Project II

NEXT GENERATION WASHERS

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DECLARATION

I declare that this written report represents my own idea in my own words, and where others, ideas or words have been included, I have mentioned 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 or source in my submission.

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

Name - Minal Agarwal

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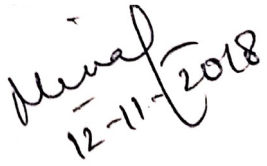
Date - 09-11-2018

Sign - 

APPROVAL SHEET

The project titled as "Next Generation Washers" by Minal Agarwal is approved in partial fulfillment of the requirement for the degree of "Master of Design" in Industrial Design.

Guide -

Chairman -

Internal Examiner -

External Examiner -

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Appreciation to all other PD faculty members for their valuable suggestions and feedbacks on the project. I am also thankful to my friends and colleagues, for their support and valuable inputs.

At last but not least I am grateful to my family, who have supported me throughout.

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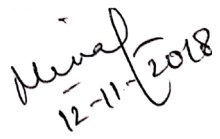
Sign - 

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ABSTRACT

Today,a washing machine is one of the most important appliances in a household. It gives us a complete comfort of washing clothes. It has helped us make more time for ourselves and our close ones. The process of washing which used to be an elaborate process has been reduced to just a few presses of buttons.

The project is an elaborate take on the design of washers which will fit into the lifestyle of a family, 5 years down the line. The process included a detailed understanding of the scenarios of the future, understanding the user needs and requirements.

The design process not only covers the function and usability but also a detailed understanding of form and how the form will fit into the interiors of an urban house.

1. INTRODUCTION

1.1 Introduction

The washing machine of today has made our life easier but the design has remained constant to an extent over a large period of time. The project began with understanding the history, working of the washing machine and trends of the market, which was followed by reading about the future technologies and patterns of living.

1.2 History of Washing Machines

History of washing machines goes back in time, it began with wooden drums with agitators which were operated with hands.

Figure 1 to Figure 11 show the development in the design of washing machines.

Figure 1 http://www.oldandinteresting.com/history-washing-machines.aspx

Jacob Christian Schäffer 1767

Hand operated (no motor)
Wooden drum
Vertical axis rotating
Simulator
Stagnant drum

Figure 2 https://www.britishmuseum.org/research/collection_online/collection_object_details.

Henry Sidgier, 1782

Hand operated
Rotating drum
Horizontal axis

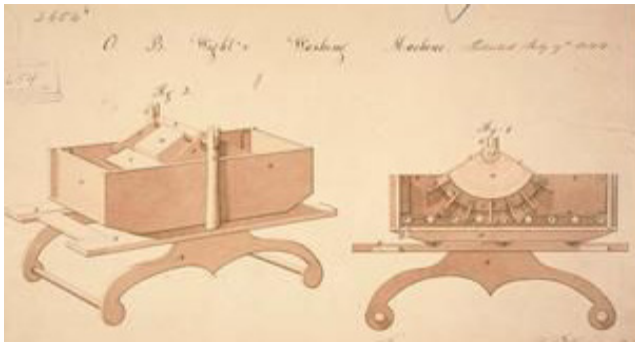


Figure 3 https://en.wikipedia.org/wiki/File:WashingMachinePatent1844.jpg

Nathaniel Briggs, 1797

Hand operated
Vertical axis
Washing and wringing

Figure 4

Richard Lansdale, 1862 London Exhibition

Hand operated
Rotating drum
Vertical axis
Washing and wringing

Figure 5

First Electric Washing Machine, 1908(Thor)

Electrically operated
Used drive Belts
Tumble wash
Two Direction
8 revolutions per minute
Single Motor

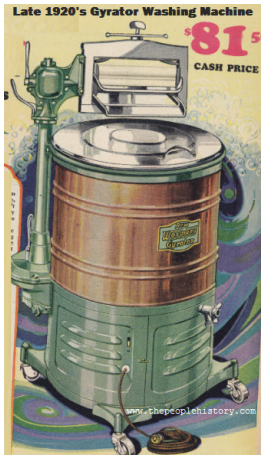


Figure 6

Gyrator Washing Machine,1920s

No centre post
Rotating drum
Vertical axis
Easy to move
Wringing

Figure 7

Bendix Automatic Washing Machine, 1937

Electrically operated
Fully automatic
Damp Dry
Front Loading

Figure 8

General Electric Top Loading Washing Machine, 1947

Five different push buttons to adjust water temperature, spin speed and agitation speed

Figure 9

Maytag washer, 1976

Electrically operated
Micro-controllers for timing process

Figure 10

Fisher and Paykel, smart drive Washer, 1998

Computer controlled system, To determine factor such as load size and automatically adjust to wash cycle,self diagnosis of a fault

Figure 11

James Dyson CR01, 2000

Fully automatic
Double drum rotating opposite to each other

Reading and observing the history of Washing Machines helped me in mapping the developments that have happened in the design since it originated. This further helped in forecasting the new developments that may occur in the next generation of washing machines.

1.3 Working of Washing Machine

A Front loading Fully Automatic washing Machine

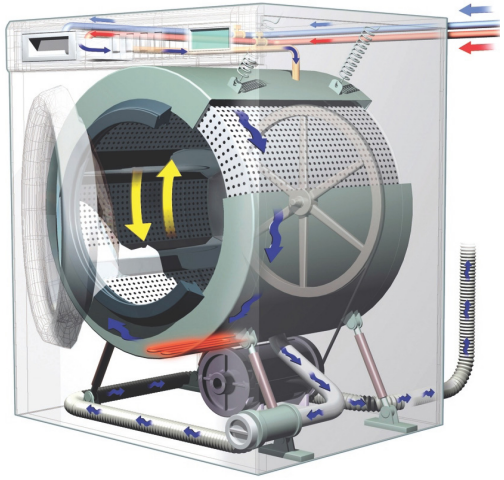


Figure 12

1. There's a fixed outer drum (blue) and a rotating inner drum (red) with small holes around its edge. The drums are mounted on a horizontal axis.

2. The inner drum is held to the frame of the machine by heavy-duty springs.

That's because, when the clothes spin, they can make the drum shake violently; the springs help to absorb the vibrations.

3. Hot and cold water enter through the detergent tray at the top.

4. The inner drum turns back and forth. The plastic paddles on the inside (shown here by grey triangles) help to slosh the clothes through the detergent and water held by the outer drum.

5. An electric motor turns the inner drum, typically using a long rubber belt (yellow).

6. A heating element heats the water as necessary.

7. When the wash cycle is finished, the pump sucks the water away. The water empties down a tube to the drain.
Figure 12 shows the internal mechanism of a front loading washing machine.

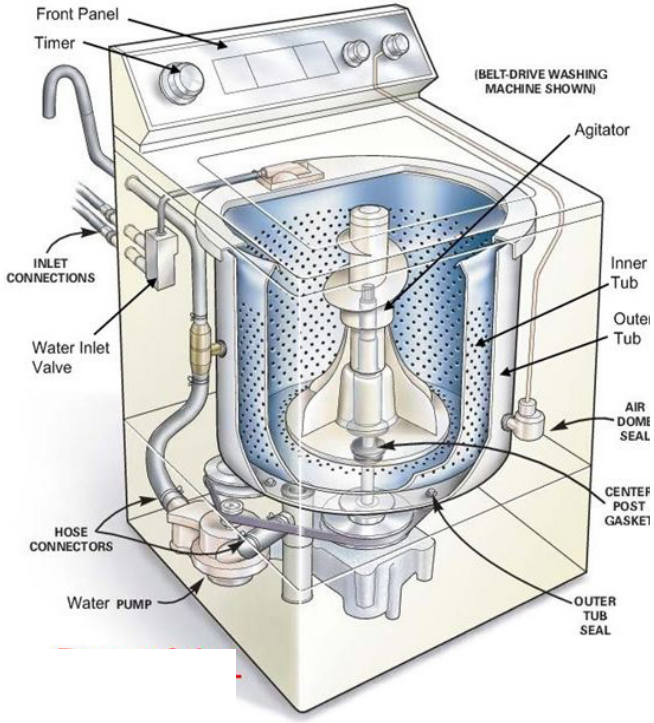


Figure 13

Top loading Fully Automatic Washing Machine

1. Lift the lid on top and drop your clothes in from above.

2. Just like in a front-loading machine, there's an outer drum (blue) and an inner drum with holes in it (red), but they're mounted about a vertical axis.

3. Hot and cold water enter through pipes near the top, passing through the detergent tray and flushing the detergent into the machine.

4. During the wash cycle, a large plastic agitator (green) turns around, moving your clothes through the water. Both drums remain stationary.

5. The agitator is powered by an electric motor using a rubber belt. During the spin cycle, the same electric motor turns the inner drum (red) at high speed, throwing water through its holes into the outer drum.

6. When the wash is finished, the pump drains the water from the outer drum.

Figure 13 shows the internal mechanism of a top loading washing machine.

2. STUDY AND RESEARCH

2.1 MIND MAPS

The process began with a study of the future forecasts in the area of technology and environment. Technologies in the field of clothes, Homes, Transport and manufacturing was studied. The major changes which shall occur in few years were noted down.

Diagram 1 depicts the mind map of how technology will affect the clothes, homes , transport and manufacturing in the future.
Diagram 2 represents the environmental affects over the future.

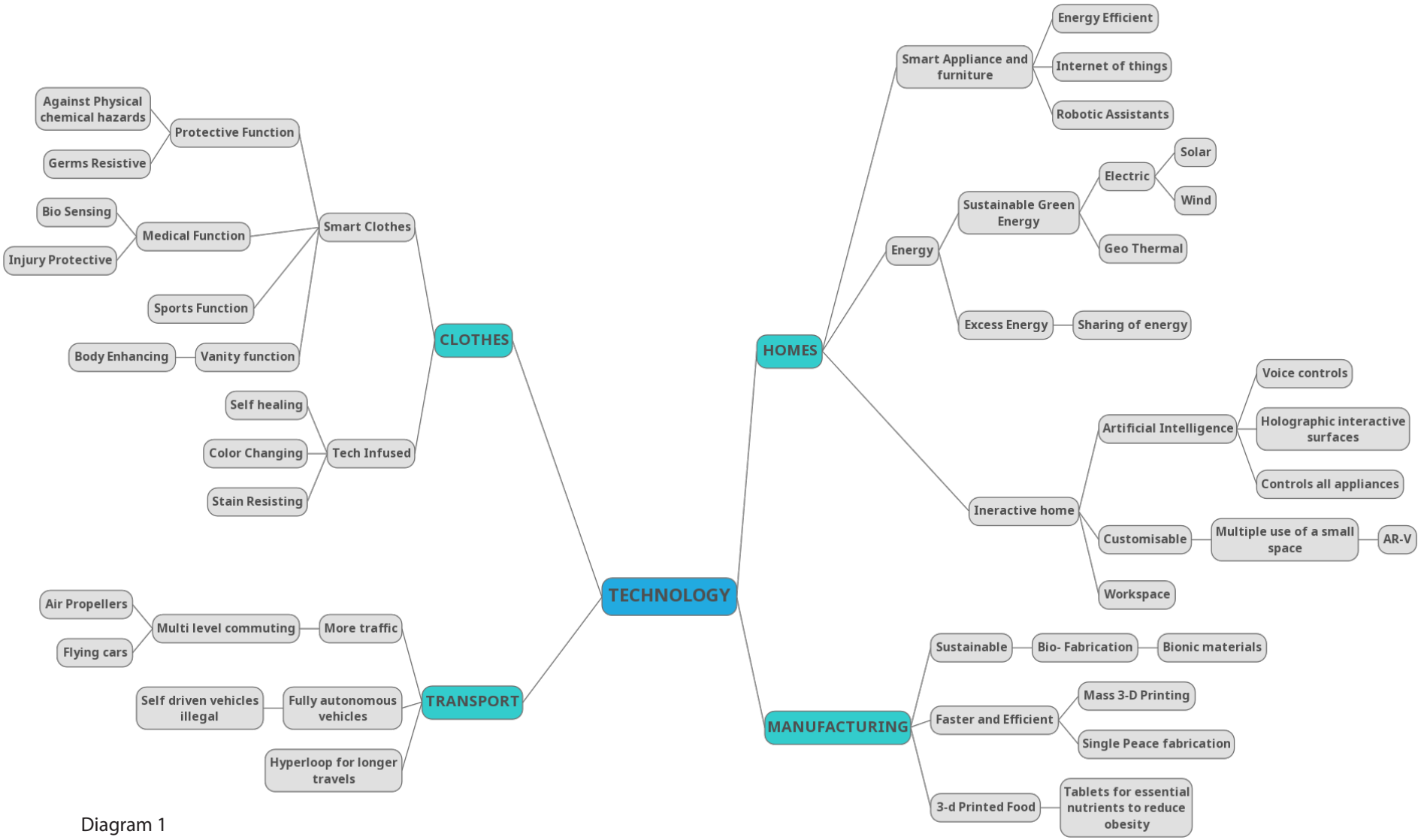


Diagram 1

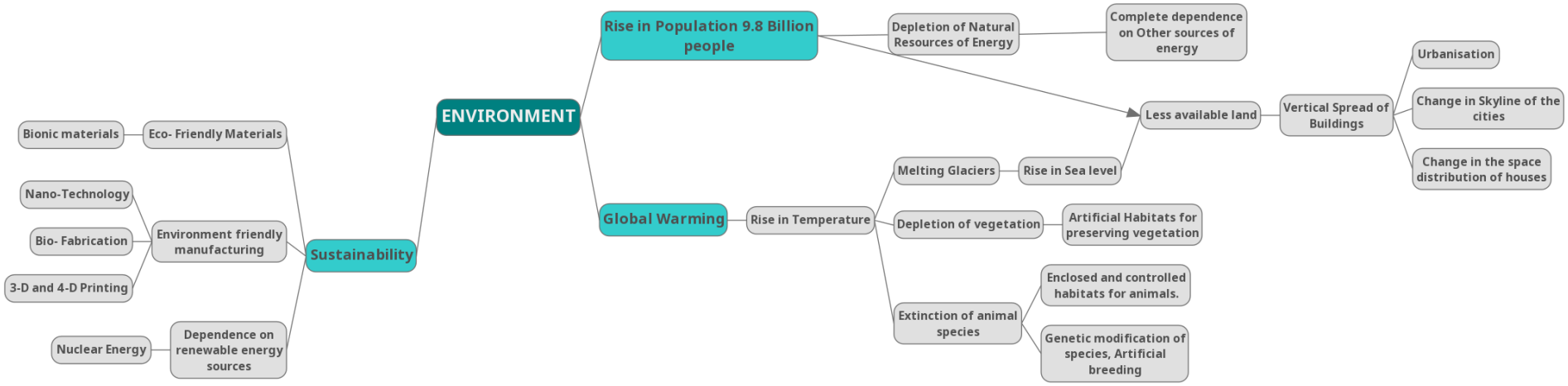


Diagram 2

These helped in setting up scenarios of the future, re-imagining the cities, houses, lifestyle and clothes of people.

The environmental factors were also taken into consideration. **Diagram 3** is a graph representing the growth in technology till 2050.

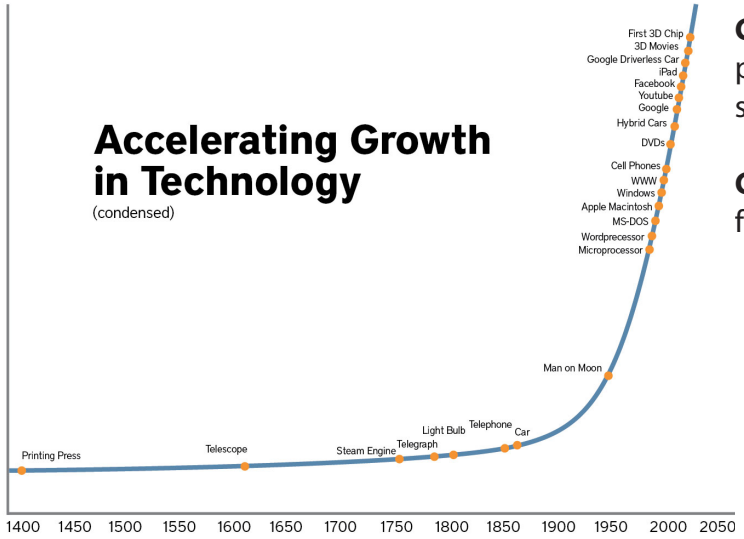
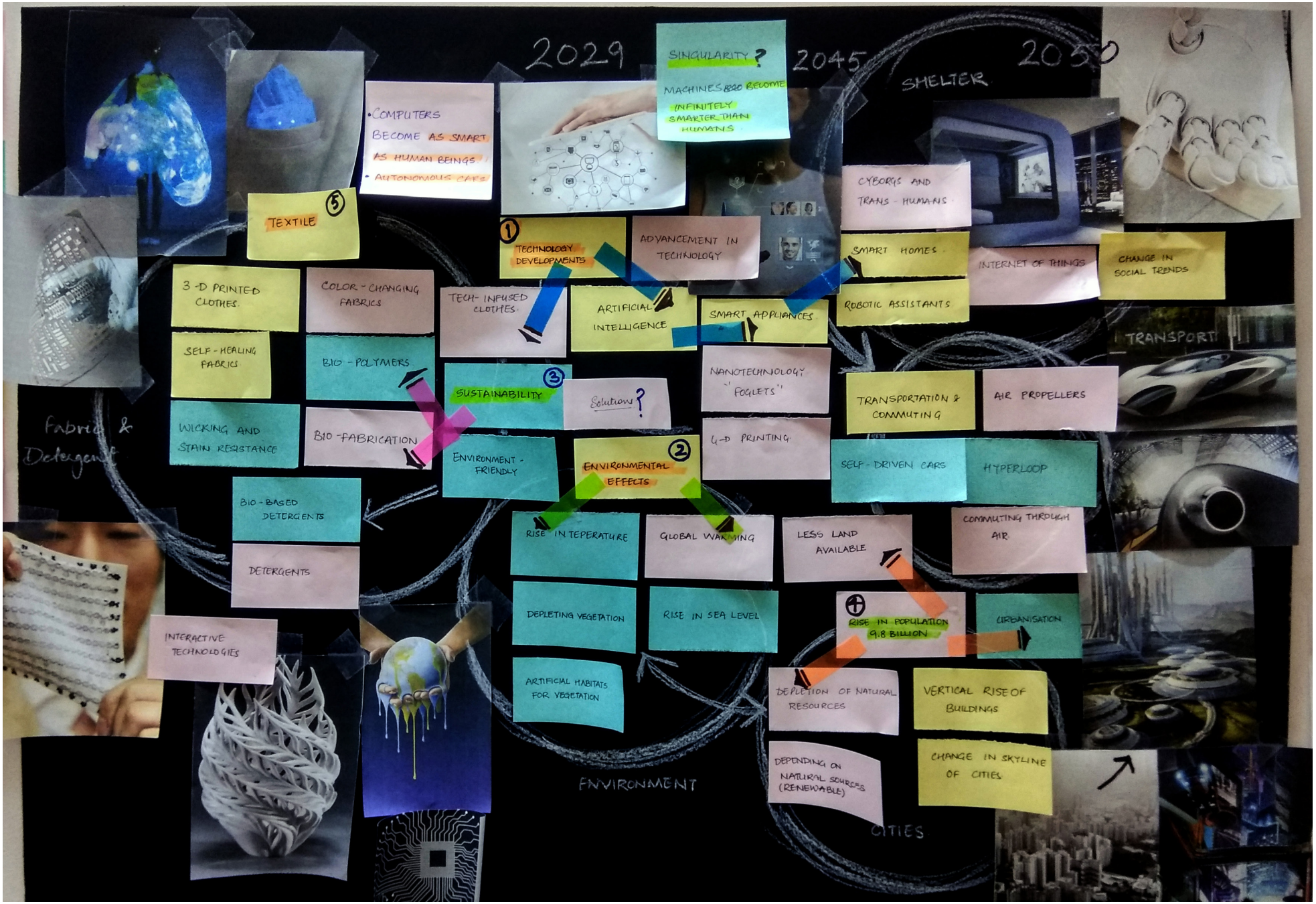


Table Reference : 'Singularity is near' by Ray Kurzweil
Diagram 3

Collage 1 shows a mind map which plots all the parameters that shall occur and will affect future scenarios.

Collage 2 collection of images representing future to form a visual language.


2029
SINGULARITY ?
MACHINES MAY BECOME INFINITELY SMARTER THAN HUMANS
2045
SHELTER
2050
COMPUTERS BECOME AS SMART AS HUMAN BEINGS
AUTONOMOUS CARS
TEXTILE
5
1
TECHNOLOGY DEVELOPMENTS
ADVANCEMENT IN TECHNOLOGY
CYBORGS AND TRANS - HUMANS
SMART HOMES
INTERNET OF THINGS
CHANGE IN SOCIAL TRENDS
ROBOTIC ASSISTANTS
3 -D PRINTED CLOTHES
COLOR - CHANGING FABRICS
TECH- INFUSED CLOTHES
ARTIFICIAL INTELLIGENCE
SMART APPLIANCES
TRANSPORT
SELF - HEALING FABRICS
BIO - POLYMERS
3
SUSTAINABILITY
Solutions ?
NANOTECHNOLOGY "FOGLETS"
TRANSPORTATION & COMMUTING
AIR PROPELLERS
WICKING AND STAIN RESISTANCE
BIO - FABRICATION
ENVIRONMENT - FRIENDLY
2
ENVIRONMENTAL EFFECTS
4-D PRINTING
SELF - DRIVEN CARS
HYPERLOOP
BIO - BASED DETERGENTS
DETERGENTS
RISE IN TEPERATURE
GLOBAL WARMING
LESS LAND AVAILABLE
COMMUTING THROUGH AIR
INTERACTIVE TECHNOLOGIES
DEPLETING VEGETATION
RISE IN SEA LEVEL
RISE IN POPULATION 9.8 BILLION
URBANISATION
ARTIFICIAL HABITATS FOR VEGETATION
DEPLETION OF NATURAL RESOURCES
VERTICAL RISE OF BUILDINGS
DEPENDING ON NATURAL SOURCES (RENEWABLE)
CHANGE IN SKYLINE OF CITIES
ENVIRONMENT
CITIES

Collage 1


Speed
Nanotechnology
Smart Fabric
Artificial Intelligence
Connect
Sustainability
Smart Living

Collage 2

2.2 FUTURE TECHNOLOGIES

Manufacturing

Nano- Materials
Bio Polymers
Bio Fabrication
Digital Fabrication
Advanced Robotics
4-D Printing
Figure 14 shows a 4-D material which performs certain functions

Technology

Internet of things
Artificial Intelligence
Robotic Assistants
Cyborgs
Neural Lace
Full dependence on Renewable sources of energy
Figure 15 is a representation of technology

Fabric

Tech Infused
Self Healing
Decomposable
Colour Changing
Customisable
Longer life
Smart clothes
Medical Functions
Protective Functions
Sports Functions
Vanity Function

Figure 16 shows the wastage of clothes in today's scenario
Figure 17 is an image of 3-D printed clothes

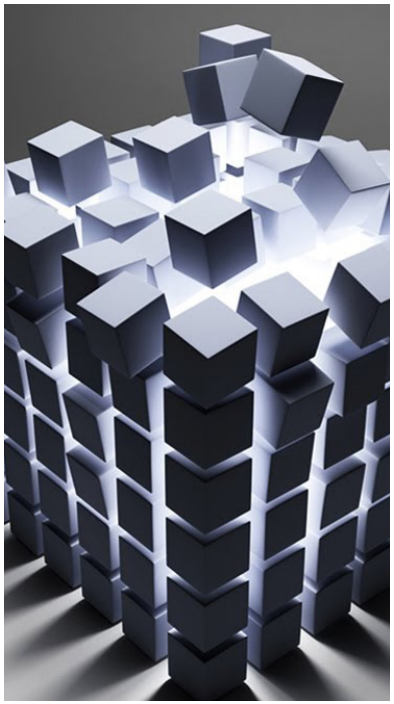


Figure 14

Figure 15

Figure 16

Figure 17

Future Cities

The next step also included visualising the future of cities, it helped in comprehending the future, understanding the design language that shall be relevant.

Cities were imagined with a vertical spread and more connectivity, flying cars, hyper-loop and much more.
Figure 18 to Figure 20 illustrations were my vision of future cities.

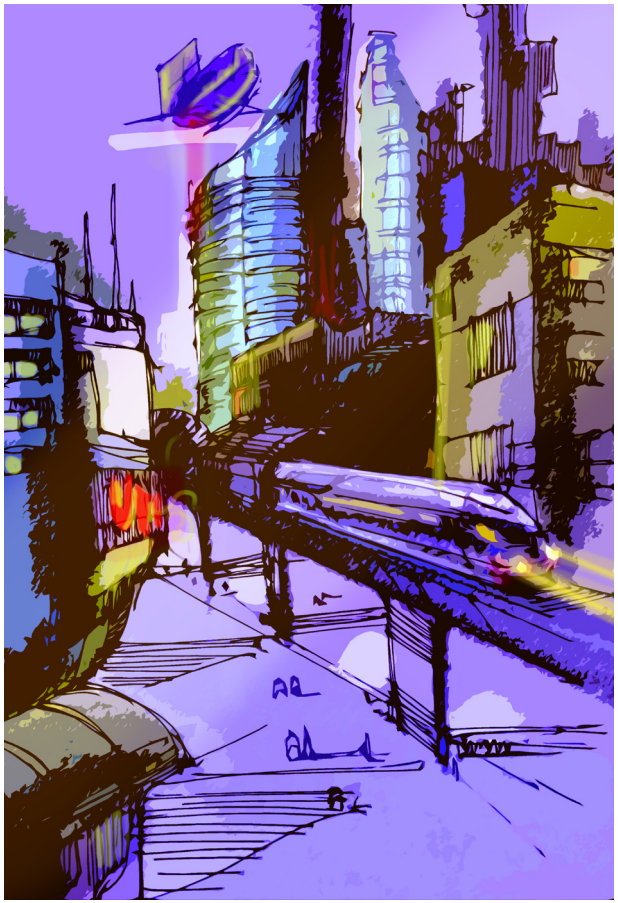


Figure 18

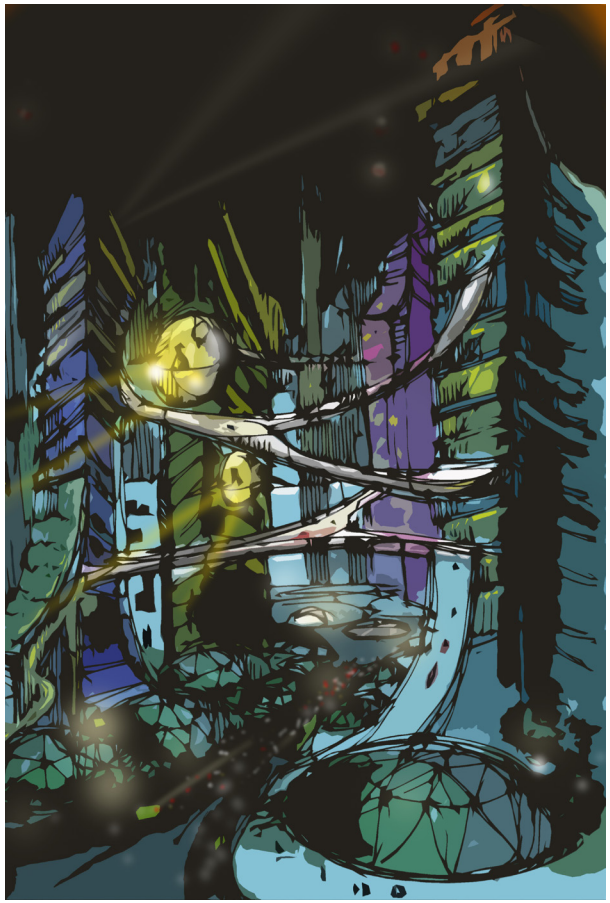


Figure 19

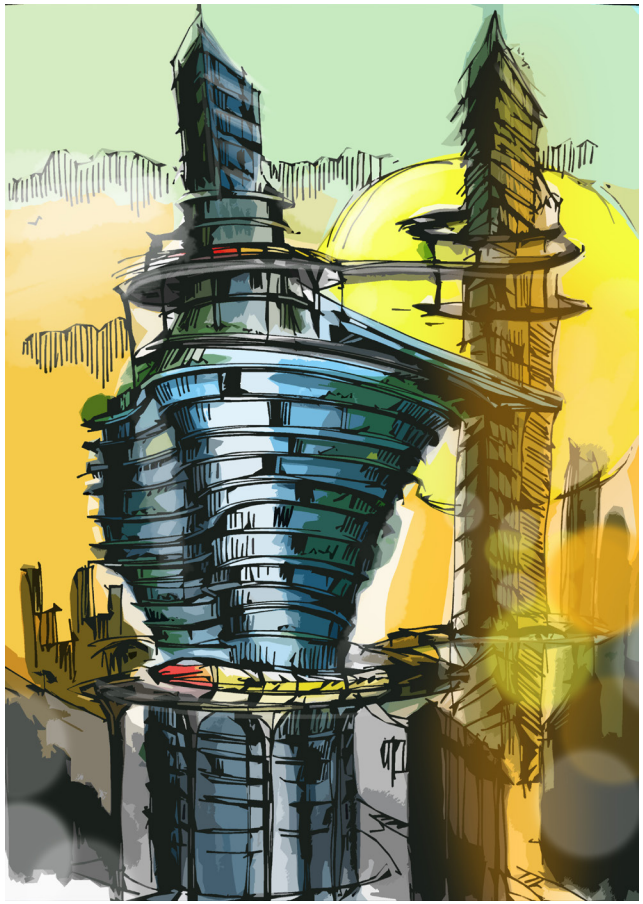


Figure 20

2.3 CURRENT CONTEXT

Primary user and Secondary user

The primary users are the family members generally the adults of the family. The children are generally supposed to not use the machine. In some households, the housemaids operate the machine. The secondary users are the people for maintenance and repair of the washer.

Location of the washer in the house

In most Indian houses, the washers are kept in the toilets(bathrooms), since washing machines require constant inlet and outlet of water. In some cases the washers were also kept in open courtyard like spaces with water supply.
Figure 21 shows the location of a washing machine in a bathroom.

Frequency of usage

The frequency of usage varies according to the number of people in a family, the occupation and time spent in the house.

It might vary from everyday to once in a week (on the weekend).

Load

The load capacity of washing machines varies from 5kg to 12kg.
Table 1 showing the drum size and the number of clothes, household where it shall be used.

Figure 21

Drum Size	T Shirts	Number of Bulky Items	Household
5 kg	25	Sheets and Towels	Individual or Couple
6 kg	30	Single Duvet	Couple
7 kg	35	Double Duvet	Small Family
8 kg	40	Queen or Light King Size Duvet	Medium Family
9 kg	45	Medium King Size Duvet	Large Family
10 kg	50	Heavy King Size Duvet	Large Family
11 kg	55	Heavy King Size Duvet	Very Large Family
12 kg	60	Heavy King Size Duvet	Very Large Family

Table 1

2.4 CURRENT PROBLEMS

Loading and unloading in a front loading washer

Loading and unloading clothes in a front loading washer requires to bend and sit on the floor, since the position of the door is very low. It is nearly tough for people suffering from back-pain or Arthritis to carry out the action. At the same time front loading washers provide a better washing comparison to top loading washers.
Figure 22 shows the posture while loading clothes in a front loading washer.
Figure 23 machine placed over a raised platform

Figure 22

The need of the washing machine to be near a water supply and drainage

The washing machine requires to be kept near a constant water supply hence restricting its place of use and also restricts its usability.

Figure 23

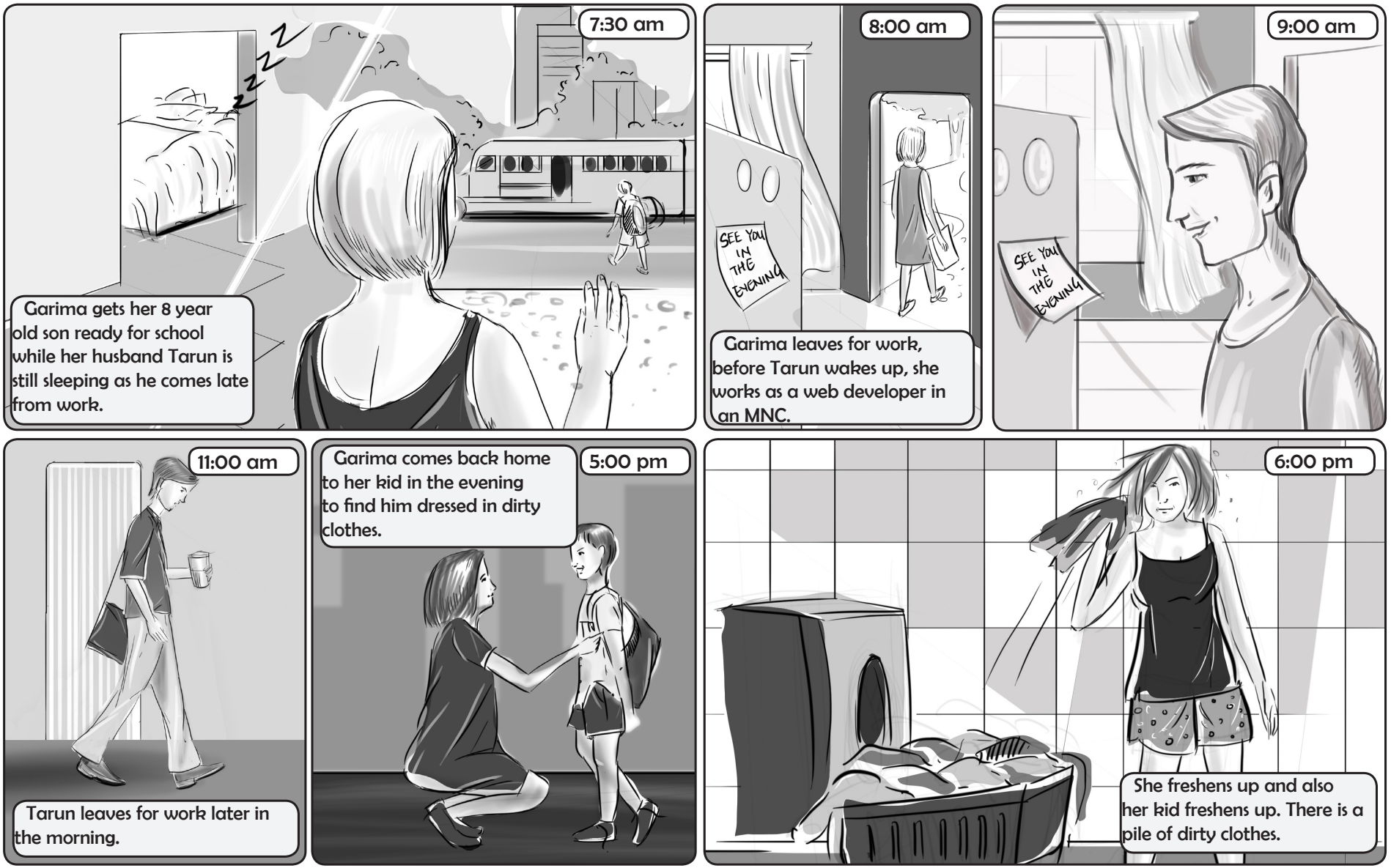
Not all clothes can be washed together

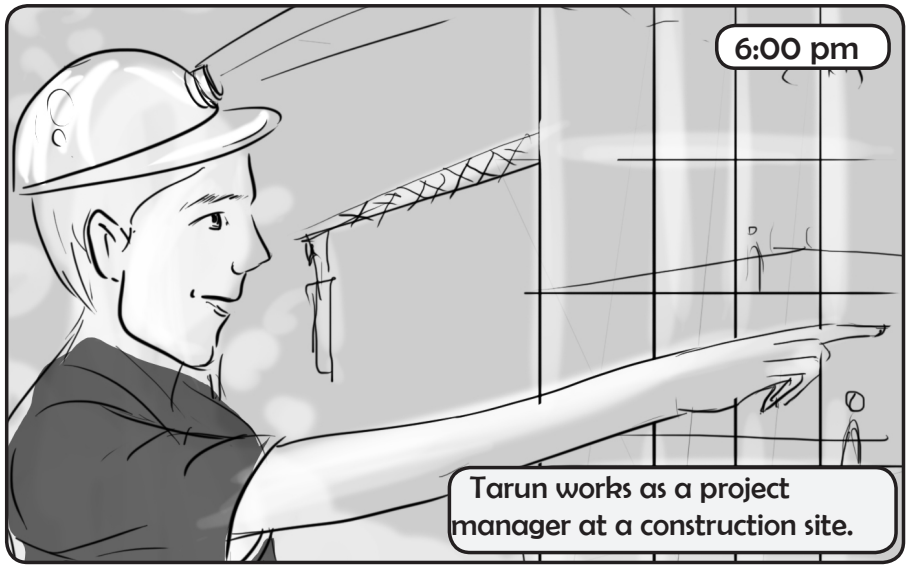
In a family, there is a huge load of clothes and they are not equally dirty and don't have similar properties. The users tend to clean the whites, light colour and delicate fabrics separately. There are also a different set of clothes which are more soiled which cannot be washed along with the whole load.

Excessive use of water

Doing laundry in a washing machine requires a drastic amount of water.

2.5 SCENARIOS OF THE FUTURE 2025





This couple looks for an alternative for washing their clothes more efficiently without wasting much time of their lives.

The Attributes of future scenarios

Lack of family time

People will be busy working and earning livelihood that they will not have time to spend with their near ones. They would want to save time by reducing the time spent on daily household chores.

Individualistic living

People will be responsible for their own work, we shall move towards individualistic living. The work might be carried out by the individual responsible for it. For example, People might do their own dishes and wash their own clothes even in a family.

Health Issues

Due to lack of time and busy schedules of people it will difficult for them to find time for fitness and a good lifestyle. Physical fitness issues shall be more common. Problems like backaches and joint aches might become even more common due unhealthy lifestyles.

Customised lifestyle

All devices shall be connected to each other and could be controlled by ones mobile phone. This shall give one the freedom to customise all of their devices according to their respective choices and tastes. The people will have customised houses, cars.

Lack of connection between a family

The family members will spend less time together, or only interact through digital mediums.

2.6 MARKET MAPPING

A market study was carried out to understand the current products popular in the market. They were mapped on a matrix with Y- axis as time vs. X-axis as Fashion (**Diagram 3**).

The top right corner of the matrix was considered as the target segment. "Radical, Innovative, Distinct and Extreme" were used as keywords for the ideation since the product targets the market five years down the line.

Why front loading washers?

Front loading washers were chosen to be worked on, since they have a better efficiency and use lesser water as compared to top loading washing machines. They have a better scope to be more in use in the future.


Radical
Innovative
Current
Known
Old fashion
Traditional
Established
Actual
Distinct
Extreme

Diagram 3

3. IDEATION

3.1 DESIGN BRIEF

Design Statement

To design an innovative and convenient to use next generation washer which will not only be user friendly but also shall have a unique identity.

Users & target market segment

The primary users are the family members generally the adults of the family. The children do not are supposed to not use the machine. In some households, the housemaids operate the machine.

The secondary users are the people for maintenance and repair of the washer.

User requirement

Easy to use
Good quality of wash
Uses less water
Increasing the usability of the washer.
Adding unique identity
Quicker washes

Broad product specifications

User Friendly
Space saving
Latest technologies for washing
Unique identity

3.2 IMAGE BOARDS

Keywords were chosen to create image boards, which helped in ideating. The image boards provided inspiration for further formal explorations.

SLEEK : This keyword was defined by *smooth curves* and *glossy* finishes. The forms also have a *light* look and feel to it (**Figure 24**)

MINIMAL: It refers to least numbers of attributes in a form, but every attribute in the form has a considerable impact in the appearance. The finishes are also *smooth and subtle*. (**Figure 25**)

CLEAN : Simple forms and straighter lines. Sharp intersection of surfaces to compose a form(*clear edges*). Variation in finishes but yet kept subtle. (**Figure 26**)

RETRO: *Rounder and soft* forms are used. Intermixing of finishes,Like wood and metal together. (**Figure 27**)

Figure 24

Figure 25

Figure 26

Figure 27

3.3 INITIAL IDEATION

The initial set of ideations helped in getting design directions for further exploration. (**Figure 28**)

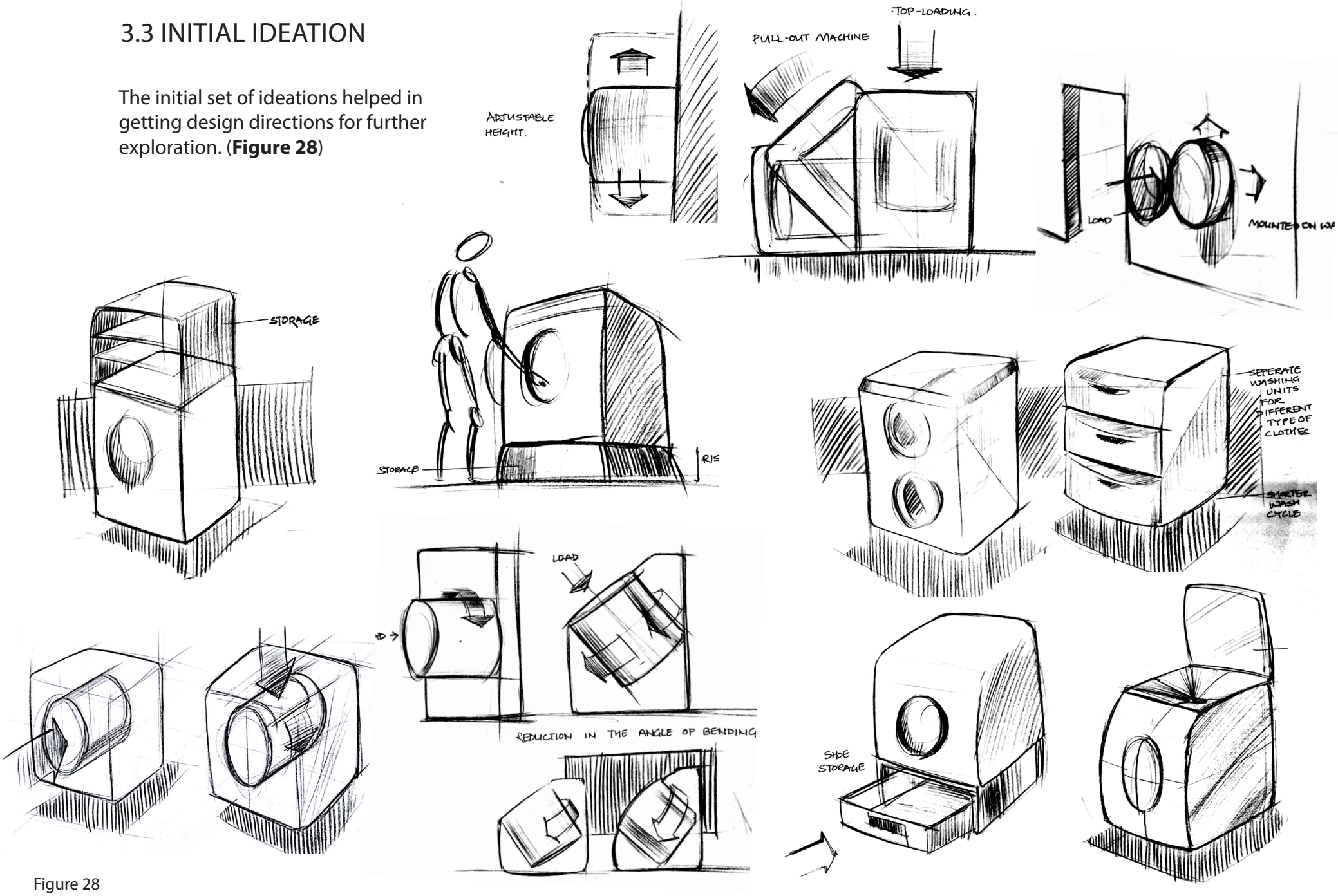


Figure 28

3.4 IDEATION SKETCHES

Figure 29 to Figure 46 are the sketches of the next stage of ideations.

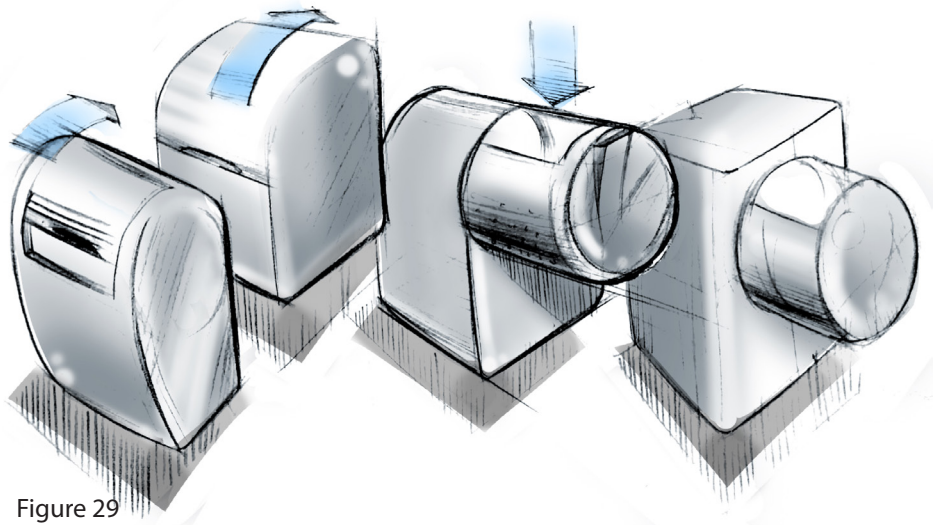


Figure 29
The sketches demonstrate the different methods of operation of the drum, (pulling out, different axis of rotation)

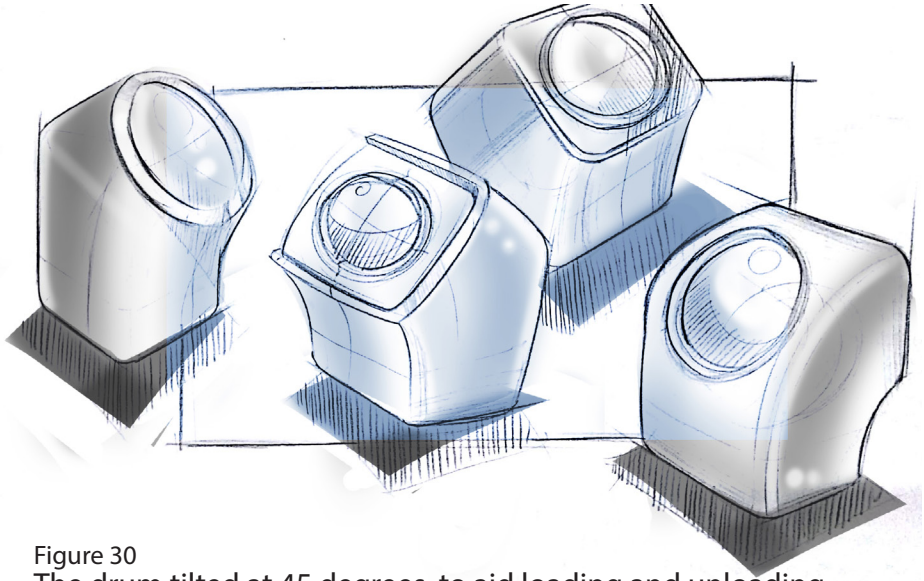


Figure 30
The drum tilted at 45 degrees, to aid loading and unloading, prevents bending and kneeling down while doing laundry.

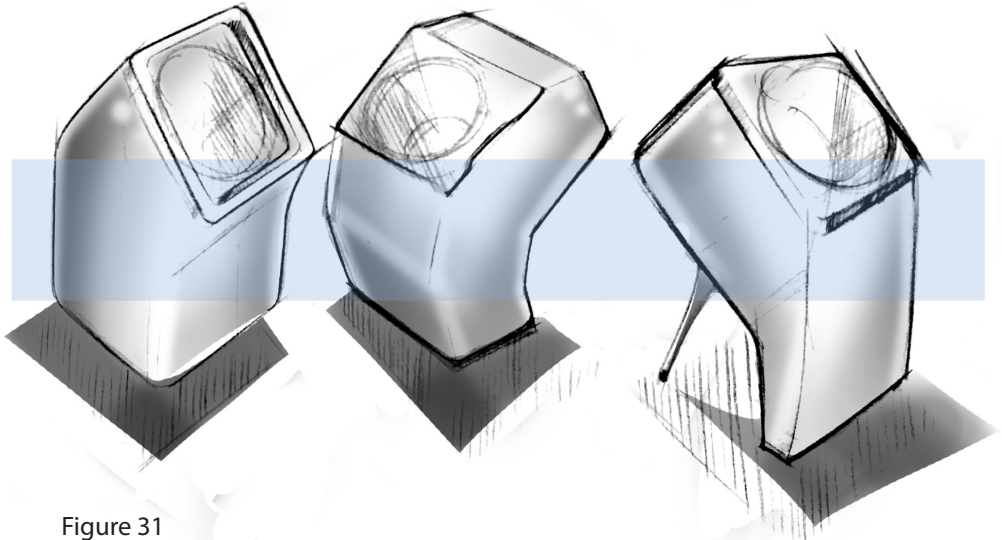


Figure 31
The drum tilted at 45 degrees, to aid loading and unloading, prevents bending and kneeling down while doing laundry.

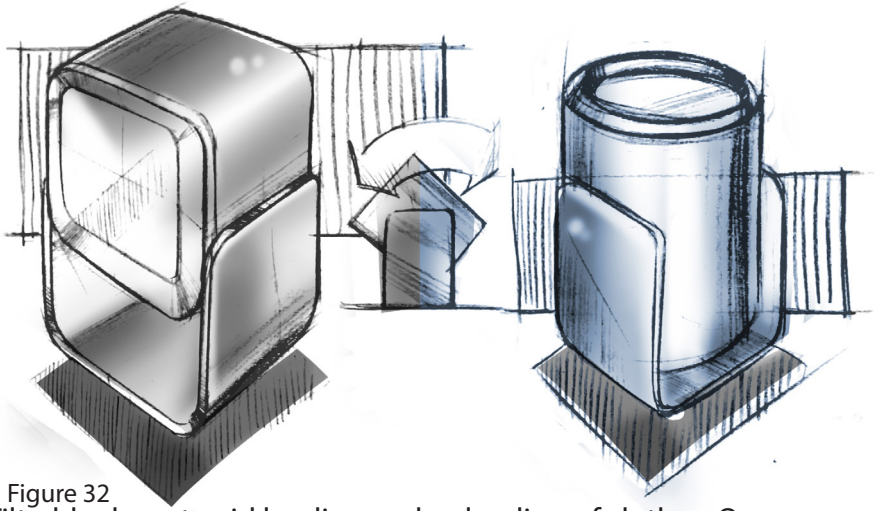


Figure 32
Tilt-able drum to aid loading and unloading of clothes. One can adjust the drum to their convenience.

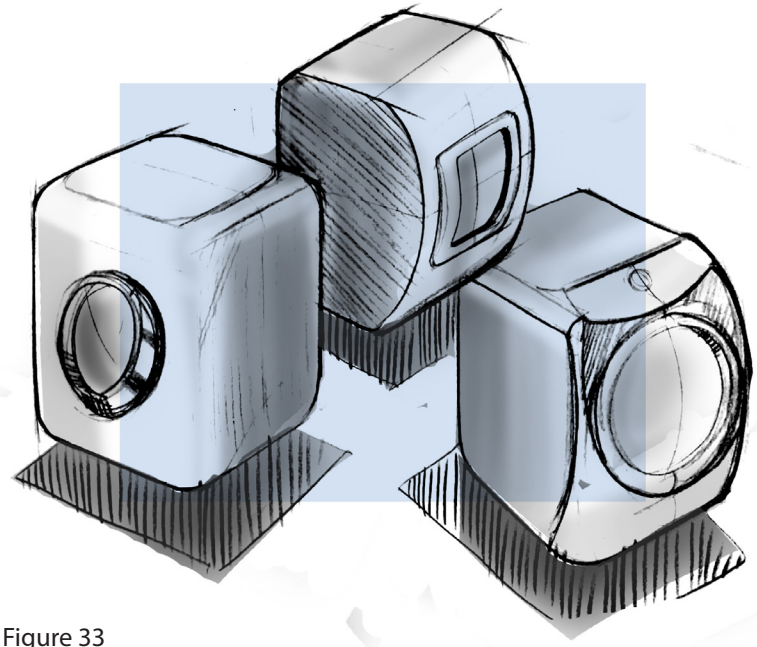


Figure 33
Sketches showing Soft and bulky form exploration.

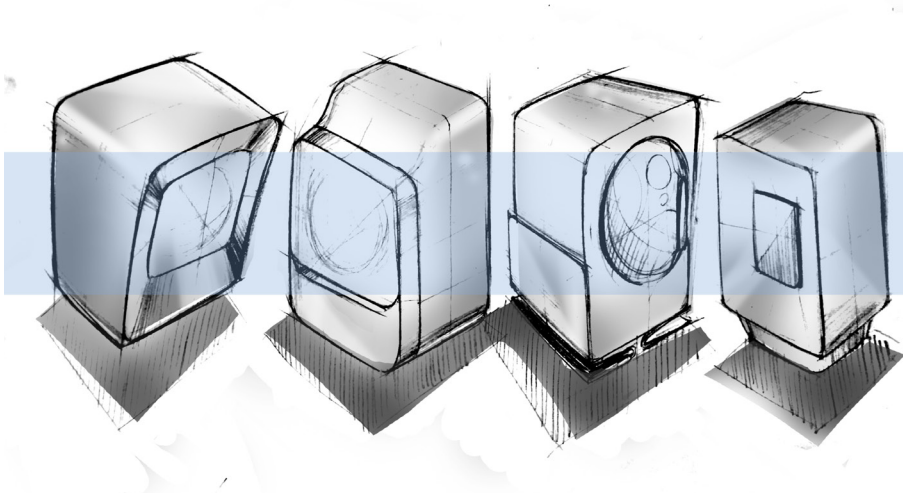


Figure 34
Examples of sleek and simple forms.

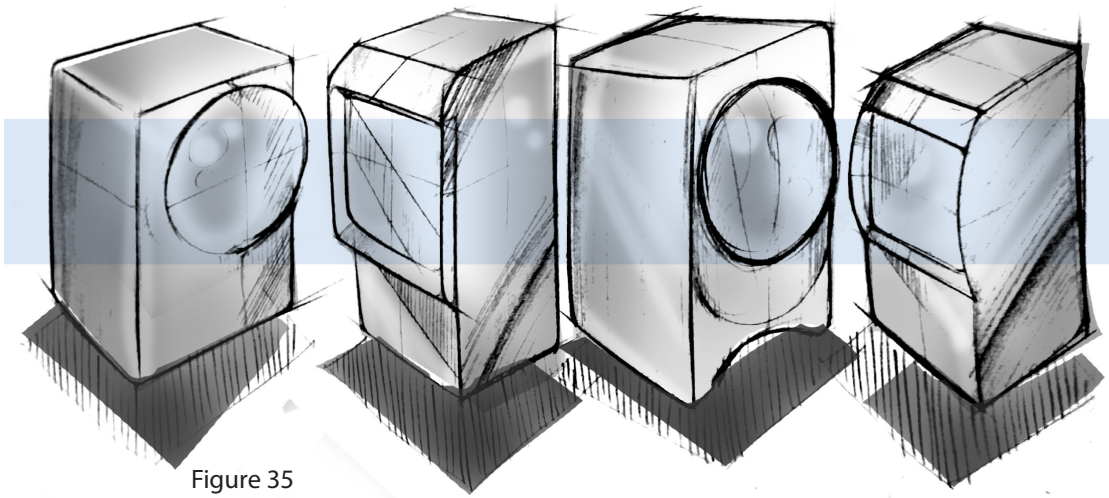


Figure 35
Boxy forms with minor variations near the area of interaction.

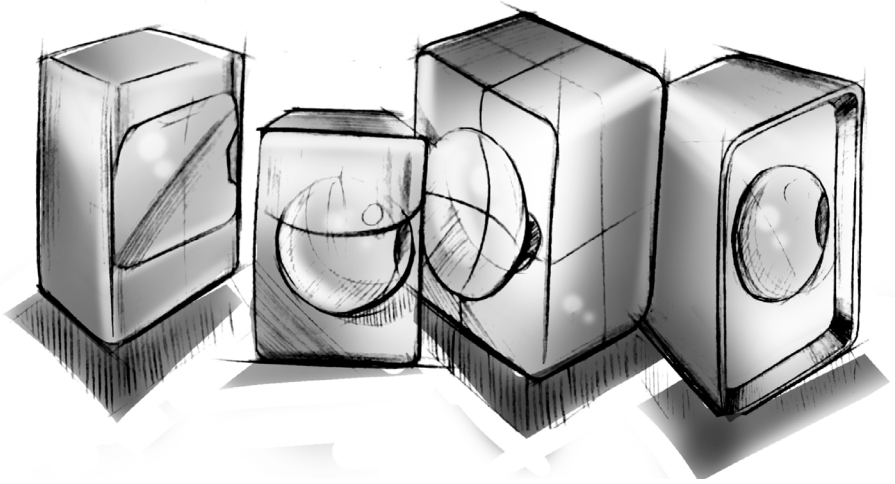


Figure 36
Minimal forms with smooth edges and play with the door of the drum.

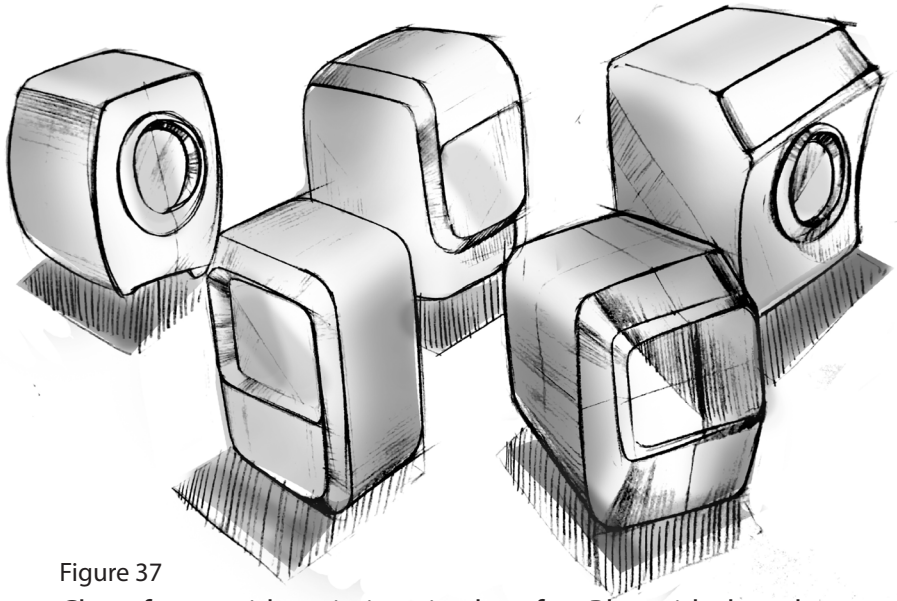


Figure 37
Clean forms with variations in chamfers.Play with the edges of the form.

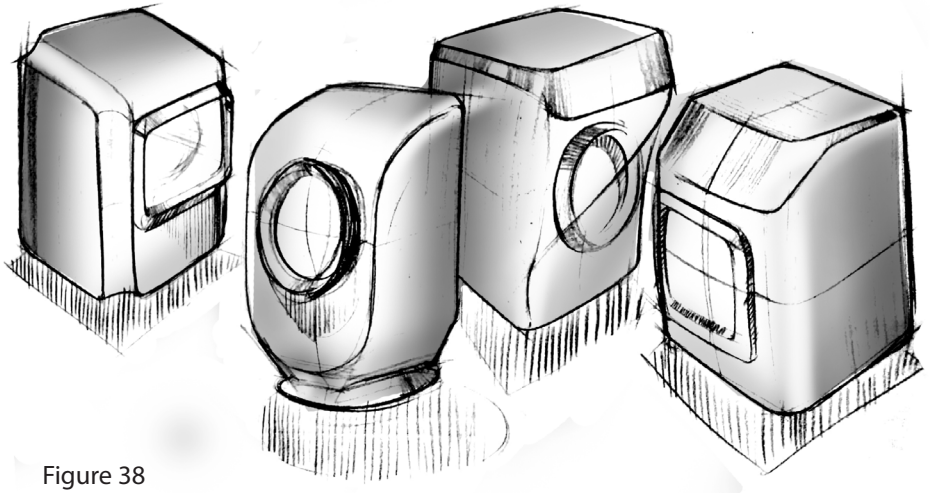


Figure 38
Clean forms with play in fillet radius and experiments with the edges.

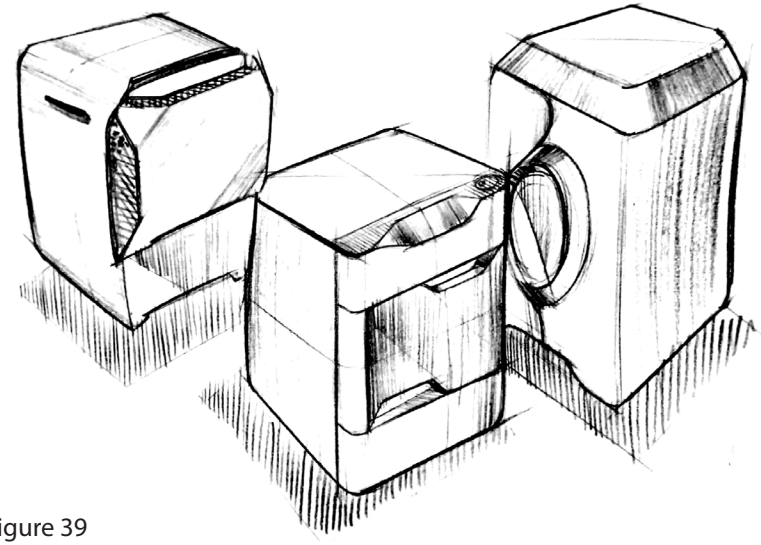


Figure 39
Futuristic forms,experiments with the door.

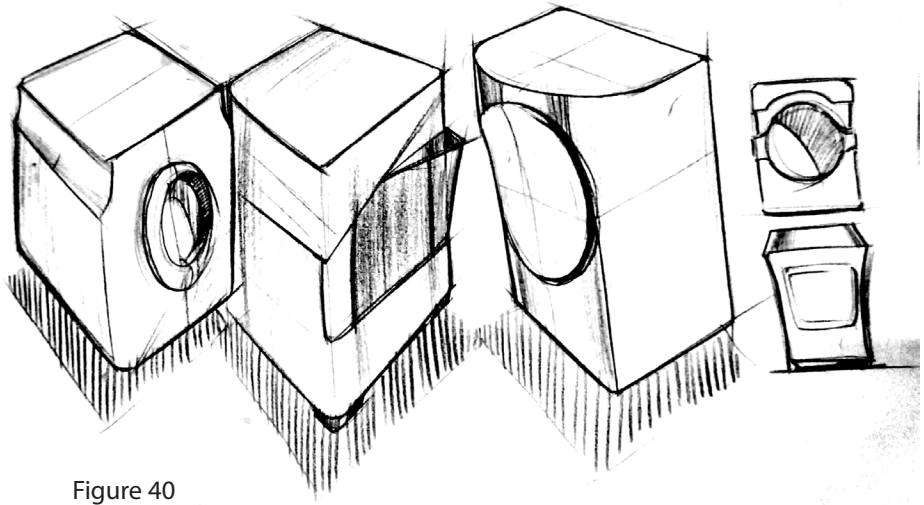


Figure 40
Minimal forms with sharp edges and play with the door of the drum.

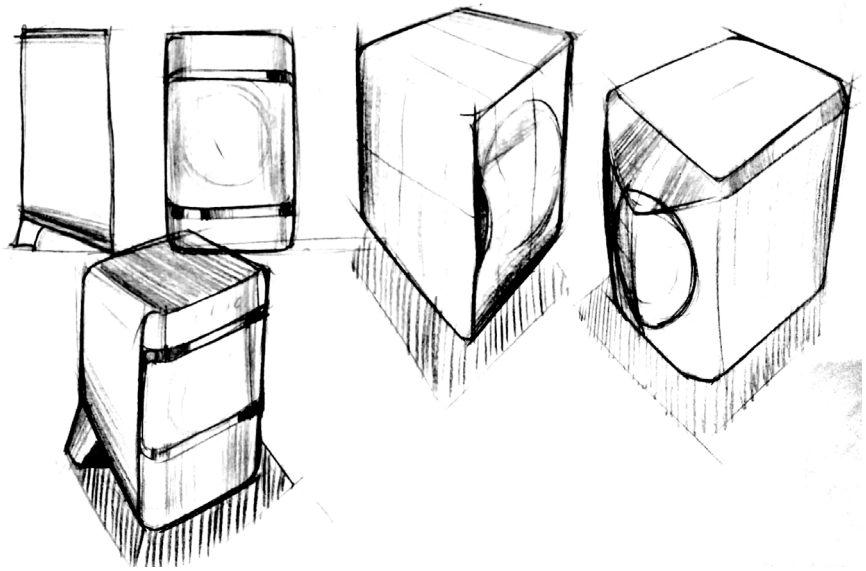


Figure 41

Forms inspired from modern day gadgets, like mobile phones.

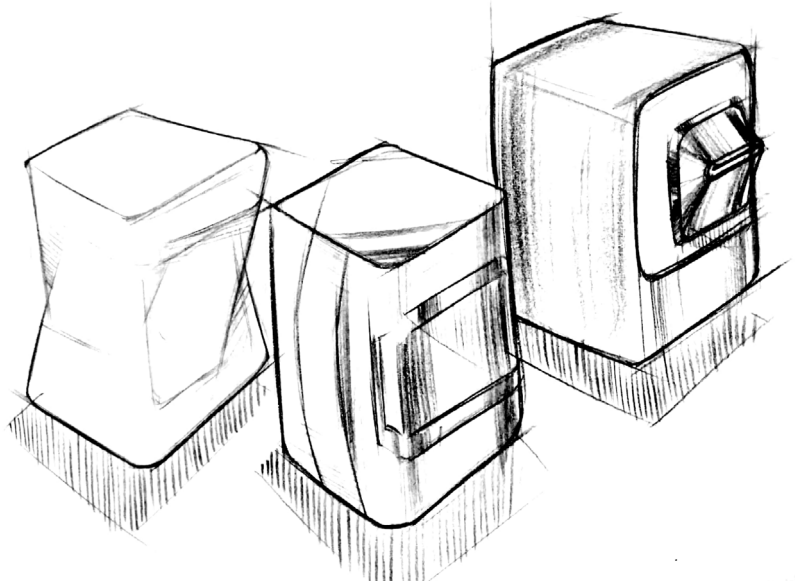


Figure 42

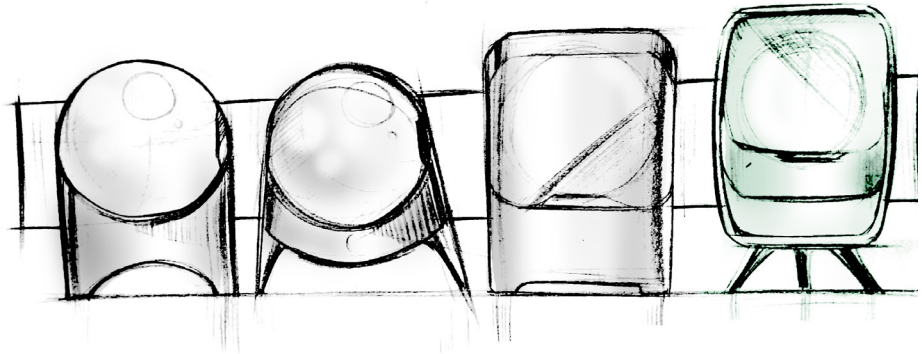


Figure 43

Retro inspired forms with legs, play of materials and experiments with form.

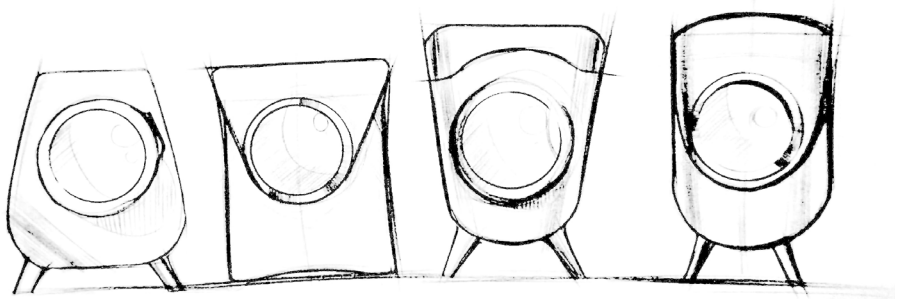


Figure 44

Retro inspired forms with legs, play of materials and experiments with form.

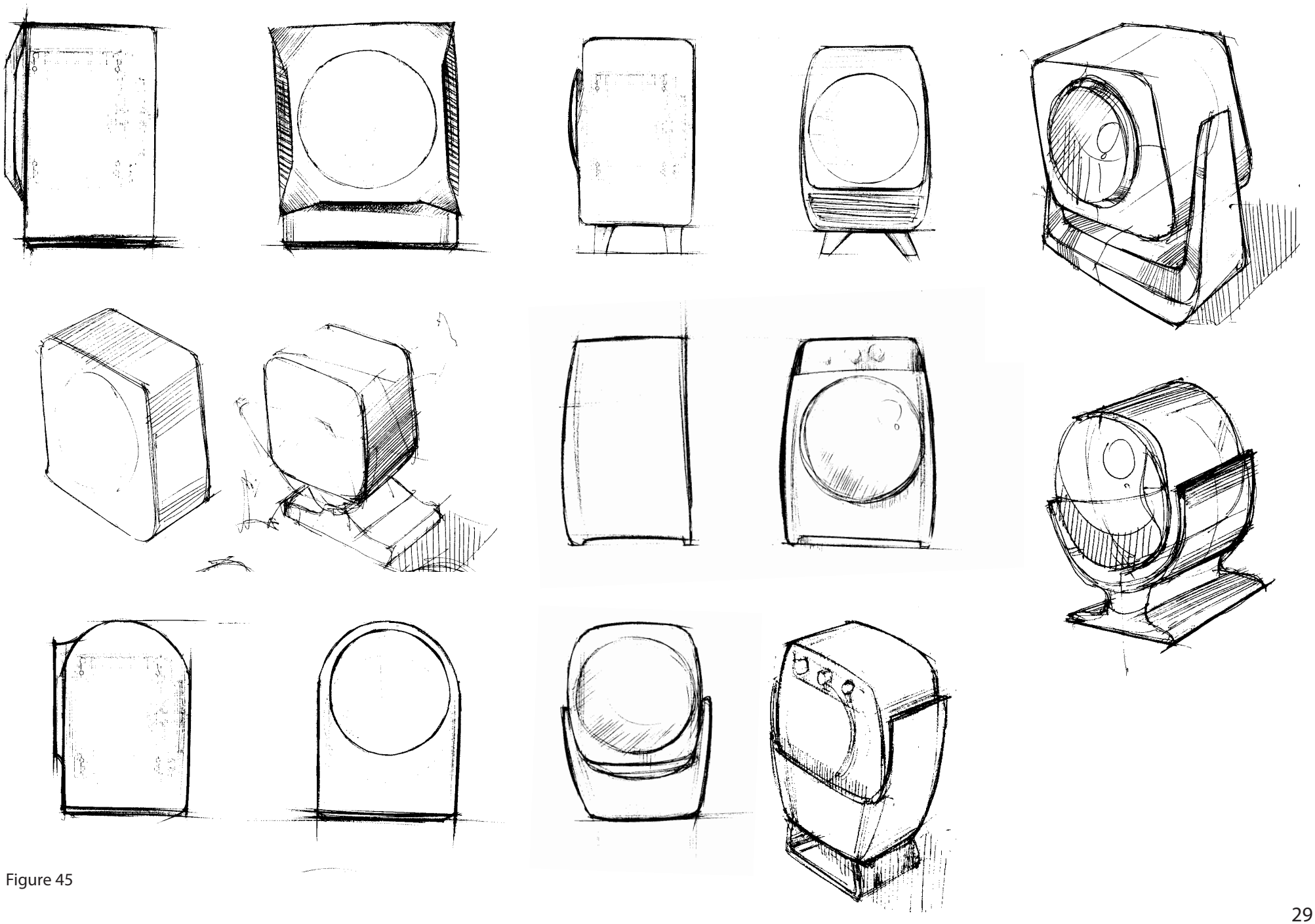


Figure 45

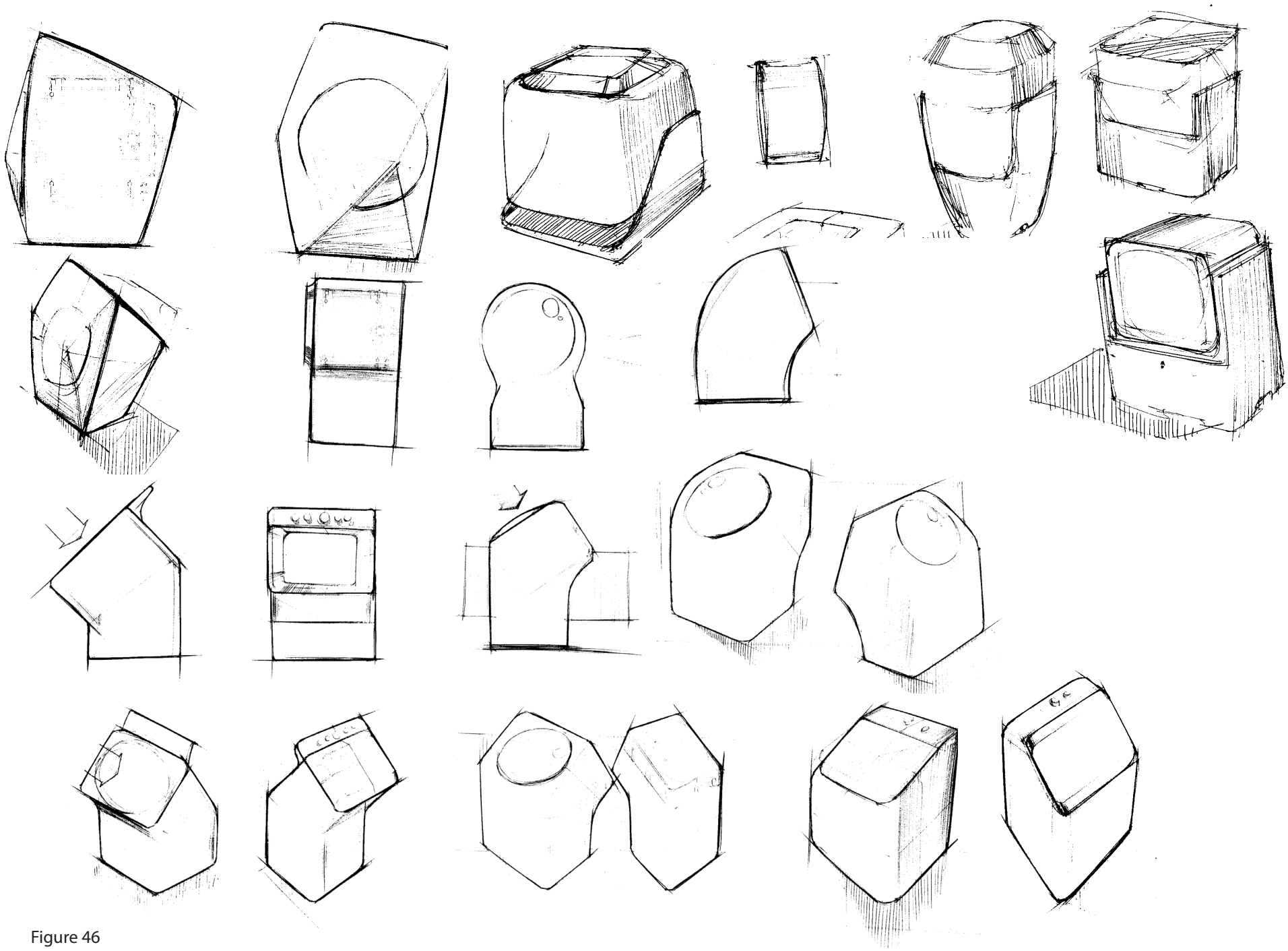
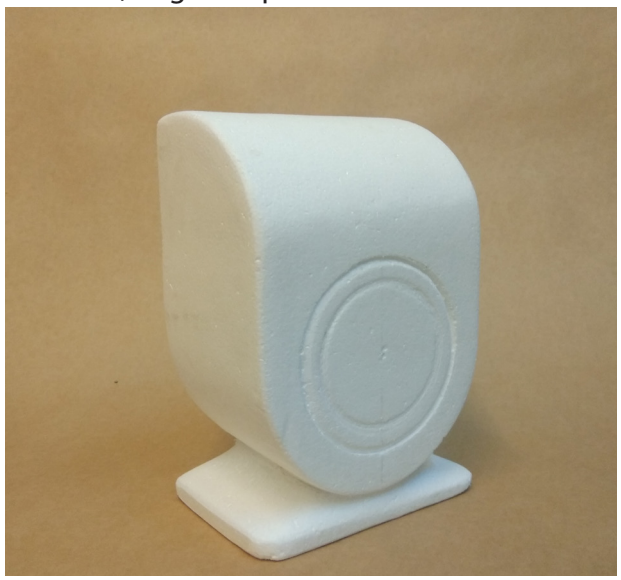


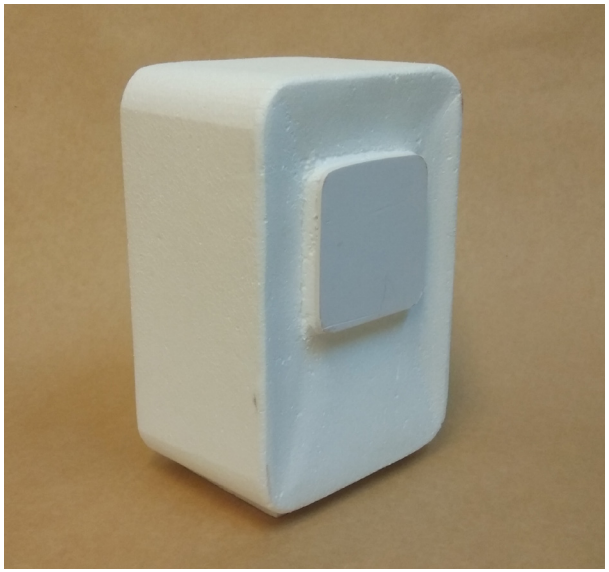
Figure 46

3.5 MOCK-UP MODELS

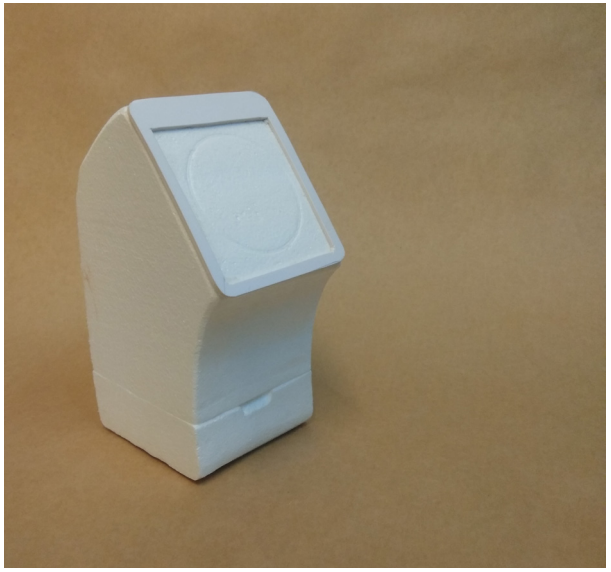
Mockup 1 to Mockup 6 , Thermocol mock-ups made out of thermocol,
Scale 1:5, to get help in 3 dimensional visualisation.



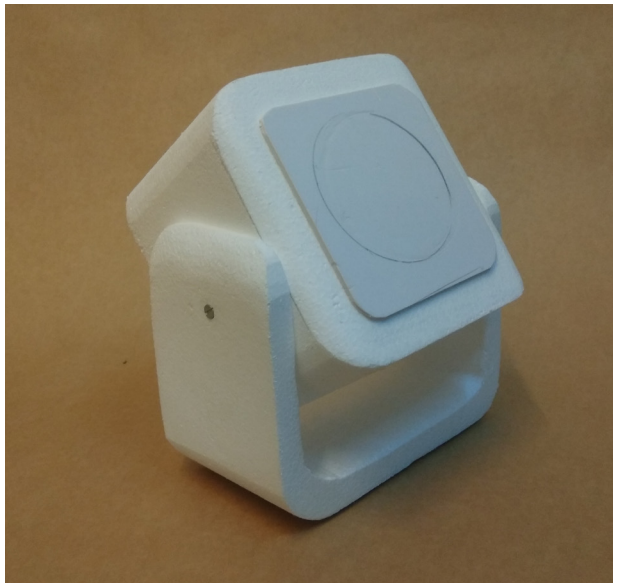
Mockup 1



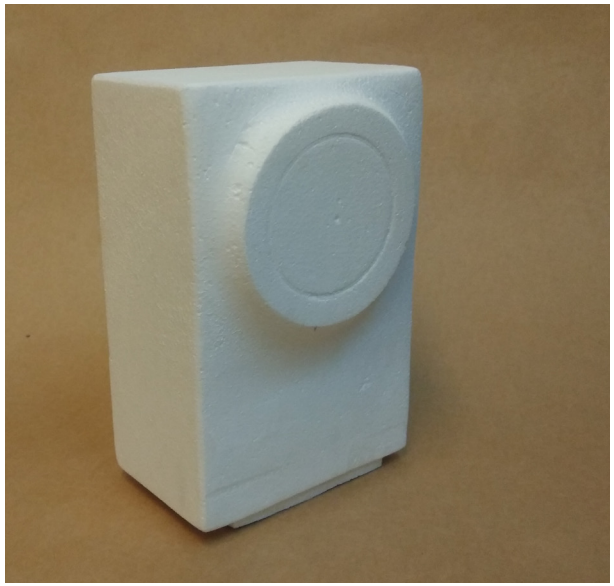
Mock-up 2



Mock-up 3



Mock-up 4



Mock-up 5

Mock-up 6

4. CONCEPTS

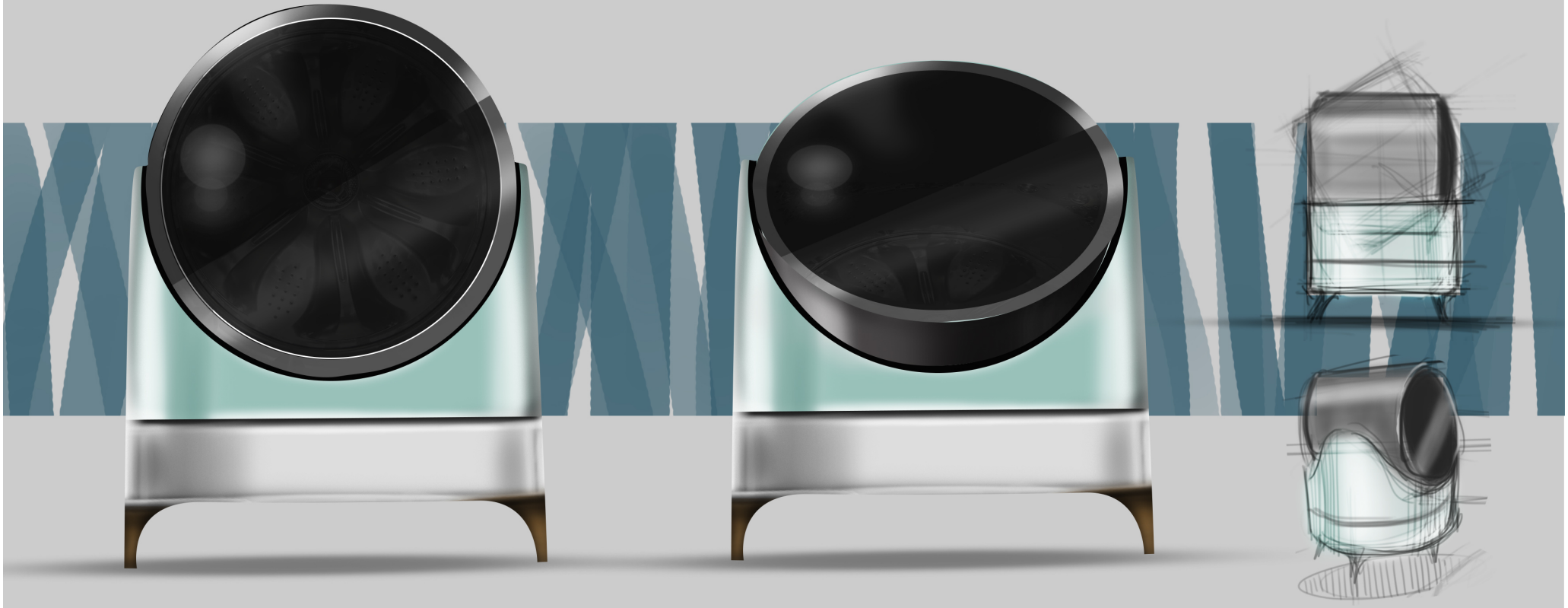
4.1 CONCEPT 1

This concept was based on a simple idea of pulling out a drum and loading it from the top, hence it shall not require the need to bend while loading and unloading clothes.

The washer shall take smaller loads, and will be easy to use. The interface will be on the door of the drum.

Figure 47

4.2 CONCEPT 2



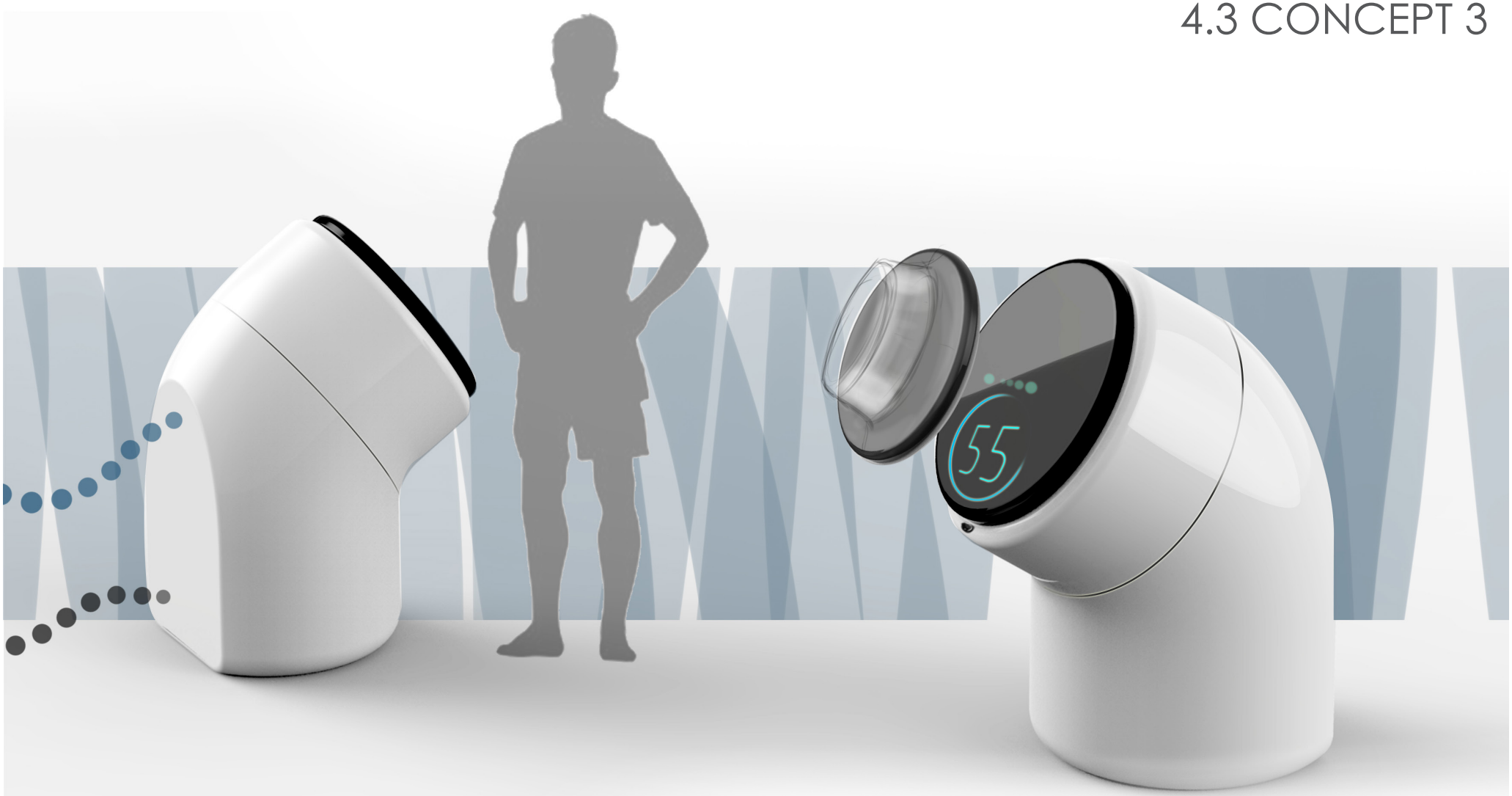
The second concept was of a tilt-able drum which can be adjusted according to the user's convenience. The interface is on the door of the washer hence it is easy to be operated by the user.

The washer is inspired from Retro theme, hence there is a play of finishes and material. The legs add to the composition of this Retro themed washer.

Figure 48

Figure 49

4.3 CONCEPT 3



The third concept was a manifestation of a futuristic vision, it is a washer that shall have the drum inclined at 45 degree for the comfort of the user.

The clean finish and attractive display shall make it fit for any location of the house without it being an eyesore.

Figure 50

4.4 CONCEPT 4

This concept is a mix of retro and modern style. The bottom stand adds to the stability of the body. In this washer the drum rotates similar to a front loading washing machine but is loaded from the top.

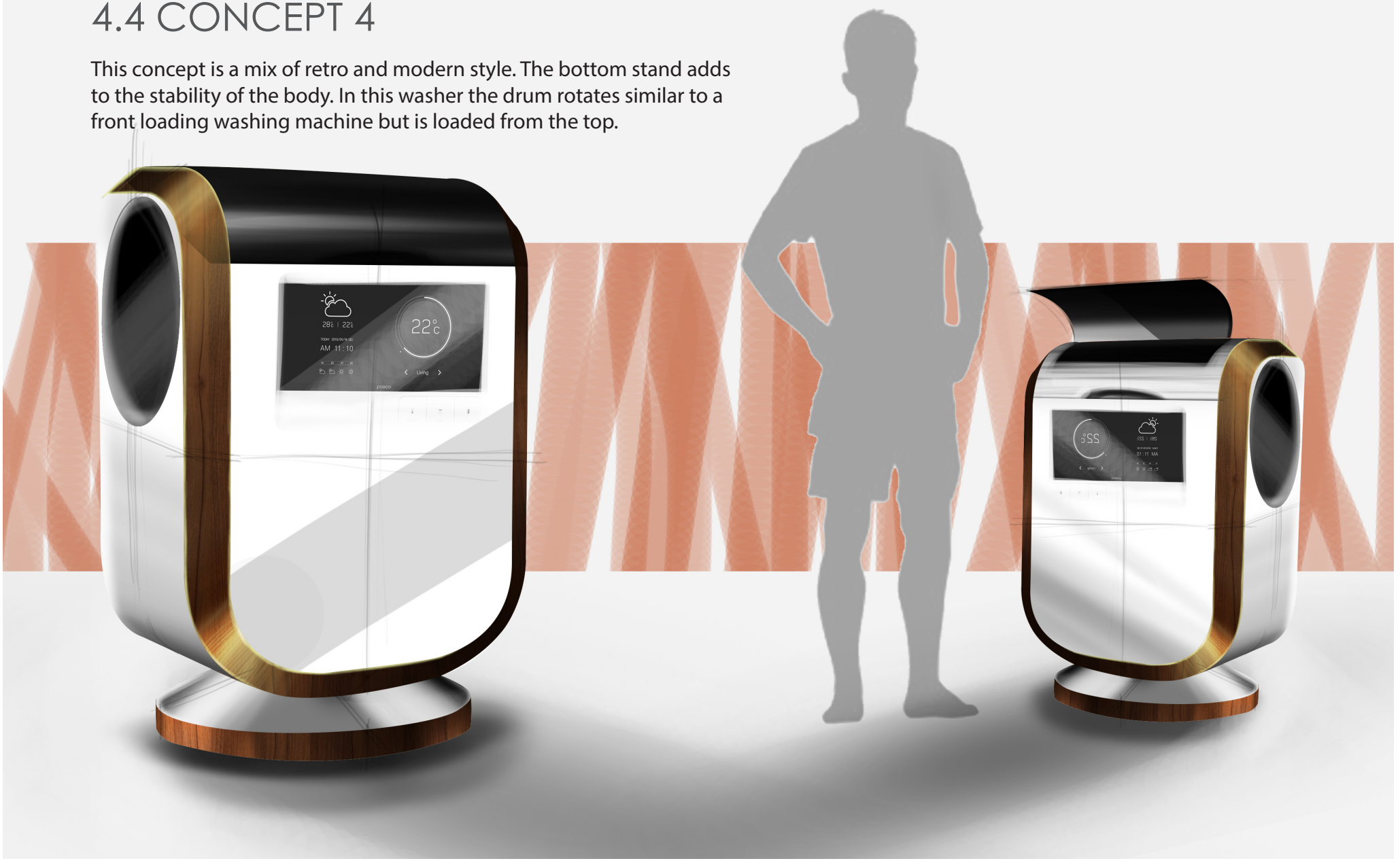


Figure 51

4.5 Concept Selection

Table 2, is an evaluation table wherein scores were given to each concept on the basis of different parameters. The parameters were also assigned some weight-age which was multiplied to the rating to achieve the final score.

		Concept 1		Concept 2		Concept 3		Concept 4	
Criteria	Weight-age	Rating	Score	Rating	Score	Rating	Score	Rating	Score
Form	40%	2	0.8	4	1.6	4	1.6	1	0.4
Usability	30%	3	0.9	3	0.9	2	0.4	2	0.6
Interface	20%	2	0.4	3	0.6	3	0.6	2	0.4
Manufacturability	10%	1	0.1	3	0.3	2	0.2	2	0.2
			2.2		**3.4**		**2.8**		1.6

Table 2

4.6 Final Design

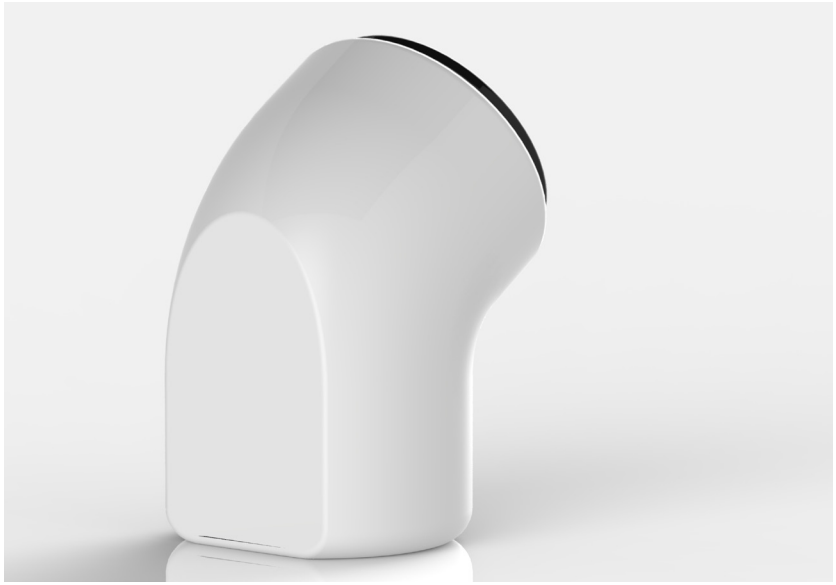


Figure 51

Figure 51

Figure 51

Figure 51


15 min
2 times
Delicate Wash
100% Dry
WAFFY

A washing machine with the drum tilted at an angle of 45 degrees to have the opening at the top, to eliminate the task of bending down to load and unload the clothes.

The machine washes small loads, perfect for daily washes upto 4 kgs.

Shorter wash cycles, so one can wash the clothes quickly and get them wadrobe ready.

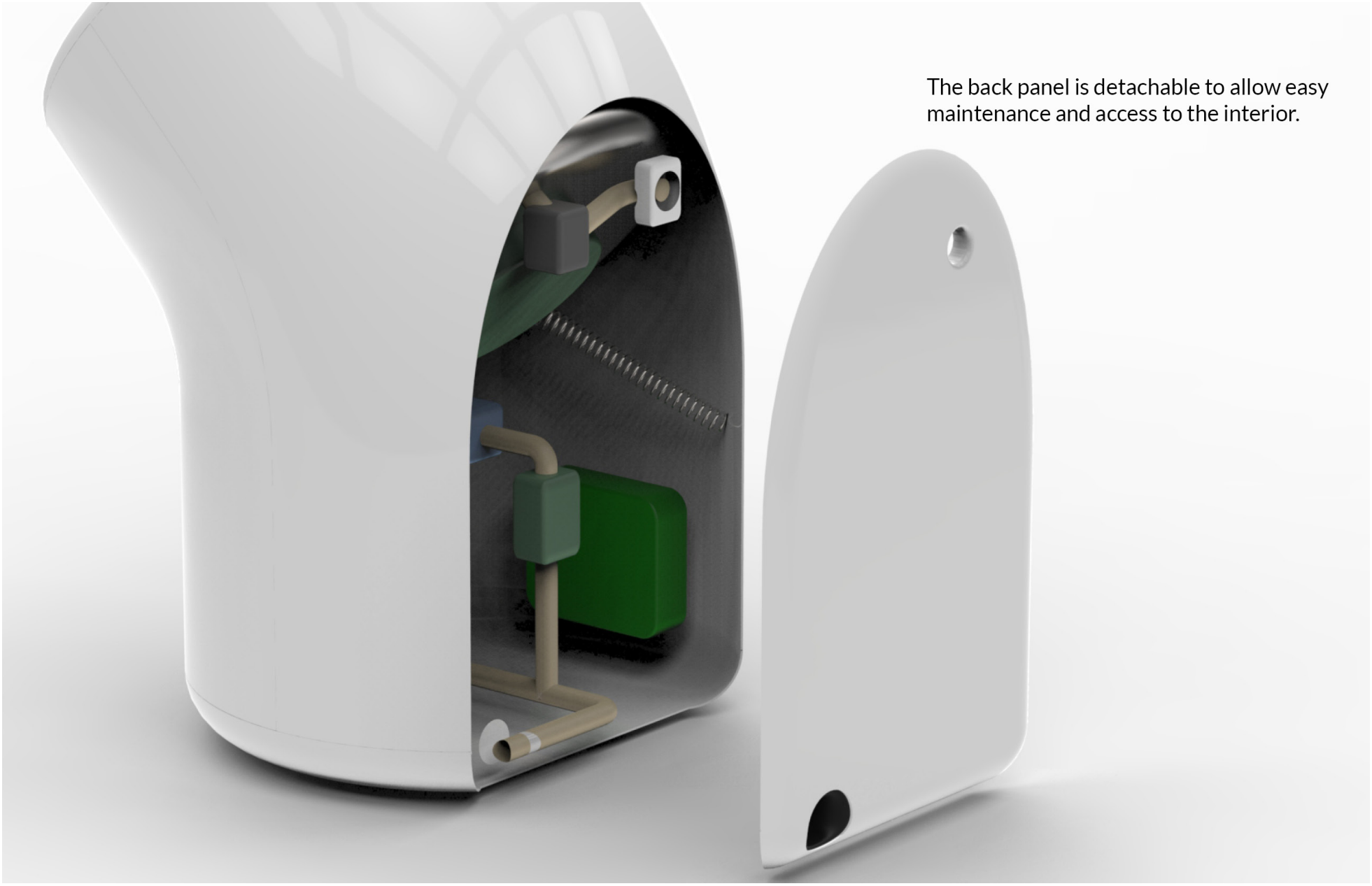
It is a complete solution for the laundry requirements of a small family.

Provides wash more efficient than top loading machine, and helps in a better quality wash.

Silicone lining on the opening helps in an air tight door. Once the door is closed, the locking mechanism completes the circuit to switch on the machine.

Smart Glass technology allows a display on the top of the glass. The centre of the door is transparent to allow the user to look inside the drum during an ongoing wash.

A small storage space at the bottom for storage.



The back panel is detachable to allow easy maintenance and access to the interior.

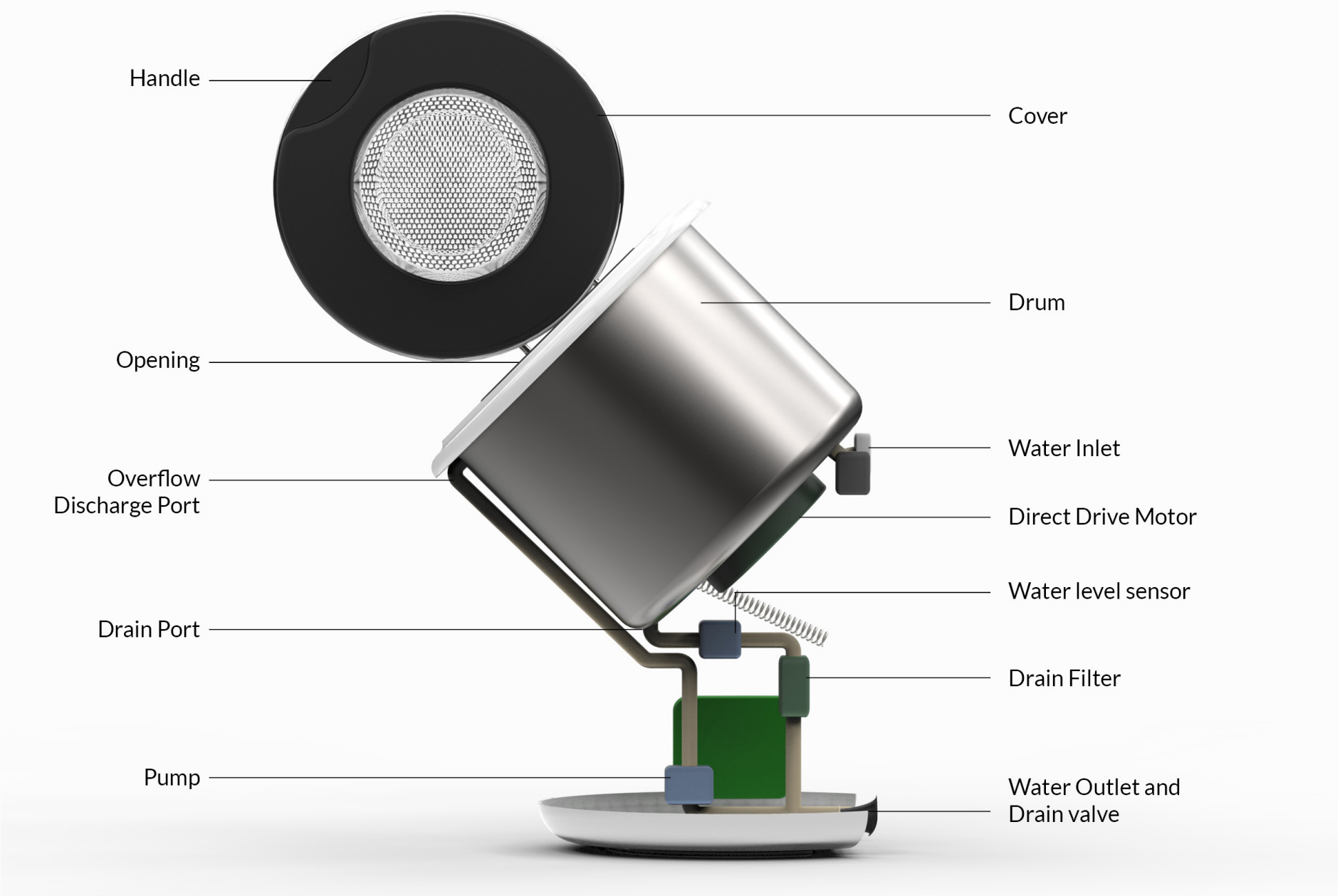
The flat edge at the back, aligns itself to the wall hence occupies less space as compared to a cylinder.

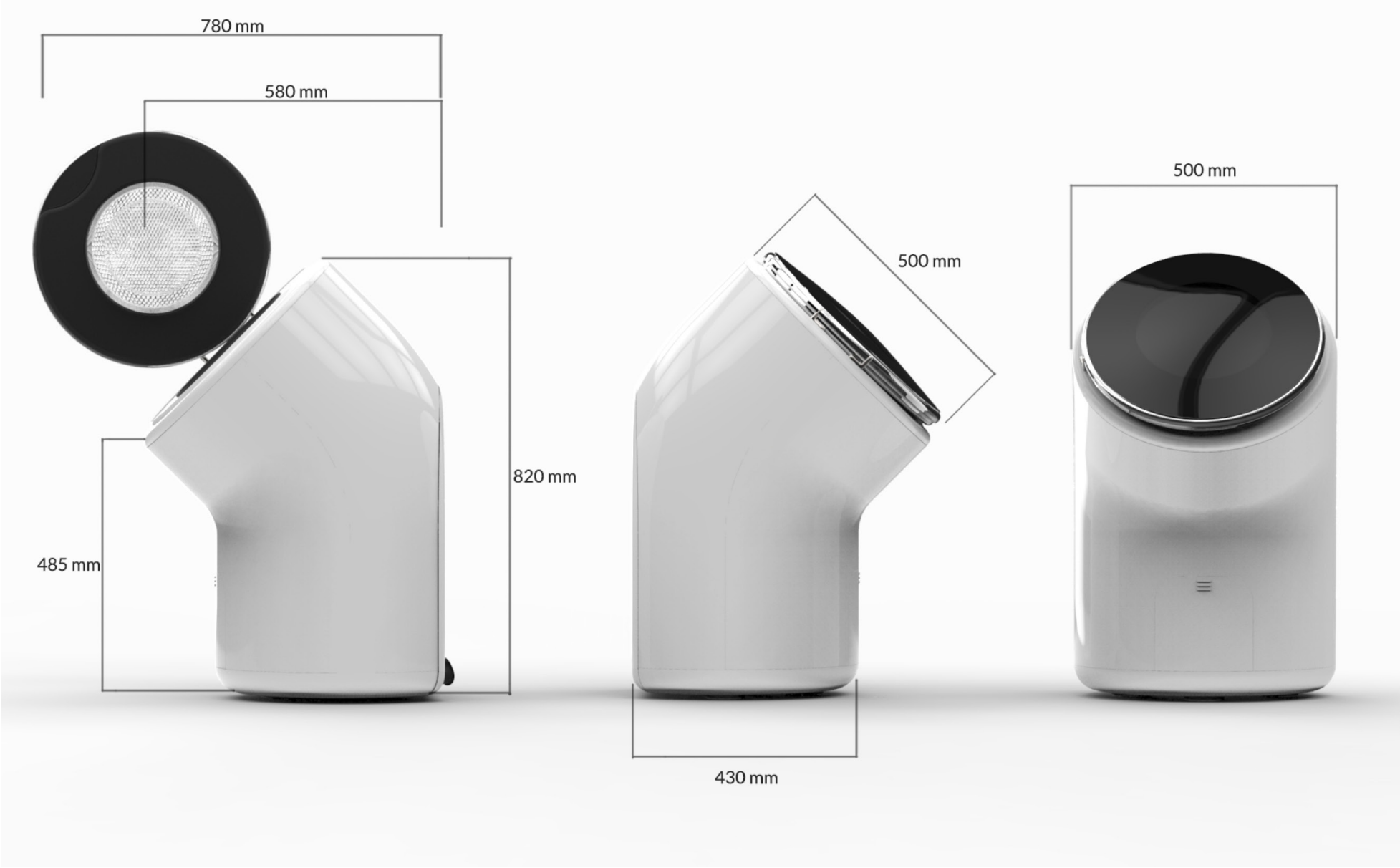
A chrome finish on the curve of the cover. A glossy smooth white finish for the body which gives a clean classic appearance to the product.

Microprocessors at the back of the door, the bottom curve turns to form a handle for the door.

To balance the cantilevered load of the drum, counterweight shall be provided at the bottom of the body of the machine.

A small machine which fits in your house without being an eyesore. It will become an essential part of your lifestyle and will help you cope with the hectic routine.


Handle
Cover
Drum
Opening
Water Inlet
Overflow
Discharge Port
Direct Drive Motor
Water level sensor
Drain Port
Drain Filter
Pump
Water Outlet and
Drain valve


780 mm
580 mm
820 mm
485 mm
500 mm
430 mm
500 mm


WELCOME!

5. INTERFACE

5.1 Survey

37 % people said that it has too many options.
34 % people said that they were Unable to understand the meaning of each icon.

41% state that the terms are not self explanatory.
28% felt the need to refer to the manual before using a washing machine.

5.2 Details of Interface

Figure 52 to Figure 59 show the details of the possible interface.
An effort has been made to design a customisable interface for the machine

hes,
user
nterface
nology

Figure 52

Humanising the interface
Voice Input
Smart glass technology

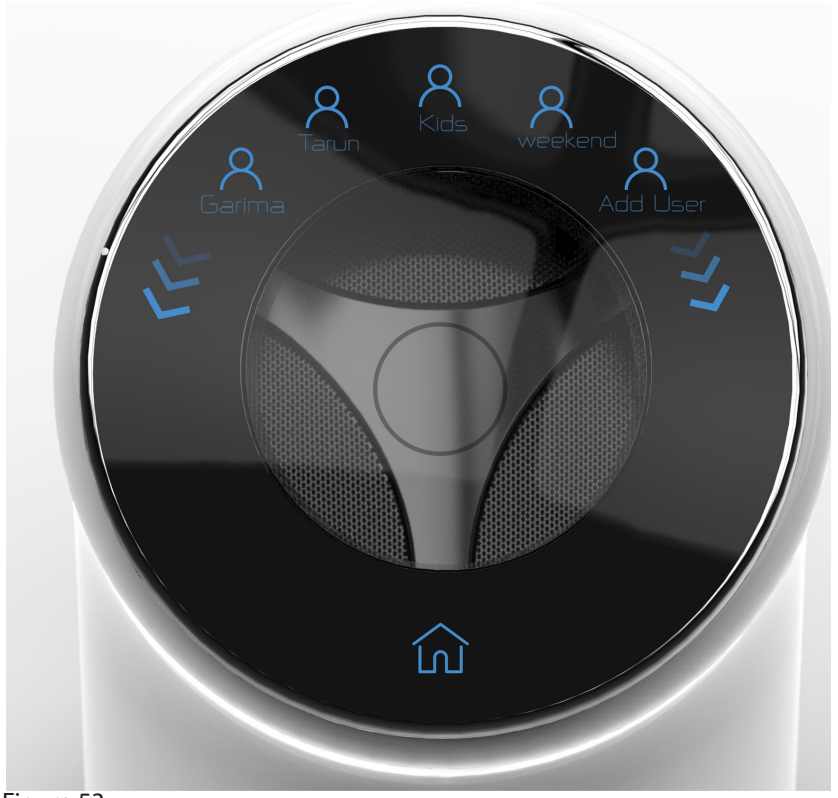


Figure 53

BASIC SCREEN
Customised washes, according to the user

Figure 54

Figure 55

WASH MODE
Displays a **summary of the wash**
Allows to **make amends,**
Start the wash
Calculates wash-time through **fuzzy logic**

IDLE MODE
Displays a **time left,** in numerals and pie chart.
Child lock mode : allows the child to draw on the screen.
Music options

Figure 56

ADDING USER -MODE
Name

Figure 57

ADDING USER -MODE
Options :
Sportswear
Wool
Intensive
Silk
Cotton
Delicates
The wash mode will be adjusted accordingly.

Figure 58

Figure 59

ADDING USER -MODE

Gets access to your favourite songs.
Also detects your phone in vicinity.

Figure 60

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Singularity is near by Ray Kurzweil.