FAUCETS FOR SMART USAGE OF WATER

INDUSTRIAL DESIGN PROJECT II

MPR-428

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INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

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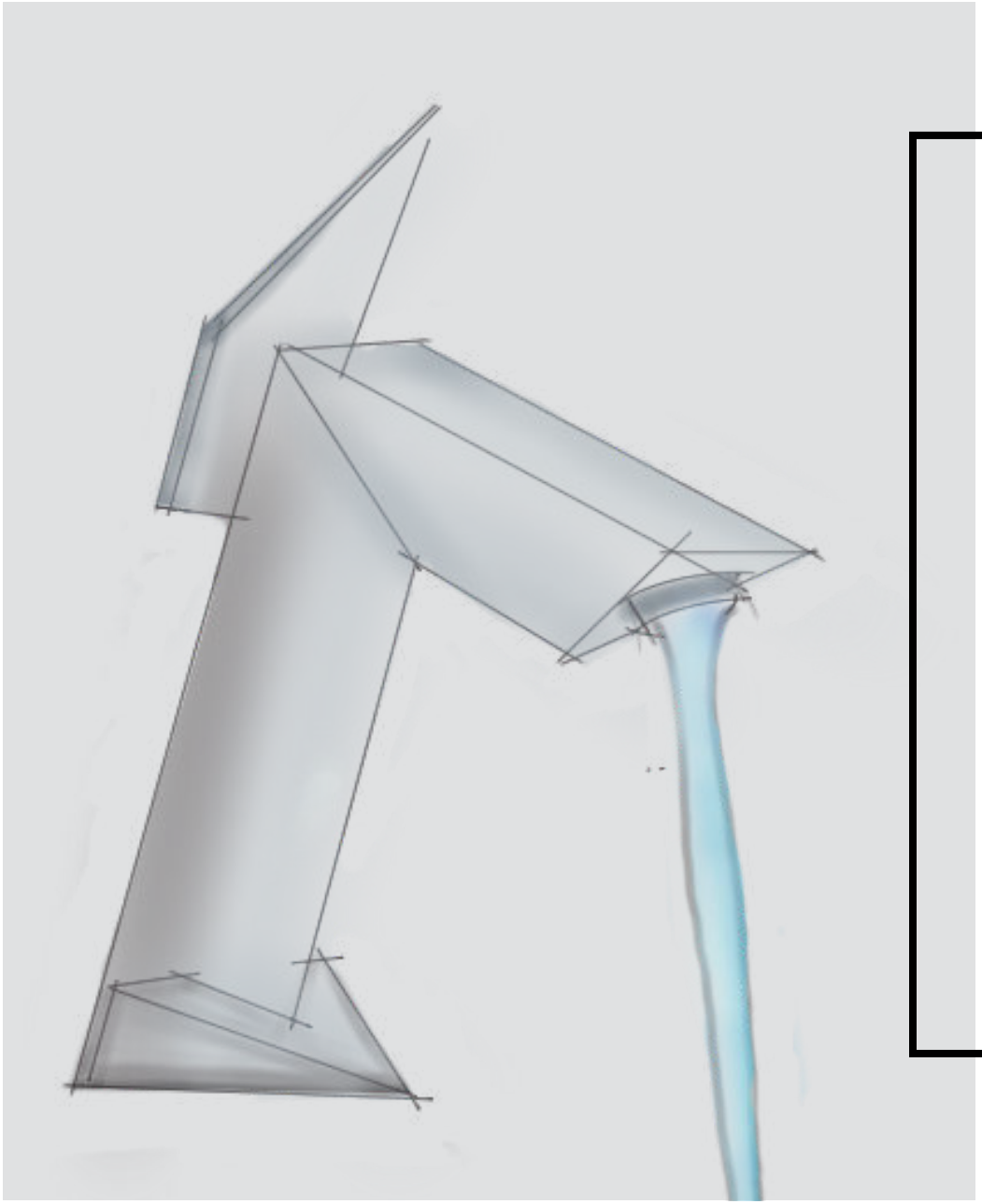

DESIGN PROJECT - II

FAUCETS FOR SMART USAGE OF WATER

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IDC, IIT BOMBAY

PROJECT GUIDE

PROF. PURBA JOSHI

DECLARATION

I hereby declare that this written submission represents my idea in my own words and where others' ideas have been included; it has been adequately cited and referenced with the original source. I declare that I have adhered to all principles of academic honesty and integrity and have not fabricated or falsified any data/idea/facts/sources in my submission. I understand that any violation of the above entitles the institute to take disciplinary action against me to which I shall be answerable to.

Name Bhavik grover

Place Mumbai

Date 01-11-2015

Signature

APPROVAL SHEET

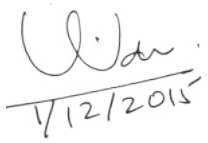
The project titled 'Faucets for smart usage of water' by Bhavik grover, is approved for the partial fulfilment of the requirement for the degree of 'Master of Design' in Industrial design

Guide:

Chairperson:

Internal Examiner:

External Examiner:



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And finally, many thanks to all my friends at IIT and my parents.

ABSTRACT

Water wastage is one of the biggest problems of today's modern world, and it is witnessed predominantly at the industry, household level. The project addresses the upper-class segment of a user where water wastage is prevalent in their daily household usage, and have targeted the areas where awareness about water wastage can also be provided, I have selected faucets because at household level user interacts with faucets mostly for his daily life water using activities, The faucets in basin area were focused because most number of the water usage activities.

The project is to design a faucet that prevents water wastage in daily activities of brushing teeth, washing face, shaving etc., And also making the user interactions more intuitive and informative. I have tried to make the entire process experiential, with combinations of digital and manual interactions of faucets, Certain functions like manipulation of the flow, temperature control were taken into consideration for all concepts.

The formal study for ideation has been done using semantics approach and features has been shortlisted by taking inferences from market research and semantic studies.

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'We never know the worth of water,till the well is dry'

~ THOMAS FULLER

1.MOTIVATION

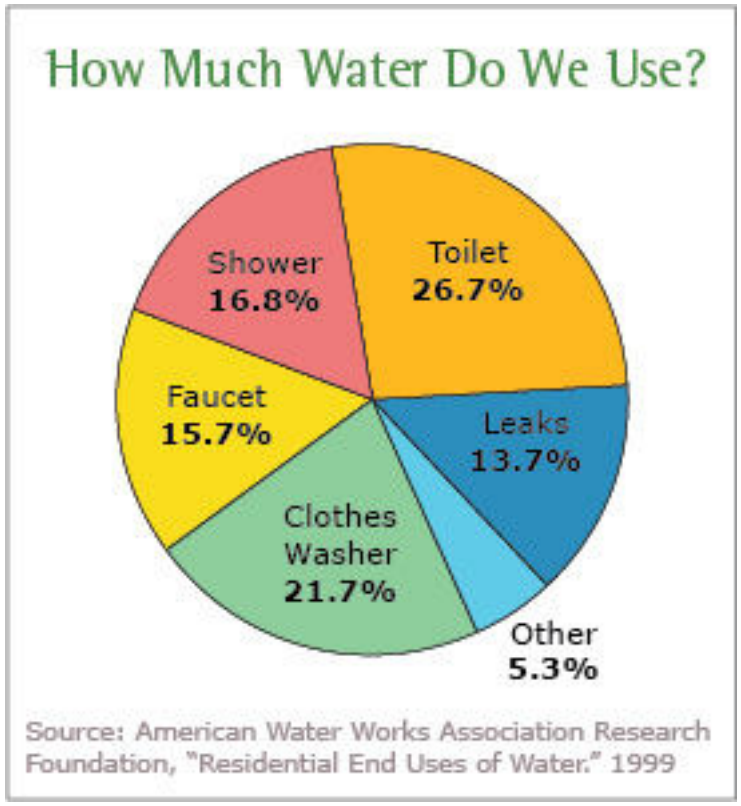


Fig1a Fresh water on earth

Water is vital to the survival of everything on the planet. The Earth might seem like it has abundant water, but in fact less than 1 percent is available for human use. The rest is either salt water found in oceans, fresh water frozen in the polar ice caps, or too inaccessible for practical usage. While population and demand on freshwater resources are increasing, supply will always remain constant. And although it's true that the water cycle continuously returns water to Earth, it is not always returned to the same place, or in the same quantity and quality.

We wake up in the morning, take a shower, brush our teeth, grab a cup of coffee and head out for the day. Water is an important part of our daily lives and we use it for a wide variety of purposes, but do we really understand how much we use?

The average family uses more than 300 gallons of water per day at home. Roughly 90 percent of this use occurs indoors. Nationally, outdoor water use accounts for 10 percent of household use yet can be much higher in drier parts of the country and in more water-intensive landscapes.

It takes a considerable amount of energy to deliver and treat the water you use every day. For example, letting your faucet run for five minutes uses about as much energy as letting a 60-watt light bulb run for 14 hours. Heating water for bathing, shaving, cooking, and cleaning also requires a lot of energy. Homes with electric water heaters, for example, spend one-quarter of their electric bill just to heat water.

1.1 CONDITION OF WATER IN INDIA

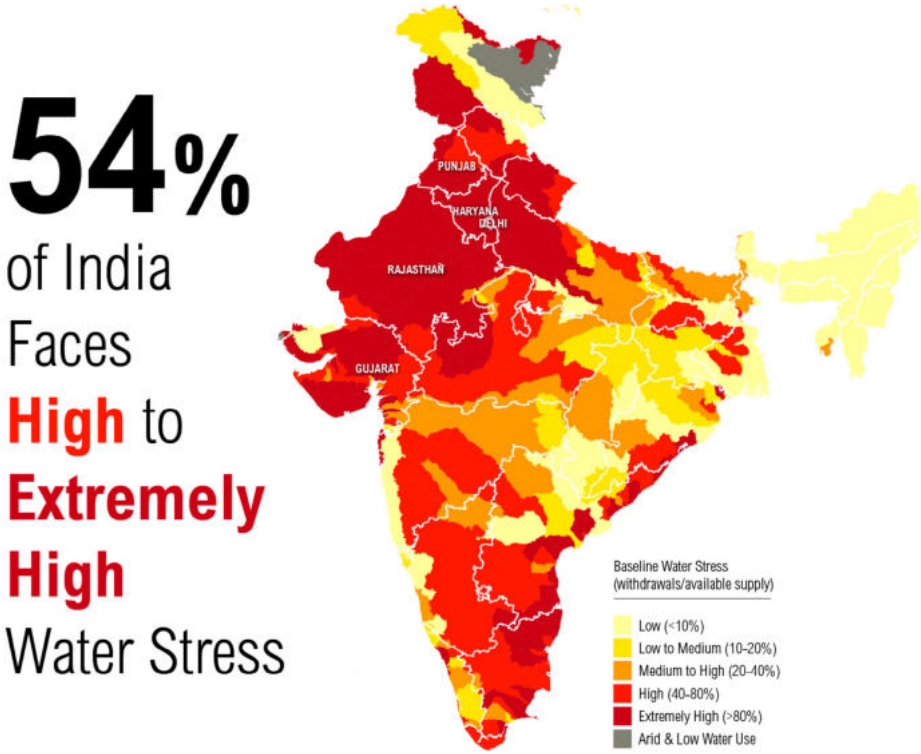


Fig1.1 India water stress map[1]

India is one of the most water-challenged countries in the world, from its deepest aquifers to its largest rivers. Groundwater levels are falling as India's farmers, city residents and industries drain wells and aquifers. What water is available is often severely polluted. And the future may only be worse, with the national supply predicted to fall 50 percent below demand by 2030.

The map in Fig. illustrates competition between companies, farms and people for surface water in rivers, lakes, streams, and shallow groundwater. Red and dark-red areas are highly or extremely highly stressed, meaning that more than 40 percent of the annually available surface water is used every year.

Groundwater levels are declining across India. Of the 4,000 wells captured in the IWT 2.0 showing statistically significant trends, 54 percent dropped over the past seven years, with 16 percent declining by more than 1 meter (3.2 feet) per year. Farmers in arid areas, or areas with irregular rainfall, depend heavily on groundwater for irrigation. The Indian government subsidizes the farmers' electric pumps and places no limits on the volumes of groundwater they extract, creating a widespread pattern of excessive water use and strained electrical grids. Northwestern India again stands out as highly vulnerable. Of the 550 wells studied in the region, 58 percent have declining groundwater levels.

1.2 FACTS ABOUT WATER WASTAGE

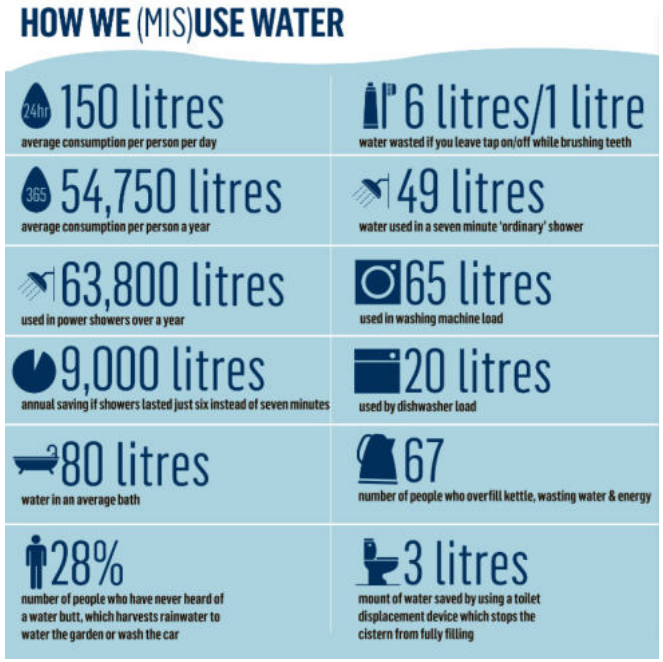


Fig1.2a. water misuse

Fig1.2 b

- The average household's leaks can account for more than 10,000 gallons of water wasted every year, or the amount of water needed to wash 270 loads of laundry.
- Household leaks can waste more than 1 trillion gallons annually nationwide. That's equal to the annual household water use of more than 11 million homes.
- Ten percent of homes have leaks that waste 90 gallons or more per day.
- Common types of leaks found in the home include worn toilet flappers, dripping faucets, and other leaking valves. All are easily correctable.
- Fixing easily corrected household water leaks can save homeowners about 10 percent on their water bills.
- A leaky faucet that drips at the rate of one drip per second can waste more than 3,000 gallons per year. That's the amount of water needed to take more than 180 showers.
- A shower-head leaking at 10 drips per minute wastes more than 500 gallons per year. That's the amount of water it takes to wash 60 loads of dishes in your dishwasher.

1.3 WHY FAUCETS, THEIR TYPES AND WASTAGES

Fig1.3a. Basin Faucet

Fig1.3b. Kitchen Faucet[2]

Fig1.3c. Bathroom Faucet

In household usage, water is mostly used in activities like bathing, washing, brushing, toileting etc. But our day starts with brushing generally and ends also, Bathing and toileting happens generally once in a day, but activities like washing hands happen multiple times and so affect behavior of a person of using water, Water conservation can happen when there is awareness about it and it gets into behavior of one being, So we select the category of faucets, there are generally three categories of faucets used within household:

- Basin Faucets: Taps which are mounted on basins, normally used for the purposes like washing face,brushing, shaving etc. The Wastage which generally happen because of valve remained opened during the process and conventional ways of operating the valve in according with purpose.
- Kitchen Faucets: They are used in the kitchen or Deep sinks, used for cleaning and washing purposes mostly, Water wastage happens mostly because of over usage of water, and bad controls of faucets.
- Bathroom Faucets: These faucets are installed in bathrooms generally used for bathing purposes, these have also same issues of overflowing, bad controls and bad interface leads to wastage of water.

2.MARKET RESEARCH

Fig2 a. Water sense

Water Sense, a partnership program by the U.S. Environmental Protection Agency, seeks to protect the future of our nation's water supply by offering people a simple way to use less water with water-efficient products, new homes, and services. Water Sense brings together a variety of stakeholders to promote the value of water efficiency provide consumers with easy ways to save water, as both a label for products and an information resource to help people use water more efficiently encourage innovation in manufacturing decrease water use and reduce strain on water resources and infrastructure.

The program seeks to help consumers make smart water choices that save money and maintain high environmental standards without compromising performance. Products and services that have earned the Water Sense label have been certified to be at least 20 percent more efficient without sacrificing performance.

Some of latest technologies were reviewed, most of them belonged to delta faucets, these kind of special faucets are for specific reason of water saving, and also water sense labeled products.

I visited some showrooms around mumbai and looked for brands and technologies in faucet ,Some of brands which were looked :

Delta, Grohe, Jaquar, Hans-grohe, Bravato, kohler, moen.

2.1.TOP TECHNOLOGIES -CASE STUDIES

Fig2.1a. Diamond seal valve

Fig2.1b. Diamond embedded disc

DIAMOND Seal Technology—that provides enhanced protection from leaks. This system reduces the number of potential leak points, simplifies installation, and provides long-lasting performance. DIAMOND Seal Technology faucets also satisfy California Health and Safety Code 116875 (AB 1953) and Vermont Law No. 193 (S152), which mandate that the weighted average lead content in pipes, fittings and fixtures used to convey drinking water cannot exceed 0.25% on wet surfaces. Once inside the faucet, water is not in contact with potential metal contaminants.

Diamonds, the hardest substance on earth provide an extremely durable finish. As the two discs in the DIAMOND Valve move against each other, the diamond-embedded ceramic disc constantly polishes the uncoated ceramic disc, reducing build up of calcium and mineral deposits and helping to ensure smooth, consistent operation over the life of the faucet.

The pairing of diamond-embedded and ceramic discs in the DIAMOND Valve yields a lower coefficient of friction, making it easy to operate the valve without lubrication and ensuring consistent performance over the life of the faucet. The diamond-embedded disc helps prevent calcium deposits from building up on the ceramic disc. [2.1-1]

Fig2.1d. Touch2o

Fig2.1e. Multi flow-shower

Fig2.1f. Multi flow-solid

Fig2.1g. H2O kinect module

Fig2.1f. H2O kinect shower

- Touch2o technology: Touch2o technology is quite new and unique technology,firstly introduced by delta faucets. It works by tapping anywhere on the spout or handle with your wrist or forearm to start and stop the flow of water. Touch20 Technology can also help you conserve water. As you prepare food or wash up in the sink, it's easy to turn the water flow off when it's not needed between tasks. Keep the faucet clean, even when hands aren't. Thoughtfully designed to make kitchen tasks easier. This technology works on the operation of proximity and resistance sensors mounted inside faucets, lose of ground connection sometimes also lead to self activation of faucet,but that happens by faulty mounting of faucet.
- Multi flow technology: It is very innovative way of toggling between two kinds of flow, a toggle button used for switching between two flows, one spray and another strain flow, which is more than 1.5 gpm to fill the vessels fast when needed, toggle button helps by switching between valves attached to same supply, this also helps to conserve and use faucet efficiently.
- H2O Kinect technology: It has kinect chambers which adds kinetic energy to water when water passes through it,It creates unique pattern, which gives more feel of water. More feel of water with less water used.

2.2.CONCEPT- CASE STUDIES

Fig2.2a Eve faucet

Fig2.2b Eve faucet screen tracking

- **Eve faucet:** This project was done by Sweden based industrial designer Rebecca Daum, her main objective behind this project was to encourage user to use less water, and to give awareness of consumption of water through faucet and mobile app as shown in figure 2.2a ,the eve faucet has visual feedback from a screen which is also push button to active flow. It gives a subtle and non-forcing visual which tells user amount of water left he/she had decided to use or had set as target for consumption as shown in figure 2.2b, second main objective of project was to explore different materials for faucet.

Fig2.2c Swirl faucet

Fig2.2d Limit faucet

- **Swirl faucet:** This faucet has very unique flow pattern as shown in figure 2.2c,its been made by simin qiu who is UK based industrial designer, he focused on pattern and made a mechanism to attain swirl patter, this pattern with creating a beautiful visual appeal also uses less amount of water as compared to normal strain flow over time, so it also helps in conserving water.

- **Limit faucet:** This faucet has transparent tube on top of it as shown in fig. 2.2d, as name suggests this faucet limits the flow speed of water and also the amount of water to be used, user can only use one liter of water at time, normally in simple process like brushing 6 liters of water is wasted in 30 seconds to 1 minute, but this faucet let user use one liter of water for 30 seconds.

3.USER STUDY

The main aspect in designing the faucet for smart usage of water is user study, Only by observing user and interviewing them we could know about activities and behavior of user while using faucets, for user study the method selected was direct user observation in real time, because faucet using is daily activity which people do not do consciously, also user observation method helps to study what our intended user do in specific situation, Observations enable us to understand phenomena, influential variables or other elementary interrelations in real life.

I visited few residential places for user study, i targeted to do two kind os studies, one for manual faucet and another for automatic/ sensor faucet. I did study for manual faucets in campus itself, with different kind of faucets and areas with different users.

The intended users i selected for study were housewives, businessmen, students. Since the expected product was supposed to be costlier than normal faucet, so i looked for users who were financially stronger and have dealt with advance faucets already.

The total number of studies done were six, from which two i will elaborate below and also mention inferences taken from them, the interviews were also done in which general questions were asked for behavior in the process.

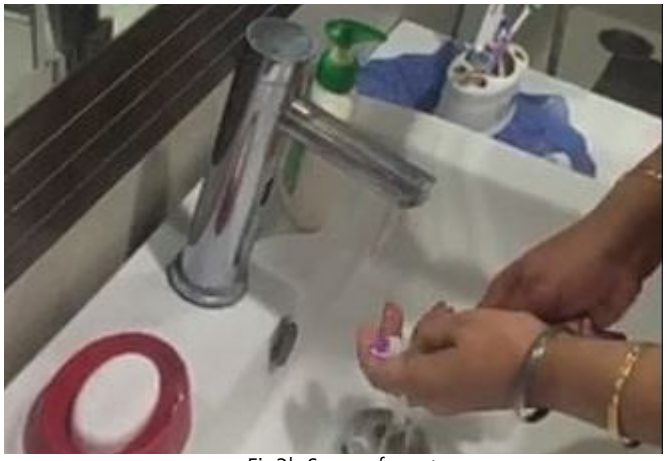


Fig3b Sensor faucet

User study of Sensor Faucet

- User persona: Name- Jyoti Nagpal

  Age- 52

  Occupation- Housewife

  Place-Ludhiana

- Task: User was observed during brushing teeth and cleaning the basin area using IR sensor faucet.

User started brushing by wetting the brush and after completing the process, she cleaned her mouth by scooping the water with hand, and then cleaned the brush at end.

Observations:

- While scooping she struggled with activating the faucet, and activated with another hand.
- While cleaning brush also she struggled with locating area for activation, making whole process little slow and annoying.

Interview:

“We just use this faucet for washing hands, for brushing we generally avoid doing on this faucet, it makes it little slow.”

Fig3a User washing face

User study of manual Faucet

- User persona: Name- Shefali

  Age- 22

  Occupation- Student

  Place- Mumbai

- Task: User was observed during washing her face using manual faucet

User started washing face by collecting water by making scoop with hands and splashing it on face, similar task was repeated several times .

Observations:

- The user let remain faucet open during whole process of washing face.
- The faucet was opened at full speed unintentionally, and the water overflowed the scoop as well.

Interview:

“If i intend to use less water i will just wash my face quickly, but can’t change way of using faucet.”

4.SEMANTICS APPROACH

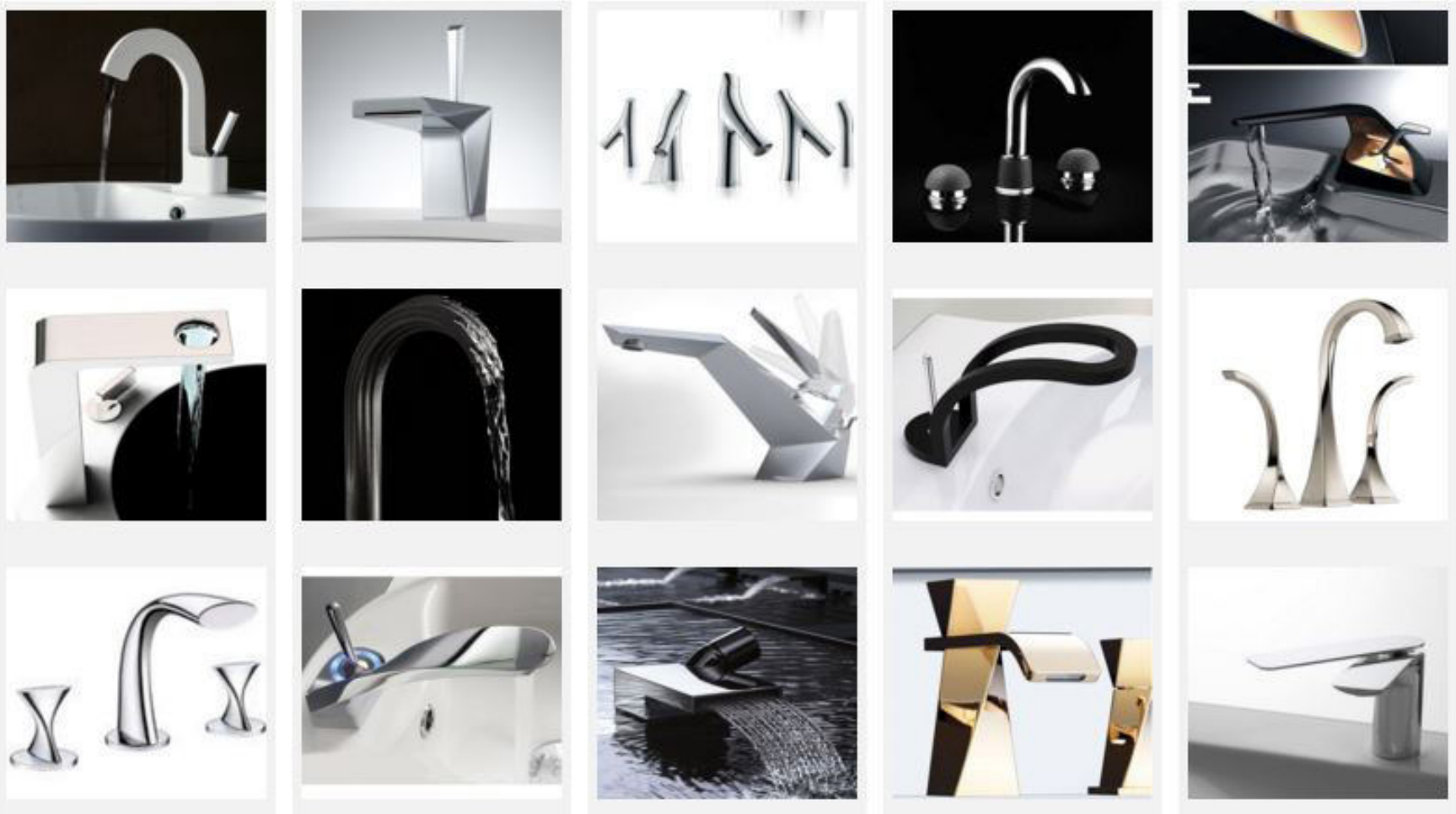
Product semantics approach have been used for formal exploration of project, Semantic gradient method which is one of the categorization method based on Eleanor Rosch theory, which states In most objects, perceptual or functional features occur in unique bundles, giving them a certain amount of predictability. This aids identification of objects. The categorization is achieved over a scale which varies from typical to atypical ,with central member which is generally used to define the category of product, and examples varies to atypical and then fuzzy boundary which are hard to be considered for that category.

This theory helps in understanding features variation over the category, how people perceive the formal features and how does they vary over the scale, those elements or features can be later used for explorations or research purposes, with understanding about the nature of category and in which category we want our product to be.

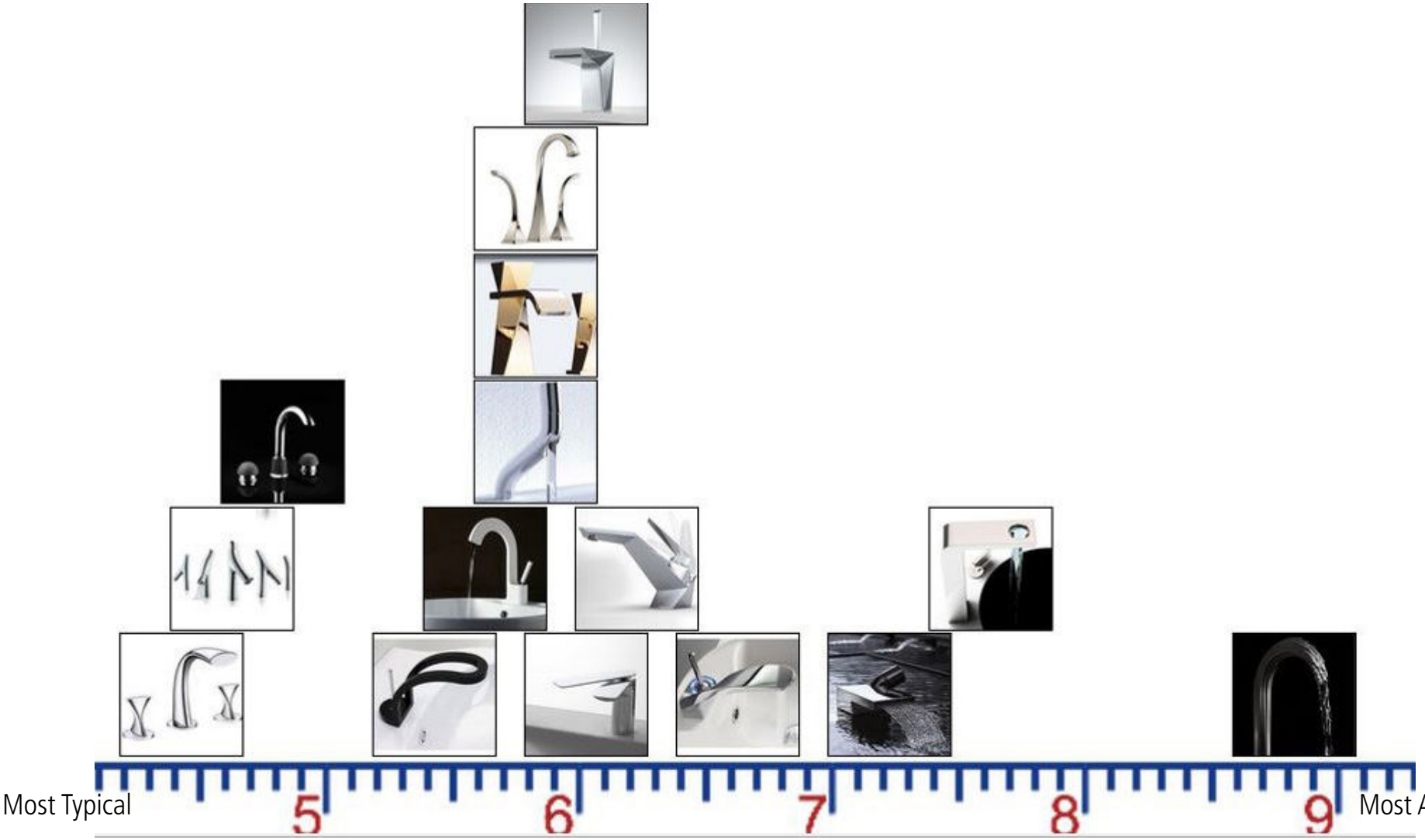
An Online web tool called SEMATOOLS have been used for semantic gradient test, that tool allows easy interfacing of our pictures which are selected for mood board and allows user to sort them easily in different categories, the categories are also customizable in the tool and it also asks questions for reasoning of results.

The pictures shown in 4.1,4.2,4.3 and 4.4 are boards and results for semantic gradient tests.

4.1.BOARD FOR FAUCET INSPIRATIONS

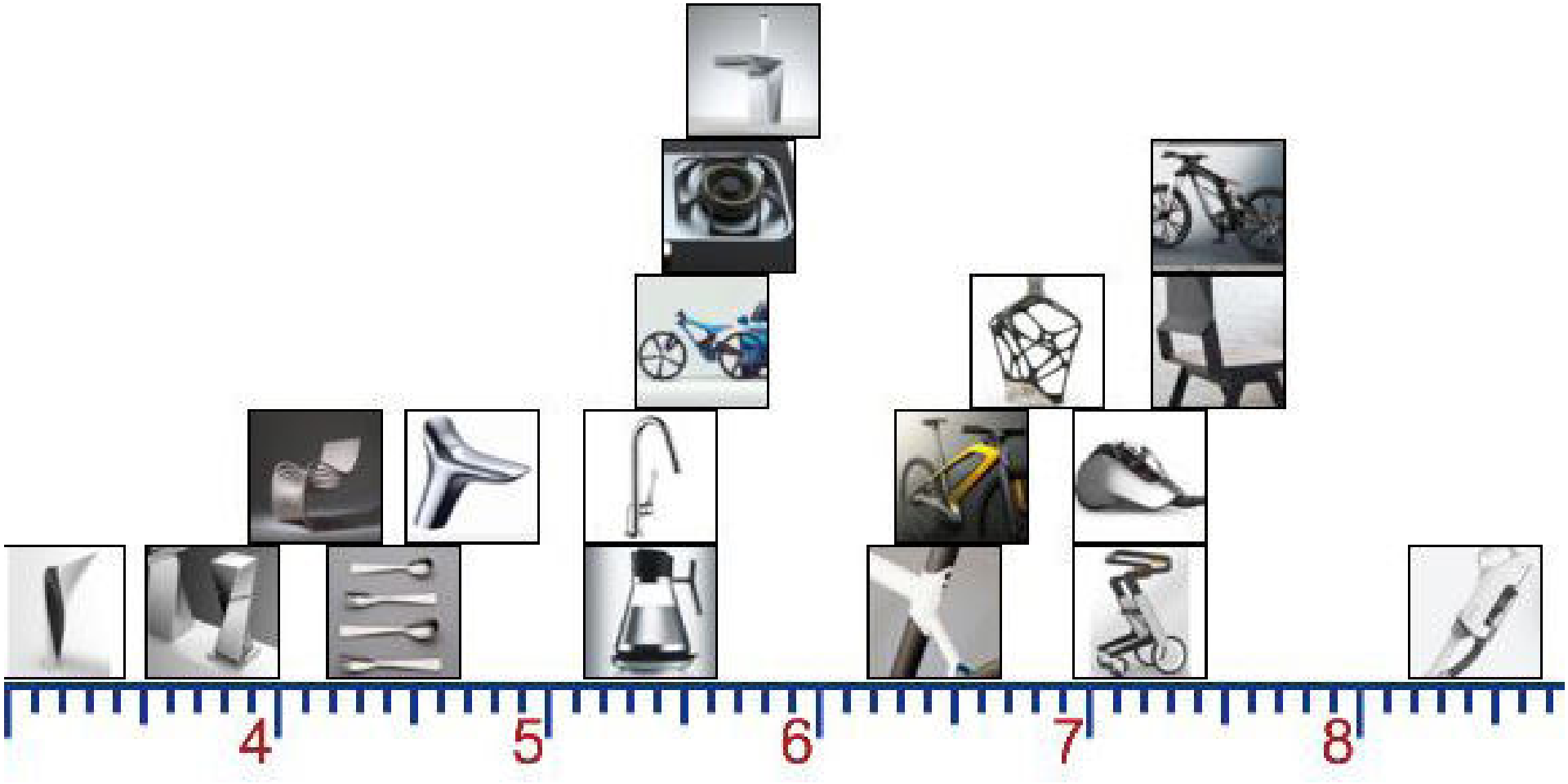


4.2. RESULTS OF FORMAL TEST



4.3. RESULTS FOR TECHNOLOGICAL RELEVANCE TEST

4.4. RESULTS OF EXPRESSION TEST



4.5.TECHNIQUES FOR DOING TEST

Semantic gradient test for formal look of faucets was done using sematools, 20 users have done the test which include some designers and non-designers as well. The link for the test is

http://lbwhosting.biz/sematools/index.php?body_page=resp_form.php&&enc_expm_id=045117b0e0a11a242b9765e79cbf113f.

In test the user is shown pictures of faucets first, and then asked to put them in categories from typical to atypical, for formal and aesthetics. At the end user is asked about reason for putting any three images in their categories. Result of the test is as shown in 4.2.

For the technological relevance semantic gradient, test was done manually, pictures of faucets with technologies mentioned were given to 10 users, most of them were designers. They sorted those pictures over the table and i noted down all the results of all tests and took their average of scores. The final results which came were then organized in Photoshop over scale for better representation as shown in 4.3.

Expression test was also done in sematools, but the scale which vary was very elegant to least elegant. The number of users who did this test was 20 ,Results of test are as shown in 4.4 and the link for test is

http://lbwhosting.biz/sematools/index.php?body_page=resp_form.php&&enc_expm_id=a8f15eda80c50adb0e71943adc8015cf

4.6.INFRENCES FROM SEMANTIC GRADIENT TEST

The faucets which varied from typical to atypical were having some specific features, Faucets which were toward typical were having transition among there ends, more of organic ,natural forms, and forms with cut sharp edges were more toward neither typical nor atypical, and forms with high finish,and simple geometrical solid forms were more towards atypical.

Faucets with different technologies have been sorted over scale of non-likely to likely of having it in faucet. The features which were more likely and not likely to have in a faucet :

Likely features

- Touch sensation
- Visibility of flow
- Informative visuals
- More experiential inter-actions

Unlikely features

- Color indications for temperature of water
- Blue tooth, wi-fi connectivity
- Numerals in displays
- Buttons or indicators
- More movable parts or joints

5.INFERENCES FROM RESEARCH

After present market and technologies research, User behavioral study with daily use faucets and results from semantic gradient test of formal study and technology relevance, some features were taken into consideration to define directions for ideation, features are as following:

- Flow of water: Toggling between shower or solid flow, helps in doing specific tasks by saving water in different scenarios, flows can also be manipulated to different shapes or patterns.

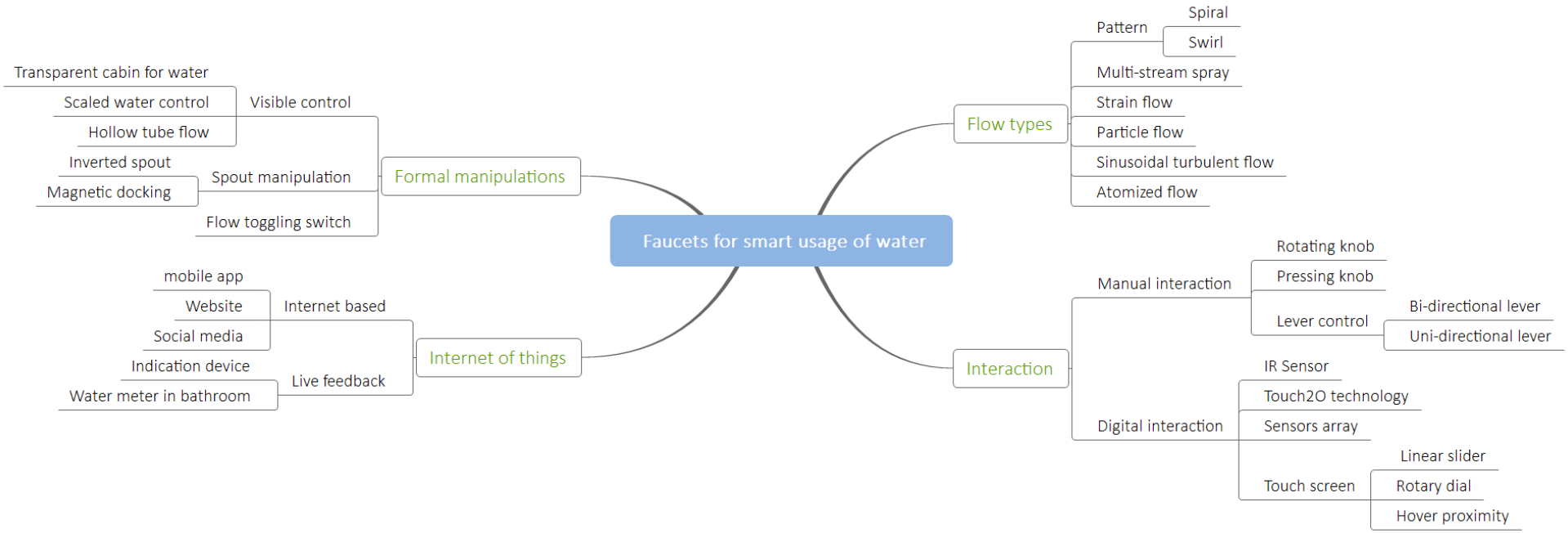
- Operational handle or knob: The major flow controlling decision lies in manual operation of rotating knob, that is intended with behavior of user for operating the faucet.

- Visual feedback: Information about water conserved or to be used, have to be visually displayed, to have decisive behavior and information gathering

- Experiential interactions: The another main focus of using faucet have been decided to have nice experience of using faucet,so the aesthetics of faucets need to have some strong expression and interaction between user and device needs to be smooth and interesting.

- To have a balance between touch and touch less faucets: Touch less and touch interactions needed to be wisely accommodated and have meaningful and purposeful function.

6.MIND MAP


Faucets for smart usage of water
Formal manipulations
Visible control
Transparent cabin for water
Scaled water control
Hollow tube flow
Spout manipulation
Inverted spout
Magnetic docking
Flow toggling switch
Internet of things
Internet based
mobile app
Website
Social media
Live feedback
Indication device
Water meter in bathroom
Flow types
Pattern
Spiral
Swirl
Multi-stream spray
Strain flow
Particle flow
Sinusoidal turbulent flow
Atomized flow
Interaction
Manual interaction
Rotating knob
Pressing knob
Lever control
Bi-directional lever
Uni-directional lever
Digital interaction
IR Sensor
Touch2O technology
Sensors array
Touch screen
Linear slider
Rotary dial
Hover proximity

7.SELECTION OF WORK AREA AND USER GROUP

Work area selected for project is faucets which are used on wash basins or faucets used for purposes like brushing,washing face/hands, shaving etc. With the research done its seen that in household usage people mostly interacts with faucets mounted on the basin, whereas with other faucet areas one has to deal with once or twice in a day, In processes like brushing teeth or shaving in which most of user are intended to leave faucet open during the process, that creates need to emerge awareness among user and to design faucet for efficient use of water.

User group for project which are selected are the people who likes to buy Efficient products, but costly. Since faucet industry has already have niche market for expensive faucets. The faucet which will be designed will be having higher technology and much greater value in terms of efficiency, since the product is meant to be costly so aesthetic of product has also to be considered with much greater value than normal faucets. These faucet can emerge into routine market with need of purpose over time.

8.CATEGORIZATION FOR IDEATION

After all the research inferences and mind mapping, categories for ideation were selected. Main priority in categorization was given to interaction of user with faucet to control and manipulate flow and to create awareness using visual feedback, The awareness was tried to bring through decisive interactions with faucets,to decide amount of water to be used for the process. The whole experience of using faucet have been targeted to be minimal in time and nice. Following are the categories decided for ideation:

- Faucets with decisive and manual interactions: In this category focus was given on decision making for usage of water by user and the operation of control to be done manually

- Faucets with decisive and digital interactions: In this category decision making in way of using faucet and amount of flow of water have been given priority

- Faucets with decisive visible interactions: For more impaction behavior of deciding water for usage, visible interaction of water being have been focused.

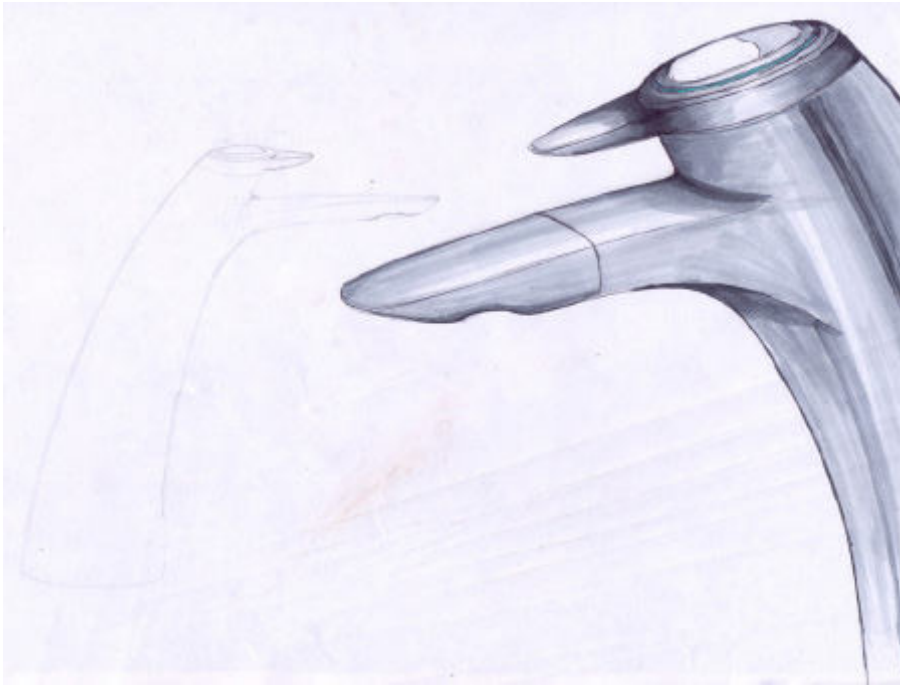
- Faucets with Inverting spout: This was explored as individual category and also included as feature in other categories, inverted spout helps in easy washing of face

9.DESIGN BRIEF

To design a faucet for wash basin area in household, which facilitates water saving by smart manipulation of flow and doing interactions with faucet according to purpose, to create awareness among user about water saving in daily life activities like brushing teeth,washing face/hands, shaving etc. with providing interactions which helps in developing decision making capability about the way of doing process and amount of water to be used for it, To provide feedback in subtle representation to encourage to use less amount of water in activities.

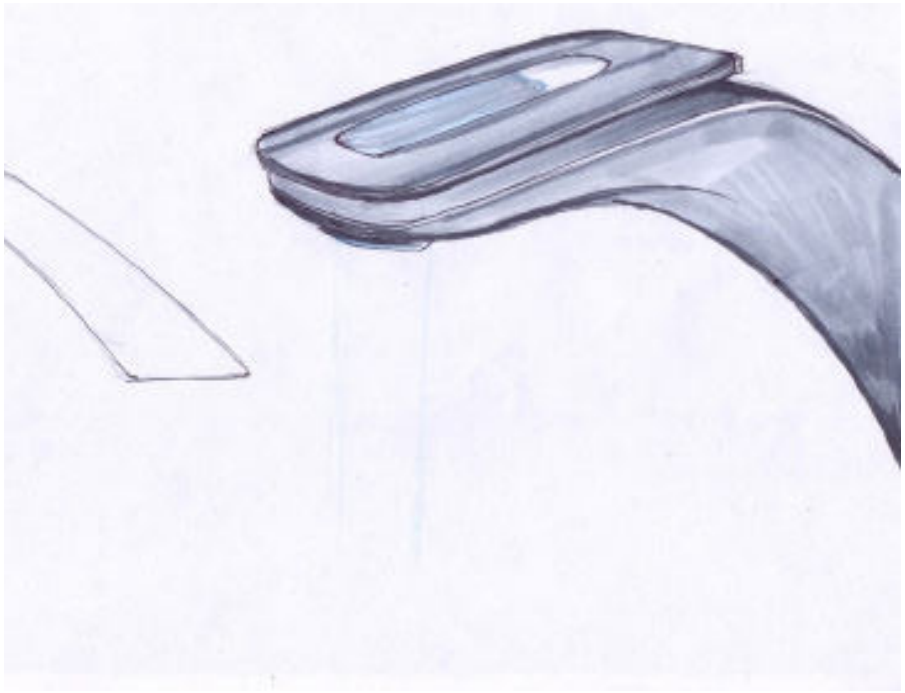
10.IDEATIONS

Ideations 1&2



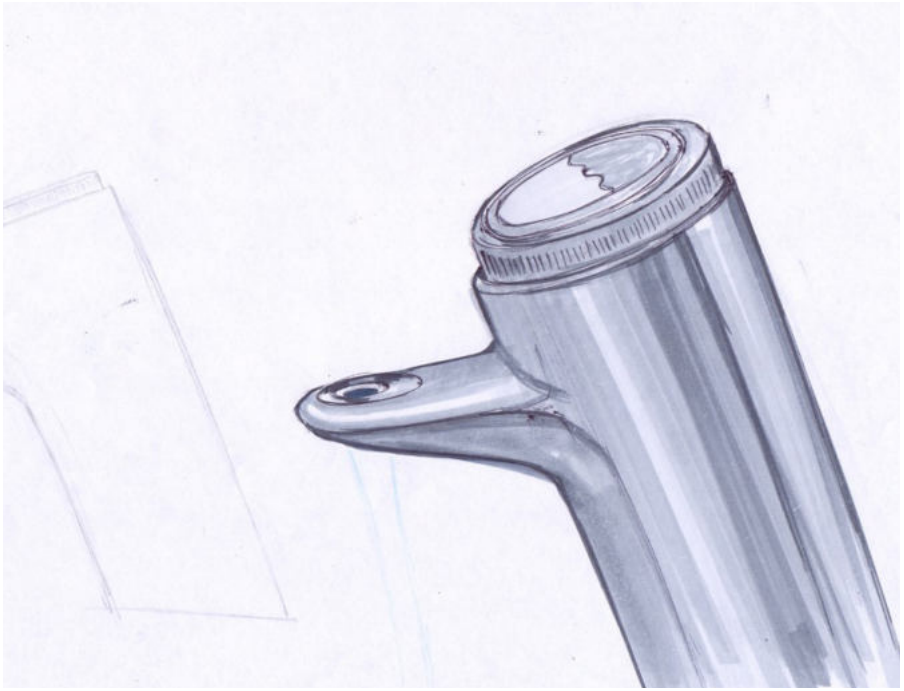
- Tall faucet with slightly curvy cylindrical body
- Touch dial faucet concept-Rotary dial
- Dial for to decide amount of water and lever to operate

1.Faucets with decisive and manual interactions



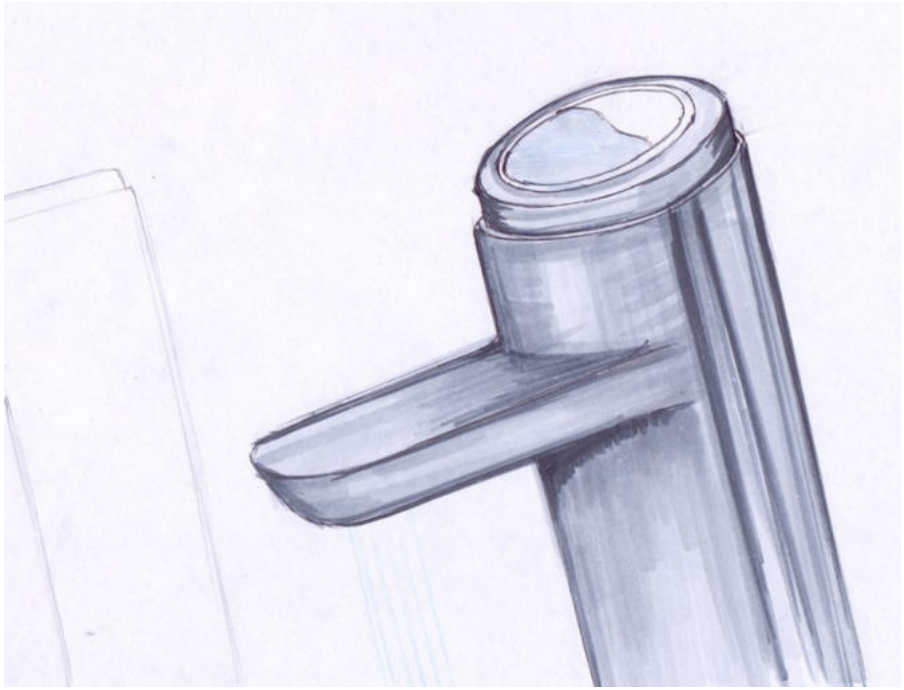
- Medium sized Soft base and flat head
- Touch slider faucet concept-Linear slider
- Slider for to decide amount of water and lever to operate

Ideation 3



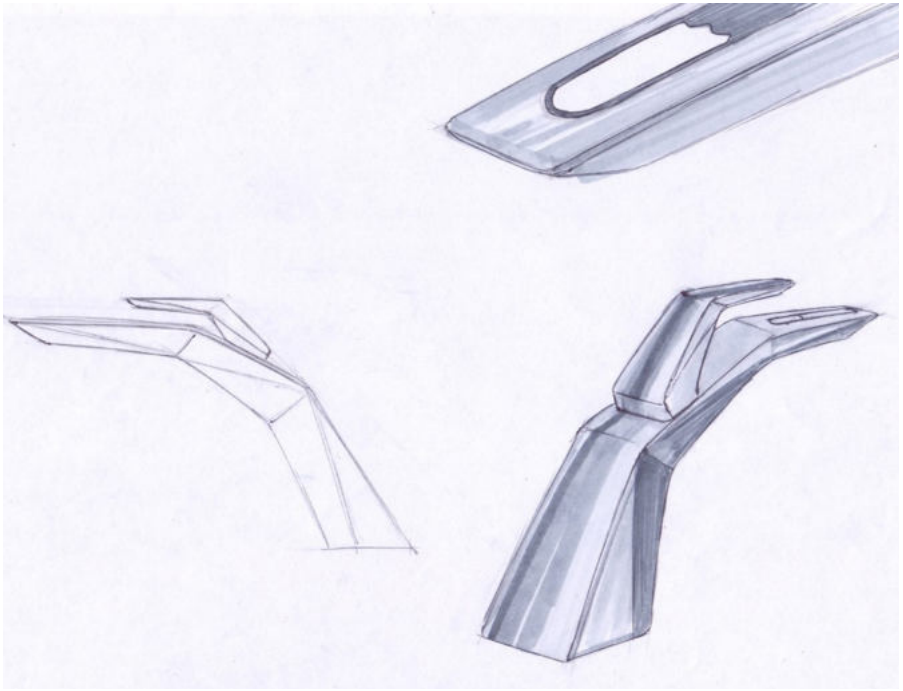
- Tall faucet with cylindrical body
- Touch dial faucet concept-Rotary dial
- Dial for to decide amount of water and Rotary button

Ideation 4



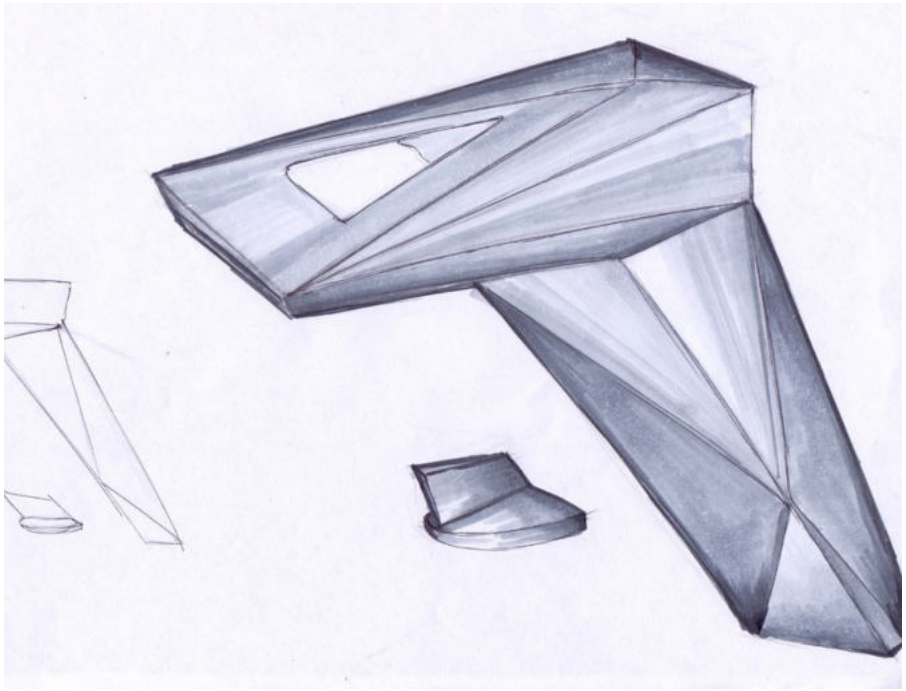
- Tall faucet with cylindrical body
- Touch dial faucet concept-Rotary dial
- Dial for to decide amount of water and Push button

Ideation 5



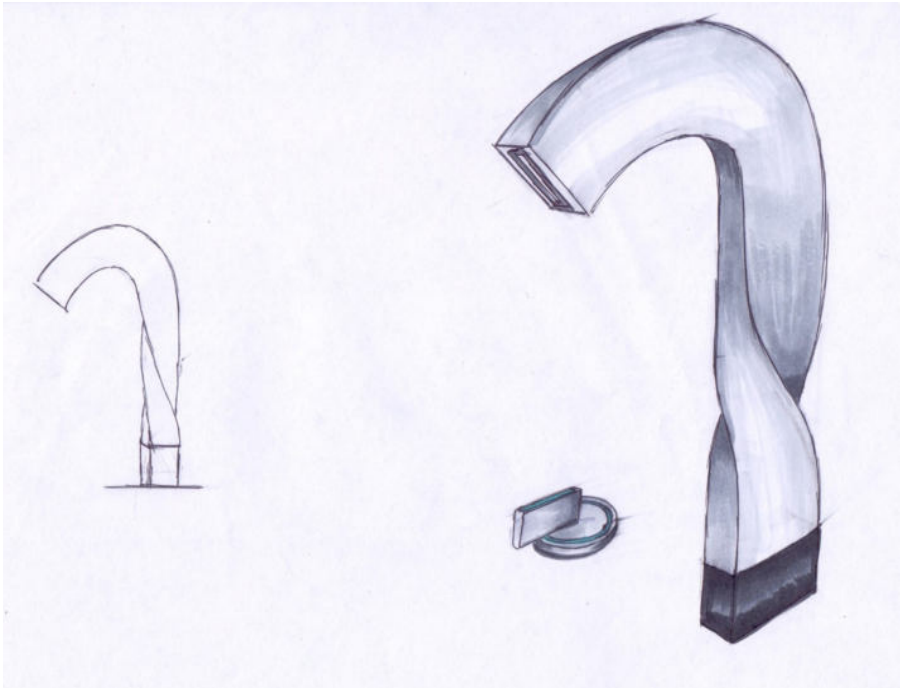
- Tall cut edge origami inspired
- Touch slider faucet concept-Linear slider
- Slider for to decide amount of water and lever to operate

Ideation 6



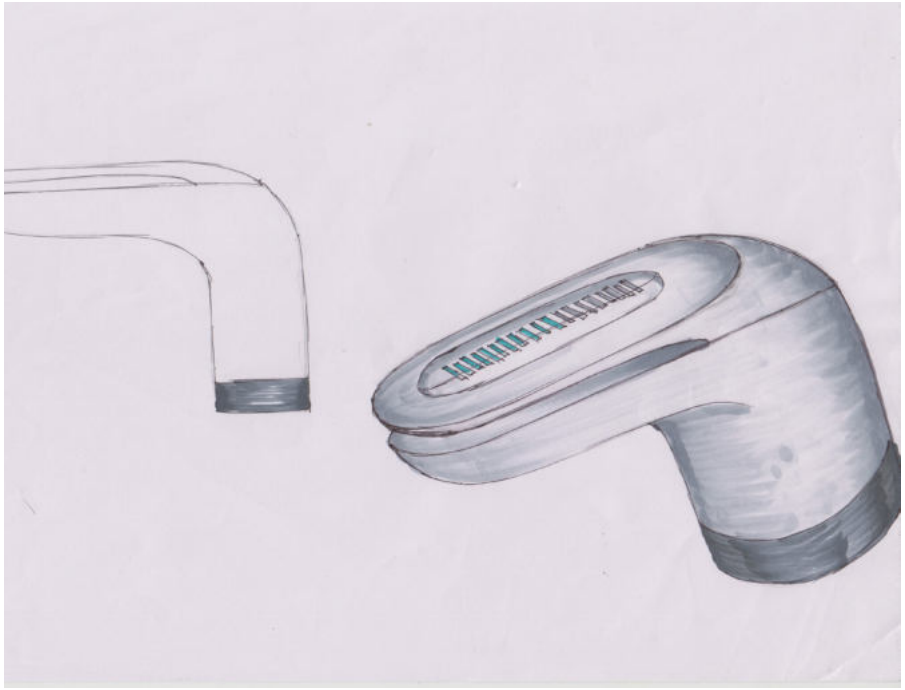
- Medium cut edge diamond cut inspired
- Touch slider faucet concept-Linear slider
- Slider for to decide amount of water and Rotary button

Ideation 7



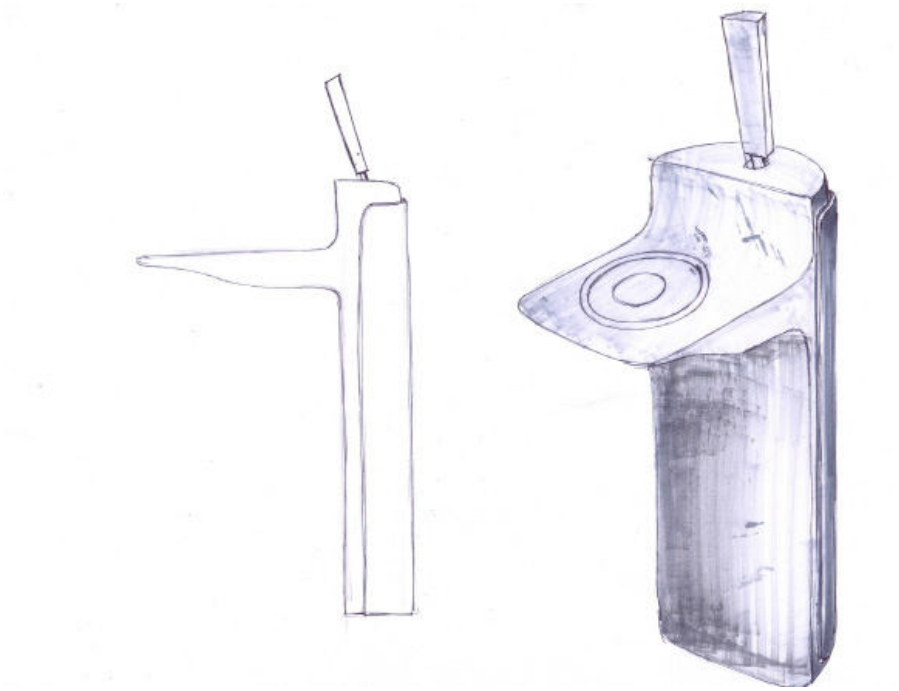
- Long J shaped,rectangular crossection with twisted base
- Touch slider faucet concept-Linear slider
- Slider for to decide amount of water on Rotary button

Ideation 8



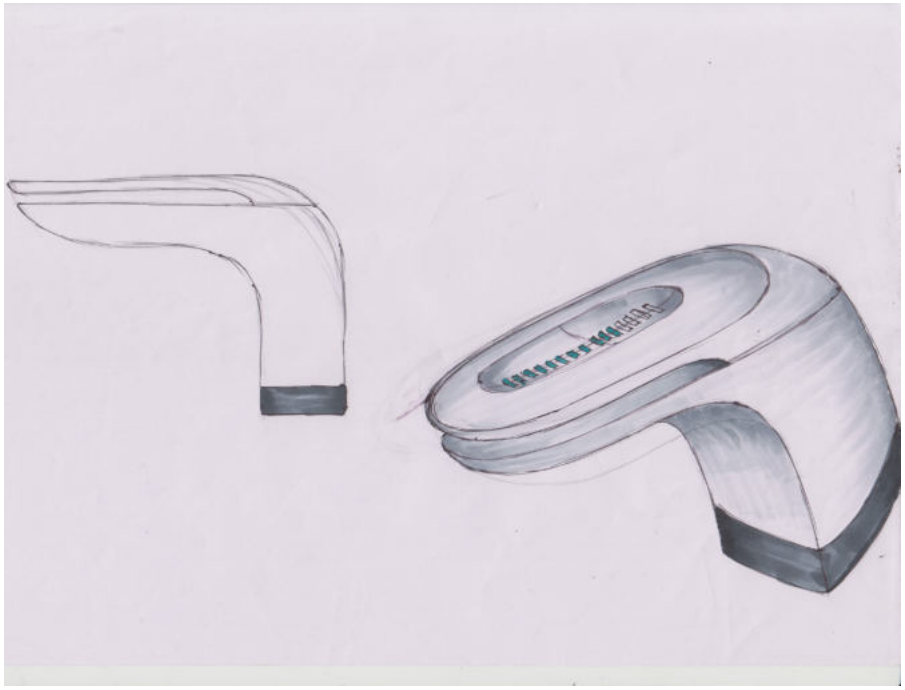
- Medium sized Soft base and flat head, white matte finish
- Touch slider faucet concept-Linear slider
- Slider for to decide amount of water and lever to operate

Ideation 9



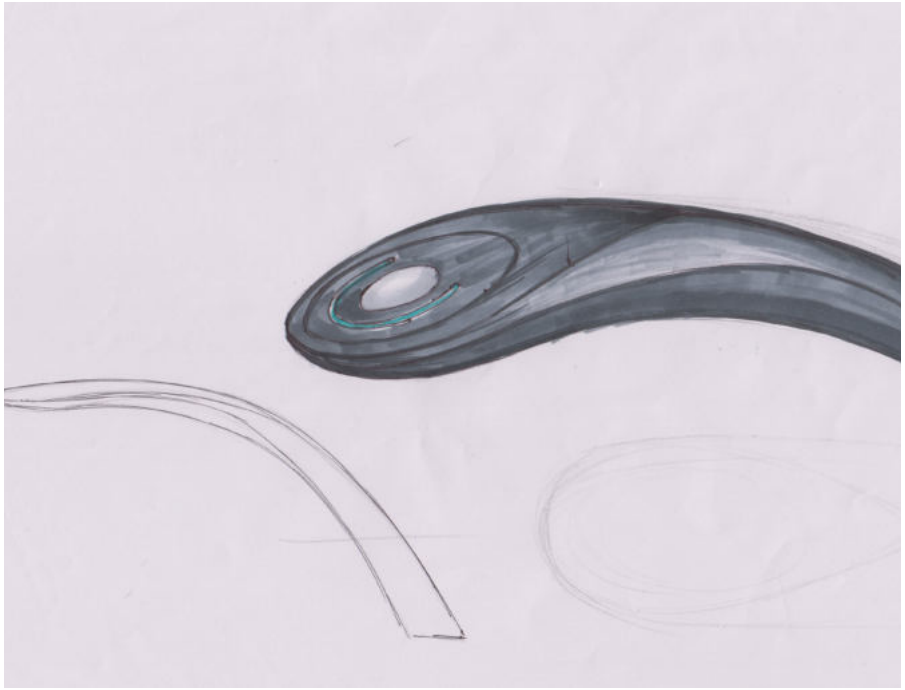
- Tall semi cylindrical body with Outer ceramic coating
- Touch ring to activate stream line and circular to toggle
- Lever to start the flow

Ideation 10



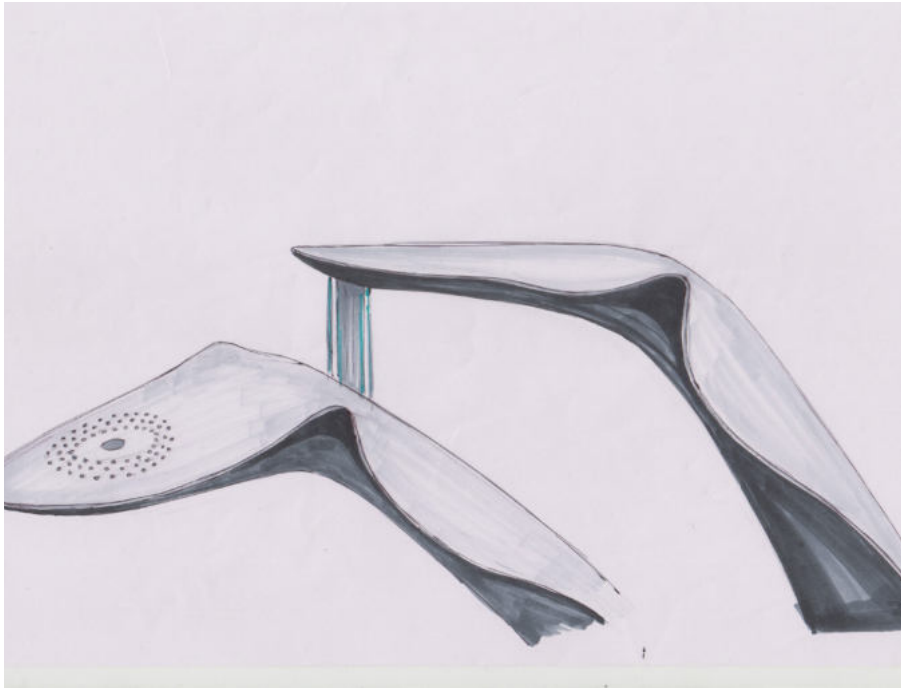
- Medium sized edgy base and flat head, white matte finish
- Touch slider faucet concept-Linear slider
- Slider for to decide amount of water and lever to operate

Ideations 11& 12



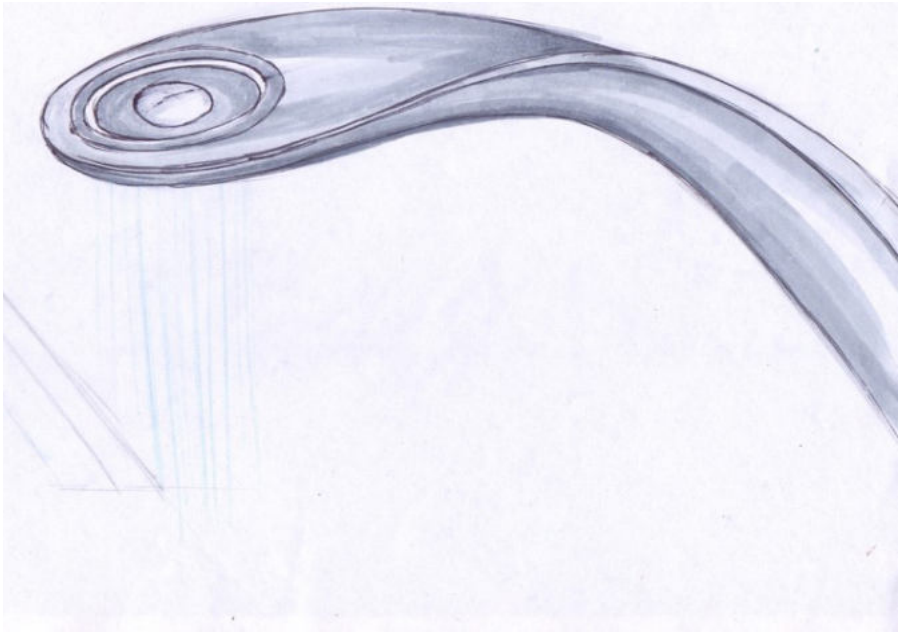
- Cut edge inspired, black matte design
- Ring and circle to toggle between flows

2.Faucets with decisive and digital interactions



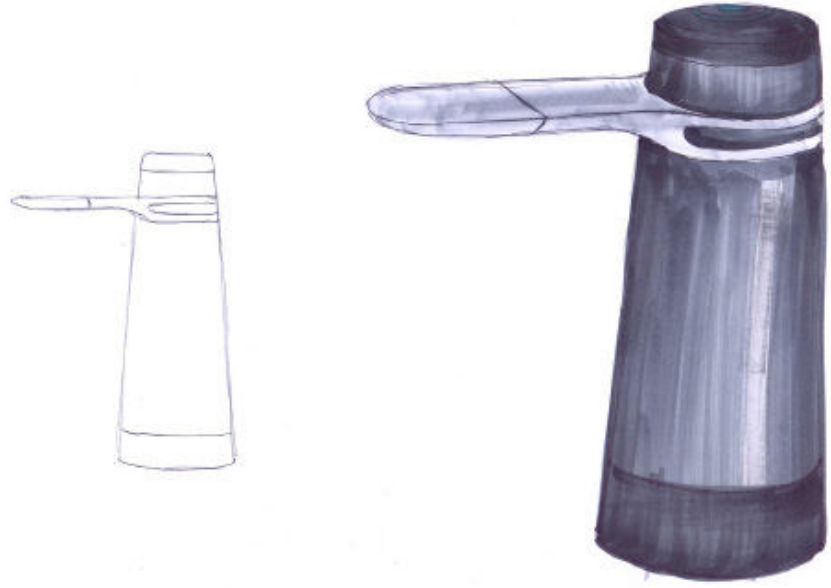
- Top white and base dark grey anodized matte finish
- Chrome line in interface to show flowy nature
- Ring and circle to toggle between flows

Ideation 13



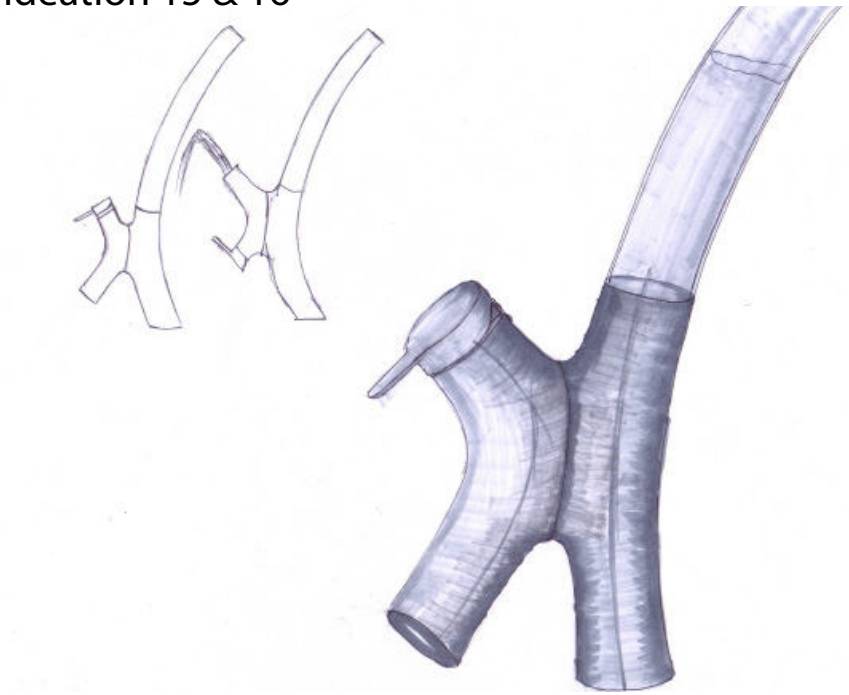
- Soft base and flat top,smooth curvature
- Ring and circle to toggle between flows

Ideation 14

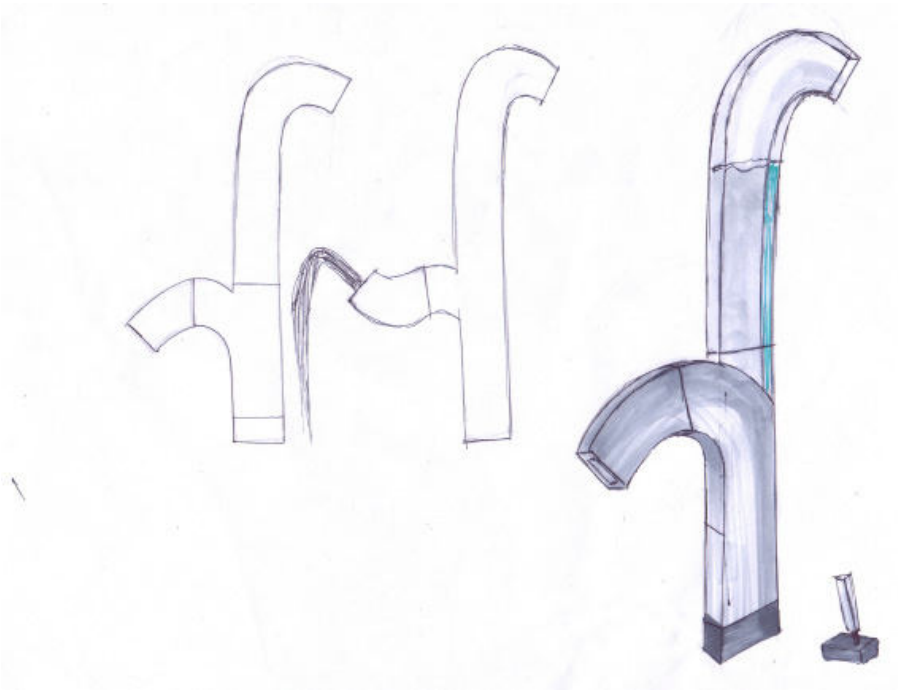


- Tall, Conical cylinder with black matte finish and chrome spout, base and top gloss black finish
- Inverted spout and rings to toggle between flows

Ideation 15 & 16

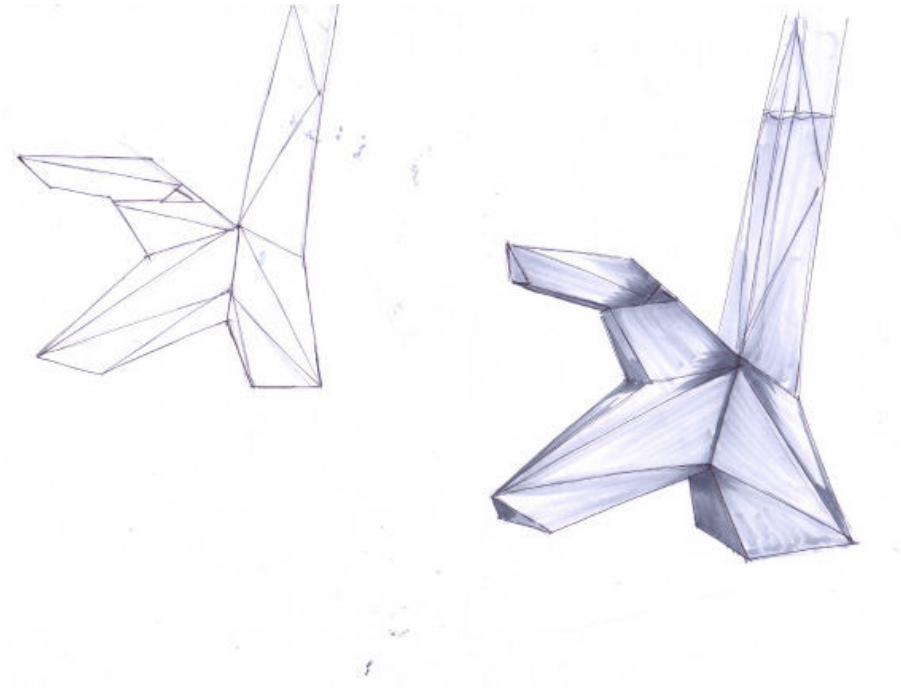


- Organic cylindrical shape with glass pipe to collect water before use for judgement
- Invertable and rotatable spout and lever to operate



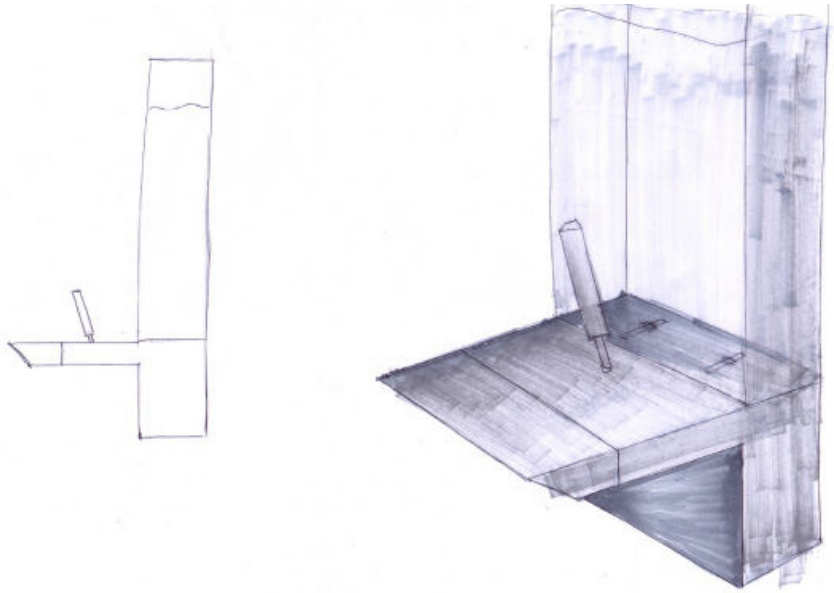
- J-shape with rectangular crossection and glass pipe to collect water before use for judgement
- Invertable and rotatable spout and lever to operate

Ideation 17



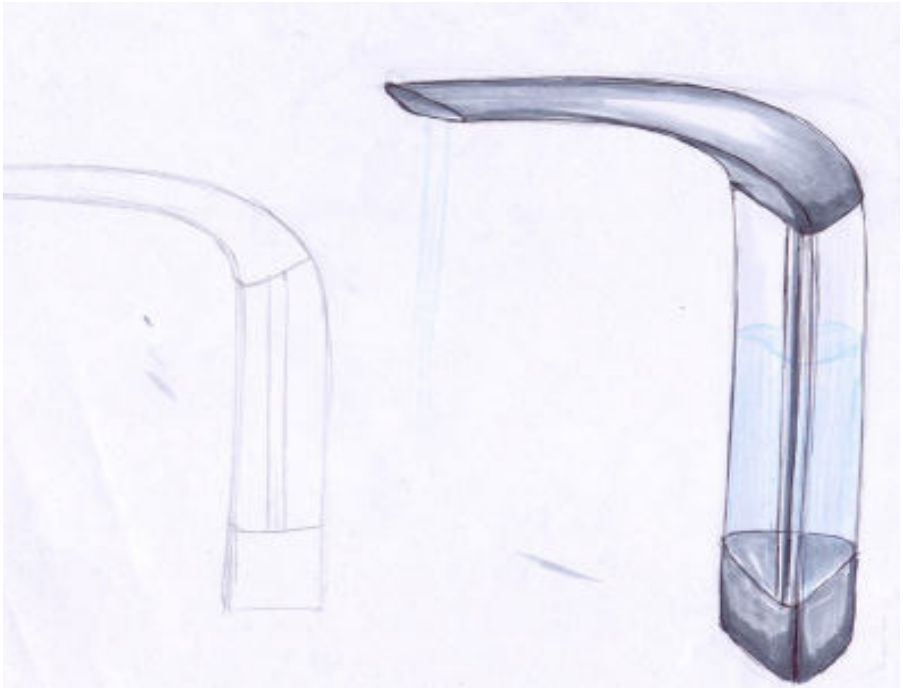
- Diamond cut sharp edgy strong crystal form and glass pipe to collect water before use for judgement
- Lever to operate

Ideation 18



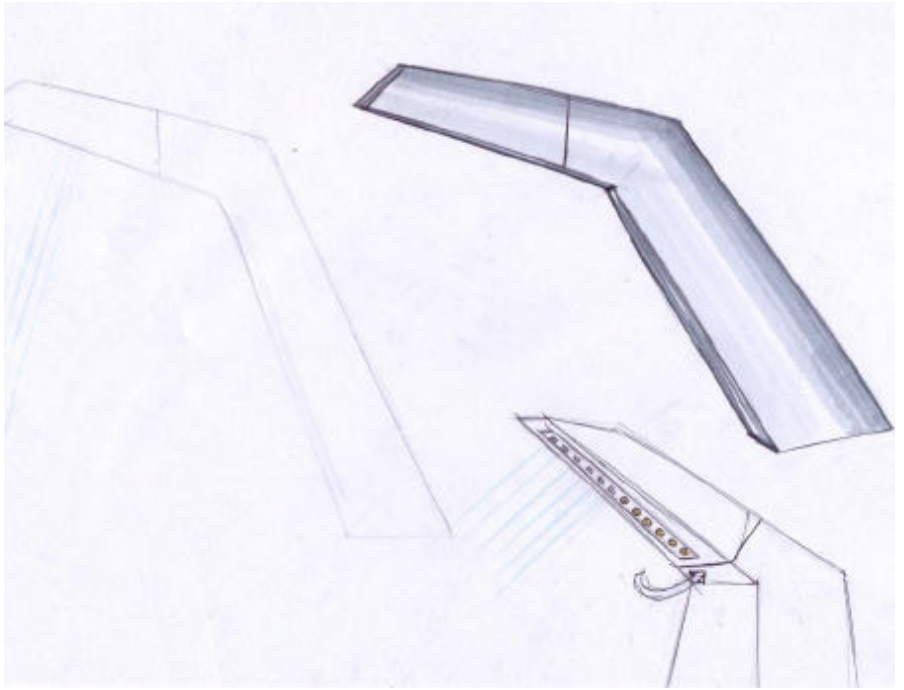
- Geometrical cuboidal minimal shape and glass cabin to collect water before use for judgement
- Lever to operate and invertable spout with streamline flow

Ideations 19 & 20



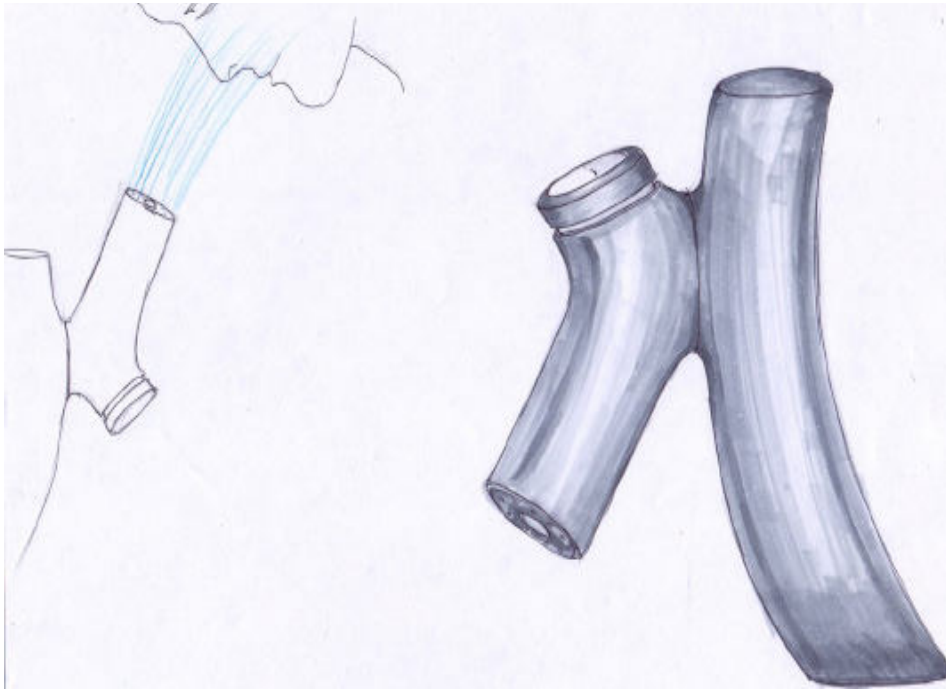
- Triangular crossection form and glass cabin to collect water before use for judgement
- IR sensor to operate

4.Faucets with inverting spout



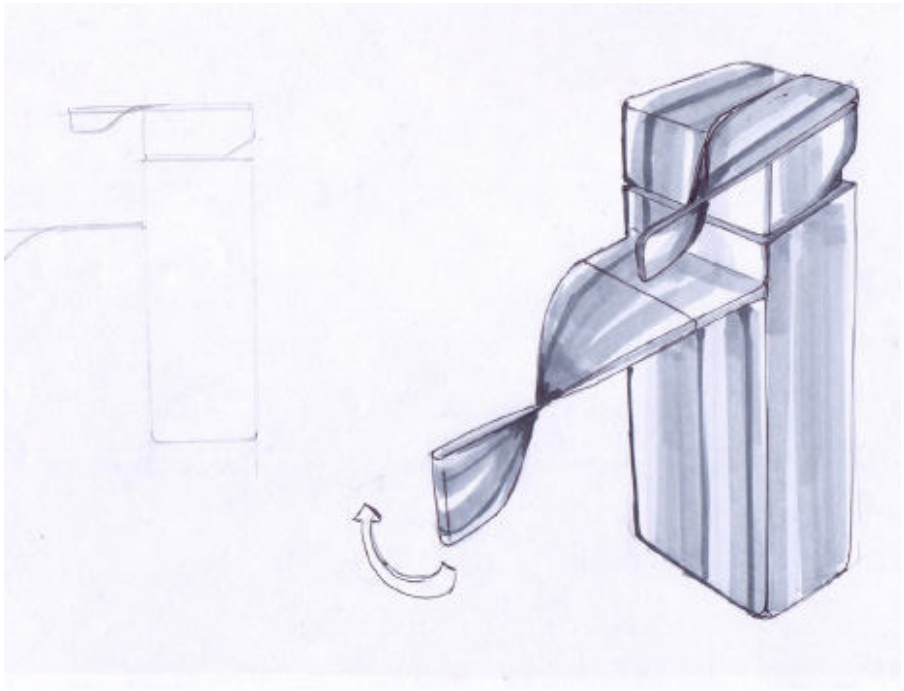
- Geometrical minimal shape with invertable spout
- Array of sensor to activate streamlines

Ideation 21



- Organic cyclindrical form with invertable spout
- Push button to activate flow

Ideation 22



- Geometrical cuboidal form with twisted and invertable spout
- twisted lever to activate flow

11.CONCEPT GENERATION

Concept 1

- Concept from ideation 1
- Touch screen dial which gives visuals of water getting filled as we roate the dial

- Strain flow
- IOT- mobile app to have information of water used in a day

Concept 2

- Concept from ideation 8
- Slider touch to decide amount of water used, White glown is active part of slider

- Strain flow only
- Lever to operate

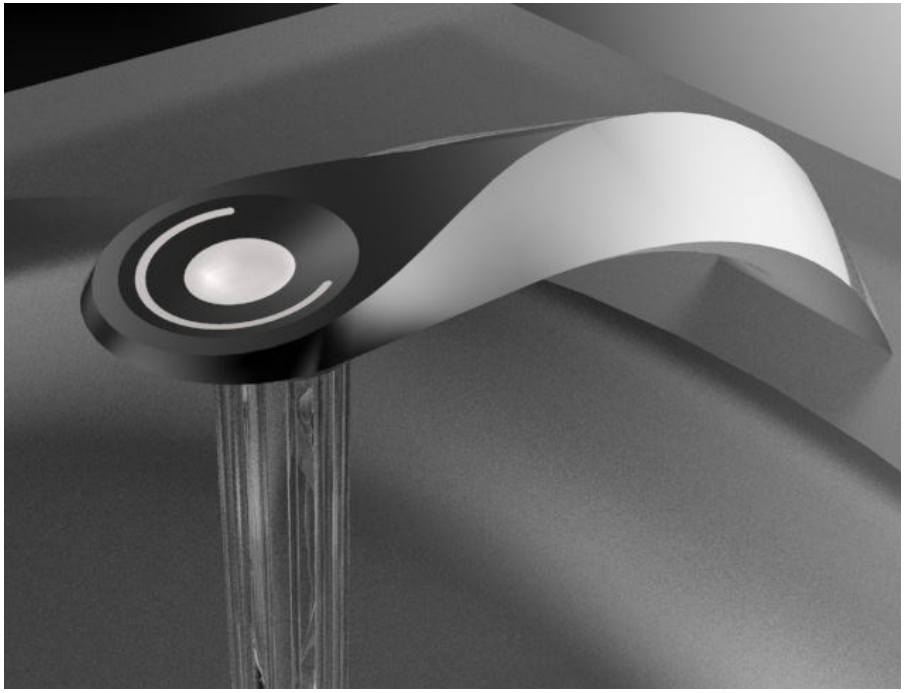
Concept 3

- Concept from ideation 12
- Strain and multi stream flow
- Soft and dynamic form with top anodized gloss white and base anodized dark grey

- Rings to activate streamlines,outermost ring for outermost streamline and vice versa
- Circular middle button to activate strain flow
- Operated with IR sensor

Concept 4

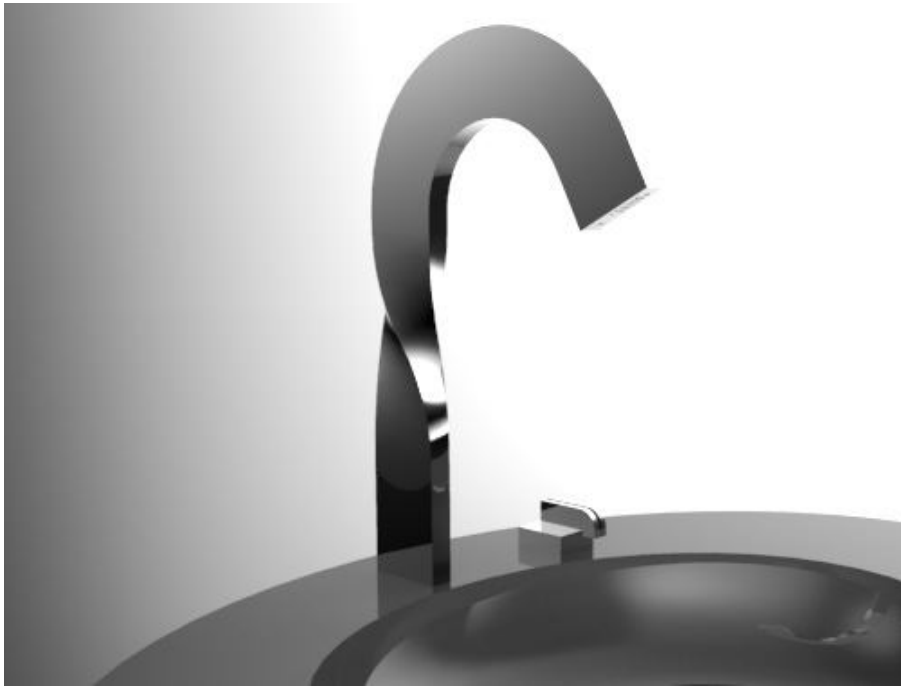
- Strain and multi stream flow
- Edhy and dynamic form with anodized black aluminium finish



- Rings to activate streamlines
- Circular middle button to activate strain flow
- Operated with IR sensor

Concept 5

- Concept of ideation 7
- Multi stream flow
- J shaped form with multi-material,base of wood finish



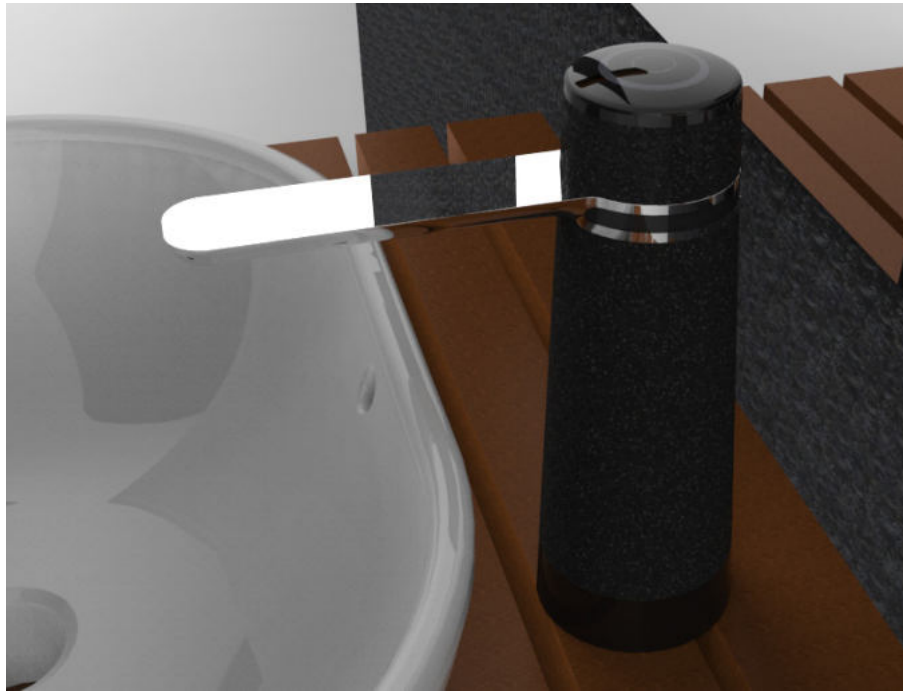
- Rotary lever to operate the faucet
- Slider over lever to decide amount of water to be used

Concept 6

- Concept from ideation 18
- Transparent cabin for collection of water

- Minimal geometrical shape
- Inverted spout and lever to operate

Concept 7

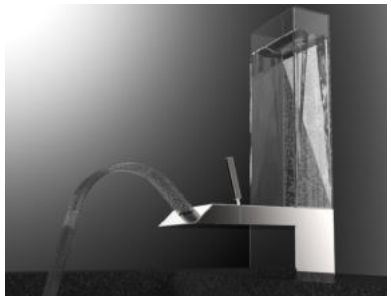


- Concept from ideation 14
- Long conical cylinder, glazed ceramic amorphous rough texture

- Flexible moving spout and invertable
- Rings in touch panel overhead to decide activation of streamline area

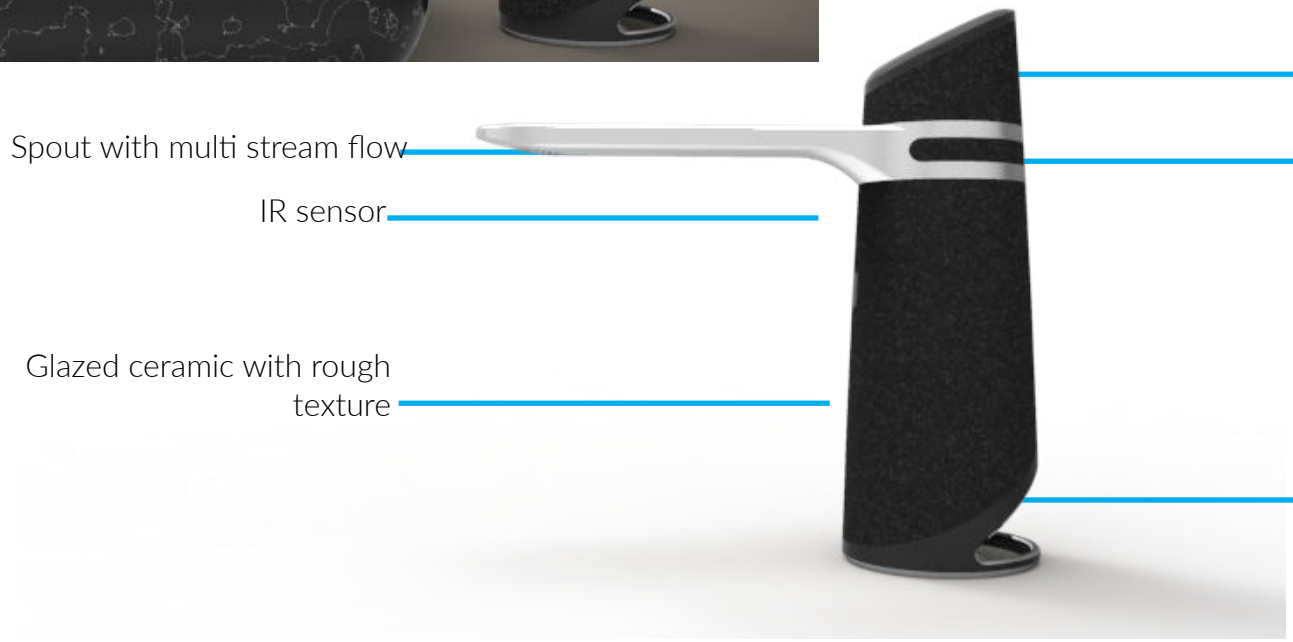
12.CONCEPT EVALUATION

S.no	Concept	Type of flow	Interaction involved	Aesthetics	Extra features	Limitations
1		Strain	• Touch screen dial to decide amount of water to be used • Flow control using lever	• Tall and slightly curved shape • Chrome finished	Tells amount of water used through IOT	Quantification of water on screen might not be easily understandable
2		Strain	• Touch slider to decide amount of water to be used • Flow control using lever	• Matte white anodized aluminum • Soft looking form, precise handle	n/a	Exact purpose of slider not clear for first time user
3		Strain and multi stream	• Circular pattern on touch panel of dots for activation of multi stream • Centre circle for activation of strain • IR sensor for starting flow	• Gloss anodized brass white in color for top and Matte anodized black for below part • Curvy chrome line representing flowy form of faucet	n/a	n/a

S.no	Concept	Type of flow	Interactions involved	Aesthetics	Extra features	Limitations
4		Strain and multi stream	• Circular outer ring to activate multi stream • Centre circle to activate strain flow	• Sharp edges, cut shaped form • Black anodized brass	n/a	n/a
5		Multi-stream	• Lever to operate the faucet • Glass cabinet to decide amount of water to be used for the process	• Chrome finished • Geometric minimal shape • Low refractive index glass for better reflections	Inverted spout	During inverted spout usage water cannot be decided and have to be directly used
6		Multi-stream	• Touch interface to select rings for selection of range of multi stream • Centre button for permanent activation of flow • IR sensor for starting flow	• Chrome finished spout • Top and bottom part of Body of gloss anodized brass • Middle part of glazed black ceramic	• Inverted spout • Flexible movement of spout	Little difficulty in first time operation

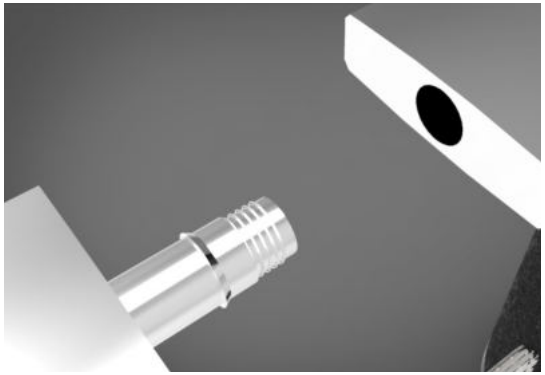
13.CONCEPT FINALIZATION

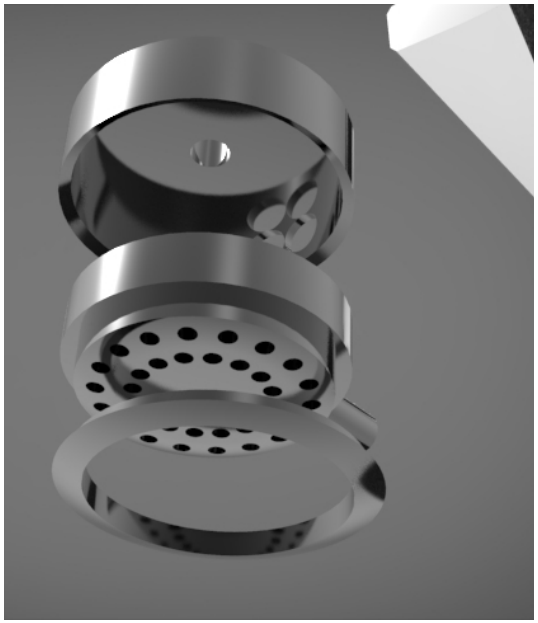
- Concept 7 is final concept which has more advantages and flexibility in using faucet over other faucets
- Flexibility in movement of spout allows easy operations during process of cleaning
- Inverted spout allows easy washing of face with inverted stream

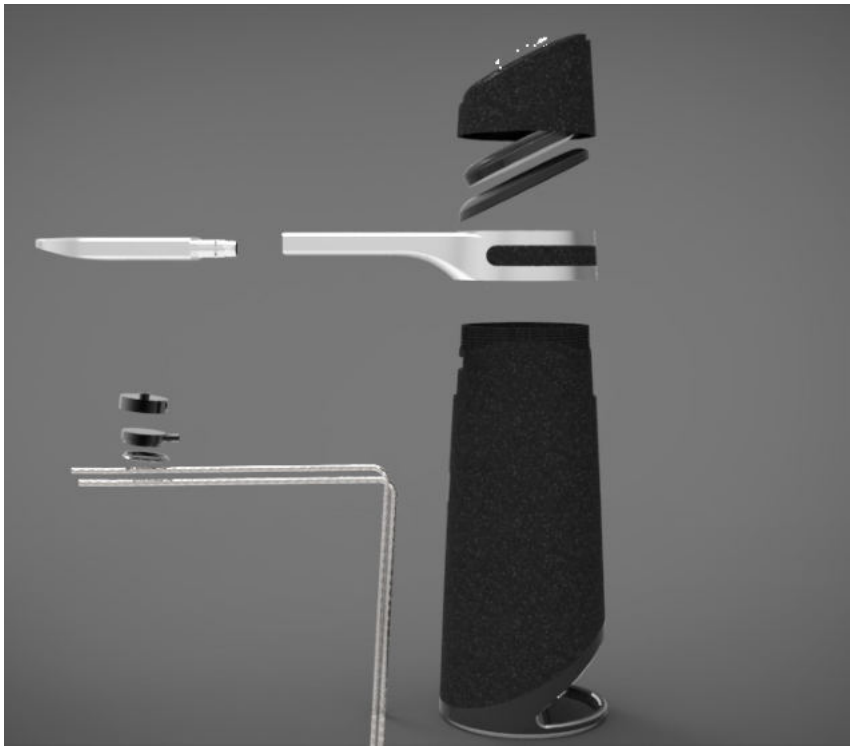


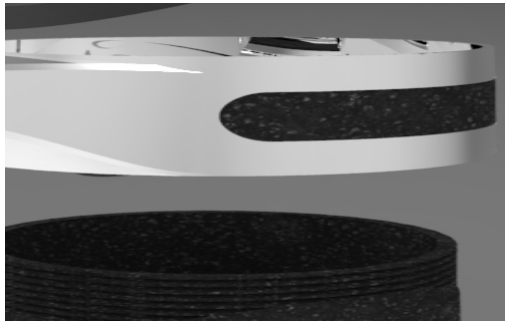
- Invertebility of spout comes with tilted valve for curved flow towards outside
- Valve has three ranges of multi-stream to cover more area while washing, selection of range happens with rings selected
- Three rings for three different ranges of flow, outermost for broader one and vice versa
- Long press of Centre button for 5 seconds activates permanent flow and stopping with one touch.

EXPLODED VIEW









14. REVISED DESIGN BRIEF

To design a faucet for wash basin area in household, that facilitates water saving by smart manipulation of flow, as well as intuitive interaction to encourage to use less amount of water in activities. Following are the aspects which will be included in final design:

- Inverting spout
- Multi-stream flow in straight and expanded flow
- Touch control panel for activation of flow
- Multi-optional way of activation, through IR or Control panel

15.FEATURES FINALIZATION FOR CONCEPT REFINEMENT

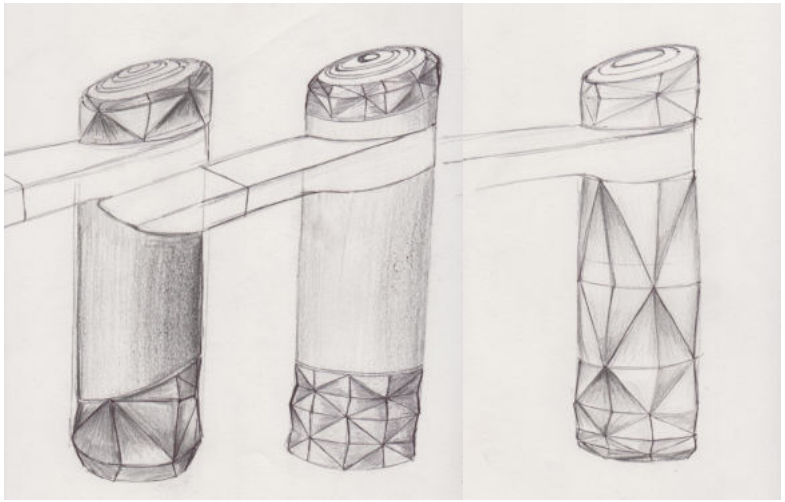
Multi-stream flow in straight and expanded flow

Inverting spout

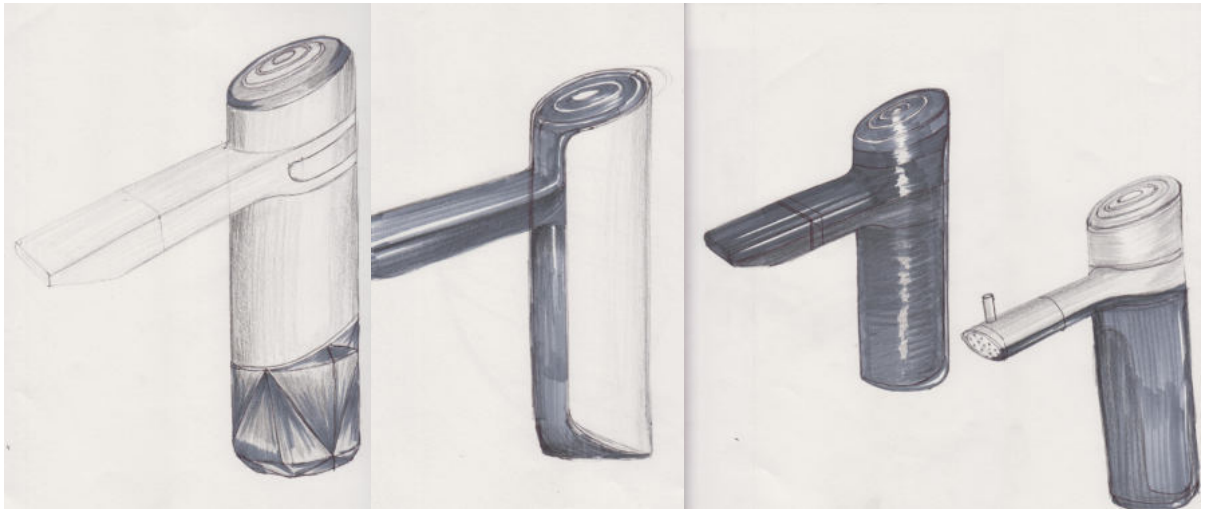
Touch control panel for activation of flow

Multi-optional way of activation

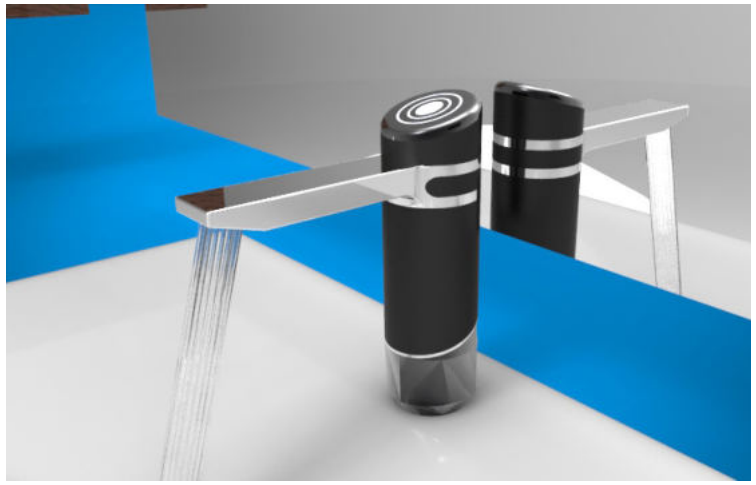
16.CONCEPT REFINEMENT



After shortlisting features from previous concept, more ideas were developed to refine form and usability aspects, target was to generate elegant form, I took facets elements and other combination of material to generate new concepts.

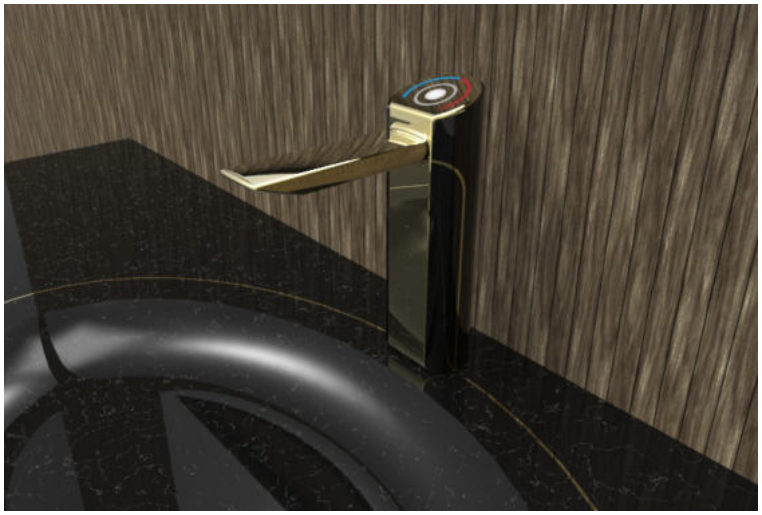


17.REFINED CONCEPTS



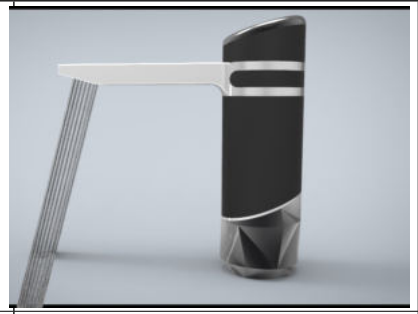
Concept 1

Concept 3



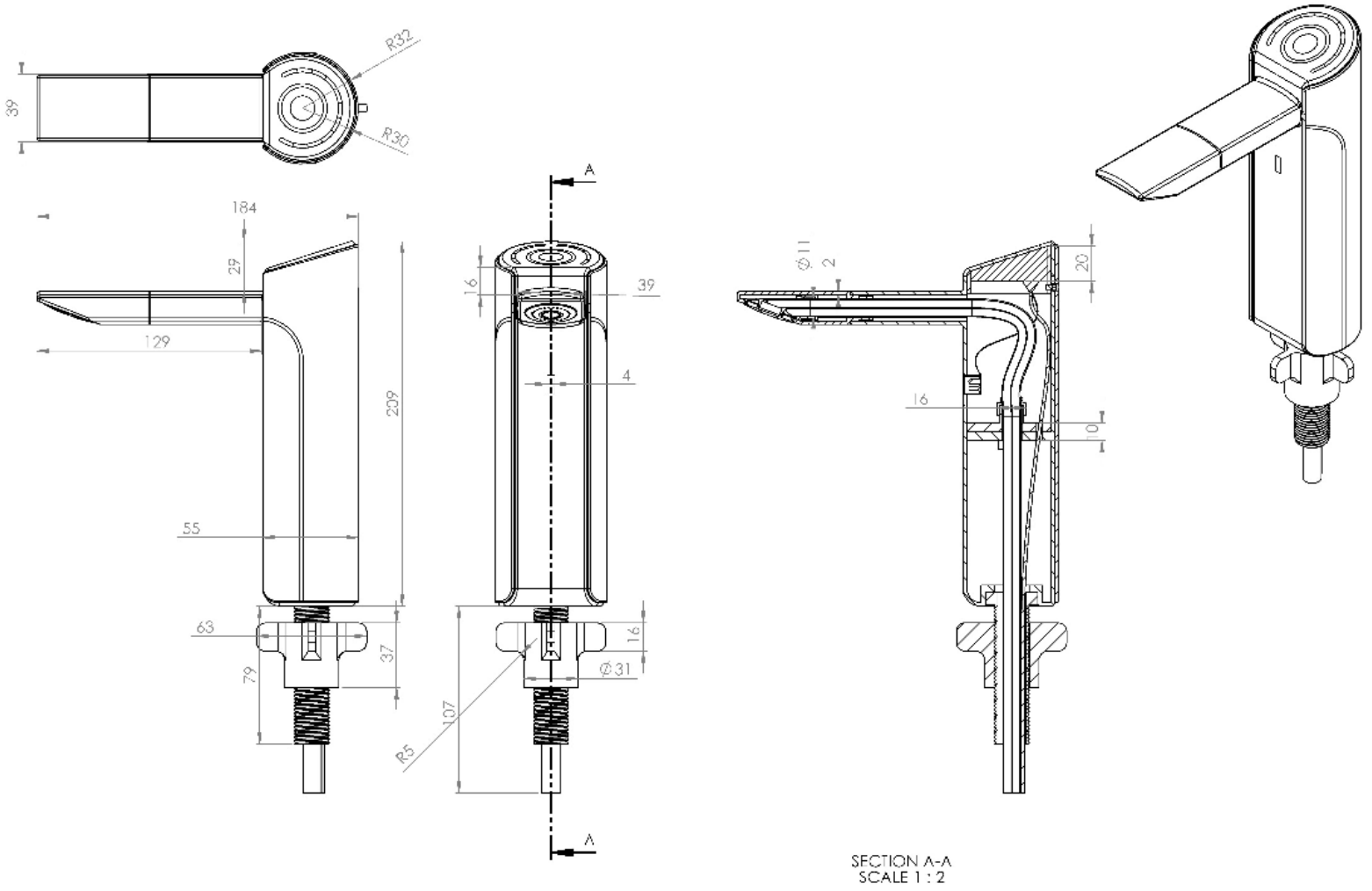
Concept 2

18.RE-EVALUATION OF CONCEPTS

S.no	Concept	User Review	Value for money	Aesthetics	Total
1		Elegant , Base have more elements 6/10 people liked	• Looks rich • Perceived value 25,000-35,000	• Looks- 6/10	6
2		Minimal, lesser visual mass,Rich 9/10 people liked	• Looks decently rich • Perceived value 40,000-50,000	• Looks-8/10	8.5
3		Clean but bit heavy looking 2/10 people liked	• Doesn't look equally rich as others • Perceived value 15,000--25,000	• Looks-3/10	2.5

19.FINAL CONCEPT

20.DETAIL DRAWINGS



21.CROSS-SECTION AND WORKING

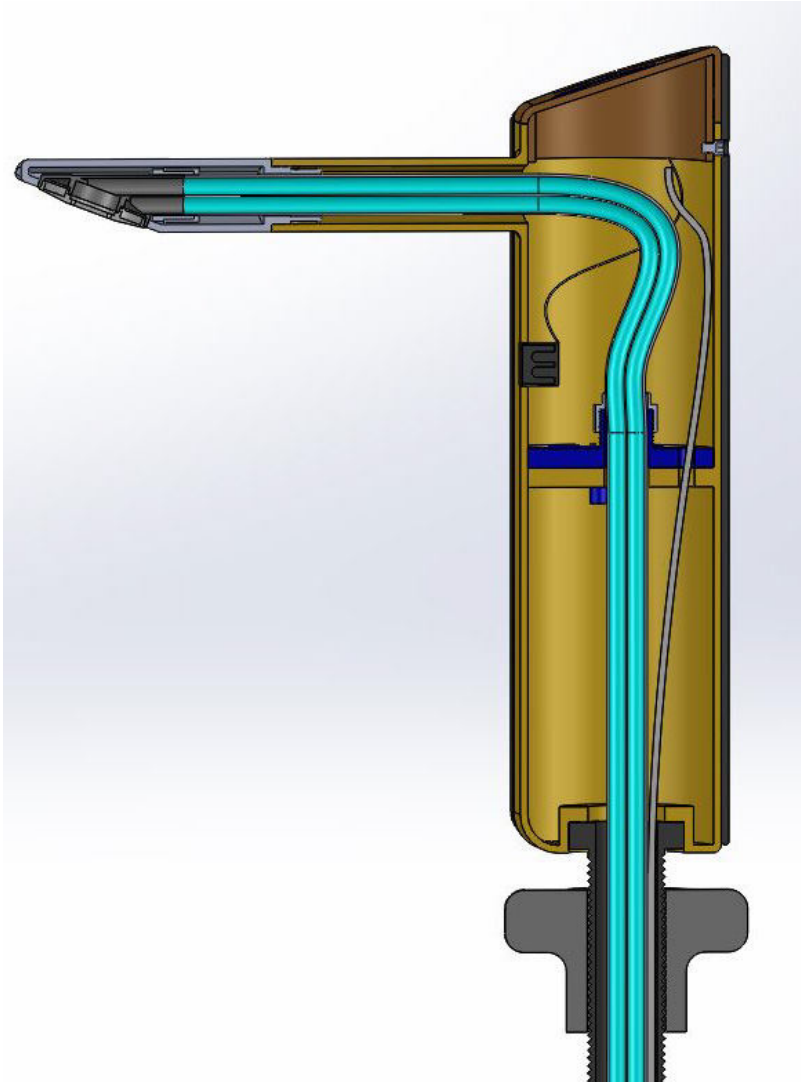
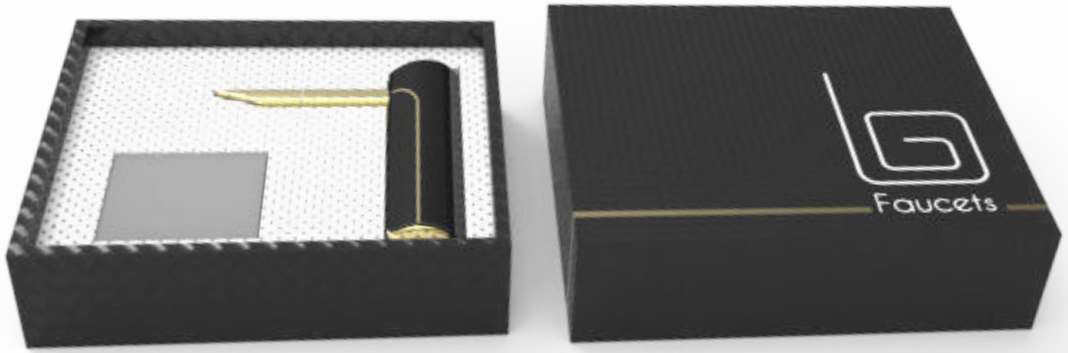


Image on left shows the cross-section view of faucet, two tubular pipes for each stream can be used for multi stream flow, The temperature shocks gets controlled by thermostatic valve and other internal components get mounted as shown in figure.

22.PACKAGING AND COLOR OPTION



Three color variation have been proposed for final version, with respect to jacket and main body.

MANUFACTURING PROCESS:

Body: Brass (Casting & machined)

Jacket: Black chrome plated ABS (Injection molding)

COST:

20,000 to 40,000 INR.

23.PROTOTYPE

REFERENCES

Image references	
Fig 1a	http://www.centralpointoregon.gov/publicworks/page/indoor-water-conservation
Fig 1.1a	http://www.wri.org/blog/2015/02/3-maps-explain
Fig 1.2 a	https://www.headboy.org/portfolio-item/sustainable-hygiene/
Fig 1.3a,b,c	http://www.deltafaucet.co.in/
Fig 2a	https://www3.epa.gov/watersense/
Fig 2.1a-d	http://www.deltafaucet.co.in/smart-solutions/diamond-seal-technology.html
Fig 2.1 e-h	http://www.deltafaucet.co.in/smart-solutions/h2okinetic-showers.html
Fig 2.2 a,b	https://www.behance.net/gallery/24494701/eve-Exploring-new-materials-for-bathroom-faucets
Fig 2.2 c,d	https://www.behance.net/gallery/22614295/Swirl
Fig 4.1-4.5	https://in.pinterest.com/bhavikgrover/faucet-design/
Test Results	http://lbwhosting.biz/sematools/index.php?body_page=resp_form.php&&enc_expm_id=045117b0e0a11a242b9765e79cbf113f

Text References

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- 1,3https://sites.google.com/a/mail.fresnostate.edu/makeadiffernece/
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- http://www.deltafaucet.co.in/smart-solutions/index.html