

DESIGN FOR ELDERLY : FOR SAFER AND EASIER COOKING

PRODUCT DESIGN PROJECT II

MPR-425

BY

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**INDUSTRIAL DESIGN CENTRE
INDIAN INSTITUTE OF TECHNOLOGY BOMBAY**

2016

Design for elderly : for safer and easier cooking

Design project II | Report

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Guide: Prof. G. G. Ray | Industrial Design Center | IITB

Declaration

I declare that this written document represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any data, facts or sources in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

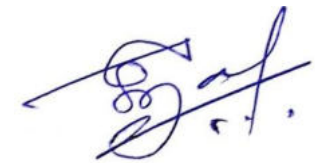


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Approval sheet

The project titled 'Design for Elderly, for safer and easier cooking' by Pai Sanket Satish, is approved for partial fulfilment of the requirement for the degree of 'Master of Design' in Industrial Design.

Guide



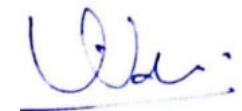
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Internal Examiner



External Examiner



Date

12/01/2016

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I would like to thank Prof. G.G. Ray for his guidance and support throughout the duration of the project.

Also I would like to thank the Industrial Design Faculty at IDC for their valuable inputs during the course of the project.

Thanks to all class-mates for constructively criticising, motivating and helping me.

Most importantly, I would like to thank my parents and friends, for supporting me during the course of this project and for motivating and believing in me and my work.

A handwritten signature in black ink, appearing to be 'G.G. Ray', with a long diagonal stroke extending upwards and to the right.

The ageing population of the world has seen an upward trend over the last two decades along with tendency of independent living by the elderly.

Currently efforts are being made to create comfortable and safer housing environment for the elderly. However the kitchen still remains as the most neglected area in terms of redesign.

This project tries to focus on the kitchen as the independent living facility in order to make cooking easier and safer focusing more on the women elderly population.

The project started with primary and secondary study, leading to multiple insights in areas of mobility, posture while using tools and consideration for user reach.

These insights were then used to derive features and to come up with design specifically for the food preparation area. The final design was developed after creating a test rig to check required heights for different activities.

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Introduction



Image source: <https://in.pinterest.com/pin/69735494201399892/>

Due to reduction of mortality rate and development in the healthcare sector, there has been an upward trend in the population of the elderly worldwide. In India as per the 2011 census, the population of the elderly (defined as people above 60 years of age by the government) was 98 million, and this number is expected to be doubled by 2030.

The current zeitgeist focuses on an individual's freedom and independence. This, along with the rise of nuclear families has changed the lifestyle to a point where almost 20% of the elderly currently live alone in India. This percentage increases to almost 45% in states like Goa, Kerala, Himachal Pradesh, Tamil Nadu, Maharashtra and Punjab. Hence there is a need of social, economic, healthcare and psychological support for the elderly, which also translates into a need for senior living facilities.

Senior living facilities can be broadly classified into 3 facilities

- Nursing care
- Old age homes/assisted living facilities
- Independent living facilities

Currently, there are 30-35 housing projects in our country for the elderly. The top players in these senior living facility providers are, TATA housing, Praranjape Schemes, Adani realty, Silverglades and Brigade. These facilities offer one to two bedroom units with facilities like grab rails in the bathroom, switch points at wheelchair height, nurse and doctor on call etc. However there is hardly any change in the kitchen where most of the domestic injuries occur. At the same time there is a lack of standard enforced guidelines for designing kitchens for the elderly.

Currently there is a drive in the world to move towards universal design principles where products and environments are designed to be accessed by the highest possible variety of people, including children and the elderly.

The objective of this project was to relook at the kitchen area and to find opportunities for design intervention

in order to make cooking safer and easier for the elderly.

During the course of this project the initial study was done to understand various factors related to kitchen and the elderly, and initial quick ideation was done along with two separate approaches looking at various areas in the kitchen where design intervention was required.

However after discussion with the project guide and other faculty, it was discussed that we need to focus on any one area of the kitchen. Again after a brief study of four major areas in the kitchen i.e. stove, sink, storage and food preparation, we decided to focus on food preparation area.

Looking at the issues in the food preparation activities, a concept was then developed as a response to these issues and also a mock up is currently under design and construction for field evaluation of the same in order to test the selected concept.

Initial brief at the start of the project was as follows:

To create a safe and stress free environment for the elderly.

The initial deliverables for the project were:

- List of guidelines for kitchen layout design
- Generating ideas for add on products for the kitchen

However after initial studies, it was decided to change the project brief and to focus on any one area of the kitchen.

The revised project brief was:

To design a kitchen for cooking purpose which is safe and easily operable/accessible by the elderly between 60-75 years of age.

Deliverables were defined as:

- Study and identification of issues in any one area of the kitchen for design intervention.
- Development of a concept and 1:1 mock up for field trials in order to solve the issues identified.

To understand the scope of the current project, the user and the environment were defined.

User

- A person between the age range of 60 – 75 years
- physically and mentally healthy
- fairly well to do economically with pension
- has the financial ability to buy, rent or renovate a house

Environment

- Food preparation area, sink, stove and storage inside the kitchen
- Excludes dining table and movement across rooms

Cuisine

Since there are multiple cooking styles in India with different ways and types of food and tools used in preparation. For the purpose of this project only coastal Maharashtrian and Goan style of cooking was considered as the user study took place in these areas. The tools used in these areas for food preparation were studied and the decision was made to try and use the traditional tools as much as possible to smooth the learning curve.

Secondary study

In the secondary study, various research papers were referred. The top 3 insights were as follows:

“The results of this study show that the kitchen is the most hazardous place, followed by the bathroom, living room and bedroom.”

Home safety of elderly in rental flats.
– Pauline Ai Leen Ang, Article
Sept 2014

This paper was one of the reasons of constraining only the kitchen in order to identify design opportunities to help the elderly.

“objects stored in wall cabinets higher than 600 mm are accessed with difficulty and therefore a version of kitchen furniture with deeper worktops and cabinets positioned on the worktops is recommended if room size enables such a solution”

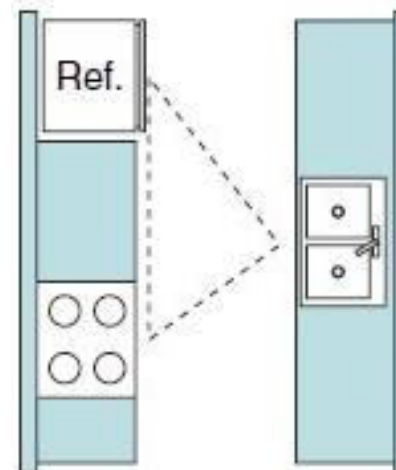
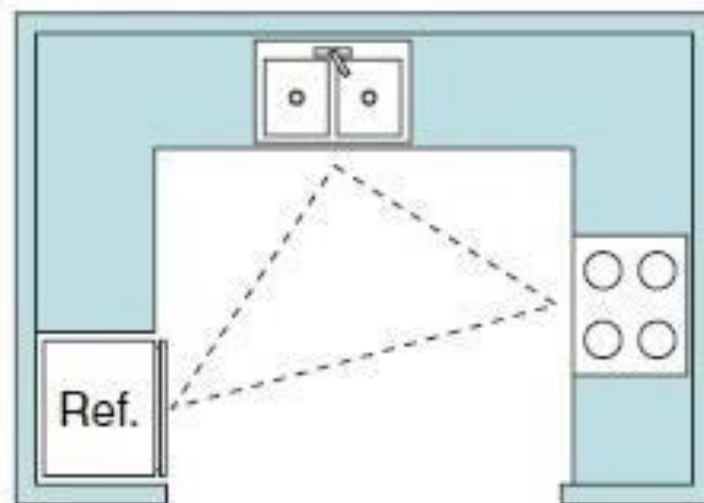
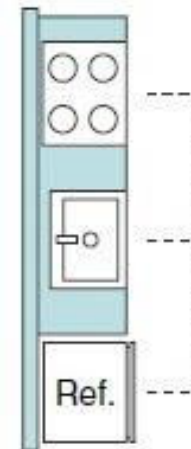
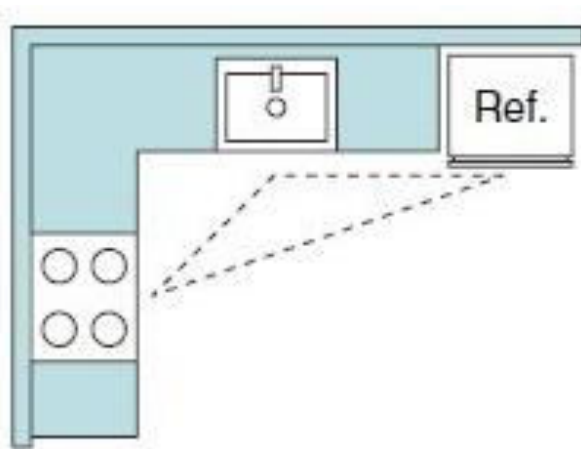
Ergonomic suitability of kitchen furniture regarding height accessibility
By: J. Hrovatin, P. Silvana, D. Ravnik, L. Oblack, Collegium antropologicum
April 2015

This study gave some pretty good arguments about importance of storing daily used items near the food preparation and stove area.

“It is observed that the resulting relational model of the paths between the main work areas of the kitchen describes a triangle between storage, preparation with cleaning and the cooking area. This represents the three points of the kitchen work triangle”

An inclusive approach for home environment design
– M. Mengoni, S. Ceccacci, D. Raponi,
Conference paper
Sept 2014

Based on these and other research papers, a brief study was then done to understand advantages and disadvantages of various types of kitchen layouts



Top left
L shaped layout

Top right
I shaped layout

Bottom. left
U shaped layout

Bottom right
Galley layout

Image source: <http://inspectapedia.com/BestPractices/Figure6-10.jpg>

Types of kitchen layouts

1) I shaped kitchen

This layout is also called one wall galley kitchen, it is primarily used when space is a constraint. It is one of the cheapest kitchen layouts available.

Pros

- ease of access
- small footprint

Cons

- less storage and countertop space

2) Galley Kitchen

A galley kitchen is commonly used in restaurant for its highly efficient utilisation of space. However it leads to a cramped kitchen at home with less space for movement or interactions.

Pros

- one of the best space savers
- Easy to adapt for multiple work spaces

Cons

- no seating space
- congested when drawers are opened on both sides.

3) L shaped Kitchen

This is one of the most popular kitchen layout. It is sometimes paired with an island.

Pros

- Allows a tight work triangle
- Easy to adapt for multiple work spaces

Cons

- corner space can be difficult to reach

4) U shaped kitchen

This layout offers the maximum amount of space and allows most freedom in terms of placement of the work triangle.

Pros

- enables efficient workflow
- allows easy movement

Cons

- corner space can be difficult to reach

It is observed that most of the elderly housing projects in India currently provide mostly **I shaped or L shaped** kitchen layouts .



Top left
An existing kitchen layout redesigned to fit wheelchairs and walkers



Top right
A linear concept kitchen design for elderly

Bottom. left
A linear concept kitchen design for elderly

Bottom right
A curvilinear kitchen concept using large edge radiuses to provide accessibility for elderly using wheelchairs

Image source: <https://www.pinterest.com>

After studying the most common kitchen layouts in India, a quick check was done to understand existing kitchen design concepts which were already available/at prototype stage around the world.

It was noticed that most of the existing design concepts deal more with people on the wheelchair and also did not entirely suite the Indian style of cooking. The focus was more on heating/baking already prepared and cleaned food as well as appliances like hot plates and dishwashers were used.

The focus was more on accessibility, storage and transport but not much thought was put into the style of cooking and usage of tools that elderlies would already be familiar with.

Indians are used to cleaning, cutting and preparing their own food using more traditional tools. Which requires slightly different approach

However, couple of good ideas were noted during study of these concepts, namely:

- Use of different heights for cutting and cooking
- Space provided on ground for wheelchair movement
- Curvilinear table shape which wraps around the shape of the torso, providing better reach
- Maintenance and ease of cleaning considered in use of materials
- Use of light background wherever possible to compensate for weakened eyesight of the elderly
- Most of the tools are provided at countertop height for ease of reach

These ideas were then used to create concepts while also keeping Indian cooking style and use of tools in mind.



Image source: konkanifoodie.blogspot.com



Image source: <http://www.pepperfry.com/>



Image source: <http://www.pankaj-boutique.com>



Image source: <http://www.tradeindia.com>

Top left
Traditional
vegetable chopper
or *Aadoli*

Top right
Modern version of
traditional chopper

Bottom. left
Chakla and belan

Bottom right
Wooden cutting
board with knife

Tools used in Indian kitchen (for Maharashtrian and Goan cuisine preparation) are as follows:

Traditional Kitchen chopper:

Also known as *Aadoli* (konkani) or *Vili* (marathi) is a very versatile traditional tool. It can be used to clean meat and fish, grating a coconut, chopping vegetables. Modern versions of these tools are available which come with a vacuum base and folding blade.

During user study it was decided to retain this tool with minimum changes as the elderlies are used to this tool and can work very fast with it instead of modern chopping board.

However since they need to sit on the ground to use it, it was decided to bring it up to working height.

A modern cutting board:

This board is mainly used as a surface for chopping vegetables with a knife. The main advantage is since the board is light, it can be

carried into the living room so that cutting can be done while watching TV and talking to spouse and the guests in the living room or on dining table

Chakla and belan:

Though electric roti makers are now available, the elderlies still prefer using the chakla nad belan for making *chapati /poli*.

Apart from these tools, a mixer grinder and small stone or brass mortar and pestle are also regularly used in Goan and Maharashtrian cuisine. These are typically kept on the countertop near the stove.

Also the elderlies traditionally used a ragda (large stone basin and pestle) for making masalas however due to physical effort involved, this job is either done by the maid or a younger person in the house. And a wet grinder is used in place of traditional ragda.

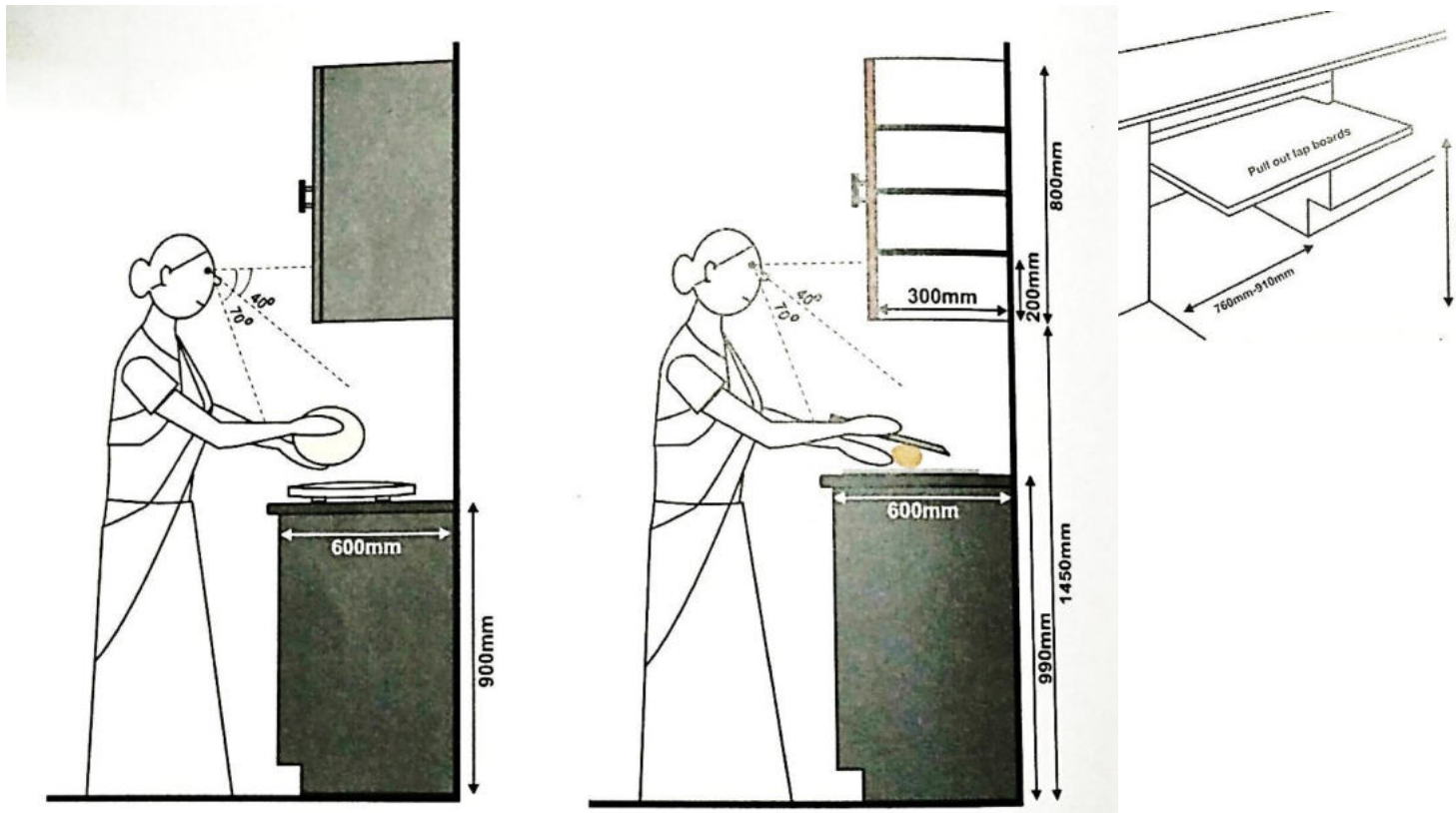


Image source: "Residential Interior Design for the Elderly", By Lavanya Bachwal & Gaur G. Ray, 2010

Top left
Counter top height and dimensions required for dough making and vegetable cutting

Top right
Height and dimensions required for pull out lap boards for chair bound people

Also the anthropometric data as well as design considerations were derived from a guide book 'Residential Interior design for the elderly' by Lavanya Bachwal and Gaur G. Ray during second phase of the project where following points were considered.

Different food preparation activity i.e. kneading and cutting, required different force and precision and therefore different working height

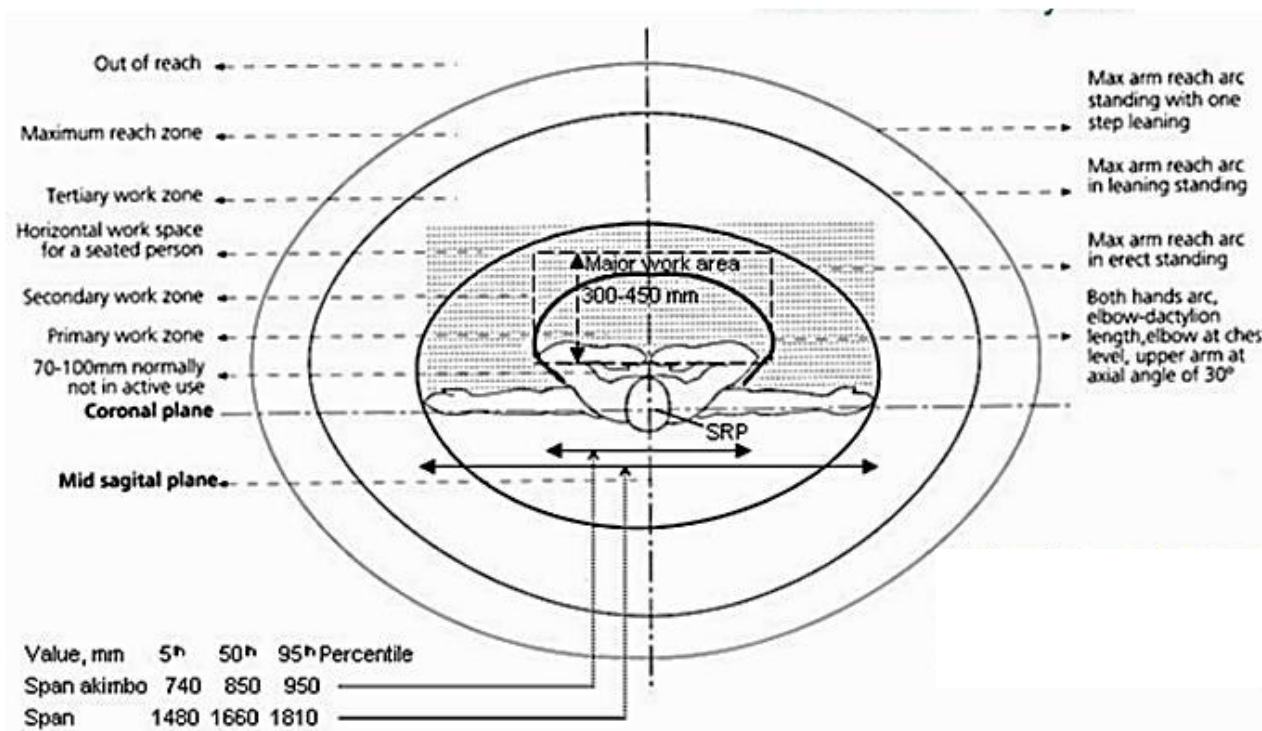
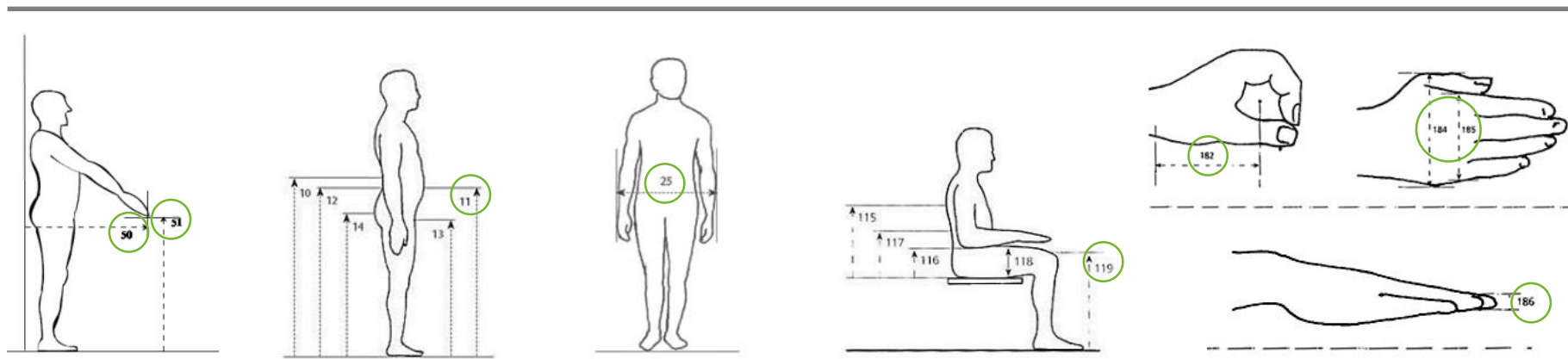
It is necessary to consider both standing and sitting posture for most of the jobs in the kitchen. In case of standing posture, a high stool could be provided.

Pull out lap boards are recommended which can be at alternate levels and should be put below work top for chair bound people.

Also changes due to ageing which would affect kitchen activities were noted.

Changes due to ageing which affect cooking

- Loss of muscle strength and mass
- Bones become weaker and spine changes, resulting in loss of height by 1 to 3 inches
- Ligaments lose flexibility making joints stiff
- Ageing heart is less able to tolerate heavy workloads
- Eyesight is affected, especially depth perception and ability to see well in dimly lit areas
- Hearing high pitched sounds becomes difficult
- Deterioration of memory
- Ability to smell starts diminishing



Top
Various dimensions considered for static standing, sitting and hand

Bottom left
Horizontal body range movement dimensions

Image source: <http://iitg.vlab.co.in/>

R.No.	Parameters		Min	Percentiles					Max	Mean	±SD	Ratio
				5th	25th	50th	75th	95th				
10	Elbow	Male	791	945	1003	1039	1072	1123	1405	1038	56	0.63
		Female	808	879	923	953	989	1039	1202	956	50	0.63
		Combined	791	908	970	1022	1061	1115	1405	1018	65	0.63
11	Abdominal extension	Male	795	925	977	1015	1050	1110	1345	1016	59	0.62
		Female	813	829	857	900	942	1019	1155	908	62	0.59
		Combined	795	881	965	1009	1047	1109	1345	1005	67	0.61
25	Maximum body breadth (relaxed)	Male	364	415	459	503	549	619	795	509	68	0.31
		Female	371	391	422	469	519	599	700	477	65	0.31
		Combined	364	405	499	494	539	619	795	502	69	0.31
50	Lower position length	Male	340	419	529	599	659	769	1030	597	102	0.36
		Female	495	519	579	659	694	809	850	644	82	0.42
		Combined	340	439	539	609	669	769	1030	607	100	0.38
51	Lower position height	Male	510	659	729	779	839	939	1100	788	89	0.48
		Female	560	619	719	769	819	889	950	765	81	0.5
		Combined	510	649	719	779	839	939	1100	784	88	0.48
119	Knee	Male	438	472	497	519	539	567	612	520	30	0.32
		Female	412	440	462	484	499	520	578	483	28	0.32
		Combined	412	456	489	509	534	563	612	511	33	0.32

Anthropometric data was also used to determine various dimension of the product to be designed.

Specific data number is highlighted in the images in the previous page which was then used to figure out, handle size, adjustable height requirement for different activities and the workspace dimensions.

Image source: <http://iitg.vlab.co.in/>

Top

Values of various dimensions considered

Primary study



An initial study was done of kitchens used by the elderly to identify issues and opportunities for design intervention

The insights and observations were as follows

- They prefer keeping daily used items either on the worktop or as close as possible to stove and food preparation area.
- The food preparation area is located as close as possible to the stove to reduce mobility
- Existing counter top space becomes very cluttered due to location of storage and food preparation area
- Cutting board is moved between room with the TV and kitchen frequently
- Special multipurpose blade (Aadoli/Vili) is used for most of the cutting and grating operations (also used for cleaning the fish)
- The need to sit on the ground while using this tool is the biggest pain point for the users









Along with the user study, a brainstorming session was conducted to identify the issues and factors affecting elderly and the kitchen

The factors were identified and clustered under following headings

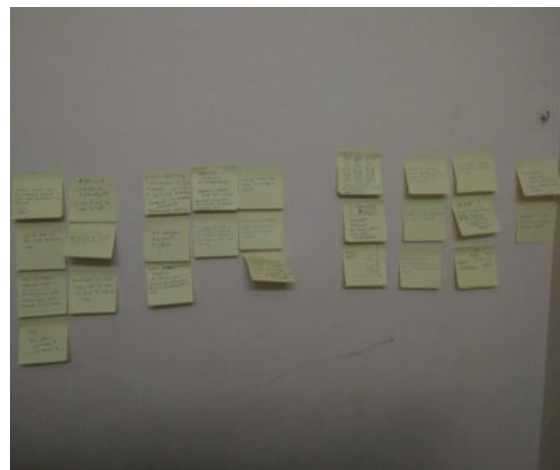
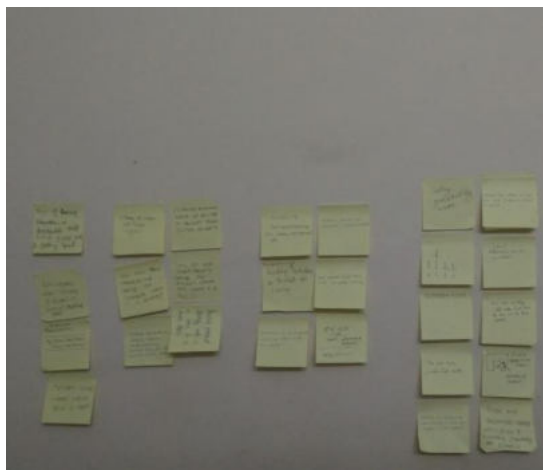
Environment:

- Smoke generated from cooking should be handled properly
- Visibility to be improved (enough light in the room, light inside the cabinets etc.)
- Thermal (the environment inside the kitchen might get too warm)
- Sound level should be within 55 dB (day time) to 45 dB (night time)



Visual ergonomics

- Labels and/warning on cooking equipment and containers
- Switches should be prominent , properly placed and marked
- Base cabinets should have LEDs for better visibility
- Partitions with large labels can be included to define areas in cabinet and worktop



Ergonomics

- Different levels/counters for different operations
- Placement of heavy items
- Reachability to top and bottom cabinet
- Bending to be reduced
- Linear burners/hot plate (to avoid stretching)
- Handles should be easy to grip
- Door and cabinet opening to be assisted
- Daily used items to be stored on worktop
- Space between worktop and cabinets to be accessible
- Opening containers can be difficult

Layout and mobility

- Module to module proximity (check for triangulation possibility)
- Seating facility to be provided
- A place to store and access mobility aids
- Mobility to be reduced by optimising work triangle
- Open kitchen layout for better access
- A walker with built in seat can be introduced
- Carrying stuff from fridge to worktop and worktop to sink can be difficult



Ageing

- Don't like to change the way of cooking
- Recreational facilities which do not distract while cooking are required
- Should not feel like they are being treated like old people
- Do not trust people easily
- Ageing problems, cognitive impairment, deterioration of strength
- Maid can be hired to do part of the work
- Not all old people usually like plain, simple and dull colours and products

Safety

- No sharp edges
- Slippery floor
- Slow movement /Wandering mind
- Slow reaction time
- Sensors could notify caretaker/spouse in case of accident
- Burners could be avoided
- Sensor for alarm in case gas or switch is left ON
- Floor near sink should be anti-slip
- Warning mechanism if vessel is too hot

Cleaning and maintenance

- Worktop should be easy to clean
- Changing the cylinder is difficult without assist
- Fridge maintenance to be considered (i.e. cleaning the water tray)

Reminders

- Uneaten/perishable items to be kept in fridge/storage
- Reminders for timing while cooking
- Reminder for grocery shopping

After identifying all the factors, only the factors related to food preparation area were considered for designing the concept during the second phase.

Also before selecting the area to be focussed on, various steps in a typical cooking activity were noted.

steps for typical cooking activity

Choosing a recipe

Preparing the ingredients

- Collecting Ingredients and utensils
- Transporting ingredients and utensils
- Cleaning ingredients and utensils
- Processing the ingredients
- Removing the waste

Cooking the meal

- Carrying ingredients and utensil(s) to the stove
- Using a stove and other appliances
- Removing utensil(s) from the stove

Serving the meal

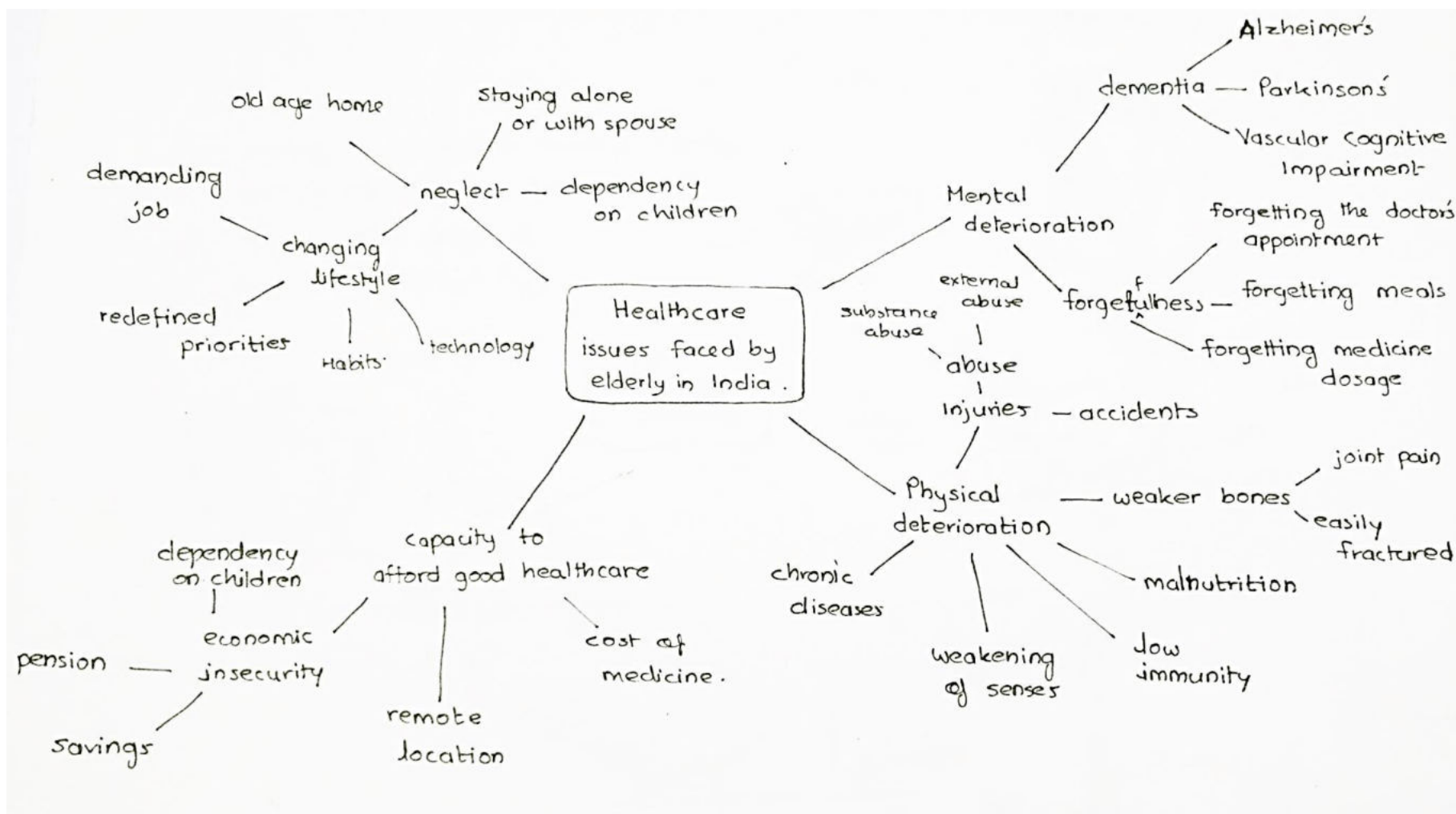
- Transporting vessel to serving area
- Storing unused items

Cleaning the cooking area and utensils

- Transport to sink and then to storage

Garbage disposal

Usually the preparation of ingredients and cooking the meal happens simultaneously depending on the type of meal being prepared



Top
Mind map for
healthcare issues
faced by the
elderly in India

Ideation phase 1

Initially after the primary and secondary studies, three project approaches were proposed.

Approach # 1

- Minimal changes in existing layout with addition of assists (equipment, sensors and reminders.)
- Way of cooking should be retained
- storage, mobility and safety aspects will have priority.

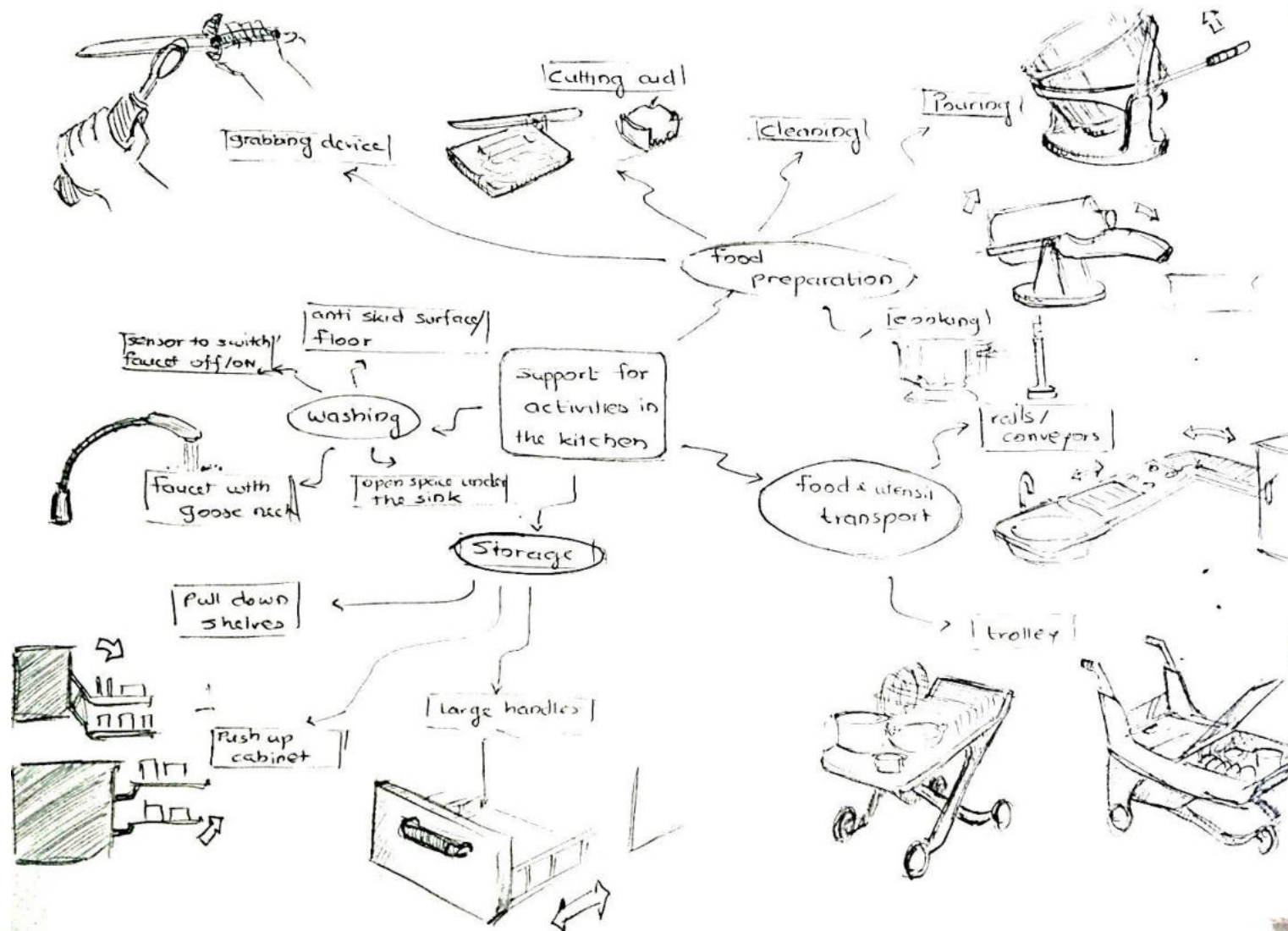
Approach # 2

- Redesign of complete layout considering most of the factors
- Addition of modular elements and furniture

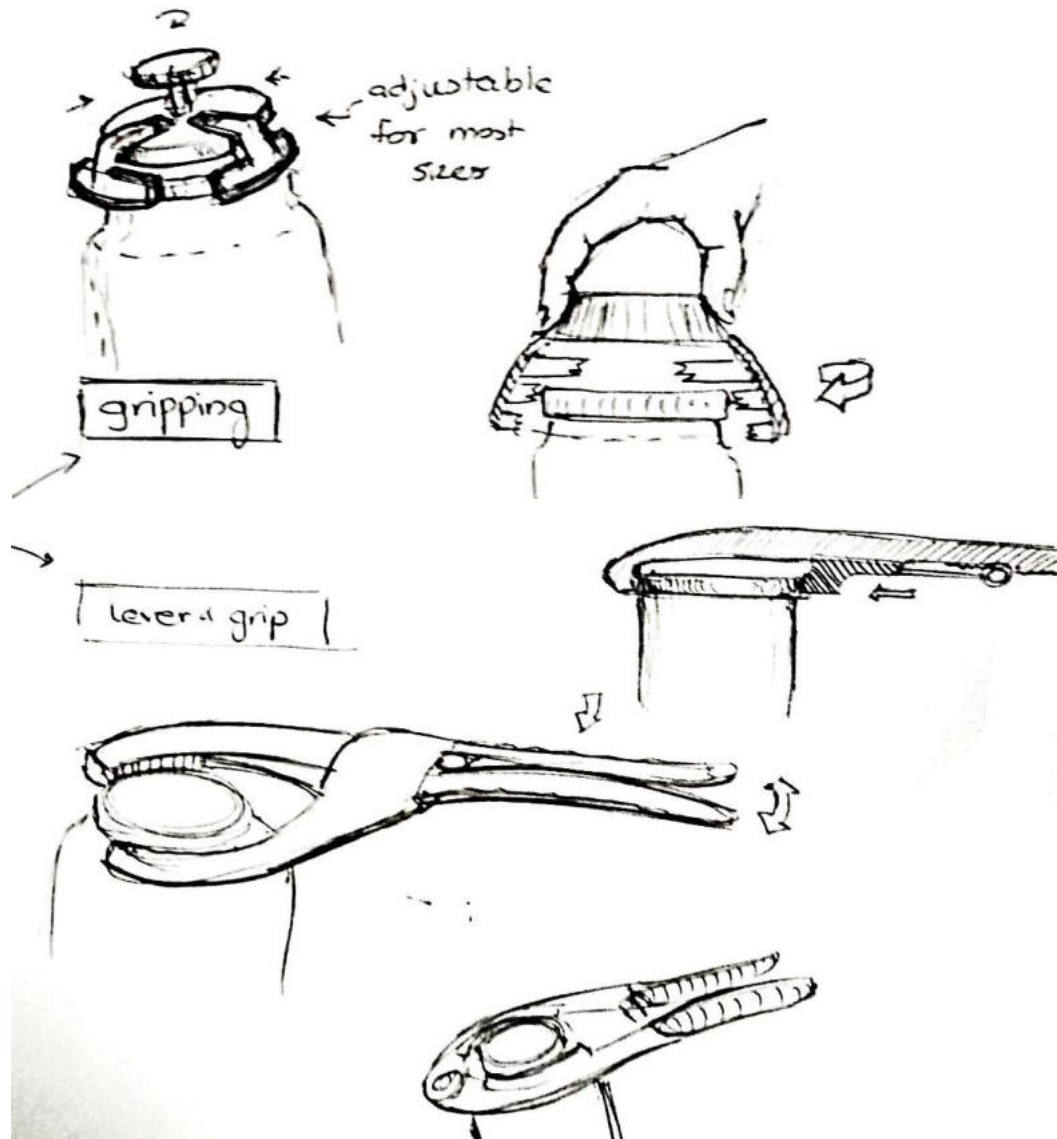
Approach # 3

- Smart kitchen using IoT for assisted living.
- Smart appliances
- Quick response and communication systems

Ideation was done for the first two approaches. The third approach was discarded as we did not want to increase cognitive load and hassle of learning a new system for the elderly



Left
Mind map for
approach #1

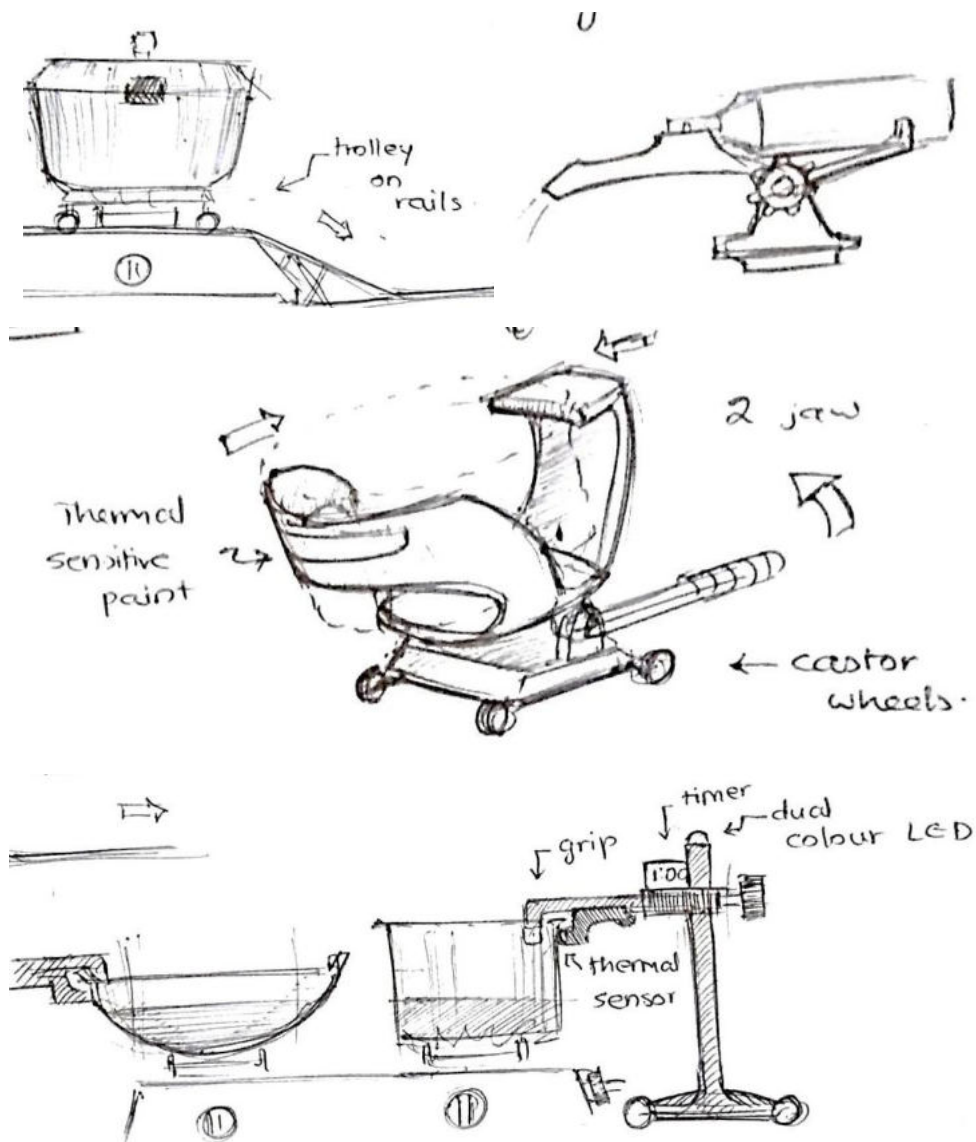


Approach #1

Jar & Bottle opening :

Considerations

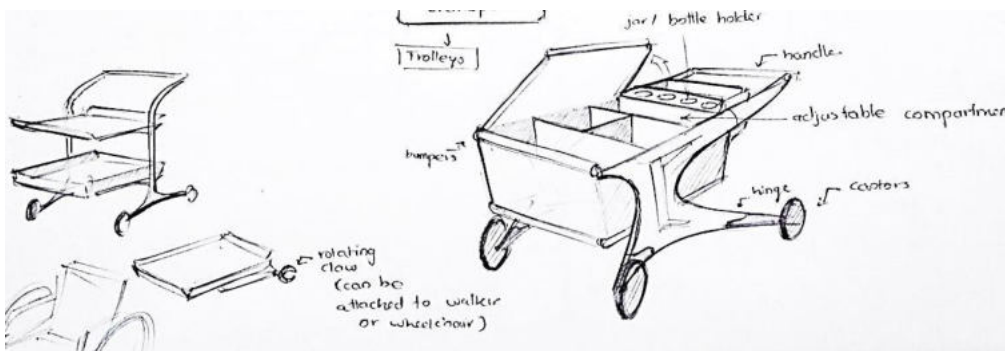
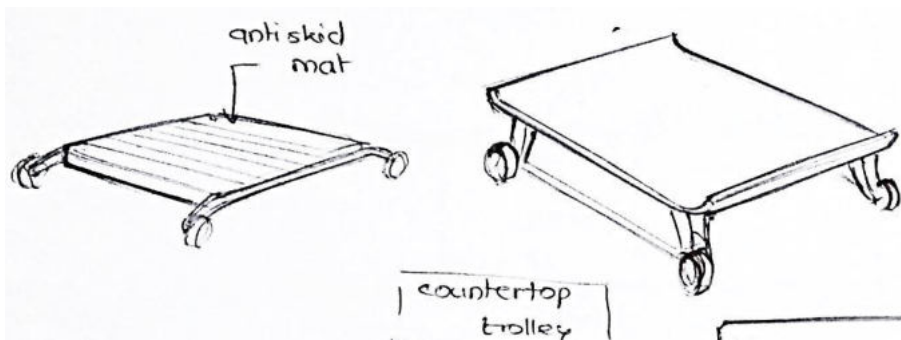
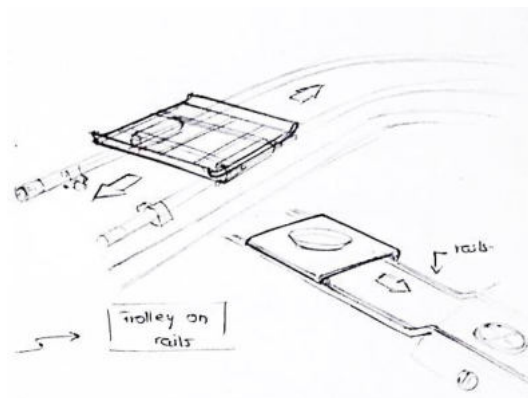
- Single handed operation
- Strong gripping mechanism
- Large soft handles
- Reduction of effort



Cooking and serving:

Considerations

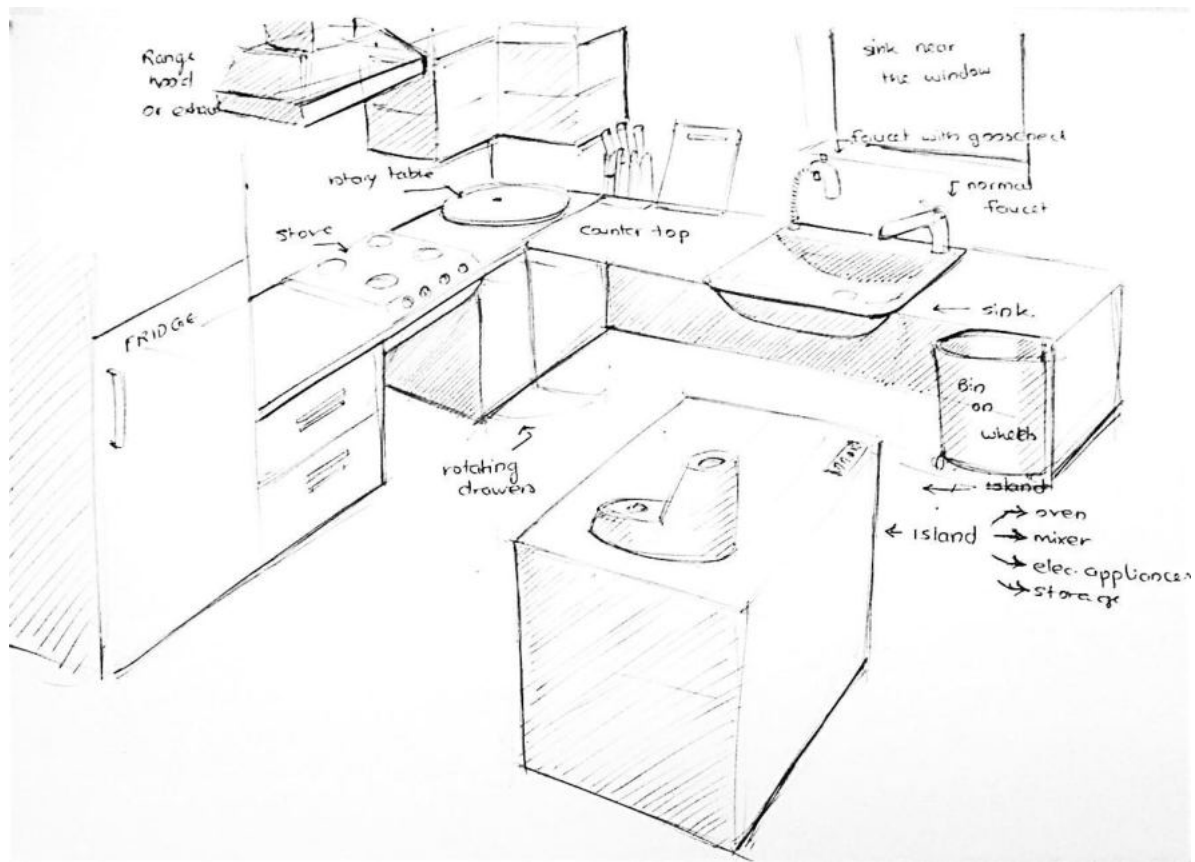
- Single handed operation
- Pouring from vessel/ jar to be simplified
- Vessel should be stable while stirring
- Feedback regarding temperature



Food and utensils transport

Considerations

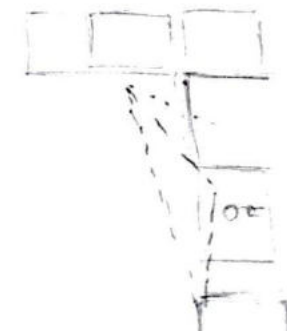
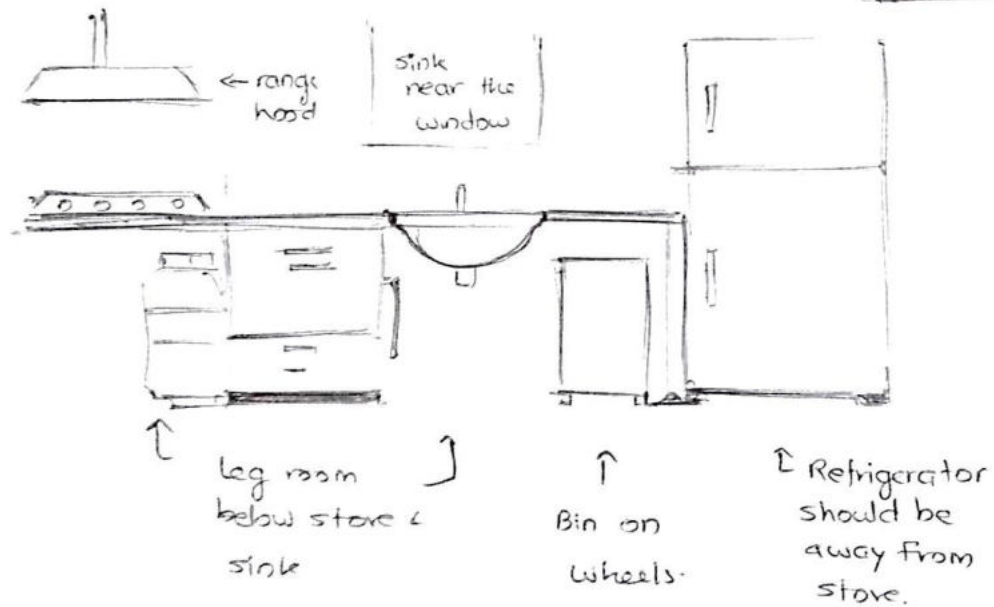
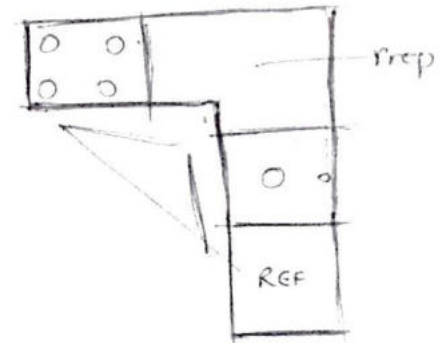
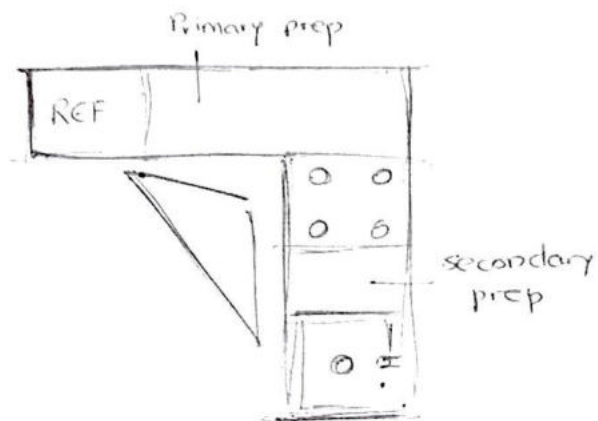
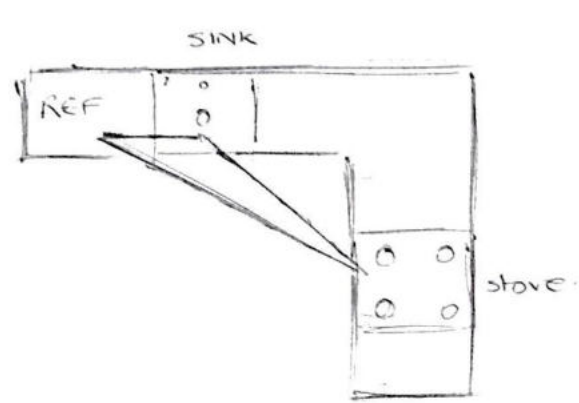
- Reduction of mobility
- Ease of loading/unloading

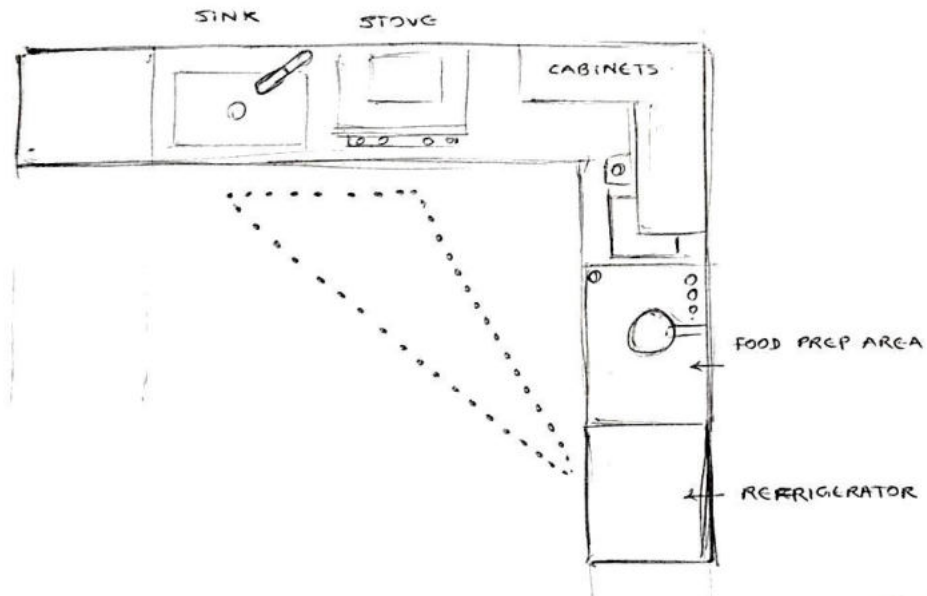
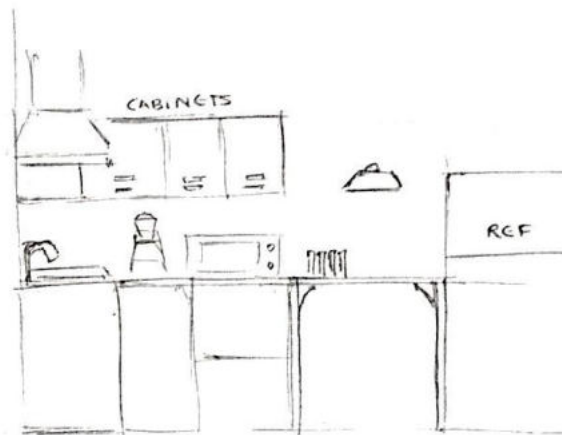
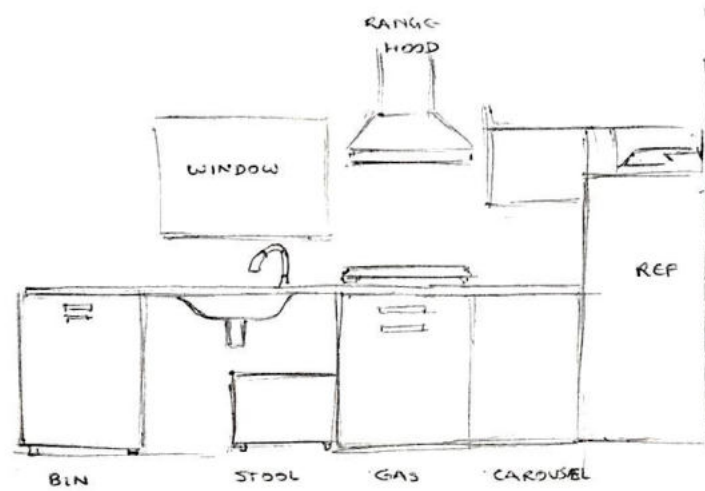


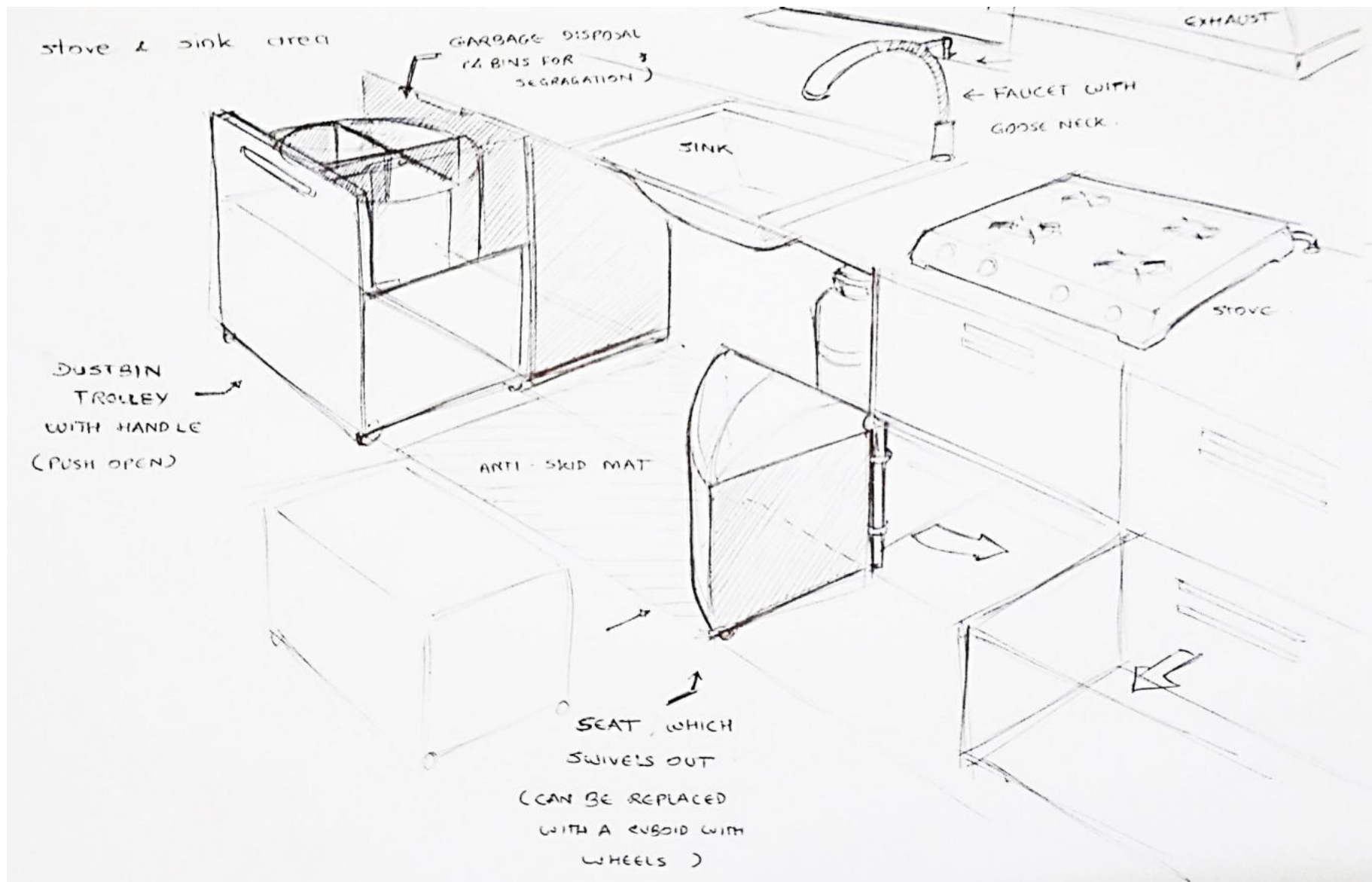
Approach #2

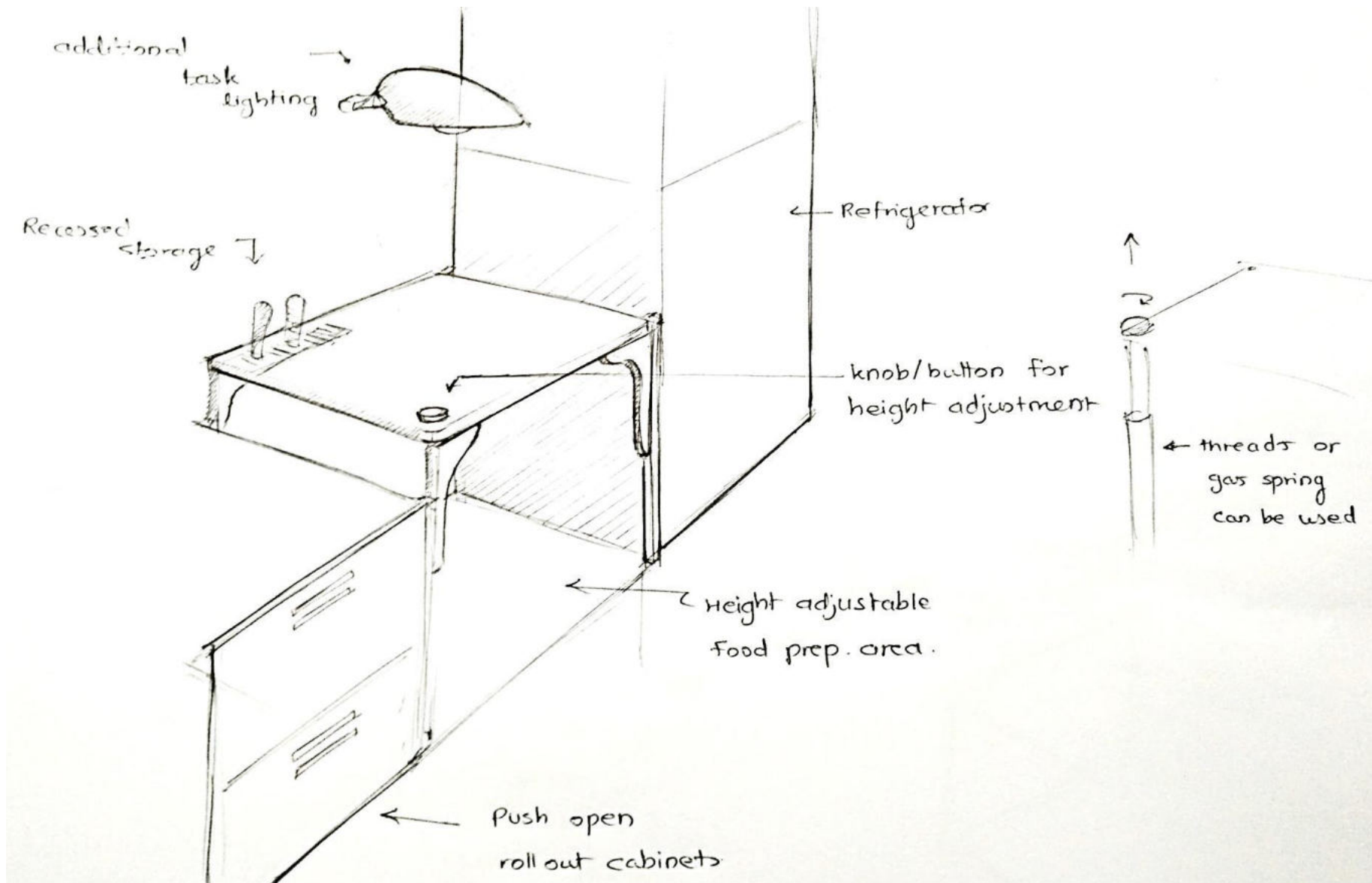
In this approach, instead of add ons, the entire layout was considered.

After checking the plans of various senior living facility projects in India, it was decided to first focus on the most common i.e. L shaped layout

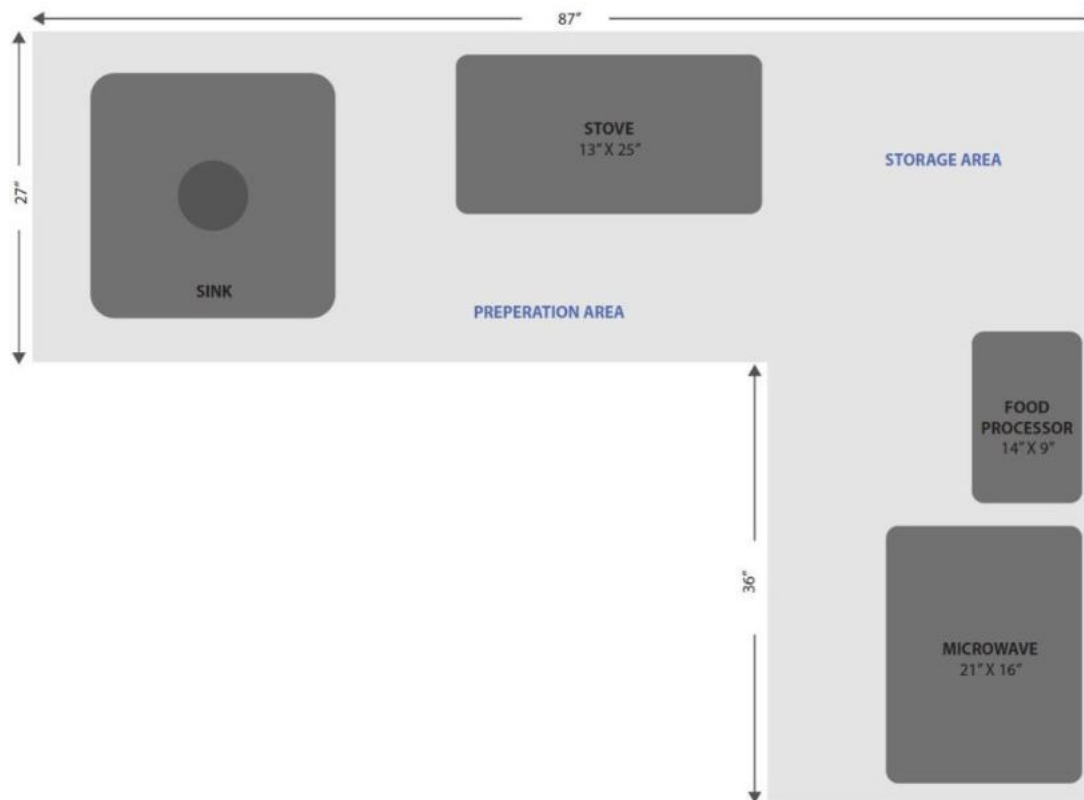








Ideation phase 2



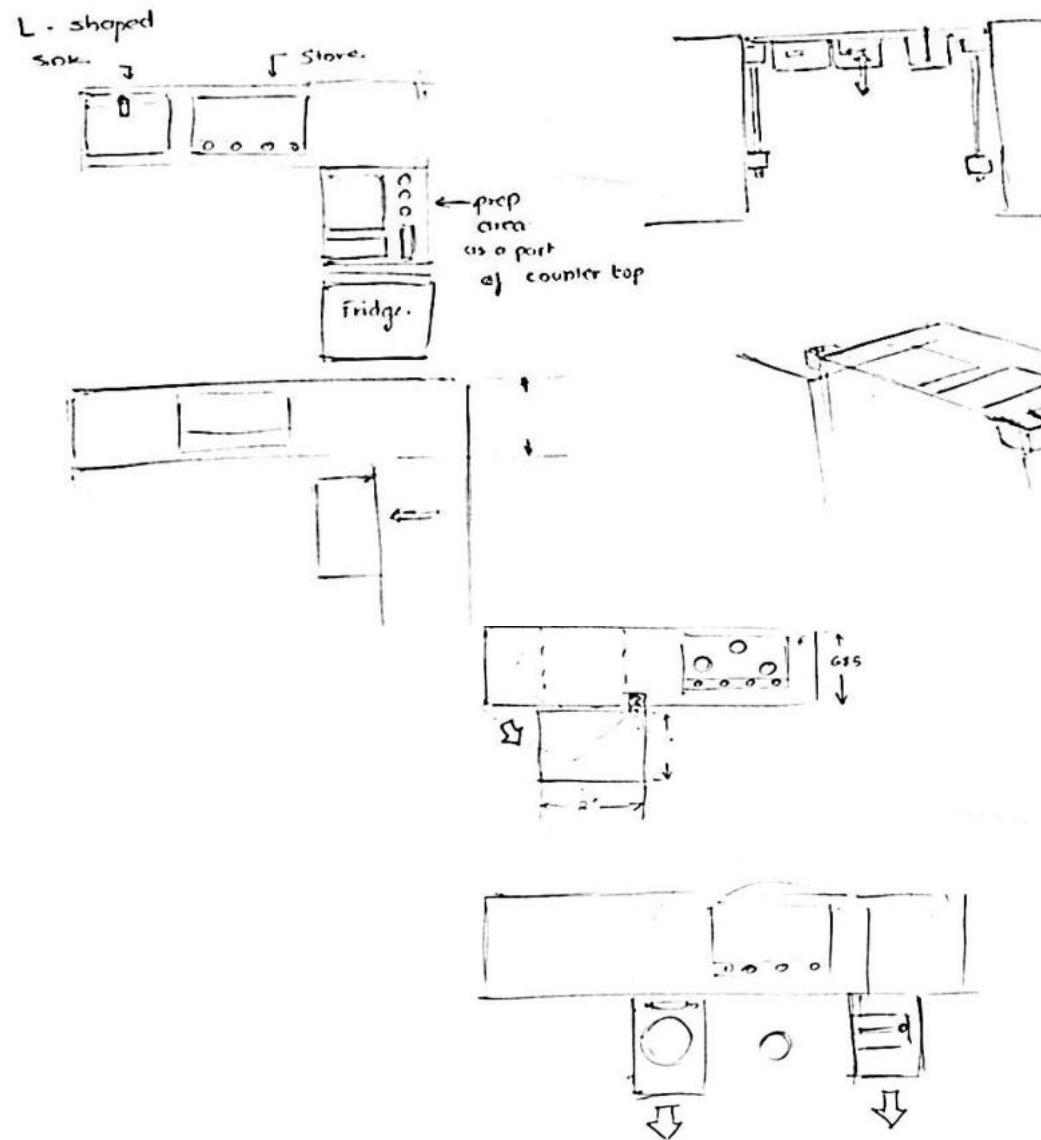
However, after the initial Ideation, it was decided to focus on any one area of the kitchen. After one more brief user study, food preparation area was selected based on following grounds,

The highest amount of time and effort is spent on preparing the ingredients for cooking

This area along with usage of stove leads to the most number of injuries

The issues identified were:

- Need for a dedicated food preparation area near the stove
- Need for sitting on the ground to be minimised
- The skill set of elderly with traditional tools needs to be retained
- Independent cutting board is required apart from food preparation space
- The food preparation counter needs to be height adjustable as different operations required different working height



Since the cuisine selected was coastal Maharashtrian and Goan, following activities were considered

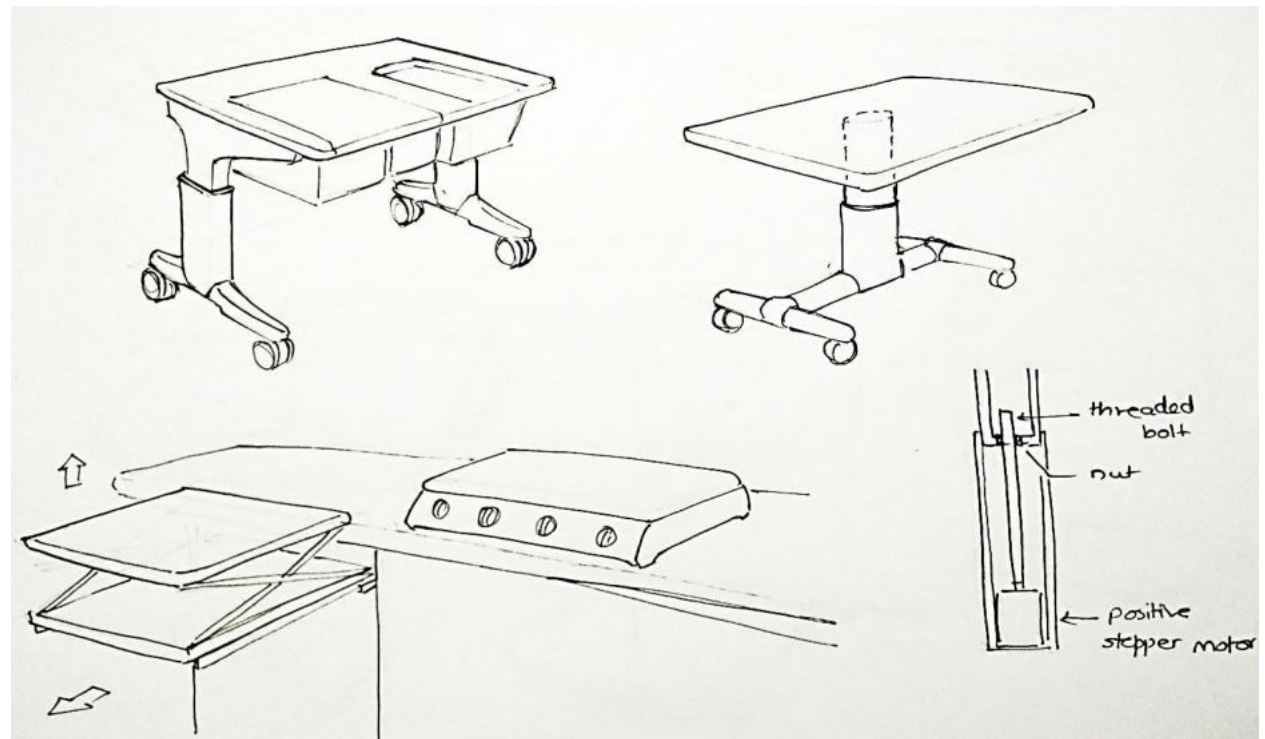
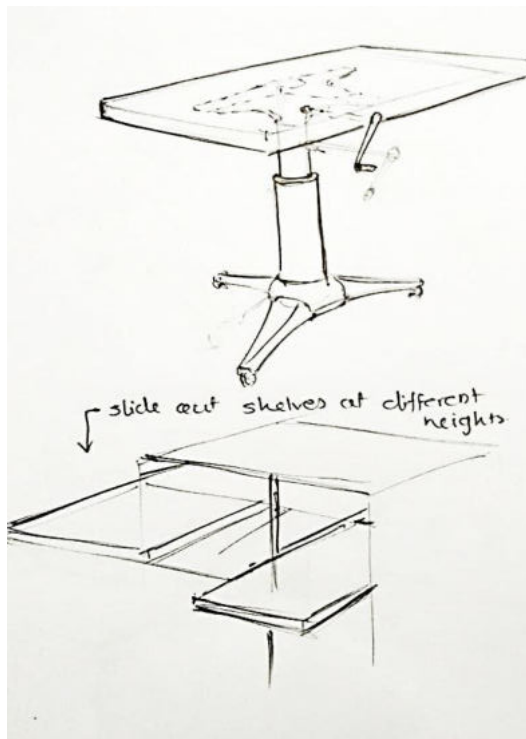
- Grating the coconut
- Cleaning of fish
- Cutting meat
- Cutting vegetables
- Kneading dough
- Rolling chapatis/puris

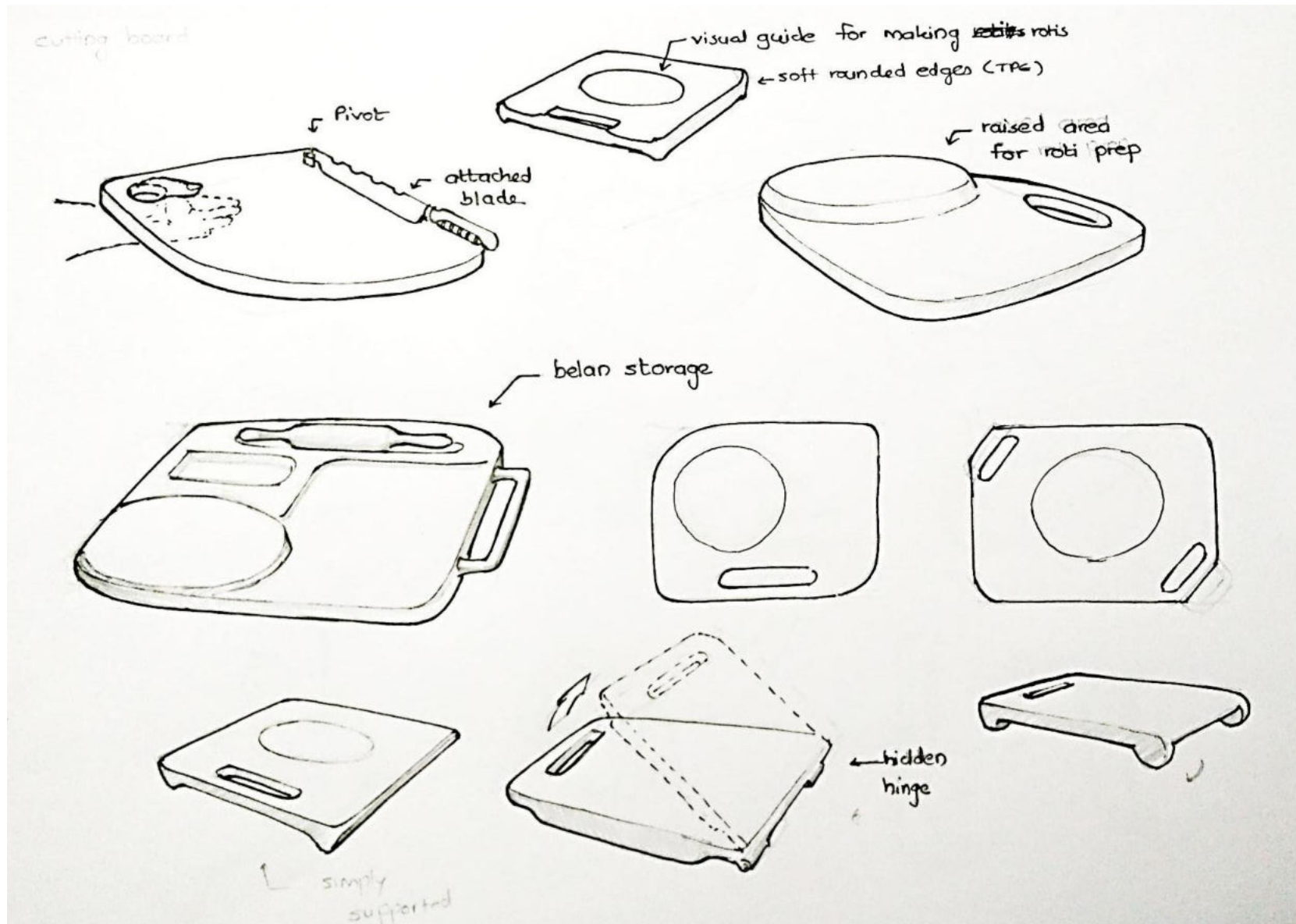
Various possibilities were then considered for location and access of food preparation area

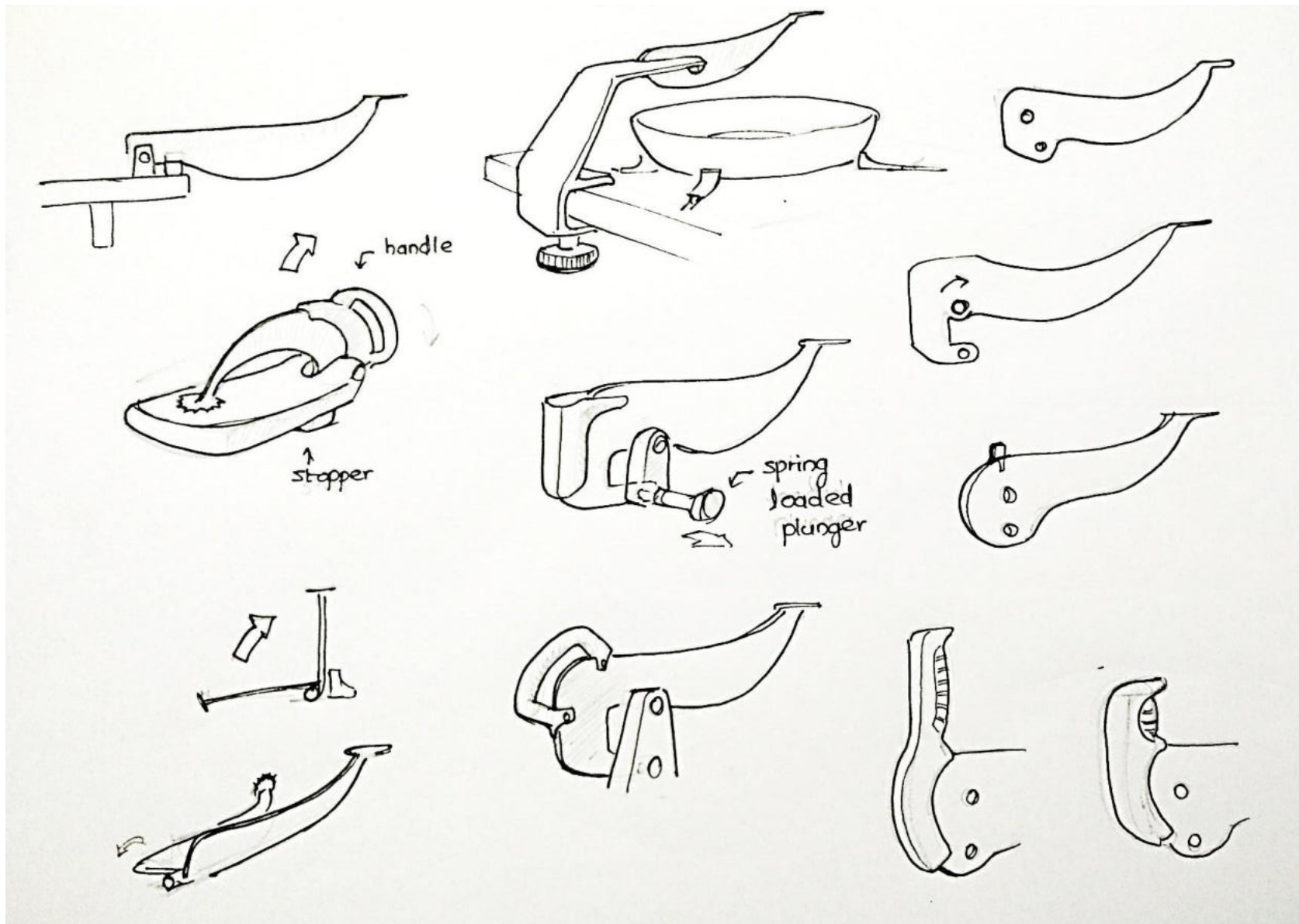
Also it was decided to use the traditional tool as the elderlies are familiar and experts at using the vili. It provides better control while cleaning and cutting meat, chopping vegetables and grating coconuts

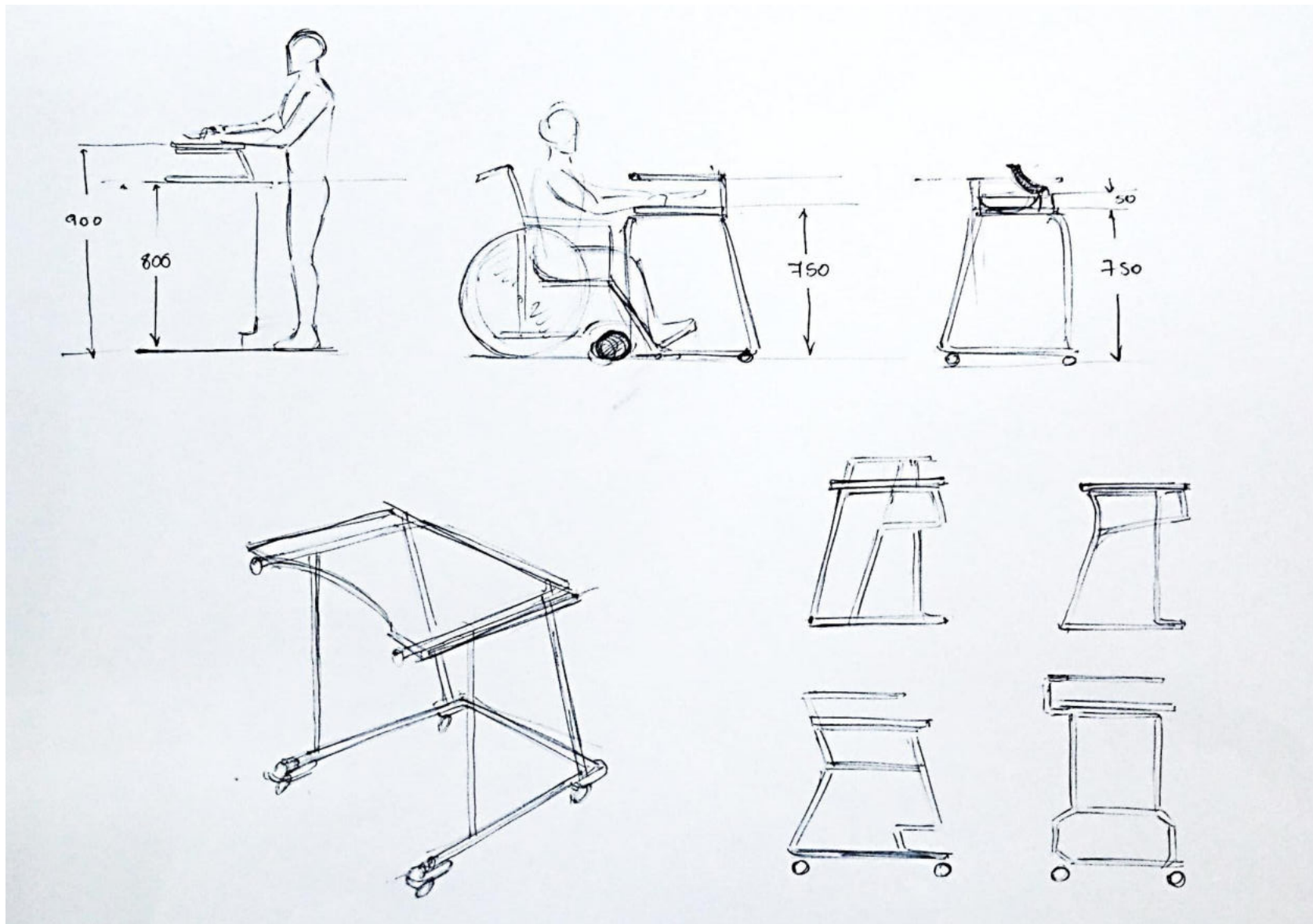
It was also decided to combine a detachable cutting board with platform for making rotis as the user could easily carry it in the drawing room whenever required.

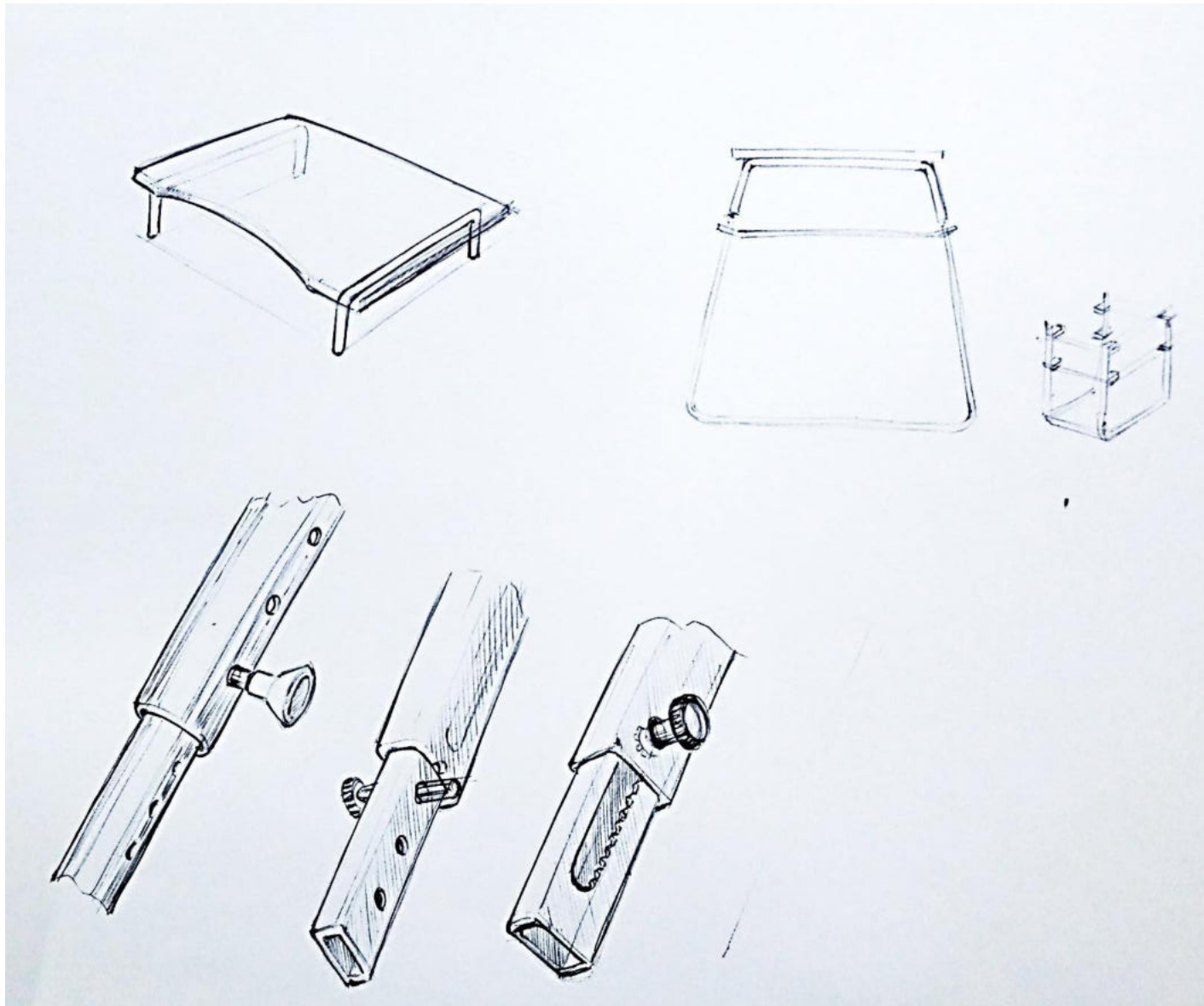
The following pages showcase the ideation process at this stage

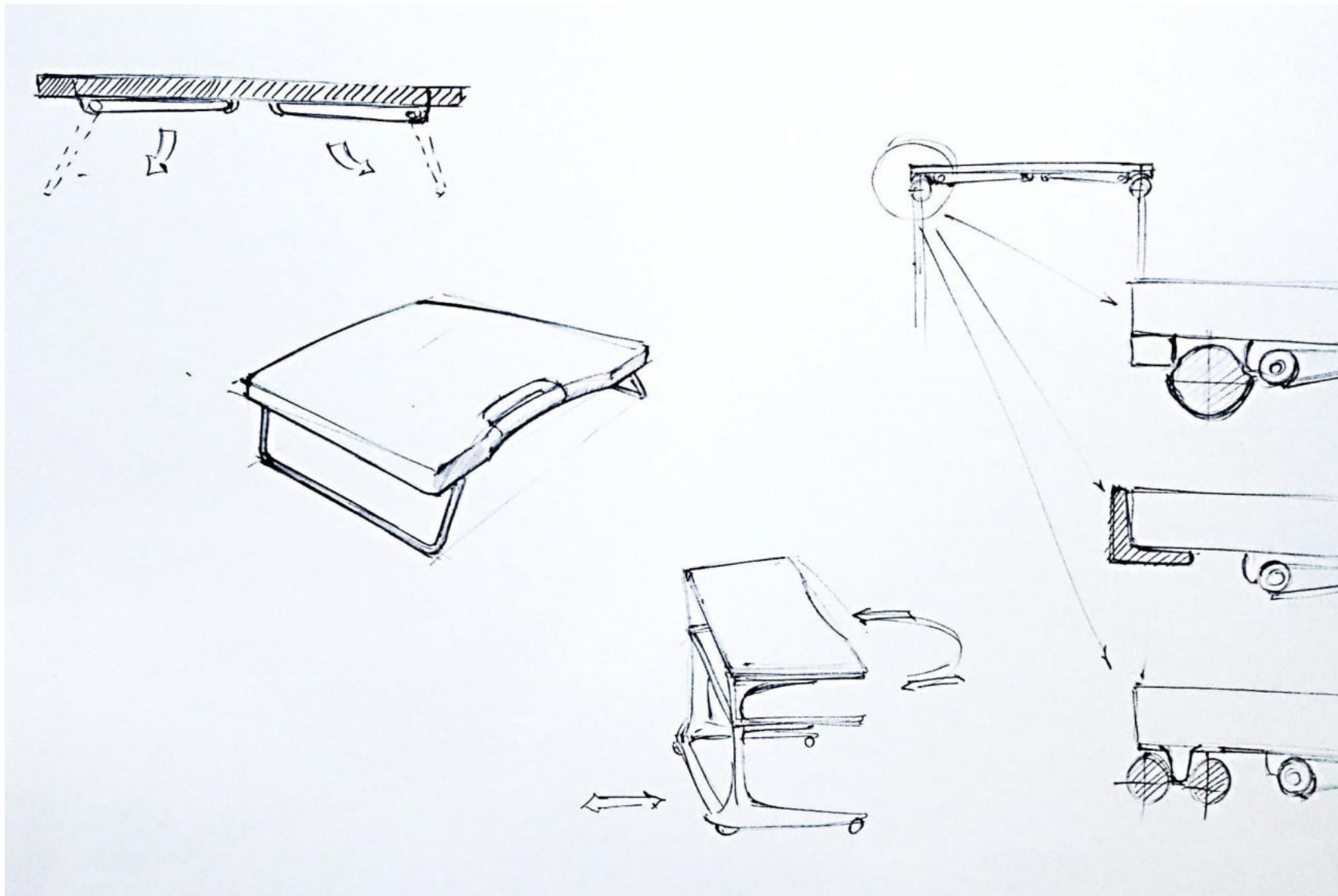


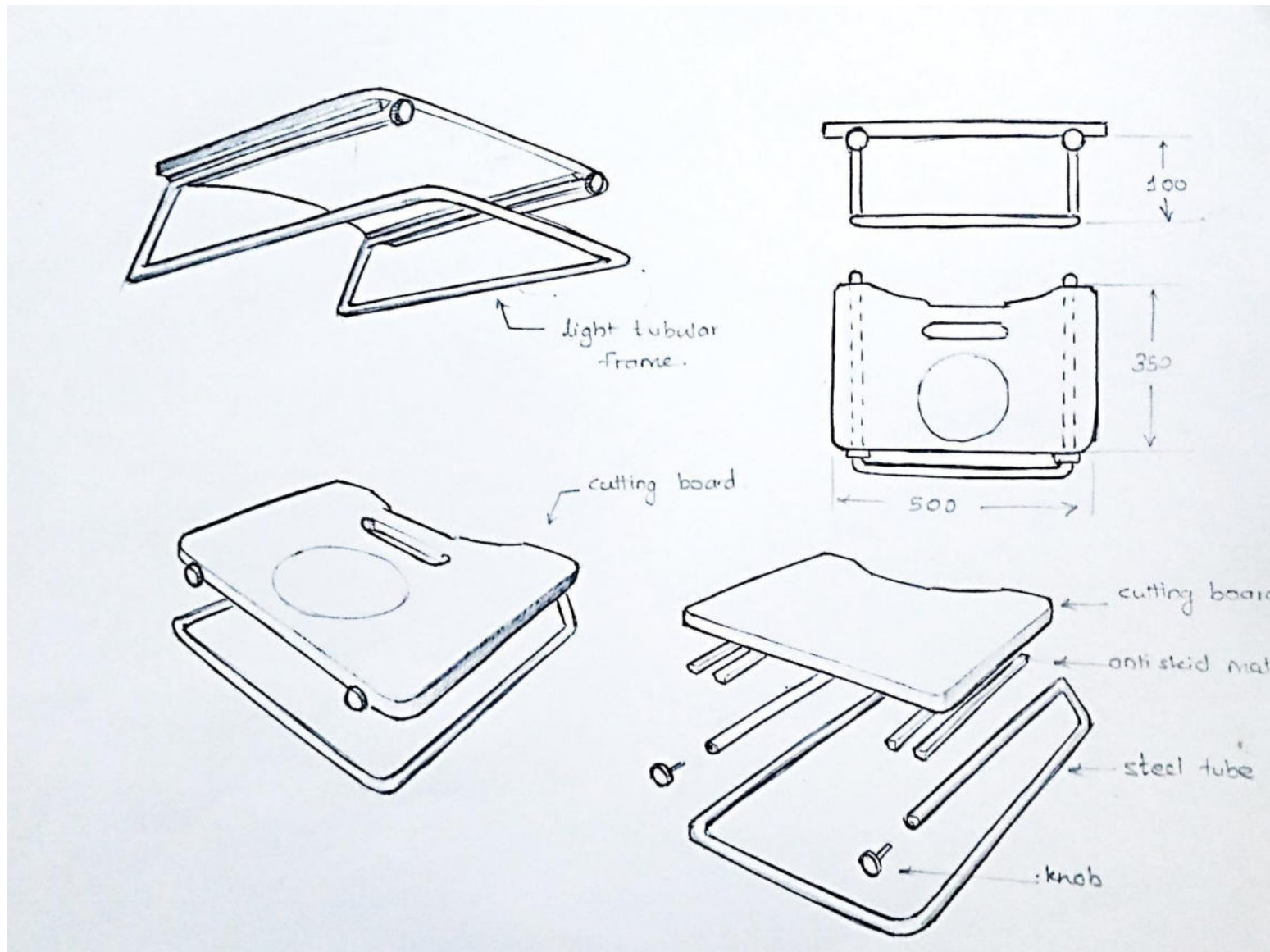


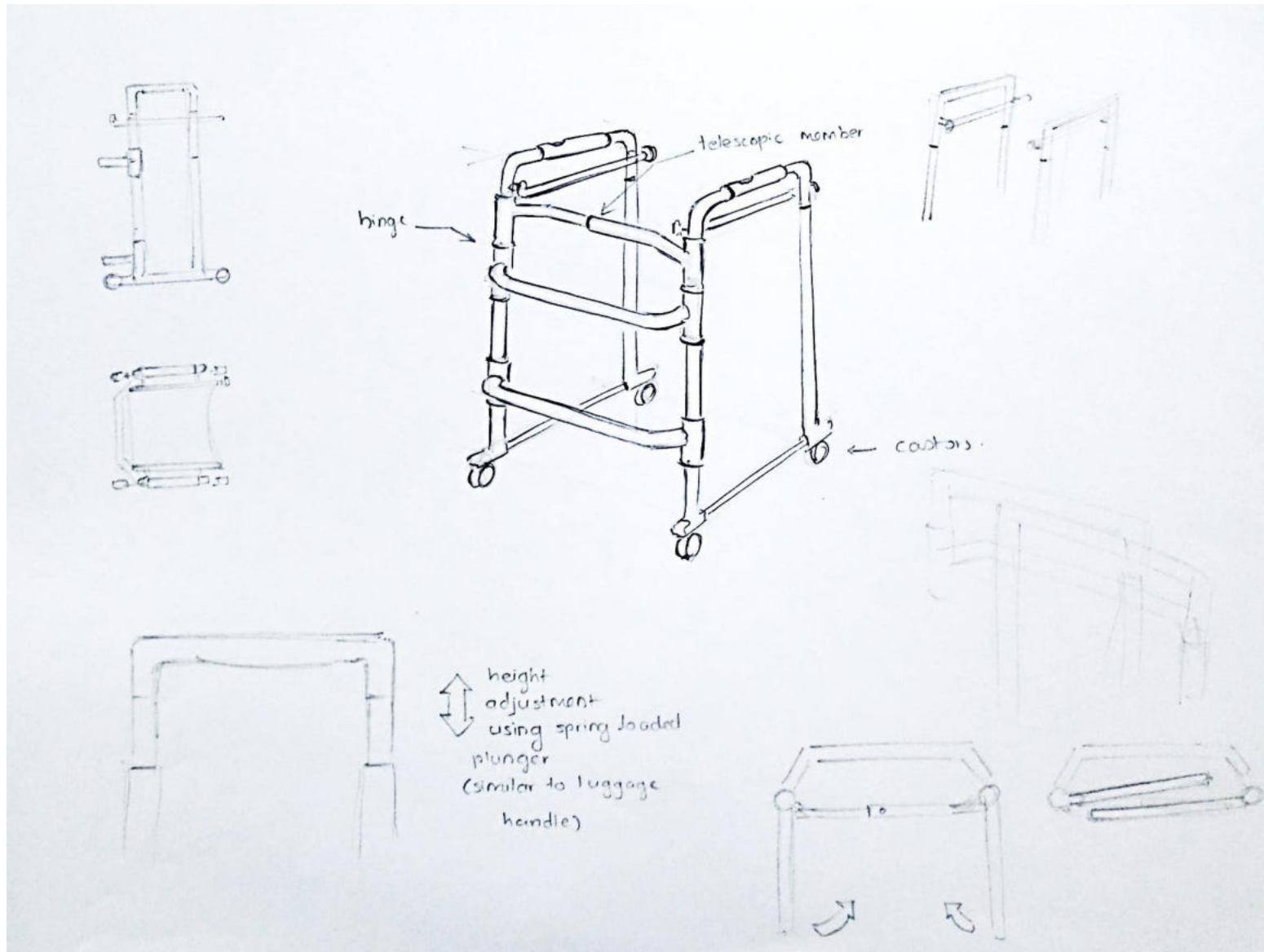


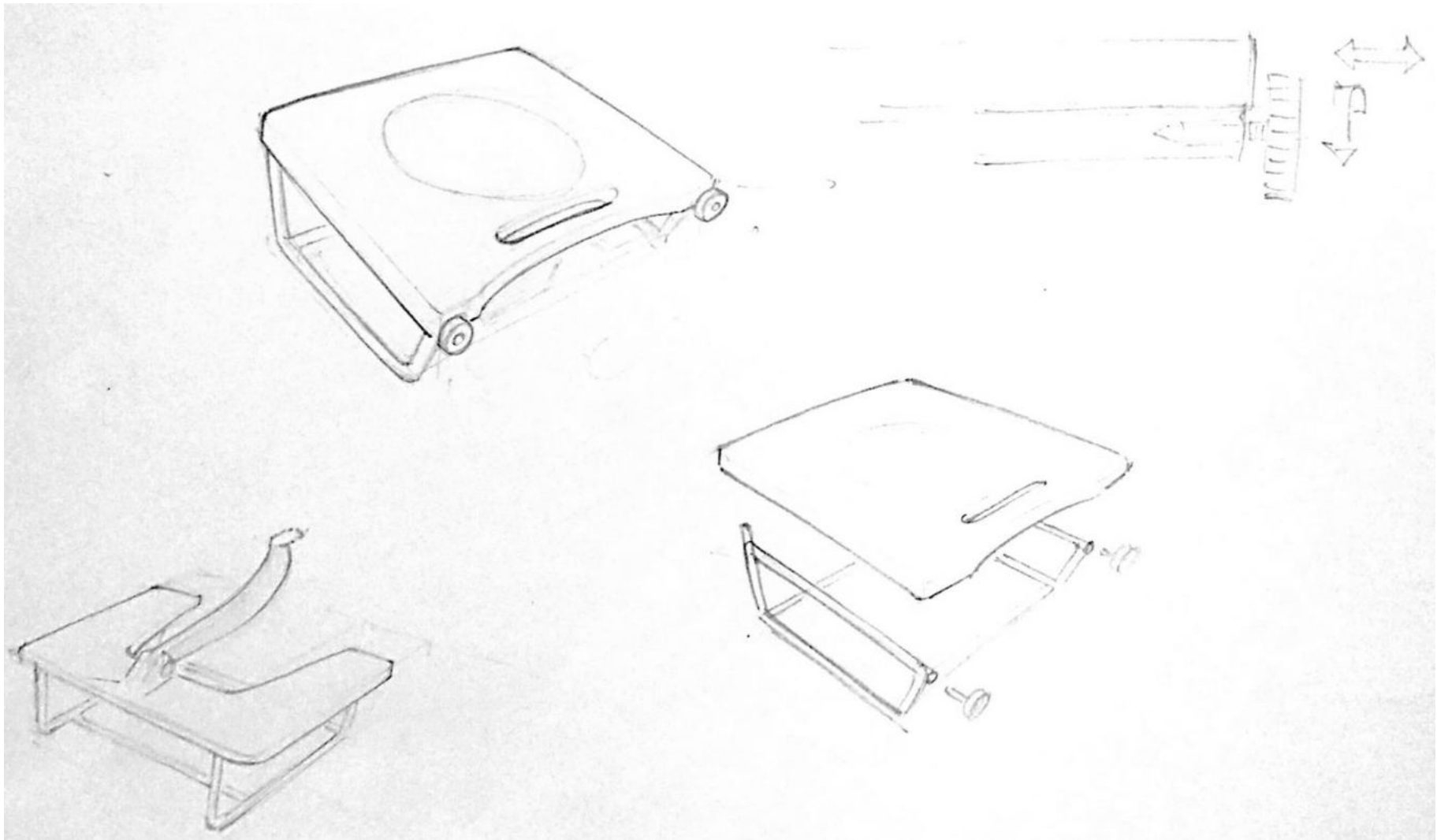


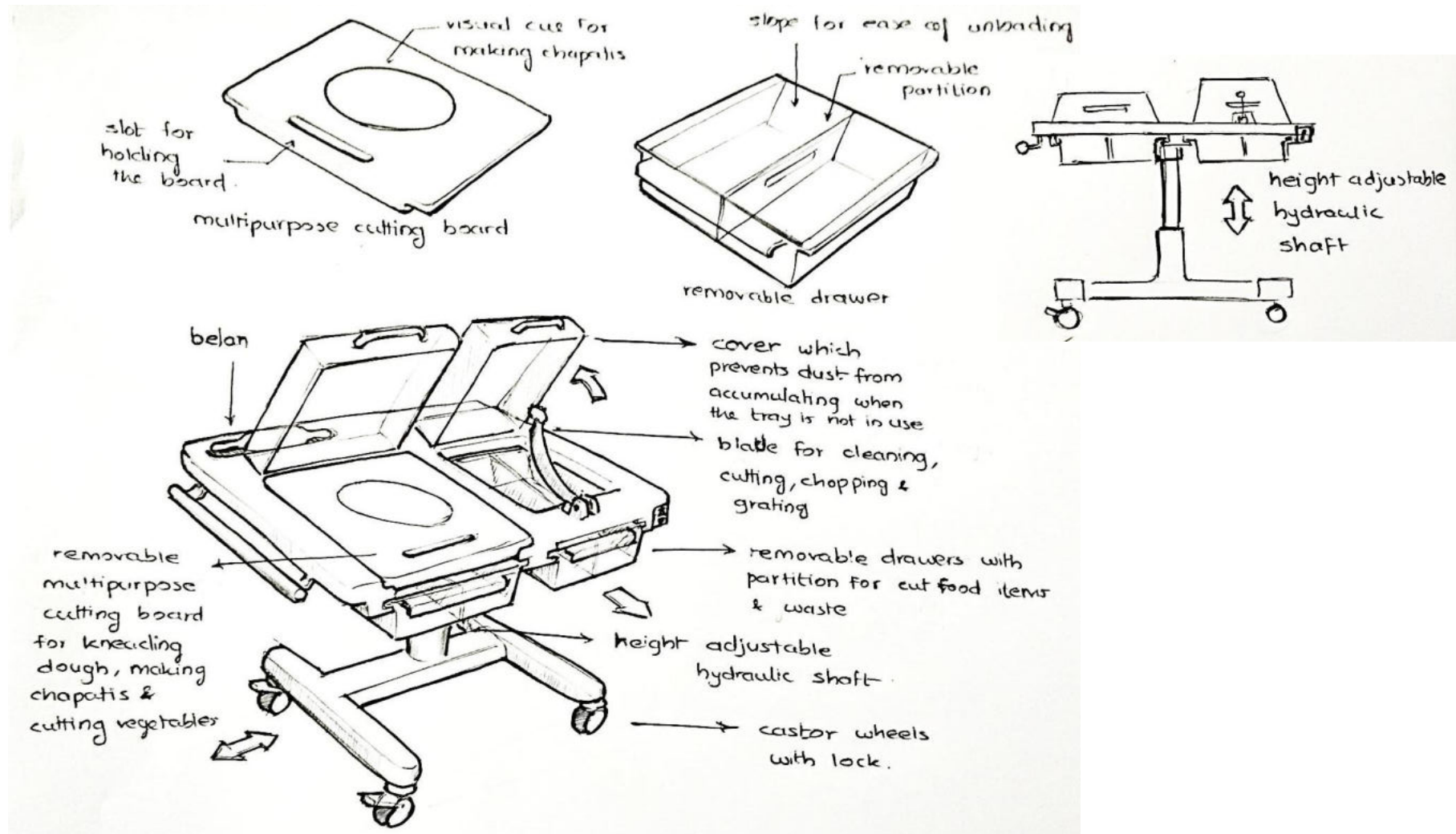












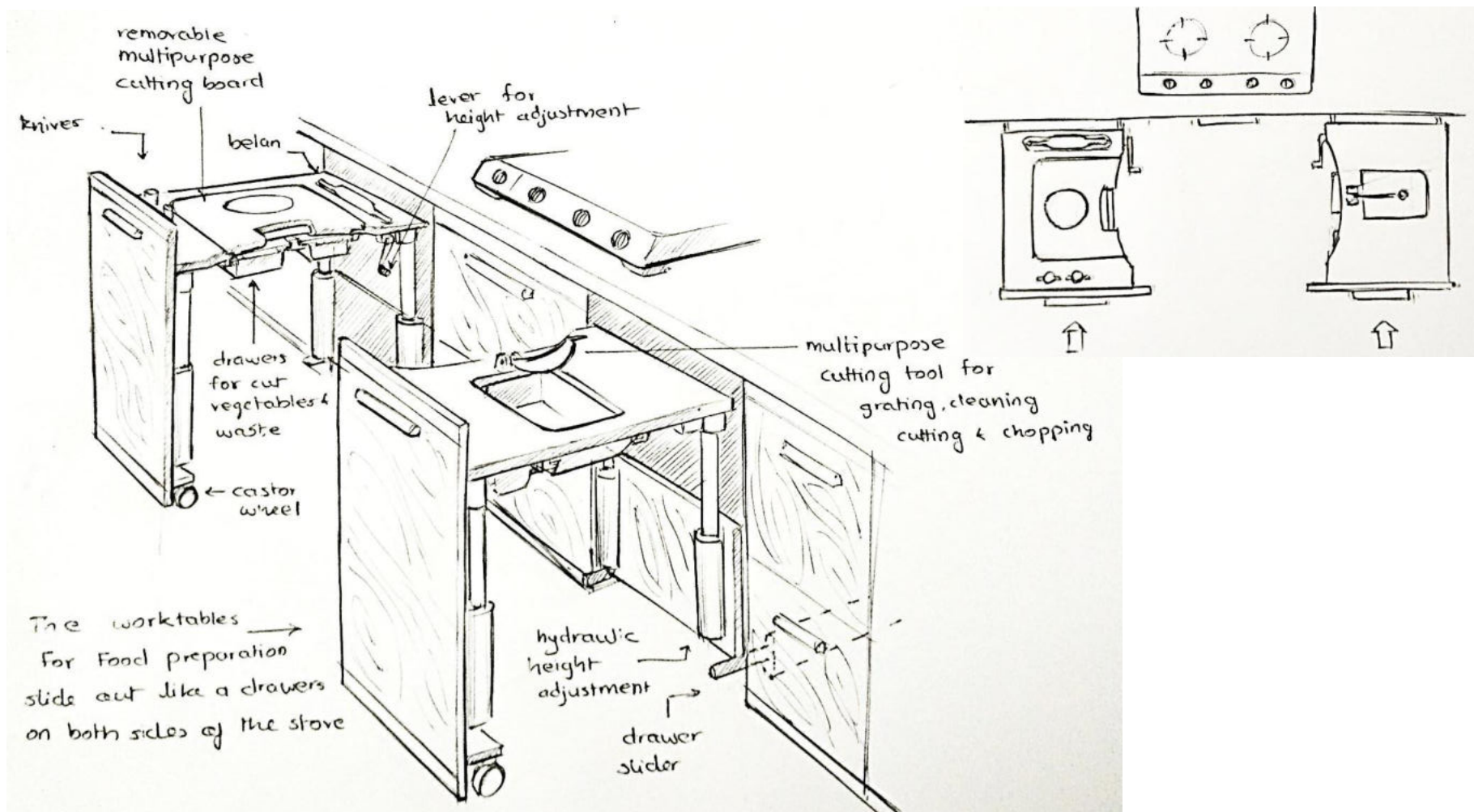
Top
Concept #1

Concept #1

This concept proposes a movable kitchen island for food preparation purpose.

The salient features are as follows:

- The trolley can be moved from one section of the kitchen to another and additional attachments can be later added for transporting food and vessels. Since it has castor wheels with locks it can also be fixed at a location which is desired.
- Hydraulic height adjustable leg can either be given switch control or a manual lever. This allows different heights for different tasks. It also allows sitting or standing posture while working. Though standing posture is recommended.
- Drawers with removable partition are provided to store cut food and waste
- Covers with live hinge are provided to prevent dust accumulation over work area and as a guard over the cutting tool
- A removable multipurpose cutting board for kneading dough, making rotis and cutting vegetables. It can be removed and carried to the living room/dining table whenever required. Instead of chakla it contains a visual cue for making rotis.
- The traditional multipurpose blade from vili/ aadoli is shifted to the worktop and can be used for cleaning and chopping fish and meat, cutting vegetables and grating coconut
- A space for belan is provided and the drawer below the cutting board can house knives and grating board when not in use. It can also house mortar and pestle if required.



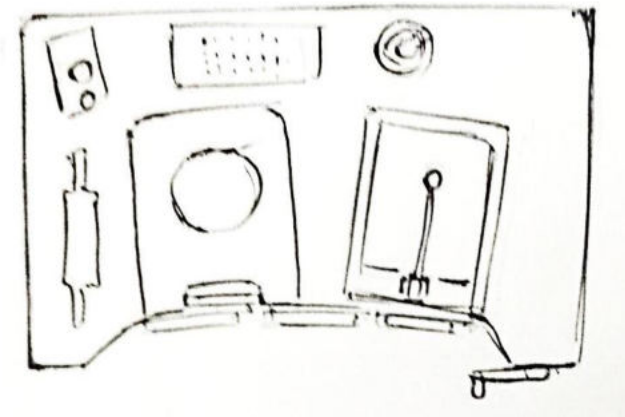
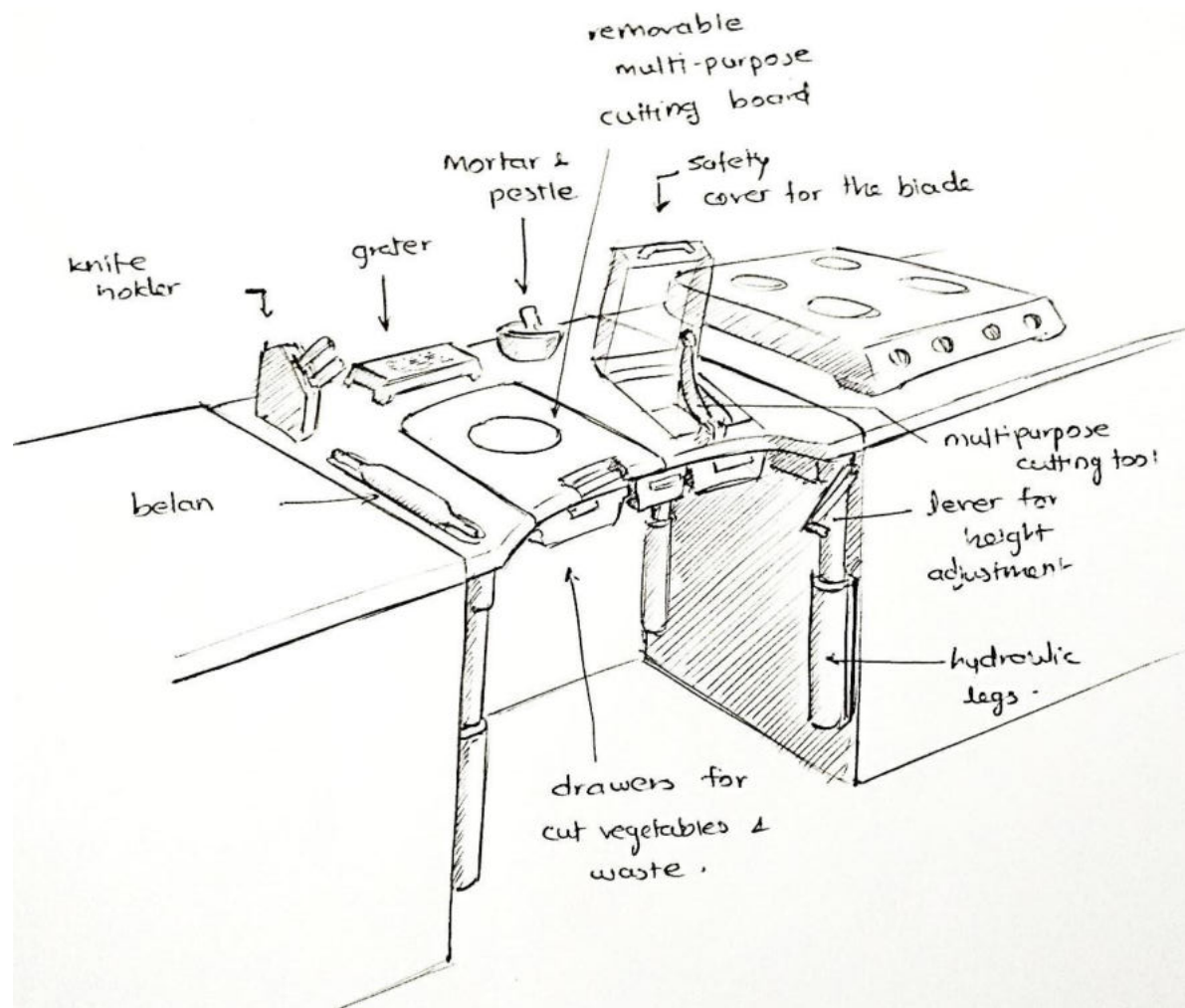
Top
Concept #2

Concept #2

This concept proposes a drawer system on both sides of the stove which would contain the food preparation worktops

The salient features are as follows:

- The drawers on both sides of the stove can be pulled out and their height adjusted. Since these tables contain curvilinear edge towards the user, the user can work much more easily with better reach.
- Hydraulic height adjustable leg can either be given switch control or a manual lever. This allows different heights for different tasks. It also allows sitting or standing posture while working. Though standing posture is recommended.
- Drawers are provided to store cut food and waste while in use. They also have a slope on one end for ease of unloading the contents
- Since the drawers can be pushed under kitchen countertop a large amount of space saving can be achieved.
- A removable multipurpose cutting board for kneading dough, making rotis and cutting vegetables. It can be removed and carried to the living room/dining table whenever required. Instead of chakla it contains a visual cue for making rotis.
- The traditional multipurpose blade from vili/ aadoli is shifted to the worktop and can be used for cleaning and chopping fish and meat, cutting vegetables and grating coconut
- A space for belan is provided and the drawer below the cutting board can house knives and grating board when not in use. It can also house mortar and pestle if required.



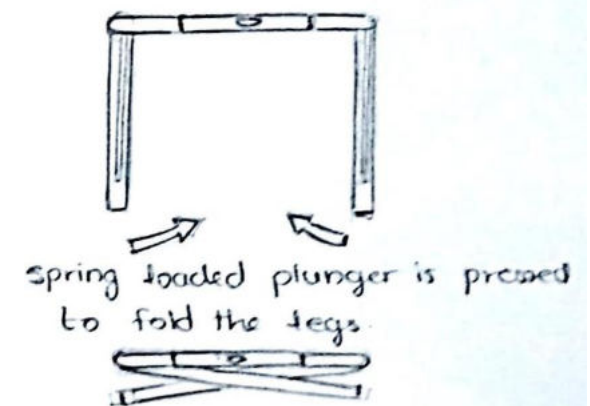
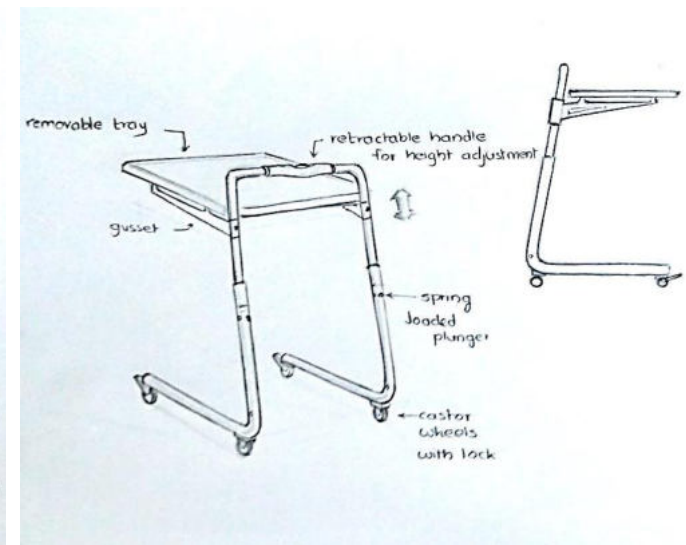
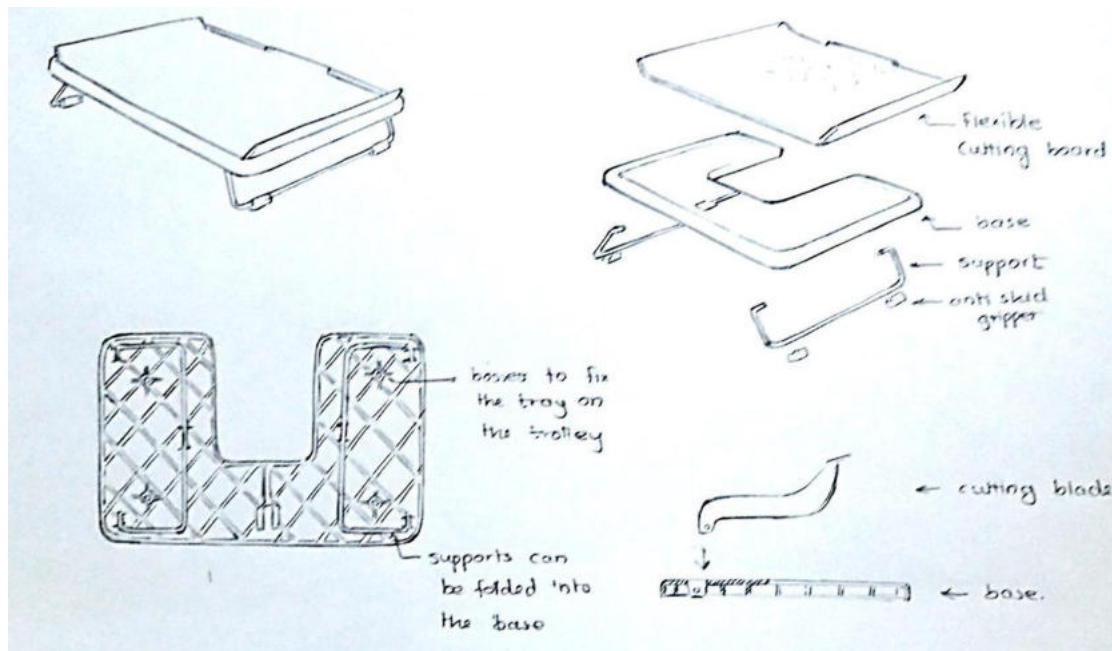
Top
Concept #3

Concept #3

This concept proposes modifying the kitchen countertop to include a height adjustable food preparation module.

The salient features are as follows:

- The module will be placed on any one side of the stove.
- Hydraulic height adjustable leg can either be given switch control or a manual lever. This allows different heights for different tasks. It also allows sitting or standing posture while working. Though standing posture is recommended.
- Drawers with removable partition are provided to store cut food and waste while in use. They also have a slope on one end for ease of unloading the contents. The central drawer is used for waste.
- A removable multipurpose cutting board for kneading dough, making rotis and cutting vegetables. It can be removed and carried to the living room/dining table whenever required. Instead of chakla it contains a visual cue for making rotis.
- The traditional multipurpose blade from vili/ aadoli is shifted to the worktop and can be used for cleaning and chopping fish and meat, cutting vegetables and grating coconut
- A space for belan is provided and the drawer below the cutting board can house knives and grating board when not in use.
- A knife rack is also placed for any two regularly used knives.



Top
Concept #4

Concept #4

This concept proposes a simple lightweight trolley with the cutting board.

The salient features are as follows:

- A removable flexible multipurpose cutting board for kneading dough, making rotis and cutting vegetables.
- The cutting board is flexible and can be bent to aid transfer of cut vegetables into vessels
- The lower part of the board can be used separately by attaching a cutting blade to it.
- The trolley is foldable and has a retractable handle for height adjustment
- The cutting board comes with inbuilt small support legs so that it can be used at a raised height by keeping it on the counter top
- The traditional multipurpose blade from vili/ aadoli is shifted to the worktop and can be used for cleaning and chopping fish and meat, cutting vegetables and grating coconut
- The cutting board as well as the lower base can be washed separately

Concept evaluation

Criteria	Concept #1	Concept #2	Concept #3	Concept # 4
Least amount of change required to existing layout	3	2	1	3
Unobtrusive	1	3	2	3
Ease of use for wheelchair or walker user	1	3	2	3
Space saving	1	3	2	3
Costing on the basis of technology and components	2	1	3	3
Ease of cleaning and maintenance	3	2	2	3
Reducing mobility need	2	3	1	2
Total	13	17	13	20

All four concepts were evaluated on the basis of criteria mention on the table provided.

A 3 point scale was used with 3 being the highest score.

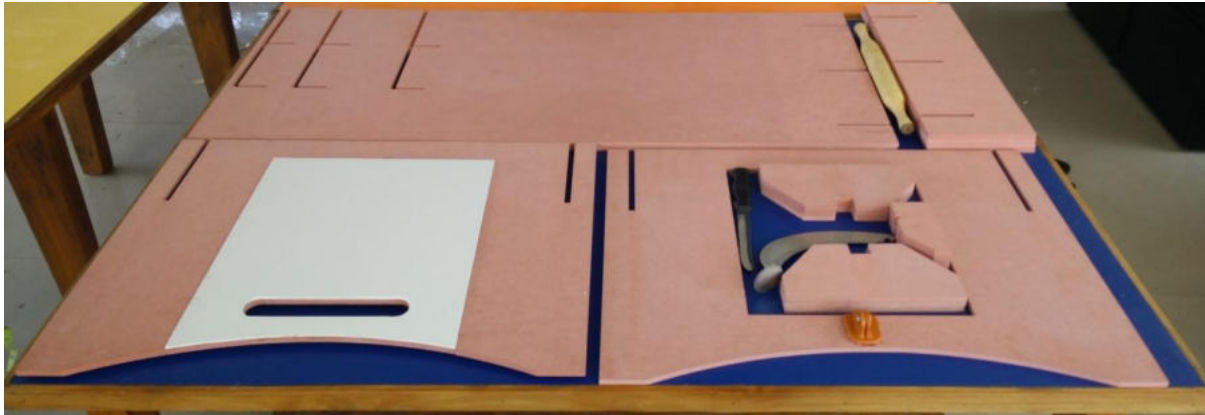
After evaluation, a basic test rig was prepared to check various dimensions considered while creating the concepts.



Top left
Setup for field
evaluation
(assembled)

Top right
Setup for field
evaluation
(disassembled)

Field evaluation



Based on concepts, A knockdown and modular model for field evaluation was designed and constructed

Field trials were taken to check the following :

- Heights considered for different activities
- Ease of use and comfort
- Size of workspace provided
- Additional feature requirement







The following feedback was received from the users,

- Height considered for cutting board (900mm) is comfortable for most users. However for people above 6 feet, platform height should be raised to at least 990 mm
- Height considered for cutting tool (750 mm) is low, should be raised by at least 800 mm
- Size of workspace provided is sufficient and comfortable
- Cutting blade should be easily removable for cleaning



Final concept



On the basis of concept evaluation and user feedback during testing.

The final product was designed in which a lot of features from concept # 4 were used.

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The trolley uses a retractable handle (similar to one found in large bags), for adjusting the height of the product.

The trolley can be packed in a very small place as the legs and the gusset plates rotate to provide minimum surface area .

Tubular SS 304 is used as the kitchen environment demands high amount of cleanability and rust resistance.

.The trolley is provided with castor wheels which have a foot operated break.



The cutting board will mainly 4 major components., the top part is flexible PE cutting board which can be used to cut vegetables and fruits.

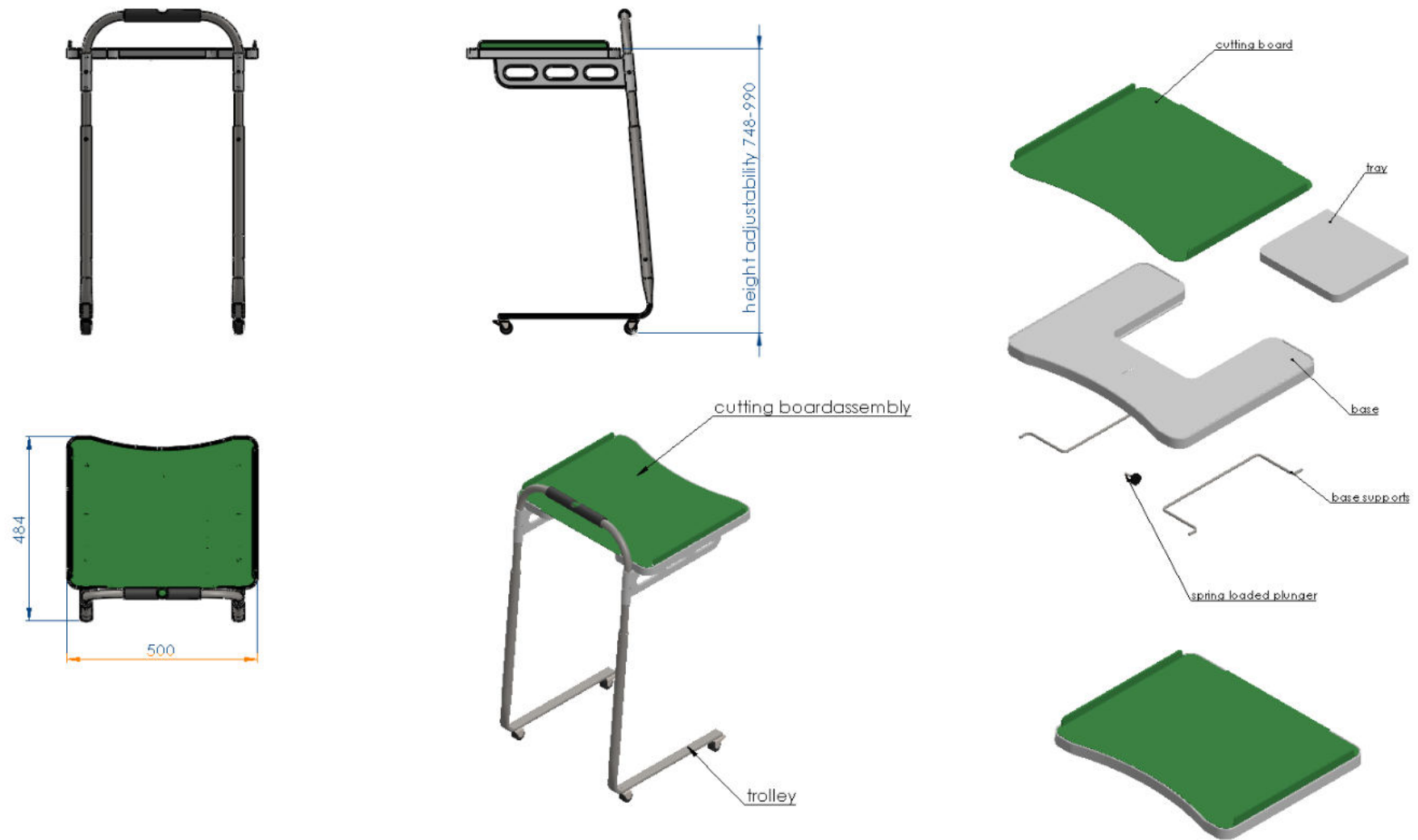
The next part is made out of HDPE and is injection moulded so that maximum amount of functionality can be provided by this one part.

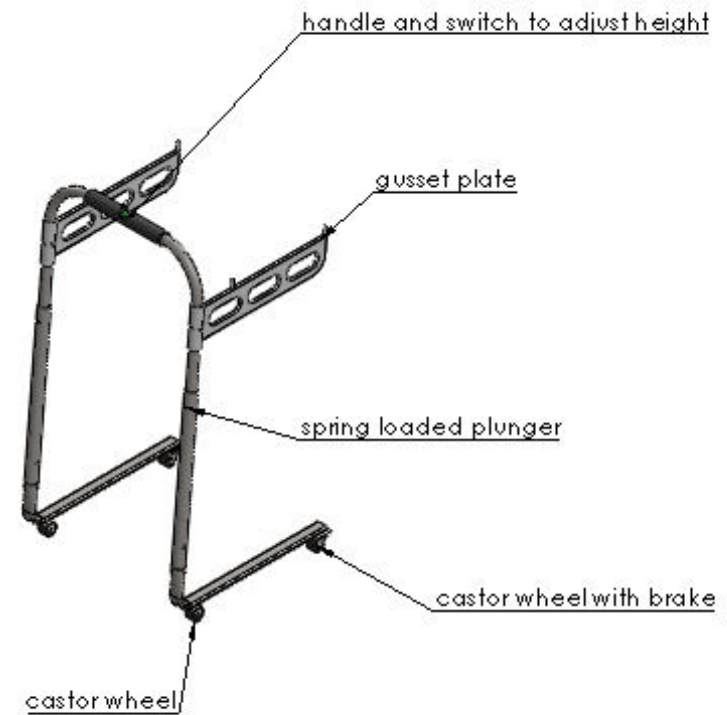
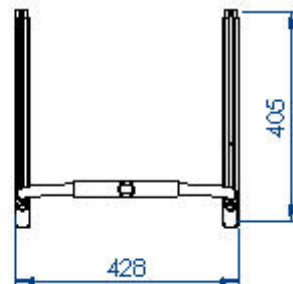
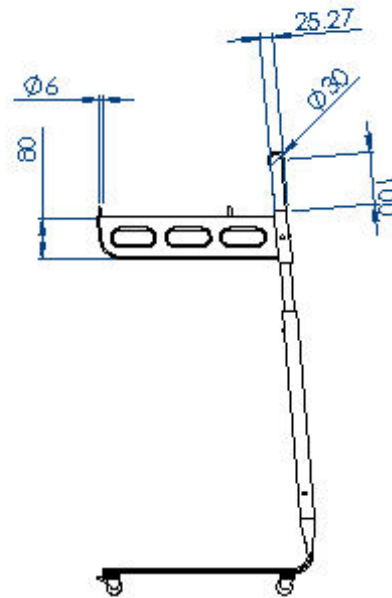
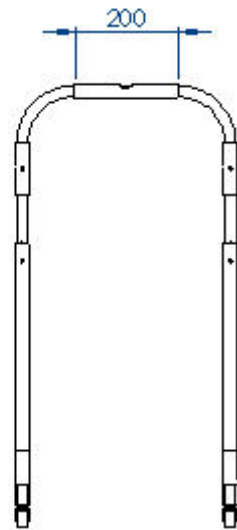
The board can be also used as a Vili holder.

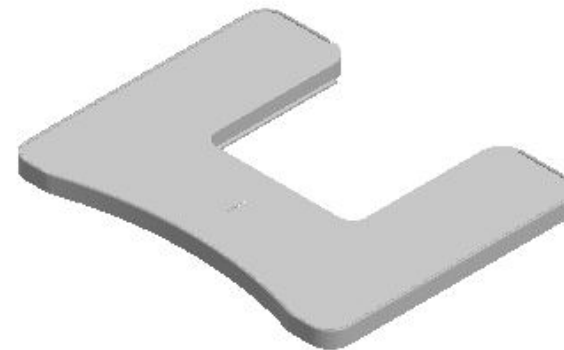
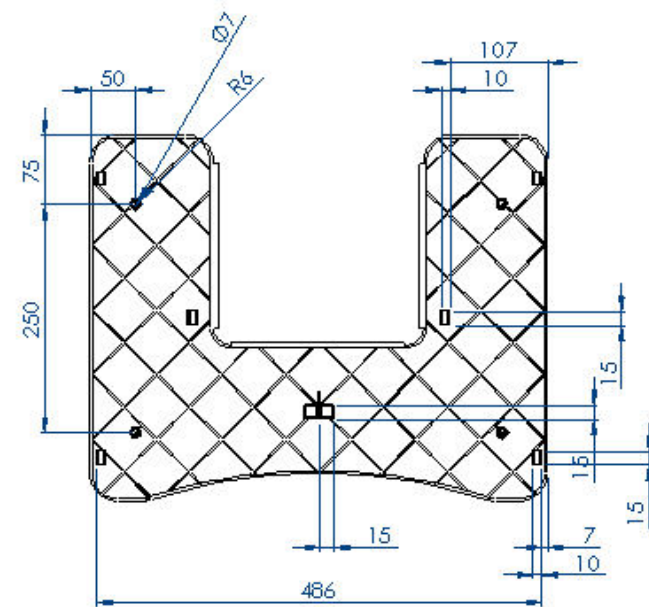
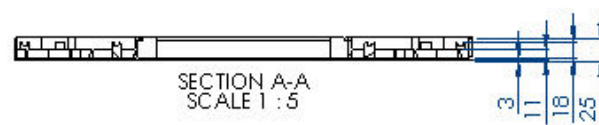
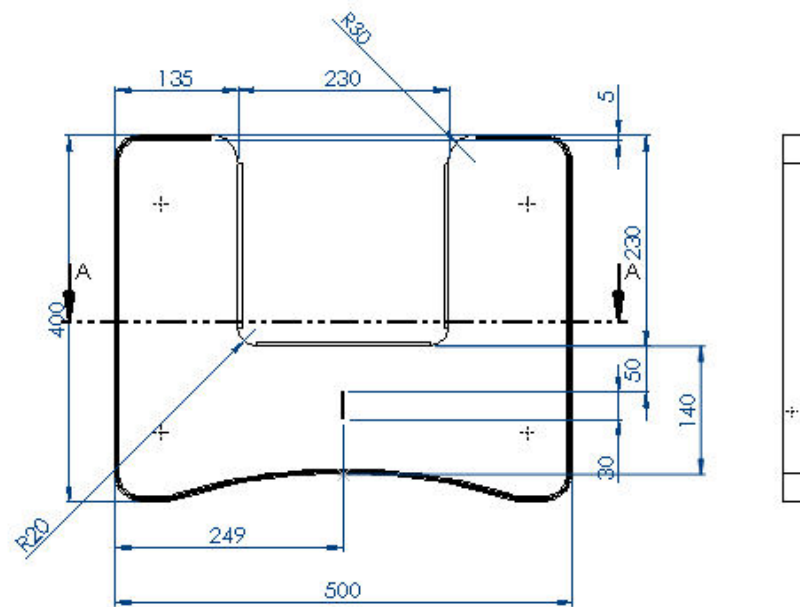
The legs fold below the board so that it can be stored and cleaned easily.

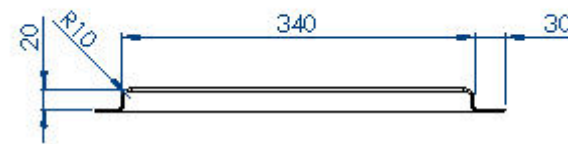
The manufacturing drawings were created for the same.

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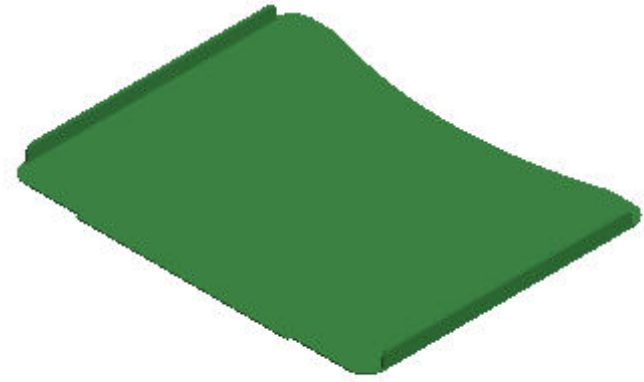
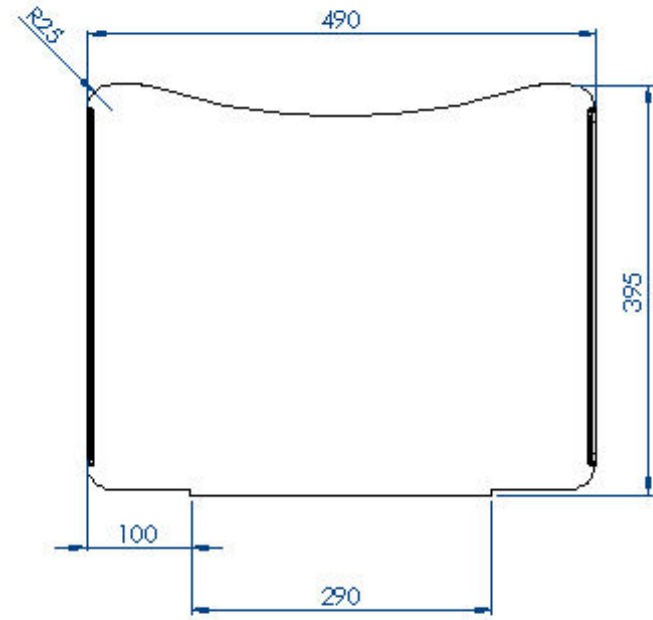


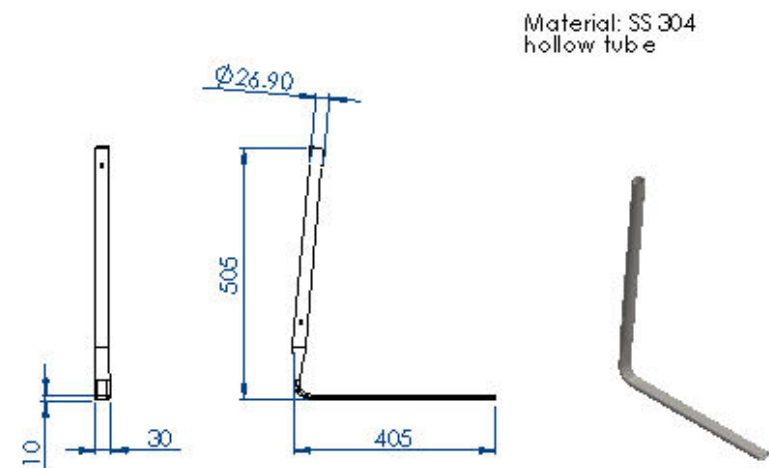
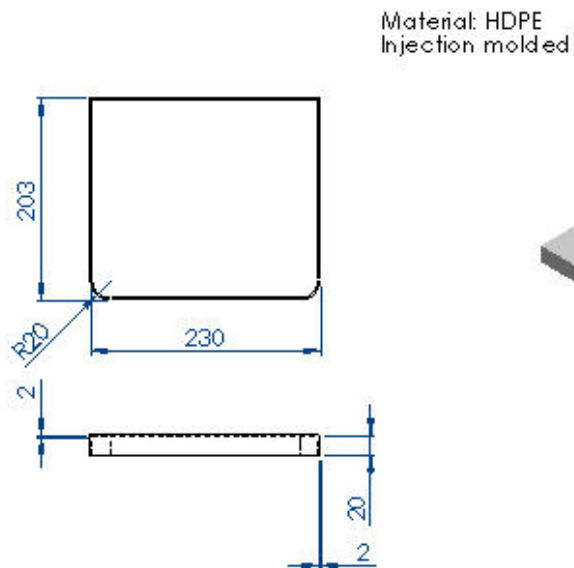
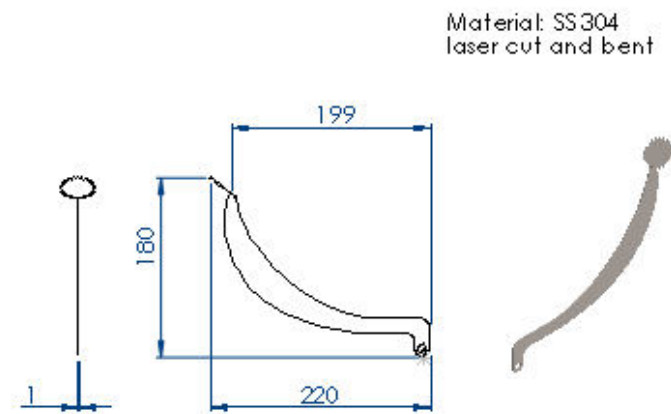
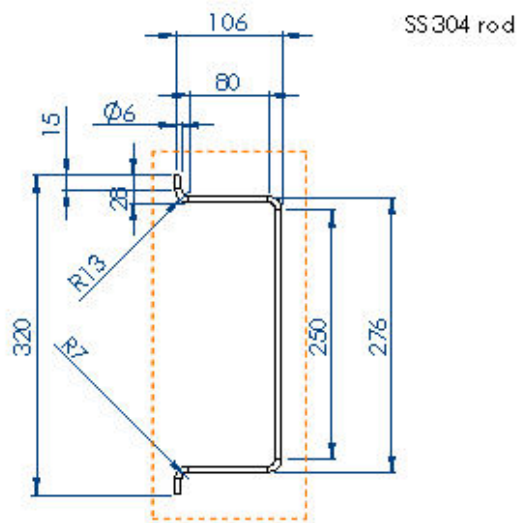






Material : PE
Injection moulded





Future scope

Future scope of this project would be to start looking at other areas in the kitchen especially loading and unloading of vessels from the stove and washing of utensils.

There is also a need for a set of guidelines for safe kitchen design which would also take into account ergonomic and need based constraints from very old and very young users.

There is also a need for creating add on products which will help in small pain points that the elderly have in the kitchen. (i.e. alarm when food is overcooked and opening of jars and bottles.

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