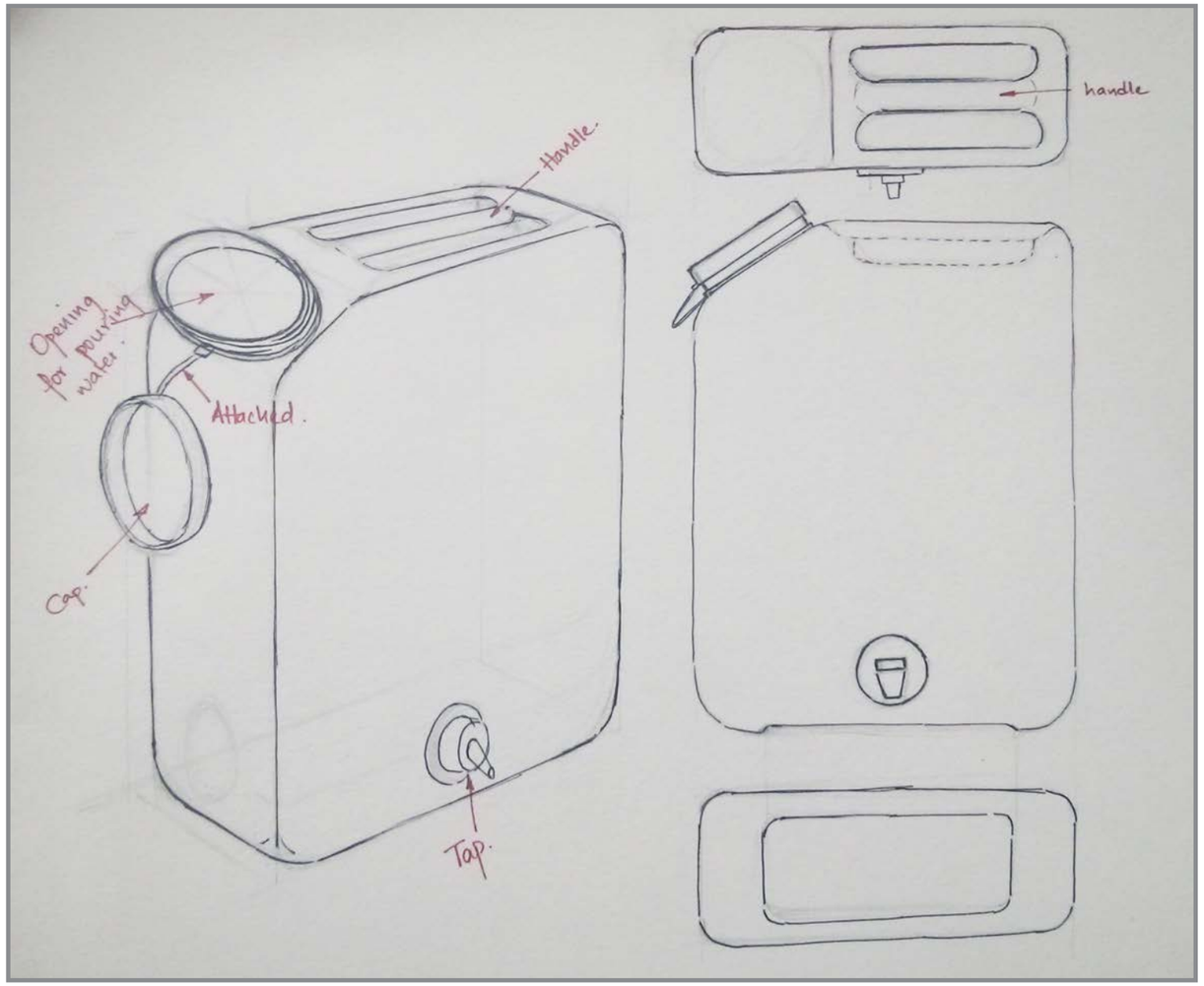
Criteria	Weighting coefficient	Concept 1		Concept 2	
		Not weighted	Weighted	Not weighted	Weighted
A	1	2	2	3	3
B	0.64	3	1.92	4	2.56
C	0.91	3	0.3	3	0.3
D	0.36	1	0.36	3	1.08
E	0.82	4	3.28	2	1.64
F	0.36	3	1.08	2	0.72
G	0.36	2	0.72	3	1.08
SUM	4.45	18	9.66	20	10.38
Rank		**2**		**1**	

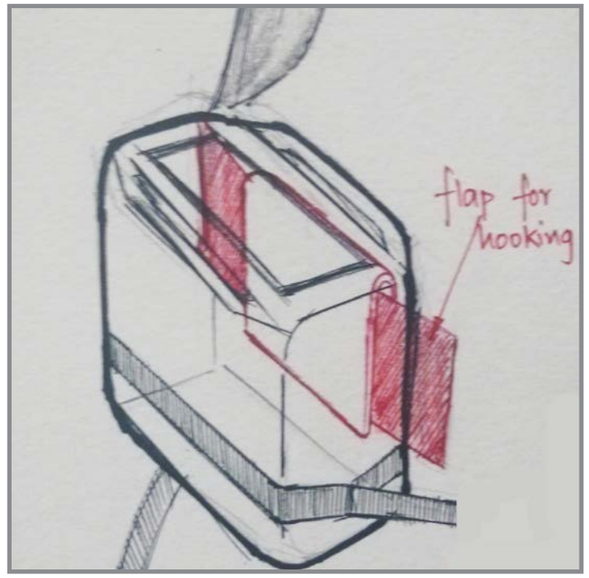
Testing the weight using a mock-up

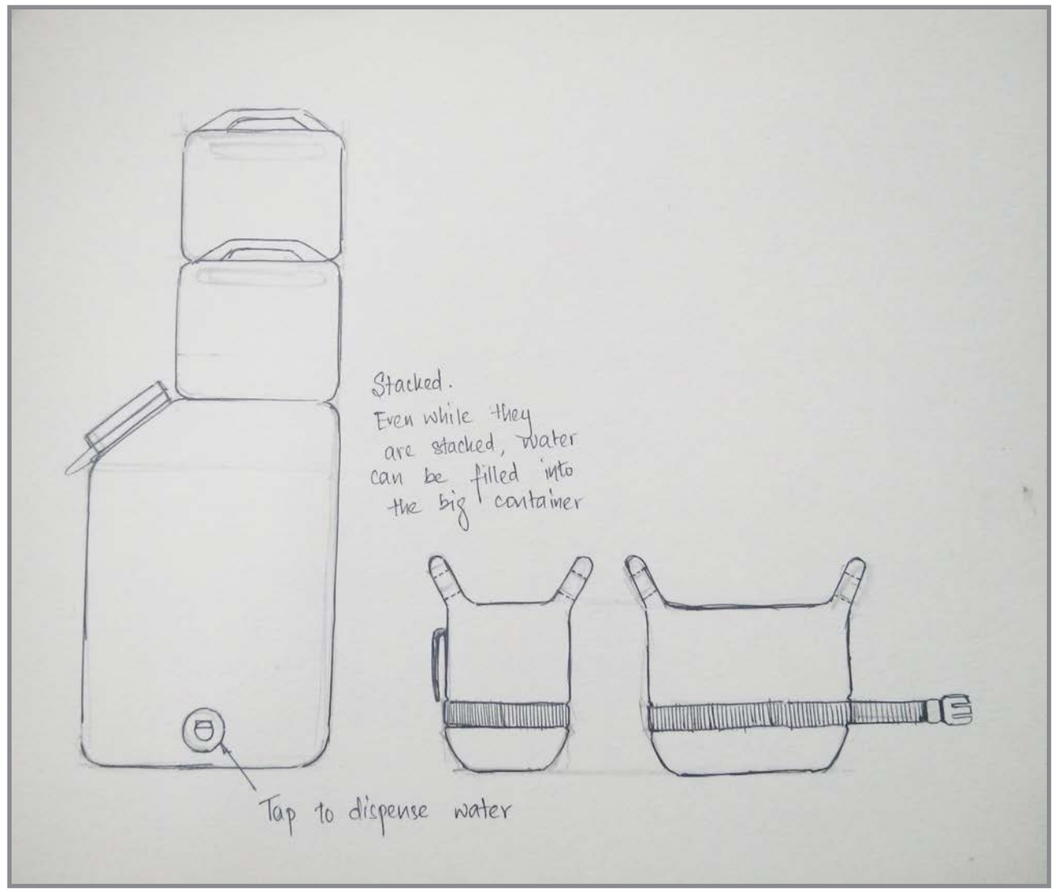
- Weight distribution around the trunk of the body
- Engage hands using a scarf or dupatta

Final Concept




handle
Handle.
Opening for pouring water.
Attached.
Cap.
Tap.


flap for hooking


Stacked.
Even while they are stacked, water can be filled into the big container
Tap to dispense water

Testing in the field

Mock up for testing was made of :

. A modified backpack
. 10 litre jerry can
. Two 5 litre jerry cans
. Cotton cloth

Terrain : Narrow path, rough, with stones, pebbles and gets muddy during the monsoons

Activity analysis





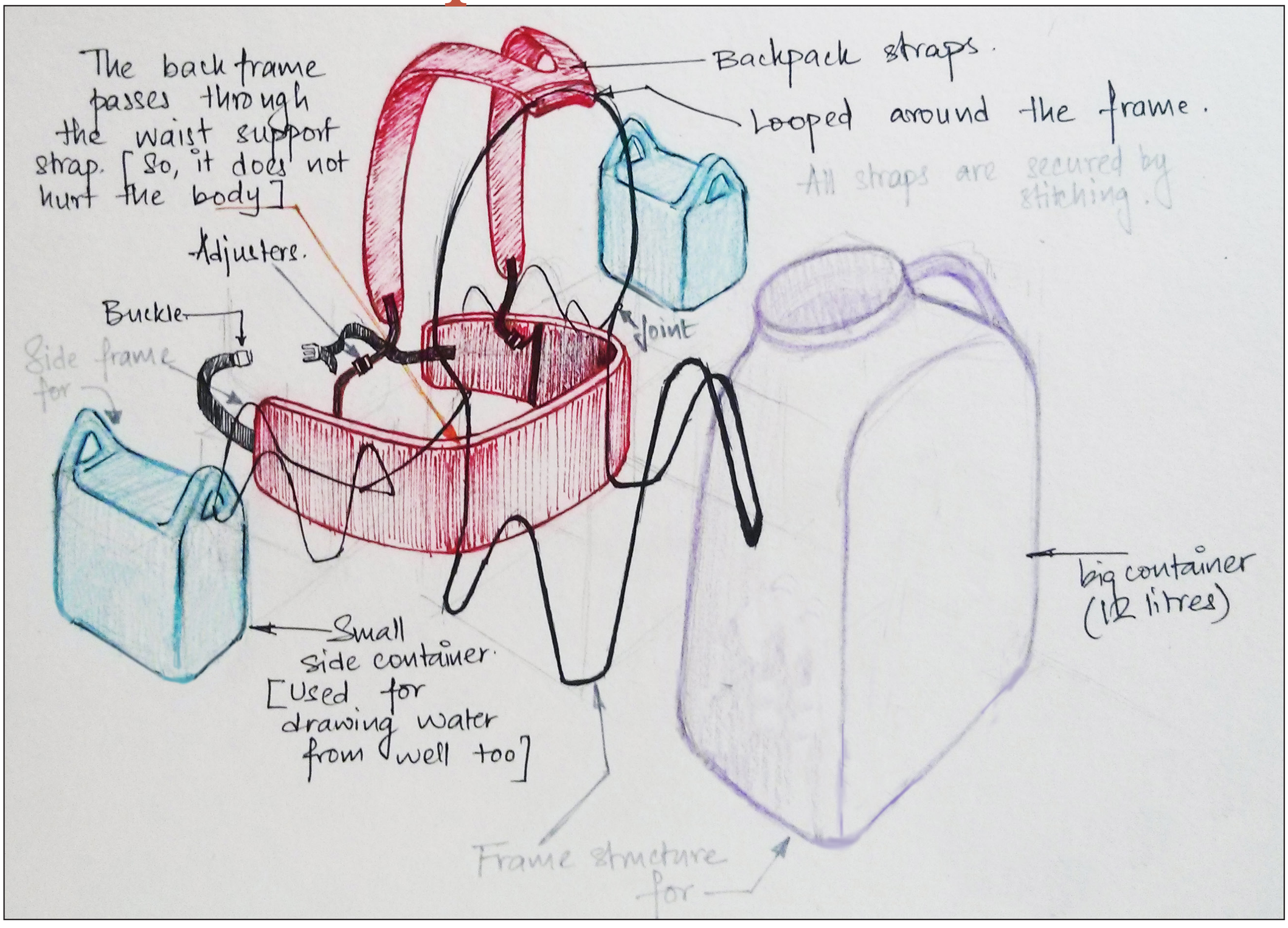




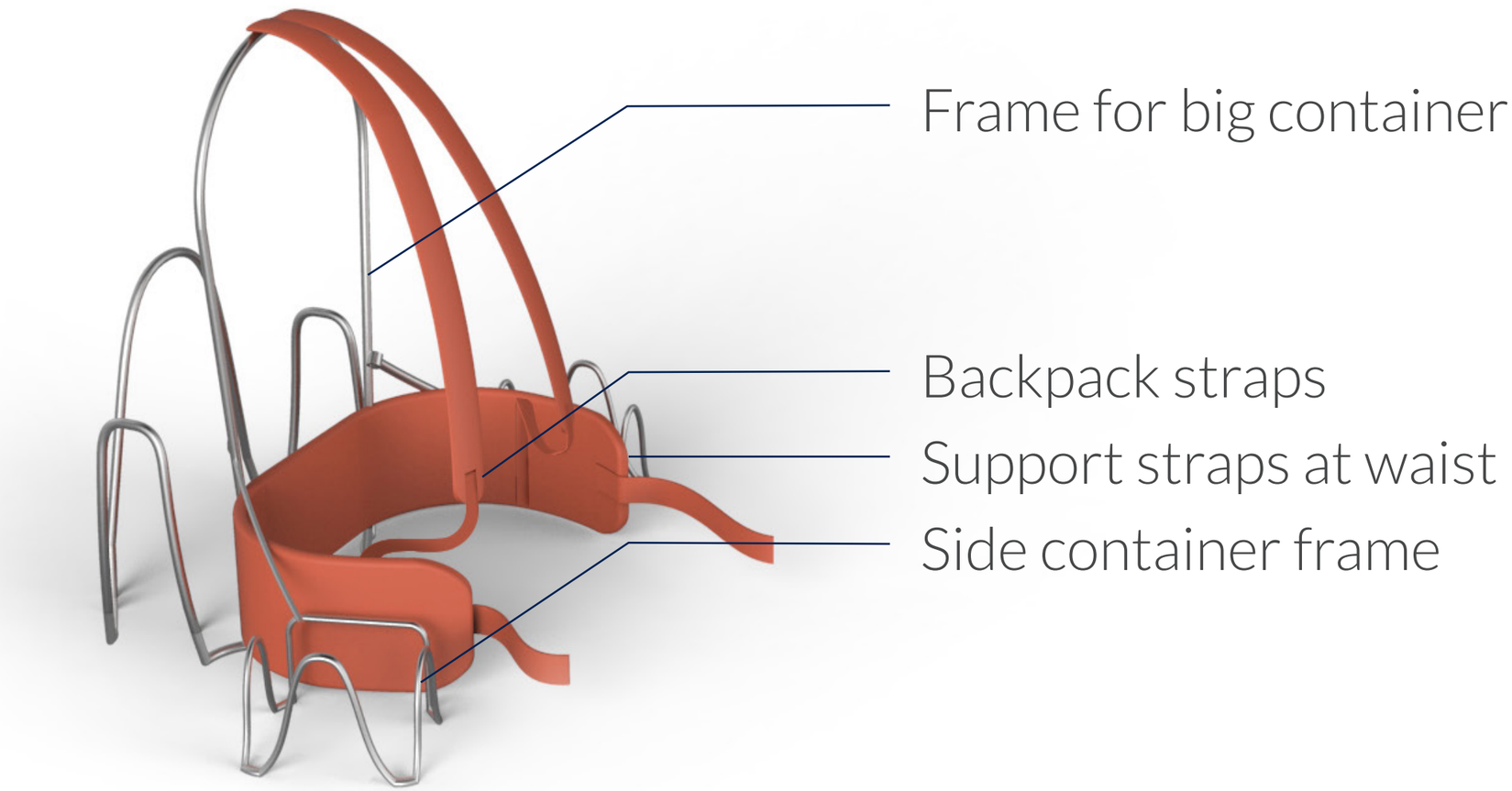

Inferences

- The dupatta should be made more hassle free, and secured properly
- A provision to carry the sieve and rope must be available or must be incorporated
- Bigger mouth of the jerry can is necessary for easier pouring of water
- The side containers must be lifted easily in one step
- The bag when put down should be stable.
- Reduction in material
- Container must not wear off soon

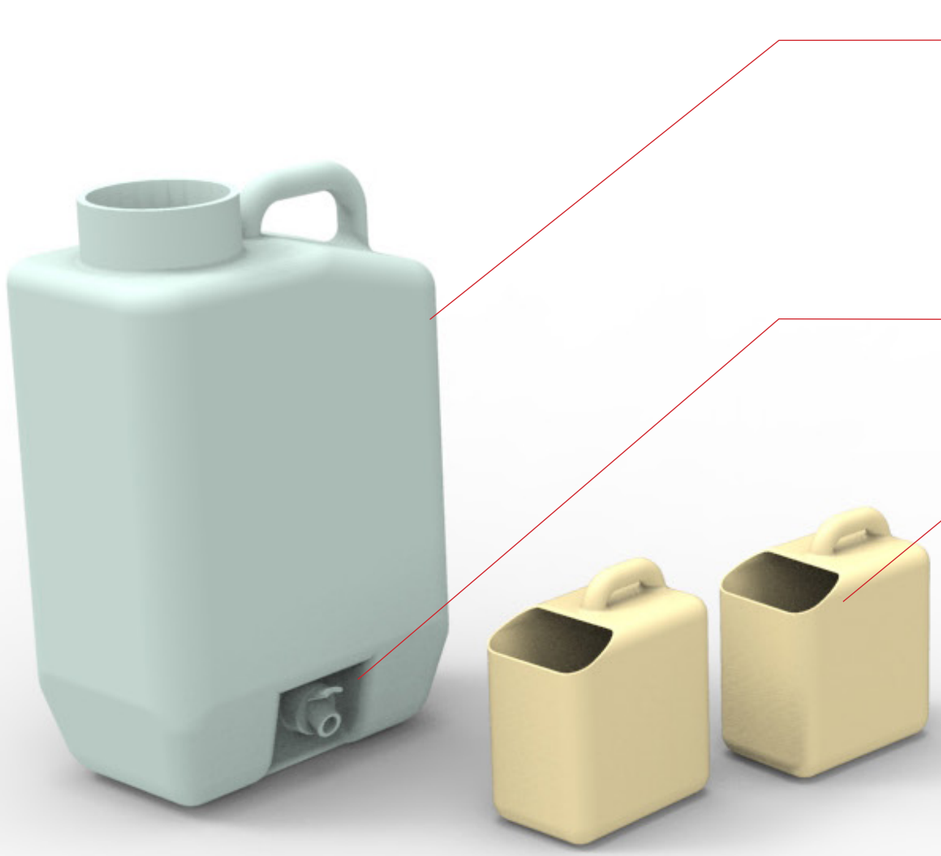
Refined concept



Full frame with support straps



Containers

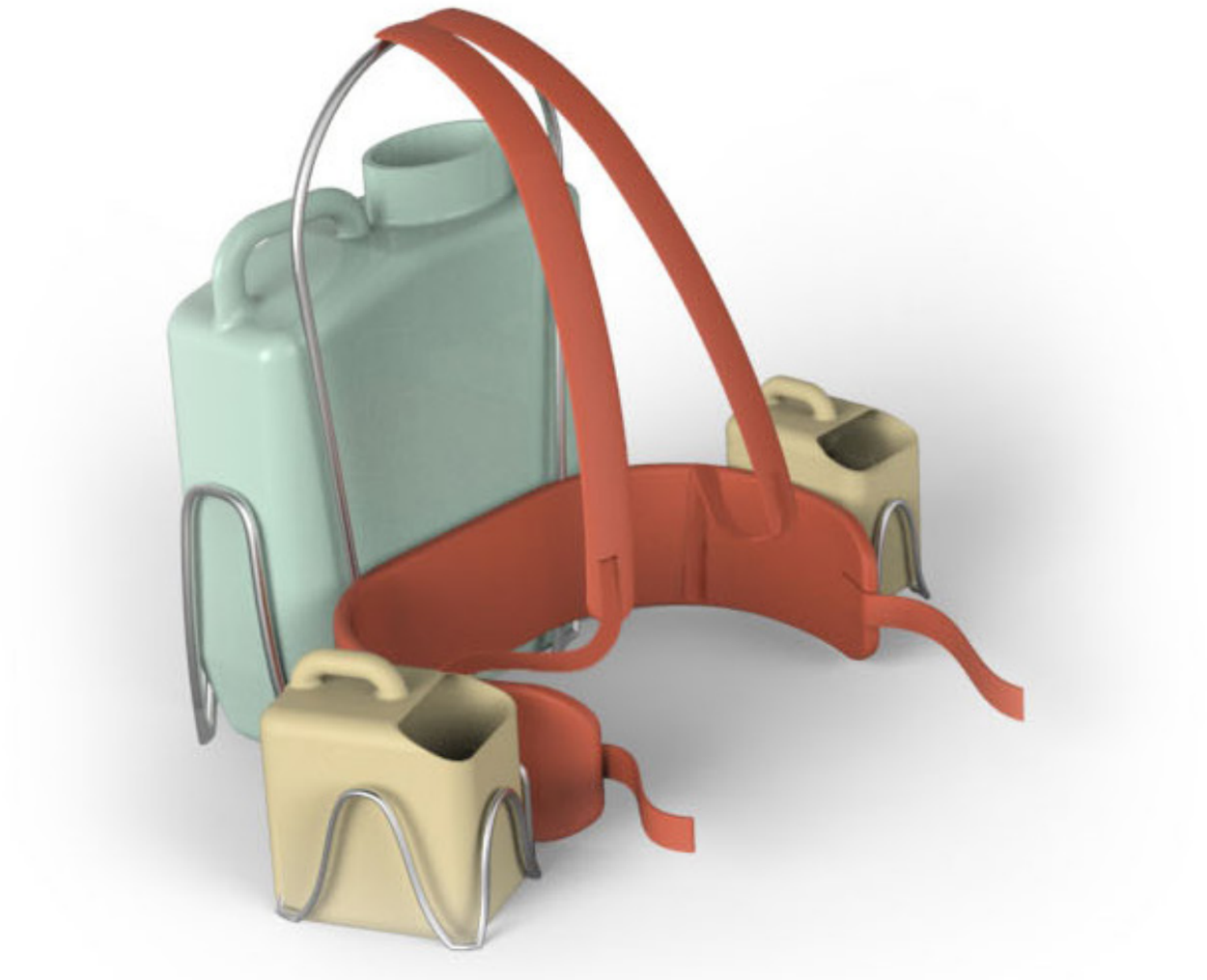


Big container: 12 litres

Tap

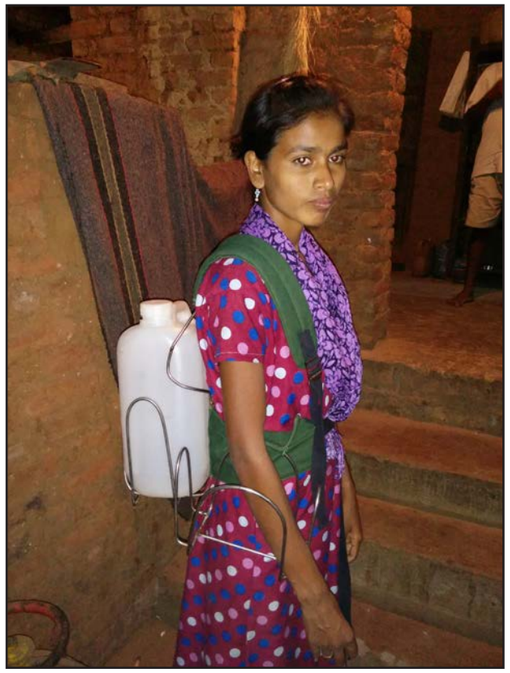
Small container: 5 litres

Full render



Prototyping

User evaluation





User Evaluation results

- Loading is easy as the steps are reduced
- Users found it more comfortable for walking up slope.
- Users felt like they could look down, and even turn behind if needed very easily
- Unloading is the back container is slightly problematic as it feels like the container will fall off

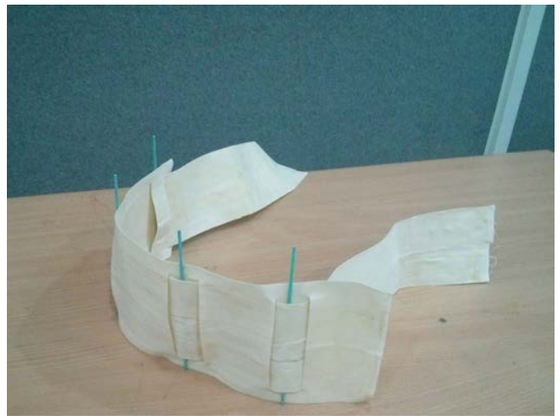
- Jerrycan with tap is was considered a good option.
- One metal member touching the body causes pain over time
- Volume of water is good, but they think they can carry more.
- The frame harness size was too big

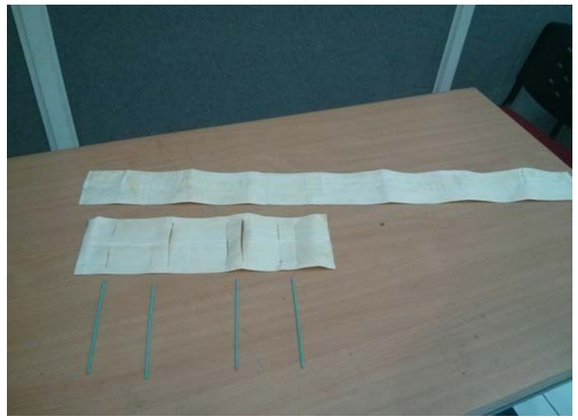
- Harness may need to be cleaned as the area around the well may be muddy during rainy season.
- The cap of the small jerrycan may get lost.

Comparative study

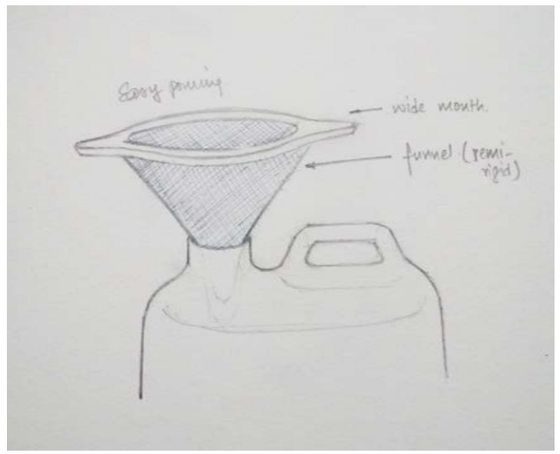
	Existing method	Proposed method
Volume of water	20 litres approx.	20 litres
Terrains	Difficult to use over hilly, rough terrain	Can be used over different terrain
Weight	2 Kg	1.8 Kg
Usability	Loading the matkas onto the head is difficult	Loading, and walking is easy
Ergonomic considerations	Causes strain on neck muscles	Reduces strain on neck muscles
Maintainability	Repair-work is difficult	Repair-work is easy
Cleaning	Cleaning the matkas is simple with hand	Cleaning the jerrycans is difficult due to smaller mouth

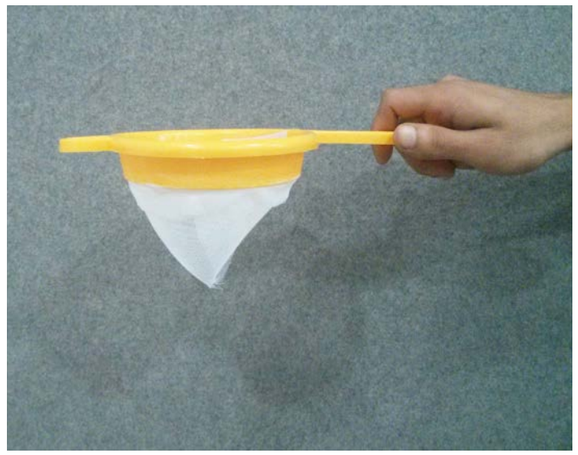
Recommendations



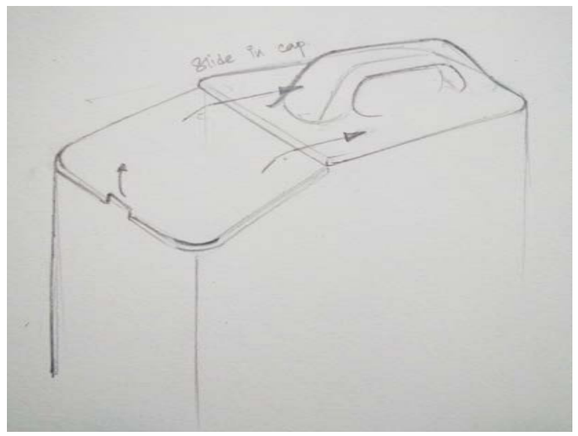


Removable harness for cleaning





Funnel like sieve for small mouth



Slider cap for small jerrycan

System level intervention

- Increase awraeness about postural problems
- Campaign about the harmful affects of load carrying for pregnant women
- Install a platform like addition along the wall of the well. This can be done by cementing bricks to the wall of the well.
- It will give the women a platform to keep their things on.

References

Image sources:

1. Fig 1: https://mozes42.files.wordpress.com/2009/12/picture-009.jpg as on 19-08-2014
2. Fig 2: http://oregonstate.edu/terra/wp-content/uploads/2013/05/Woman-wWaterCan.jpg as on 19-08-2014
3. Fig 3: farm3.static.flickr.com/2428/3696799330_045d647110.jpg as on 19-08-2014
4. Fig 4: habitat.corp.ebay.com/wp-content/uploads/2014/04/well-3.jpg as on 19-08-2014
5. Fig 5: news.bahai.org/sites/news.bahai.org/files/imagecache/bwns_imagewidget/sites/news.bahai.org/files/images/bwns_4844-0.jpg as on 19-08-2014
6. Fig 6: http://www.arthaplatform.com/news/286/can-indias-women/ as on 19-08-2014
7. Fig 7: http://www.theguardian.com/global-development/poverty-matters/2013/dec/29/waterwheel-burden-women-water-container as on 19-08-2014
8. Fig 8: http://dzinetrip.com/wp-content/uploads/2013/11/water-carrying-backpacks-pack-h2o-02.jpg as on 03-11-2014
9. Fig 9: http://www.carryology.com/insights/carry-culture/load-carrier-for-labour/ as on 20-08-2014

Thank you