

WALKING AID FOR ELDERLY

INDUSTRIAL DESIGN PROJECT II  
MPR-453

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INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY  
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## Approval

Industrial Design Project II

Walking Aid for Elderly

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M.Des. Industrial Design

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It is approved as a partial fulfilment of requirements of a post graduate degree in Industrial Design at IDC, IIT. Bombay.

External Examiner:



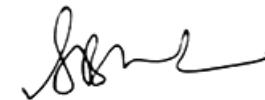
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## Declaration

I declare that this written submission represents my own ideas and where other's ideas or words have been used, I have adequately cited and referenced the original sources. I also declare that I have adhered to all the principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any ideas/source/fact in my submission. I understand any violation of the above will be the cause for a disciplinary action by the institute and can also issue penal action from the sources which has been thus not been properly cited or from whom proper permission has not been taken where required.



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I am grateful to Dr. Trimbak Kawdikar from BETiC Lab, IIT Bombay, my fellow designers and friends from past engineering colleges for contributing their valuable insights to this project.

A handwritten signature in black ink, appearing to read "Bhavan", with a long horizontal stroke extending to the right.



## Design Brief

This project aims to design and develop an ergonomic walking frame to support elderly people to maintain their active lifestyle. It's meant to motivate and encourage senior citizens to do their day to day activities independently along with walker and also to improve their outdoor experiences with families and communities.



## Abstract

In medical area, suturing is the joining of tissues with needle and “thread,” so that the tissues bind together and heal. The “thread” is actually specialised suture material.

Dr Hemant Bhansali (Laparoscopic Surgeon from Nanavati Hospital, Mumbai) and Dr Rupesh Ghyar (Chief Scientist BETiC, OrthoCAD Lab, IIT Bombay) have already developed & patented an Auto-suturing device. During this project the problems related to functionality and usability were resolved.

A simpler suturing device was developed, which can be used by surgeons as well as even paramedics with reduced cognitive load resulting into ideal suturing.

The final output of the project is in the form of a full-scale model and the working has been shown in the SolidWorks software with rendered animation.

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01

Research

# Literature Review

## Falls in Indian Older Adults

In India, a 'senior citizen' or 'older adult' is defined as a person aged 60 years and older.<sup>1</sup>

By 2050, the worldwide population of older adults may grow to almost 2 billion, with 80% living in developing countries. This is the fastest growing population in India, increasing from 6.7% in 1991 to 10% in 2021. Between 2001 and 2051, the number of old-old (age 70 years and older) is projected to increase 5-fold, and that of the oldest-old (age 80 years and older) is expected to increase 4-fold; these increases are faster than for any other age-groups.

Traditionally, older adults are taken care of by their families. A care giving crisis is predicted owing to

changing gender roles, employment of women, erosion of traditional family values, and an increasing trend for nuclear families. The number of older adults living alone is increasing. With decreased family support and informal caregivers, more older adults in India care for themselves.

The World Health Organization proposes 'active ageing', which aims to extend healthy life expectancy and quality of life for all people as they age, including those who are frail, disabled, and in need of care. It emphasises on promoting an active lifestyle, which saves substantial health care-related expenditure. Considering the magnitude of the ageing population and socio-economic changes in India, measures

to keep older people healthy and active are of utmost importance. Preventing non-communicable chronic diseases (such as fall) is one such measure.

Fall is a major cause of injuries associated with old age.

Falls are defined as inadvertently coming to rest on the ground, floor, or other lower level, excluding intentional change in position to rest.

In India, the prevalence of falls among older adults aged 60 years and older was 14% to 53%.<sup>1</sup>

According to the World Health Organization global report on fall prevention in older age, risk factors for falls involve biological, environmental, behavioural, and socio-economic factors. Biological (intrinsic) risk factors include sex, race, age-related declines in strength, balance, vision, cognition, and chronic diseases. The most common predictors of falls are abnormalities of gait or balance and a history of fall in the past year.

most commonly at home and in the bathroom.<sup>13</sup> Outdoors, most falls occurred on the roads. The circumstance (location, activity being performed, time) of falls has implications for developing fall prevention programmes. Falls commonly occur during walking or bathing and are caused by slips and trips and often in the morning. Indians prefer completing self-care

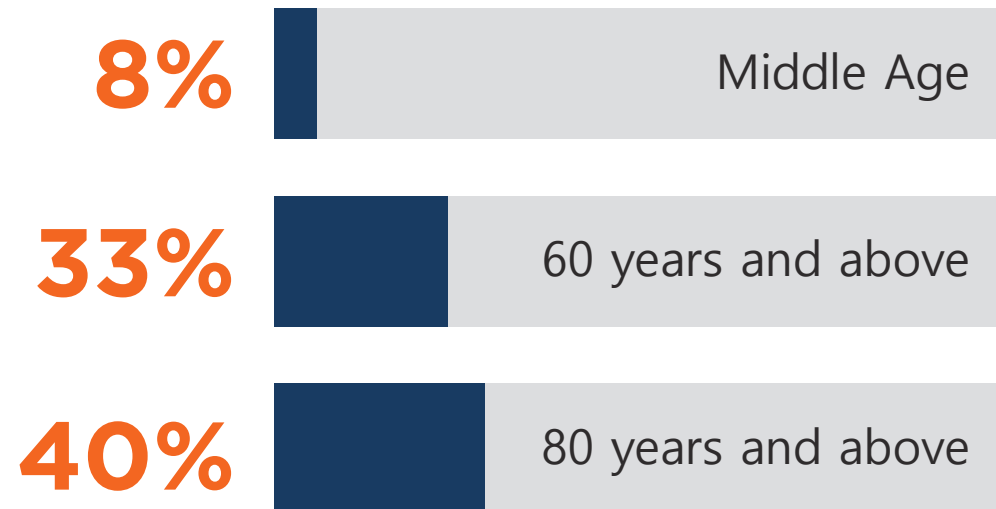
and household chores in the morning, resulting in hurrying or rushing. The use of mobility aids was also associated with falls.

**In Indian adults older than 70 years, intrinsic causes for falls and recurrent falls are the most likely factors.<sup>2</sup>**

Gait disorders and poor physical mobility are associated with difficulty in activities of daily living. Age-related decline in lower extremity strength and balance has been reported in Indian community-dwelling older adults.

Indian older adults are predominantly of the young-old age-group and thus more active. Falls occur

Falls in % per year<sup>3</sup>



## Purpose of Walking Equipments

Walking equipment is usually used for one of two purposes: as part of a rehabilitation programme when the user is recovering from an injury or operation; or as a long-term aid to mobility when the user has a permanent difficulty with walking. The rehabilitation process is a gradual progression towards independent and unassisted walking and may commence with the use of one kind of walking aid to give you confidence before progressing to another walking aid. Sometimes, complete recovery is not possible or you may have an illness or disability that permanently affects your legs, balance or coordination. In these situations, mobility equipment may be required for long-term use, and to ensure that the appropriate device is selected, your lifestyle and home environment should be reviewed.

Walking equipment may perform one or more functions including:

- Provision of greater stability and balance
- Facilitating walking pattern in terms of speed and evenness of stride.
- The equipment may also help maintain an upright body posture
- Increasing your confidence in your walking ability
- Weight redistribution - some of the weight carried through the legs when walking is transferred through the arms of the frame or stick as it is leant on for support. This may help reduce pain in the joints, muscles and ligaments in the lower limbs
- It should also facilitate in other kind of facilities as per daily requirement.

# | The Benefits of Walking Aid

## Benefits of Walking

- It is a suitable physical activity for most people. It can help you lose body fat, improve your health and fitness, maintain a healthy weight, and reduce your risk of developing heart disease, type 2 diabetes and cancers. It can be performed at your own place without worrying about some of the risk associated with other forms of exercise. It is a great form of physical activity for elderly and for people who are overweight. It can significantly increase cardio respiratory fitness.
- When mobility is reduced, the older person's ability to perform everyday activity is affected and they may increasingly become dependent on others for their day to day activities. Walker offers essential and effective support to relieve pressure. It is made from aluminium to ensure they are easy to lift and lightweight. Folding stick can easily fit in your handbag. It is a valuable defensive tool, while hiking in the deep woods.

## Health Benefits of Walking Aid

- **Back and Joint Health:** It helps redistribute body's mass and avoids all weight coming down on the back, knees and hips. It displaces body mass from the back and lower body and supports it through the stick and arms. This can reduce pressure on joints and muscles and help people with arthritis or back problems. It also fosters proper posture, particularly in upper back. Proper posture redistributes mass evenly which reduces the risk of injury and improves back health.
- **Improved Stability and Balance:** When walk over uneven surface then various obstacles can make it difficult to maintain balance. Walker stabilizes the body weight and reduces risk of falling and slipping
- **A proper walking aid helps people of all ages to maintain a healthier and active lifestyle.** It can benefit a person's health by giving them better balance. It lessens the stress on the body and relieves joint pain. Elderly use it to move around better and for the things they need to do. It can give a person more confidence and make them feel less tired and more energized in their day to day activities.

# Categories of The Functionally Impaired Elderly

The functionally impaired elderly can be categorised into the following three categories based on the degree of walking impairment they have. A study of the categories of impairments followed by user studies in old age homes, helped me narrow down to the impairment for which a design intervention was required.

## The Mildly Impaired

The first group includes people who have relatively mild impairments, such as mild arthritis, and can generally get by without help from other people. Within this group, assistive devices can be a great boon. Examples include an elderly person with arthritis

## The Moderately Impaired

The second category includes persons with moderate impairments, those who are functionally impaired in one or two activities of daily living. An example could be an elderly with arthritis plus the loss of leg movement. For those in the second group, they may not be able to make the person completely independent and they might still require human help.

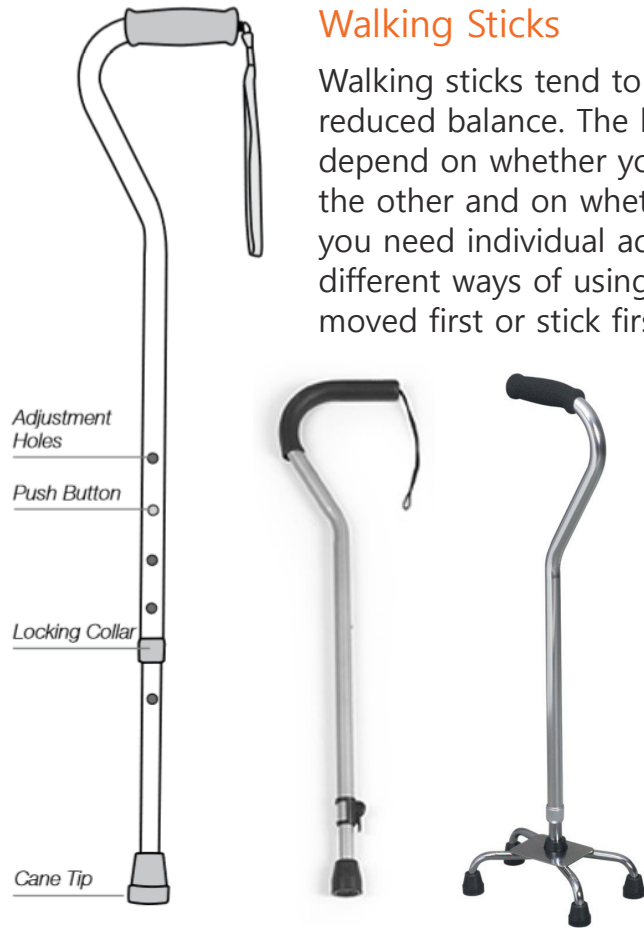
## The Severely Impaired

The third category of the severely impaired elderly makes little use of assistive aids. This group includes people with multiple health problems and severe functional limitations. Such persons may have severe cognitive impairments, as well as several physical impairments such as loss of arm and hand movement.

# Existing Walking Aids

## Walking Sticks

Walking sticks tend to be used by those with moderately reduced balance. The hand they should be held in will depend on whether you have one leg or side stronger than the other and on whether you are right or left handed so you need individual advice on this . Likewise ,there are also different ways of using them such as stick and involved leg moved first or stick first.



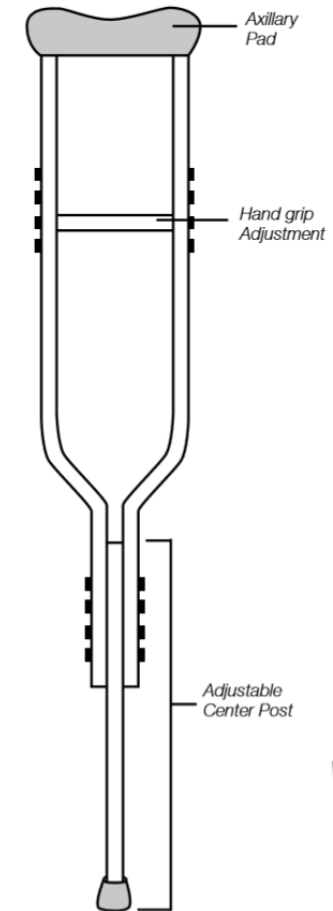
Walking Stick

Single point canes

Quad point canes

## Crutches

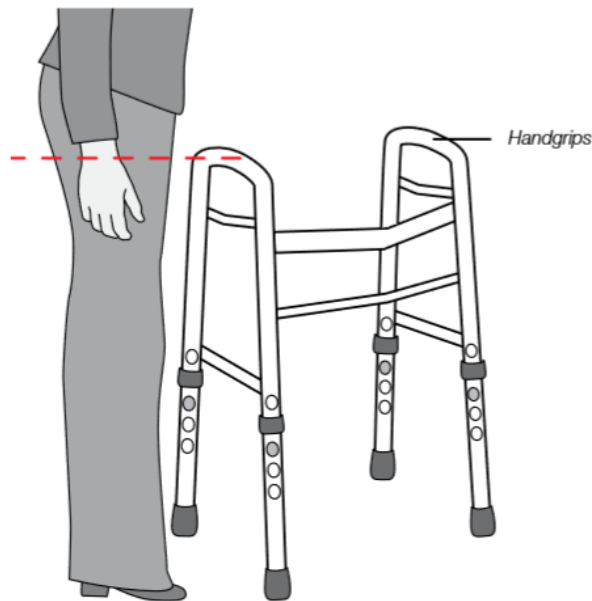
Crutches are the traditional mobility aid for when one leg is almost entirely non-weightbearing. Aluminium or wooden axillary (under the arm) models can be adjusted easily to both key measures: your overall height and hand height. There are different ways of using crutches such as two point gait, three point, four point and swing-to and swing-through gait.



Crutches

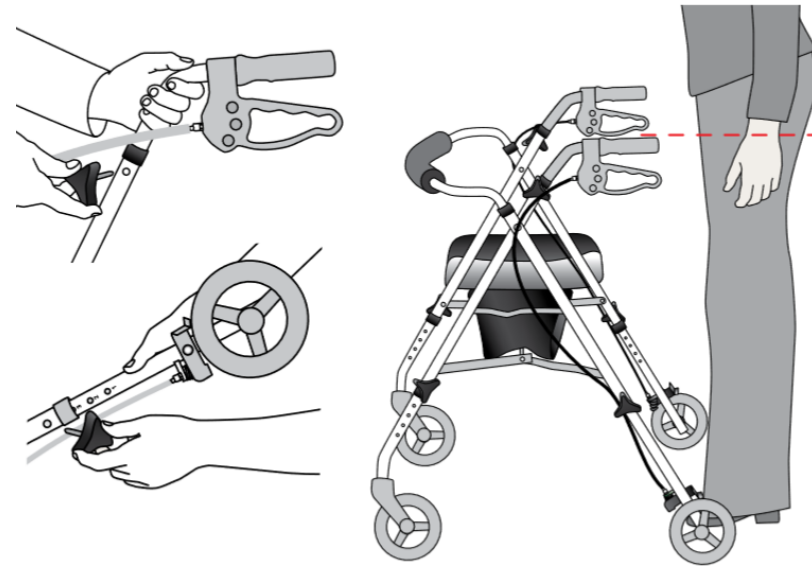
## Walkers

Walkers tend to be used by those with poor balance and/ or weak legs. A walking stick can off-load 25 percent of the user's weight compared to a frame which can transfer 64 percent of the user's weight through the arms . This weight re-distribution from legs to arms can help reduce leg pain. Although walking frames are useful because they provide a large area of support, they do not allow the user to walk using a flowing walking pattern. The user has to keep stopping and starting as the frame is picked up, moved forwards and stepped into. This means they may not be suitable for you if you get tired quickly or have difficulty starting movements (this is often a symptom of Parkinson's disease). To conclude walking frames may be used as a rehabilitation aid but other types of equipment may be more suitable for long-term use.



## Rollators

Rollators provide users with both a mobility aid and a seat to rest on when tired. These two functions require two measurements be taken to accurately size a rollator. Some rollators only allow for adjustments on the handles, while other rollators adjust at both the handles and on the legs for a more custom fit. The two wheels at the front allow these frames to be pushed by gliding them across the floor. This makes them less likely to run away than a four-wheeled frame. They may allow you to adopt a more flowing walking pattern than with a non-wheeled walking frame. Rollator comes in three types according to the no. of wheels attached and named as Two Wheels, Three Wheels and Four Wheels Rollators.



Two Wheel Rollator



Three Wheel Rollator



Four Wheel Rollator

# Market Study

## | Product Analysis

For the most part, all of the systems on the market support the user only passively and serve to maintain general mobility. The walker is the perfect aid for users who are somewhat mobile, but sometimes need support when walking. Being able to use walkers, especially rolling walkers, provides users with independence and mobility as long as possible.

In recent years, walkers have been increasingly viewed not only technically, but by their design. The creative variety of walking aids available on the market clearly shows the optimal factors of the manufacturers were identified as selling features.

Walkers have also technically developed more and more in recent

years. In addition to the standard models, there are now models available that stand out due to their reduced weight. Additionally, specialized walkers are available for individual user groups. An example of this can be called XXL walkers that are designed separately to the needs of obese users.

Meanwhile, there are various research approaches that deal with the electric drive for walkers. In these approaches, the user is supported by the drive and the force to push the walker is thus minimized.

All conventional walkers are very similar in technical design and have tubular frames with 2, 3 or 4 wheels, whereby the back two wheels

are always fixed. The systems are equipped with handles and have independent braking systems, a sitting area and an optional carrying

case. The walker is pushed by the user with both hands and offers the possibility to bear down on the handles.





Image Source: Google

Some Concept + futuristic Designs...

Image Source: Google



## Basic Folding Walker

### Pros

- ✓ Adjustable height feature
- ✓ Cost effective solution for patients needing a walking aid (Around ₹1000)
- ✓ Extremely lightweight
- ✓ Sturdy Body
- ✓ Folds easily with a one touch button release
- ✓ Portable

### Cons

- × No seat
- × Hospitalised look
- × No handle adjustment
- × No caster, difficult to turn



# NOVA Medical Mighty Mack

#1 Walker | July 2016  
by wiki.ezvid.com

Features a pillowed seat pad for comfort and has locking hand brakes for optimal control. It's strong enough for those who need a walker the entire day, giving otherwise immobile users their independence.



## Pros

- ✓ Flip-Up seat with built-in handle – easy to change it from walking to seating mode
- ✓ Locking mechanism (when not in use)
- ✓ Good to ride on slippery to rocky terrain
- ✓ Slender enough to fit in most bathrooms
- ✓ Under seat pouch
- ✓ Folding

## Cons

- Contains latex which can be an allergen
- Can not manoeuvre over staircase
- Allow bend over posture
- No handle angle adjustment
- Backrest is not ergonomic

## HealthSmart Euro Style

#1 Folding Walker | July 2016  
by wiki.ezvid.com

Comes with a large storage tote that can go under the seat or be worn as a bag with the shoulder strap, making it great for running errands. It also boasts oversized wheels that move smoothly over surfaces and make feel supported.



Image Source: Google

### Pros

- ✓ Flip-Up seat with build in handle – easy to change it from walking to seating mode
- ✓ Locking mechanism ( when not in use)
- ✓ Good to ride on sleepy to rocky terrain
- ✓ Slender enough to fit in most bathrooms
- ✓ Under seat pouch
- ✓ Folding

### Cons

- × Contains latex which can be an allergen
- × Can not manoeuvre over staircase
- × Allow bend over posture
- × No handle angle adjustment
- × Backrest is not ergonomic

## Concept Walkers/Rollators

### Evo Walker by Alex Tsui

<https://www.behance.net/gallery/1777884/4-projects-Evo-Astro-Kinetic-Q-Stop>

Evo is modern product that assist the elderly community in additional support to maintain balance and stability while walking. It also provides a seating arrangement and an ergonomic experience with usability.



### Wheeled-KÄRCHER by Alexander Knorr

<https://www.behance.net/gallery/10431583/Wheeled-KAERCHER>

This is concept rollator with unique features which helps handicapped people do the basic cleaning. Features: attached Vacuum Cleaner, Heart Rate monitor, Fall Sensor, Light guide System.



### Ascent Rollator by MIT

<http://web.mit.edu/adnane/www/adnan/portfolio/pde/ascent.html>

This is rollator tackle the challenge of lifting the elderly that have fallen. It houses a motor which drives the lead screw to uplift the seat, hence helps elderly to get up.



Image Source: Behance.com

# Features List

More than 50 walkers and rollators were studied and listed the properties or features it provides, their sizes, dimensions, weight, etc to make the overall features list. This features list is then used to carefully choose the design requirements for the Rollator depending on the target group

- **Attractive, European Style**
- **Comfortable Seat**
  - Memory foam seat
  - Padded Seat
- **Back Support**
  - Padded Backrest
  - Rod Backrest
  - Surface Backrest
- **Foot Rest**
- **Braking**
  - Loop Style
  - Push down to lock - Walker Stops
  - Pull up to release - Walker moves
- **Folding**
  - Cross Brace Design - Side to side folding
- **Storage Space**
  - Carry Pouch/ Storage Cart
  - Specially for women going for shopping
- **Handle Height Adjustment**
- **Wheel Size**
  - 6", 8", 10"...Bigger the better
- **Caster Fork**
- **Light weight**
  - Aluminium
  - Steel Reinforced
  - Max :17lbs=8Kg
  - Min:11lbs=5kg
- **Weight Capacity**
  - 140 to 180kg
- **Distance between Handles**
  - 18" = 51cm
- **Compact**
  - Seat Height 22" = 56cm
  - Overall Height
  - Min 32.5"= 85cm
  - Max 37.5"= 99cm
- **Safety Features**
  - Bell, Flash Light
- **Other features**
  - Cane and cup holder
  - Motor driven

# Product Mapping

Prof. Bapat had invited Mr. Ashok Panvalkar, Director 3F Design. Ex Phillips Design Head. He introduce us to the product mapping tool which he has be using over the years while designing the products for his clients. Product mapping was done to find out the target market position.

To make the product map around 50 product images were selected from the internet and arranged them on the graph.

On X axis pictures were set according to Lifestyle the product provides and on Y axis, they are set according to the Fashion statement. Refer image on next page.

The matrix was made and the product pictures were arranged carefully with the help of Pro. Bapat and Mr. Ashok Panvalkar (Philips Design- Director at Pune Branch) and then the inference were listed.

The oval mark with green is the area where I want to position my product. (Refer figure 1)

## Inferences

- The products are mostly concentrated diagonally from (5,1) to (1,5)
- From (5,1) to (3,3), products looks more of hospital product and it lacks the personalisation.
- As we go towards the (1,5) from (5,1) we can see change it pipe cross-section. Oval and rectangular frames has been introduce.
- Towards (1,5) walker has become multi-purpose. Almost all the products have seating arrangement, storage space, etc.
- Wheel size has increased too towards (1,5) making the product maneuverable over the terrain.
- Transition from (5,1) to (5,5), innovative style of product usability has been introduced making the product more ergonomic and comfortable as per users need.
- Positioning the product in green oval would make the product more innovative as well as aesthetically pleasing which hope to encourage elderly to walk more.

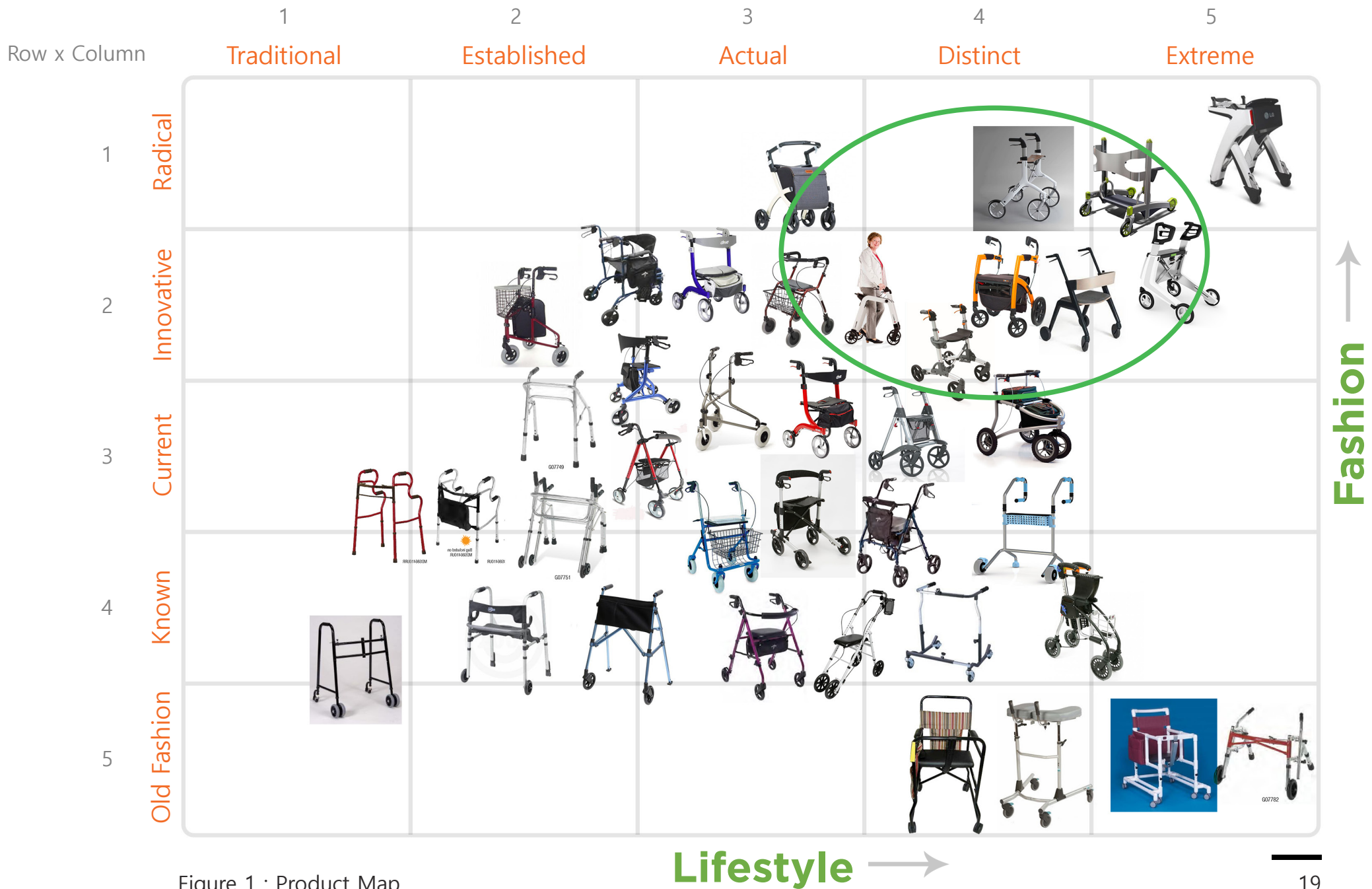


Figure 1 : Product Map

# User Study

## Interviews

After an understanding of the categories of impairments in elderly, their causes and the various walking aids used for different impairments, visits were made to elderly homes in Mumbai with a fair understanding of their walking impairments and the reasons for the same.

A total of 10 elderly were interviewed.

The methodology followed was to observe and identify elderly with different walking impairments ranging from severe to mild and the difficulties they faced with the walking aids they were presently using. Their living space was observed and made elderly do few tasks. Tasks were videotaped as well as few pictures were clicked for further analysis.

This study was conducted to know about elderly people's lifestyles, product use scenarios and to find out various problems they face while walking. This helped me narrow down to the category of elderly for whom walking aids would be useful and also the aid, which needed to be redesigned.

All the activities in the User Study were carried out indoor only to simulate the daily way of working of user.

Questionnaire is attached in the appendix

### Study Locations

- Manav Seva Sangh, Sion
- Dignity Foundation, Byculla

### Methodology

- Interview + Questionnaire
- Videography
- Slow motion analysis
- Still Photography

### Age Group

70 - 85

### Activities

- Sit – Stand – Sit
- Walk from place to place with Stick and Walker



## User 1

Age:74 | Mildly Impaired

### Problem:

Shivering throughout the body.  
Legs get swollen frequently.

### Why using walker:

Uses stick when assistance is there  
else 2 wheel walker.

### How frequently:

Morning, a 40m walker in the lobby.  
While going to doctor till taxi.  
While going to wash room.  
When the last time went outside  
Not since 6-8 months

### Problem with walker

Upper body pain due to frequent lifting of walker from past 1.5 years



## User 2

Age:71 | Moderately Impaired

### Problem:

Over weight and leg pain  
Not able to walk properly.

### Why using walker:

Uses walker to share the weight and  
also an exercise medium.

### How frequently:

Morning, a 40m walker in the lobby.  
While going to doctor till taxi.  
While going to wash room.  
When the last time went outside  
Not since July

### Problem with walker

Feels scared of falling, no provision to rest while walking.



## User 3

Age:85 | Mildly Impaired

### Problem:

Age related issues. Weak bones.

### Why using walker:

Uses stick and walker as extra support

### How frequently:

Morning, a 40m walker in the lobby.  
When the last time went outside  
Not since year

### Problem with walker

No problem

## Quote Chart from various users

Important quotes or sayings were cut out from the interviews conducted with elderly people and read them carefully to understand their needs, pains points, their likings, basically to know them better.



Figure 2 : Quote Chart

# Personal Belongings

While interviewing the elderly, the observations are made to know their personal belongings, what they carry with them all the time, what are the things they interact with. Following images shows the list of their personal belongings.



Figure 3 : List of Personal Belongings

# Understanding User - Mind Map

After interviewing the elderly basic Mind Map was made to understand the various aspects of their lives. Mind Map helped me categorising the physical and emotional needs of the elderly as well as to understand their living scenarios and the sources of income.

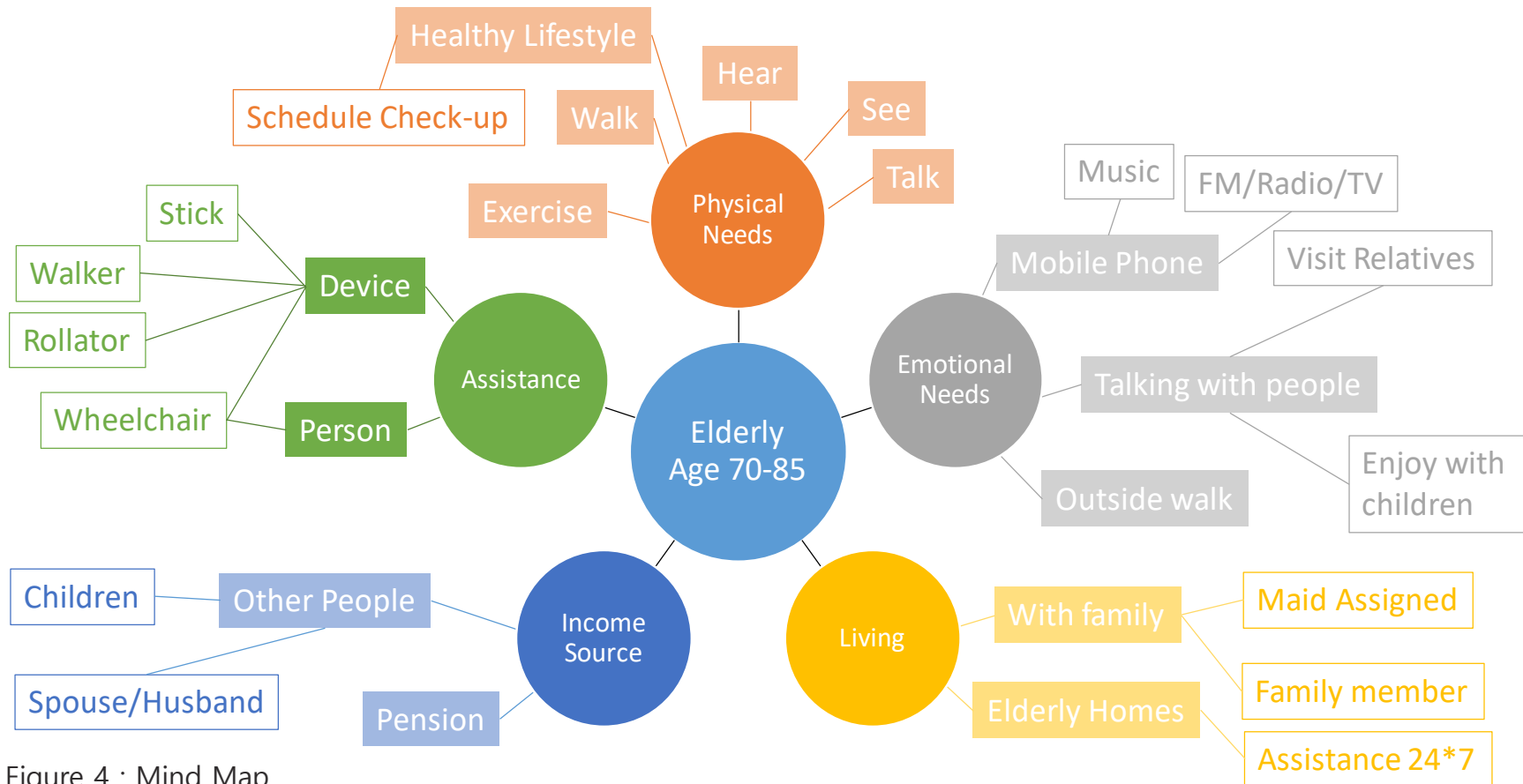


Figure 4 : Mind Map

# Observations

The interactions with the elderly, helped me to derive the following observations which were used for design in the later stages.

## Most Common Aids

The most common walking aids used by the elderly people are Cane or walking stick and basic Walker. The walker is used shorter distances and the Walkers are used to go to long distances (Approx more that 30 metres). Most commonly used walkers are the one which are doesn't have wheels or those who have only front wheels.

## Walking long distances

People gets fatigued easily, so mostly they roam around Sofa, chairs, benches, etc.

## Body Posture

A closer look at mobile walker users often shows a completely wrong use of the walker. The bent-over

posture of the user is responsible for this, caused by leaning over the handles to obtain support. Back pain is the common consequence of this overuse.

## Weight Transfer

Walkers in the market are equipped with handles whose position is parallel to the ground. The cylindrical design of the handle in most walkers is not identical to the natural form of the hand. This creates the excessive stress on the hands.

## Customisation

Once the walker is set to their comfort, they don't do much customisation in walker.

## Dimensions

Standard sizes are used which some times are not suitable for the very tall and the very short people

## Uneven Surfaces

The end caps are usually worn out which causes skidding and slipping. Most of the indoor conditions were good. Walkers runs smoothly on floors rather than in outside condition on paver blocks.

## Outdoor Mobility

Limited due to lack of pedestrian pathways and uneven surfaces. They outside mobility is only limited to go to doctor or for hear cut.

## Weight of the aid

Some aids are difficult to carry and move around with due to their size and weight. No wheel walkers are required to lift up frequently while walking makes the overall weight of walker much of a concern.

## Durability

The MS walking frames are often seen rusting. Stainless Steel walkers are seen to be more durable.

# Ergonomic Study

## Proper way of using walker/rollator

### Getting Out of Bed

#### Step 1

Get out of the bed on the same side as your affected leg. Your physician or physical therapist will show you how to move your affected leg properly and will help you the first few times while you're in the hospital.



#### Step 2

Pivot on your hips using your elbows to help. Keep your body straight with your affected leg kept to the side. Do not twist your leg.



#### Step 3

Move your unaffected leg around and sit on the edge of the bed, keeping your affected leg straight. Hold onto your walker for support and stand. Do not bend forward as you try to stand.



Figure 5 : Getting out of bed

## Walking

### Step 1

Place the walker a few inches in front of you and hold on to the walker firmly with both hands. Keep your hip straight and step your unaffected leg into the centre of the walker. To protect your hip, avoid rotating your hip or foot.



### Step 2

Lean on the walker and let it support your weight. Step forward and beyond the front of the walker with your affected leg. Be careful not to wrap your leg around the legs of the walker.



### Step 3

Lift your walker straight up (if it doesn't have wheels). Be sure to place all four of its legs down before stepping forward again.



Walking Direction →

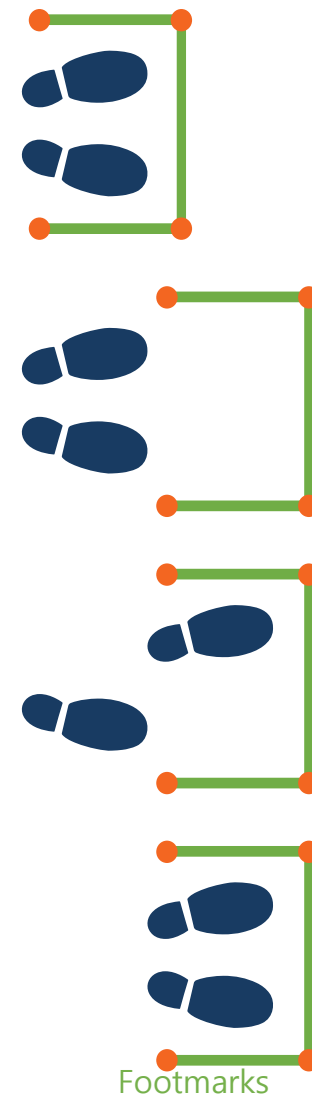


Figure 6 : Walking

## Sitting

### Step 1

Sit in firm, straight-backed chairs with high seats and armrests. You should avoid low, overstuffed chairs. Back your walker up until you feel the chair touching the back of your legs.



### Step 2

Release your hands from the walker. Reach down and hold onto the arm rests. Slowly lower yourself, keeping your affected leg straight out in front.



### Step 3

Sit, then slide back in the chair bending your unaffected leg first. You use this technique when using a toilet with arm rails as well.



Figure 7 : Sitting Down

## Slow Motion Analysis

All the activities were performed indoor only to simulate their day to day in house behaviour.

As the room was small and furniture and other stuff, there was very little room for videography. Because of it following pictures are not clear at bottom side.

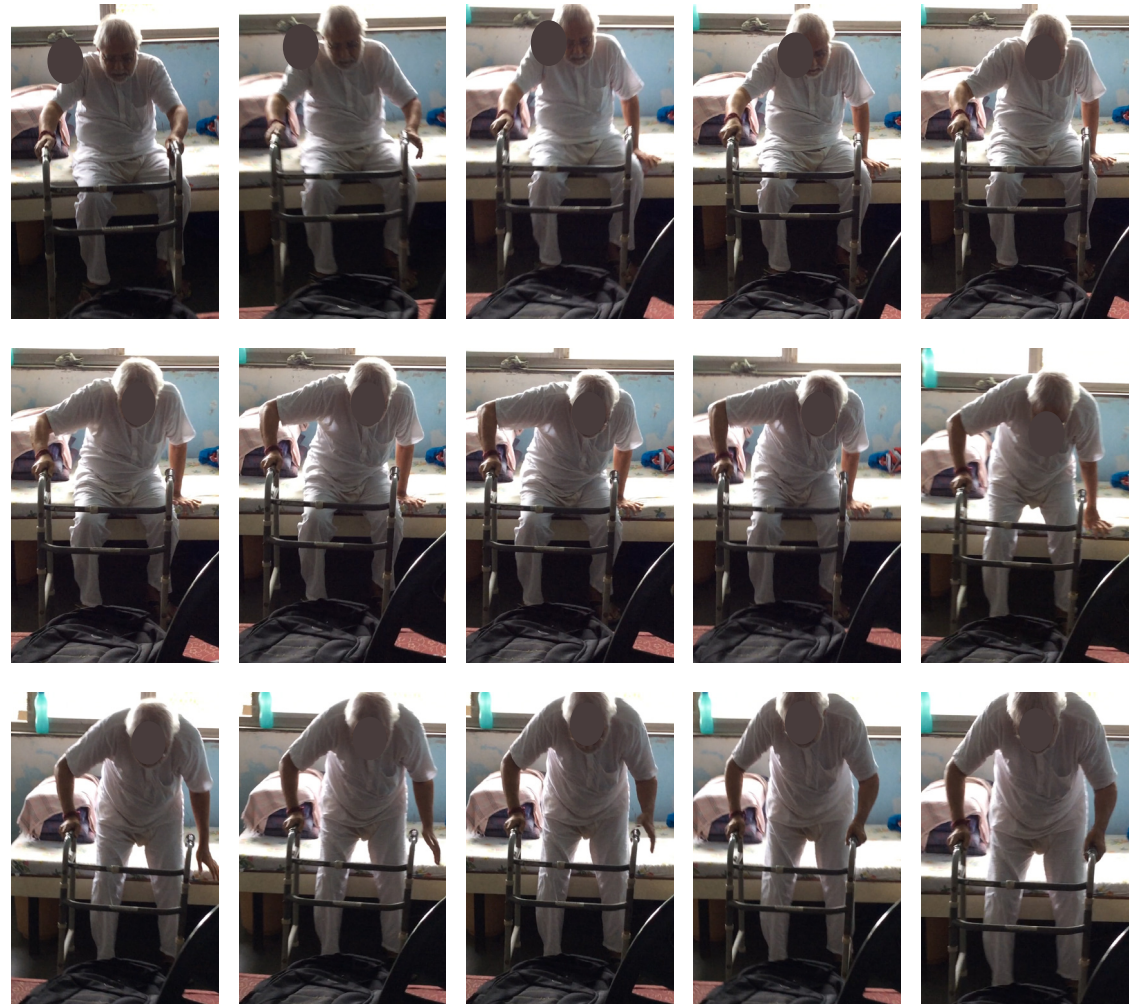


Figure 8 : Slow motion analysis - Getting Up

## Balancing and Walking



Figure 9 : Slow motion analysis - Balancing and walking

## Turning Back



Figure 10 : Slow motion analysis - Turning Back

## Seating Down

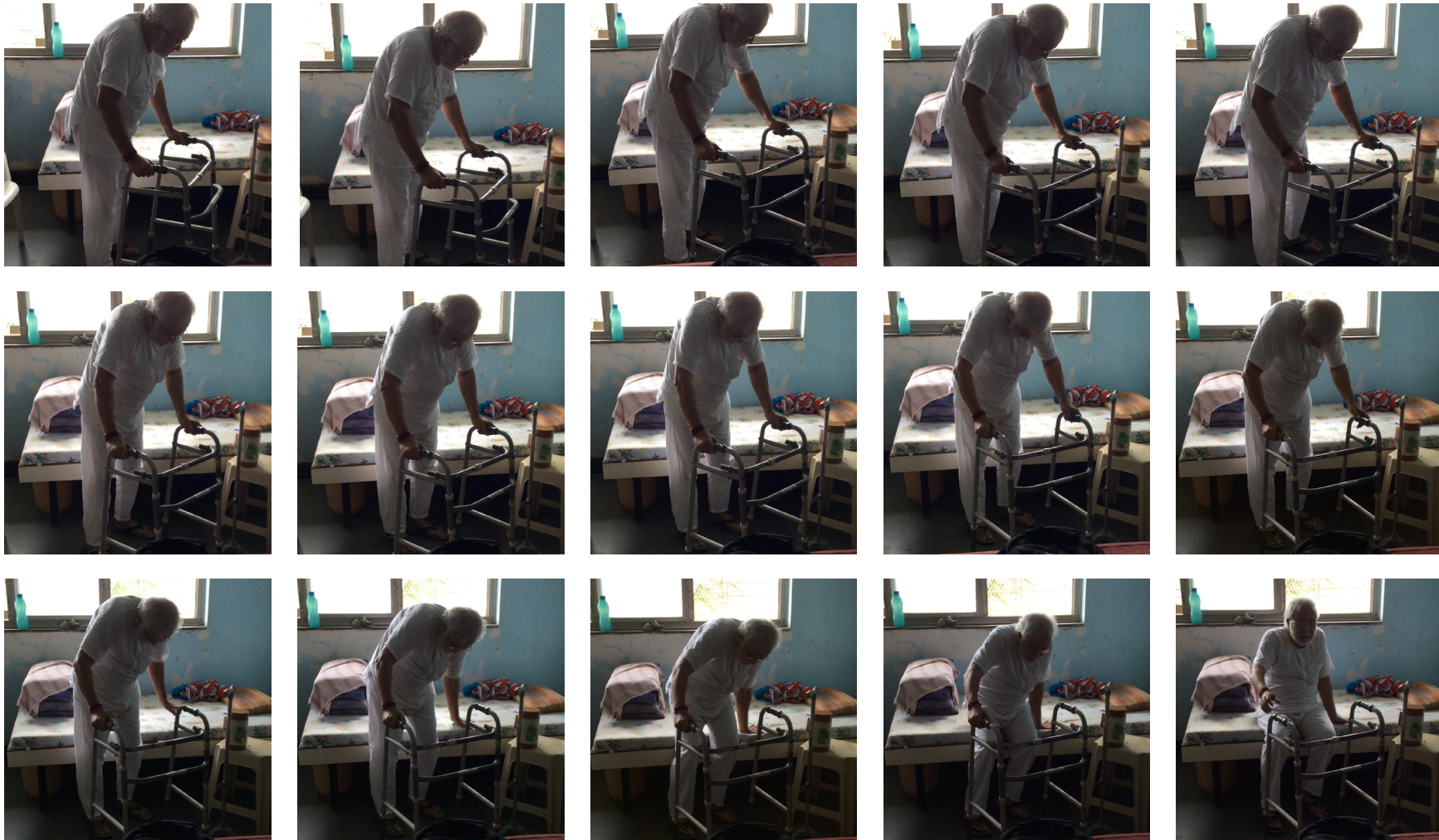


Figure 11 : Slow motion analysis - Seating Down

## Postural Analysis

In figure 12 and 13, it can be clearly seen that when the user is using the walking stick, his posture is upper right but when he uses the walker he lean on it and the back of the user can be seen making the C shape. While interviewing user mentioned that he has back pain as well as the upper body pain.

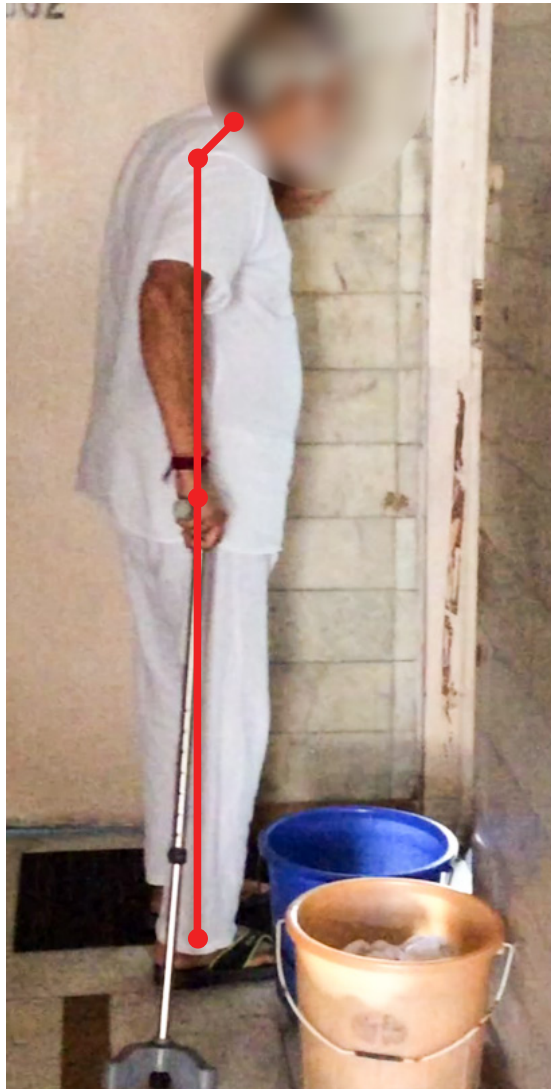


Figure 12 : Walking with Stick



Figure 13 : Walking with Walker

Considering the position of the handle compared to the body attitude it becomes obvious that many walkers take ergonomic aspects inadequately into account. For a proper design, the focus needs to be extended to the hand-arm system. The motion space of the hand towards the rest position is anatomically limited to 30 ° in ulnar and 15 ° in radial directions. At rest, the middle finger is the extension of the forearm. If the rest of the arm and the resulting angles arc superimposed to this area, it is clear that the spatial orientation of the handle is critical to the use of a walker. Due to the fixed handle position of the walker, users are forced to adapt to this position. By superposition of shape and orientation of the handle and the lack of ergonomic adjustment, the user is forced to adapt to the mobile walker. As an overlay effect, this creates excessive stress on the ulnar side of the hand that is detected by measurement in the course of verifying the results. Through the

transfer of force application and the reduction to a small area, there is a dorsal flexion and thus to a change from the resting position of the hand. Following Figure compares the deviations of the hand of the optimal position and clarifies how the handle design affects the user's bearing and attitude.

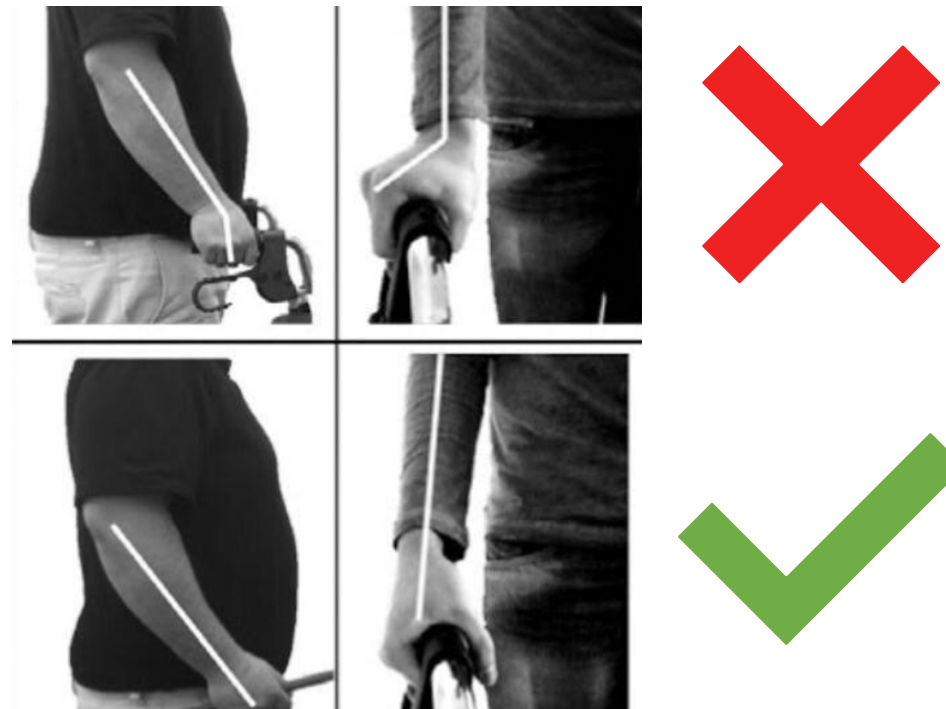


Figure 14 : Incorrect and correct hand posture

The cylindrical design of the handle in most walkers is not identical to the natural form of the hand. Contrary to some representations, the hand is not flat but curved in its rest position. The curvature of the palm of the hand along the longitudinal axis and along the transverse axis of the hand does not allow reliable contact with a cylindrical body. The contact is reduced to a limited area of the hand. Investigations on different types of handles have identified a cycloid grip body as the best possible form. The different contact surfaces between a cylindrical body and a cycloid by hand are described in detail in the following figure 16 and 17 respectively.



Figure 15 : Contact surface between a cylindrical body by hand



Figure 16 : Contact surface between a cycloid body by hand

Modifying the design of the handle form of a rolling walker distributes the forces exerted by and acted upon the hand of the user more evenly and thus reduces the strain on the hand. The design effort to implement such a change is small in contrast to the generated added value. Other factors are also critical to the usability of the handle assembly.

# Problem Identification

## Safety Issues

### Stability

Being stable in all the condition is prime concern for elderly while doing every day activities. If an inappropriate walking device is used, if incorrect techniques are adopted, or if the device is not suitable for a particular environment, your independence and safety may be jeopardised.

Probable Solution:

- Providing simple rugged locking mechanism for walker.
- Walker can be remain steady stall lock state until user want to move it.
- Providing adequate floor area between the points where walker touch the ground.

### Fall

Fall has psychological effects on elderly due to which they are discourage to go for walk. There are three states in fall which is pre-fall state, falling state and after fall. Following are probable solutions for each state.

Probable Solution:

- Fall Detector
- Fall prevention System
- Help Alarm after fall



## Postural Issues

### Sit to Stand Transition

Sit to stand is the most common activity for elderly person which they has to perform several times in a day. User study shows elderly struggling to get up properly due to lack for stable holding bar at proper position.

Probable Solution:

- Provision of Handle Bar to lift the body properly to stand
- Distance between walker and user can be reduce

### C-Curve of backbone

The C-curve of backbone not only causes higher muscle strain and higher demands on energy, it is one big reason for increased pulse frequency and blood pressure. Due to their higher age, they often have already high blood pressure. Therefore, an additional increase of pulse frequency and blood pressure should be avoided.

Probable Solution:

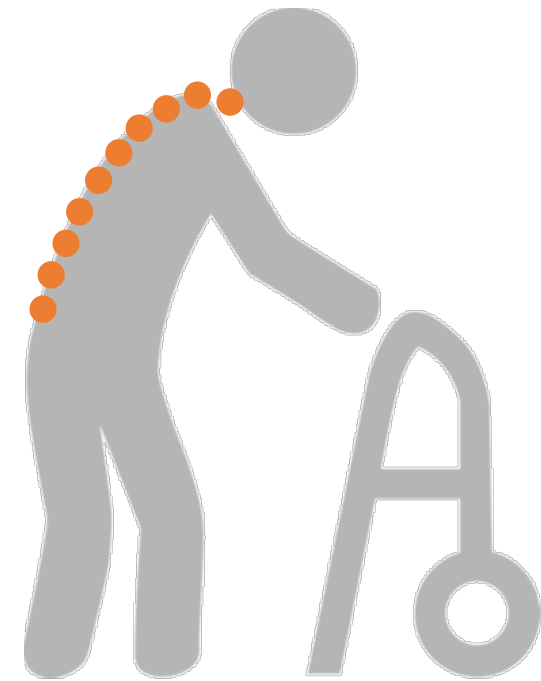
- Encouraging upright position while using walker
- Increased height of walker handle bar to prevent bad posture
- Different walker structure to prevent bad posture in all conditions

### Neck pain due to curved back

While walking in bend over posture it is been observed that, rather than body supporting the neck, it overhangs making user prone to develop neck pain.

Probable Solution:

- Encouraging upright position while using walker



# Fatigue Issues

## Lifting of walker

It is been observe that no-wheel walker has to lift up and put ahead for every step, which develops upper body pain in elderly over use. Two wheel and four wheel walker with controlled manoeuvrability can solve the problem of lifting walker.

Probable Solution:

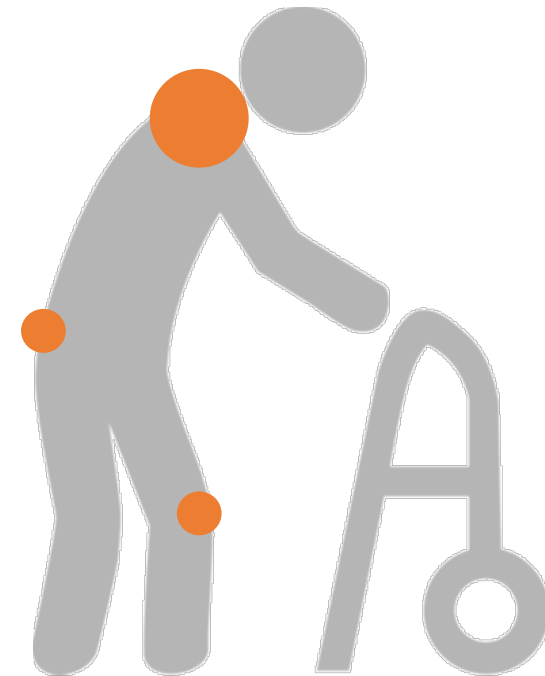
- Button press push
- Controlled Speed Mobility

## No rest arrangement

Many elderly walks in the vicinity of any seating arrangement so that whenever they would feel tired they can seat, this discourage them to go out or cover long distances. It is also been observe that many elderly people keeps a chair along the bed side. So there is a possibility of walker to become a full time chair to save space as well as need of any extra chair.

Probable Solution:

- Provision of comfortable seating arrangement



## Health Related Issue

### Lack of exercise making susceptible to other health related issues

The user study showed people are not encouraged to walk much. Walker which only solves the issue of walking can't be the solution. Walker should provide the feeling of completeness by providing space for the things user use of day today basis such as water bottle, walking stick and storage space, etc.

Probable Solution:

- Providing ease of walking
- Inspiration to walk long distances
- Giving confidence by increasing safety
- Providing storage space for day to day things

## Space Related Issue

### Using walker in small spaces as home or vehicles

Elderly has to travel to various places like other people, if the walker is their ultimate companion then it has to go with them everywhere. For this the walker has to be foldable so that it can fit into vehicles like taxi or rickshaws.

Probable Solution:

- Making walker compact and foldable





02

# The Brief

## Why Walkers/Rollators

I chose to redesign the walker for the elderly because it has several benefits over the other walking aids. It helps the elderly regain their ambulation and their confidence in walking in case they have suffered from a fall or an accident.

Regular walking frames have many disadvantages and affect the user's health in the long term.<sup>8</sup>

Walkers are desired because they provide more support and stability than any other manually operated aid like the cane or the crutches. Walkers can be applicable for permanent use during old age and temporarily during rehabilitation programs.

Two-wheeled walkers provide better stability and control over gait and at the same time also provide better maneuverability.



## User Profile

Based on the research and the insights I got from the user study, I pin down to the user and product profile based on which the design brief was framed.

Age of the elderly : Above 65 years of age

Mobility Impairment : Mild to Moderate

Users needs : Support, balance, confidence and encouragement to walk few more steps

Activities of the elderly: Mostly Indoor

The abilities and disabilities of the chosen user group were identified

### Inabilities

- Mild walking impairment - Mild arthritis
- Functionally impaired in one or two activities of daily living
- Loss of leg movement

### Abilities

- Can get around with little or without any help
- Can get up/sit down with assistance from furniture/ adjoining walls

### Secondary Users

People who are undergoing a rehabilitation program.

# Design Requirements

On the basis of the user study and the market study I jot down the basic design requirements and additional design requirements for the user profile chosen.

## Basic Design Requirements

- Wheels with Braking mechanism
- Comfortable Seat
- Proper back Support
- Folding
- Compact Size
- Height adjustable
- Light weight
- Weight Capacity- 140 to 180kg (Based on Indian anthropometric data)

## Additional Design Requirements

- Safety Features- Bell, Flash Light
- Mobile Holder
- Cane and Cup/bottle holder
- Carry Pouch/ Storage Cart – Specially for women going for shopping
- Fall Detector/Fall prevention system
- Covering or shade to protect from rain or sun rays
- Fall Detector/Fall prevention system

## Design brief

After observing and identifying the problems faced by the elderly with the existing aids and after interactions with doctors and rehabilitation therapists, a need was felt for improvement in the existing mobility aids.

Product Brief

To design a mobility aid for the elderly more than 65 years of age with moderate impairment to encourage active mobility while creating a feeling of ease, safety, independence, and well-being for the user.

The aid would help them get up and walk. It will also provide some seating arrangement.

- Easier approach
- Getting in
- Use the walker
- Getting out
- Sitting back

The product shall ensure

- Better stability and weight redistribution
- Ease of holding and handling

The structure of the walking aid should be strong and weight bearing, and at the same time it should not look bulky and unapproachable.

The aid should also be aesthetically acceptable by the elderly.

Objective

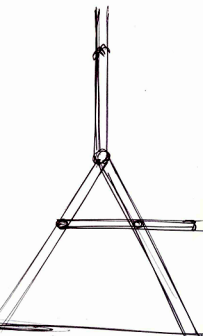
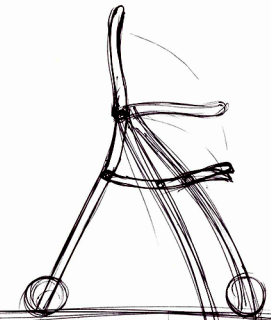
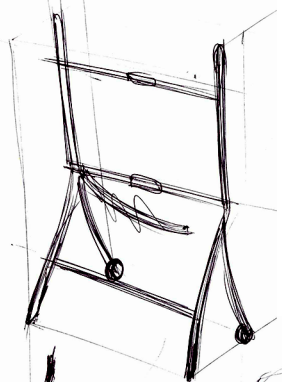
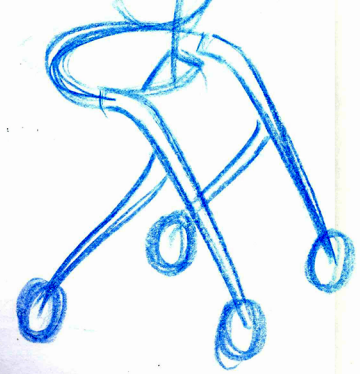
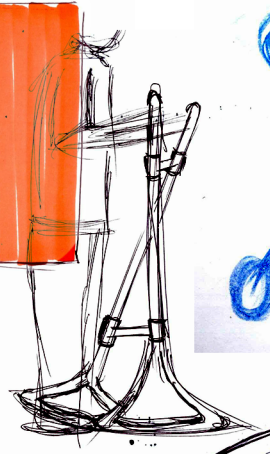
This project aims to provide a modern walking frame to support elderly people to maintain their active lifestyle. It's meant to motivate and encourage senior citizens to do their day to day activities independently along with walker and also to improve their outdoor experiences with families and communities.



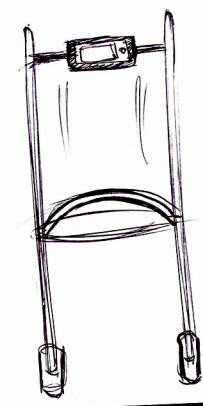
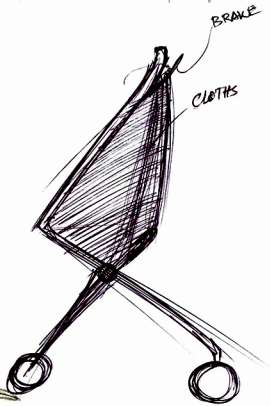
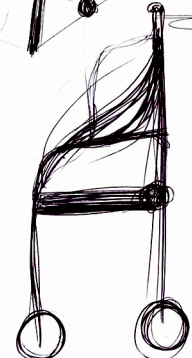
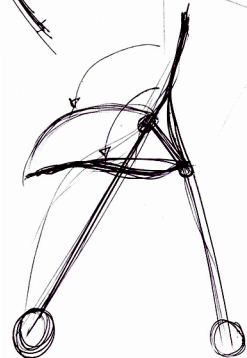
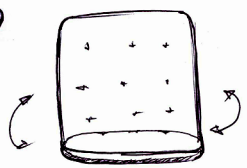
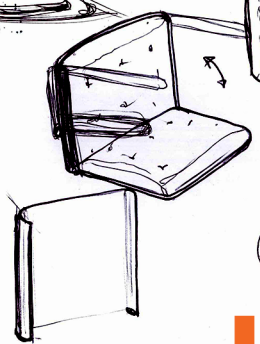


03

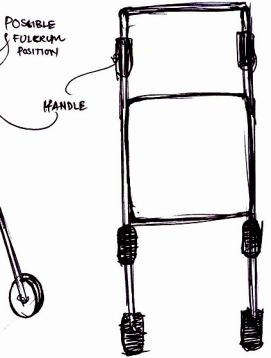
Concepts



- walker handles can become arm rest while seating position
- Travel bag mechanism can be use to do that.



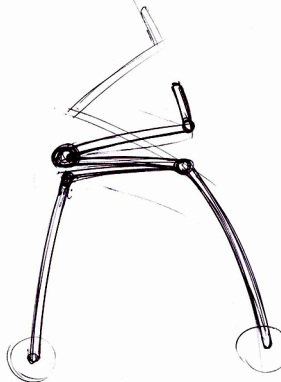
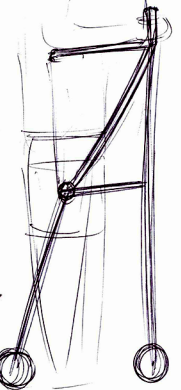
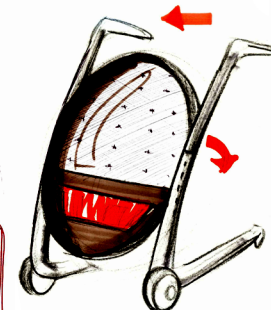
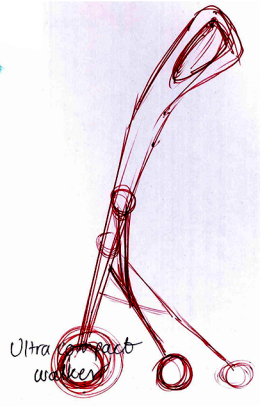
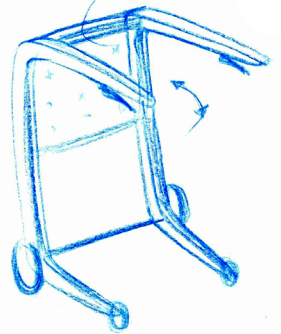
Simple Walker



FOLKROM

SIMPLE WALKER

# Ideations



Hoverboard + Walker

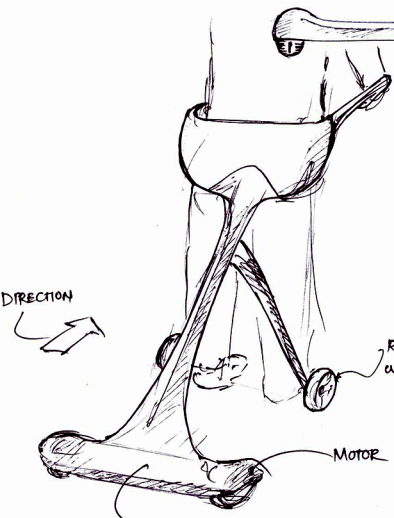
- HOVERBOARD helps elder/persons moves ahead.
- Controls can be adjusted at handle
- Helps exercise walking.
- Push to encourage walk.
- Rotatable wheels.
- Maintains gait speed.

DIRECTION



MOTOR

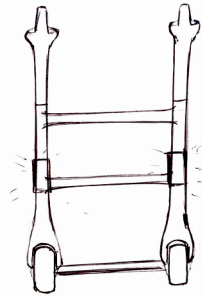
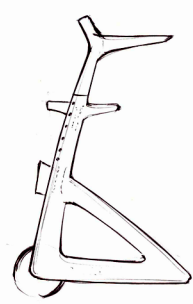
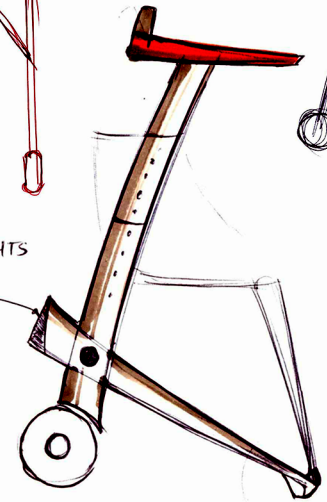
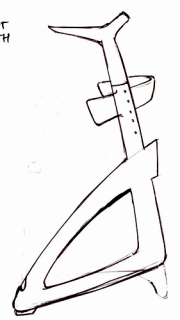
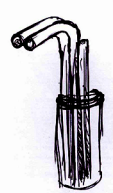
HOVERBOARD



Ultra Compact Walker

SEAT CLOTH

LIGHTS



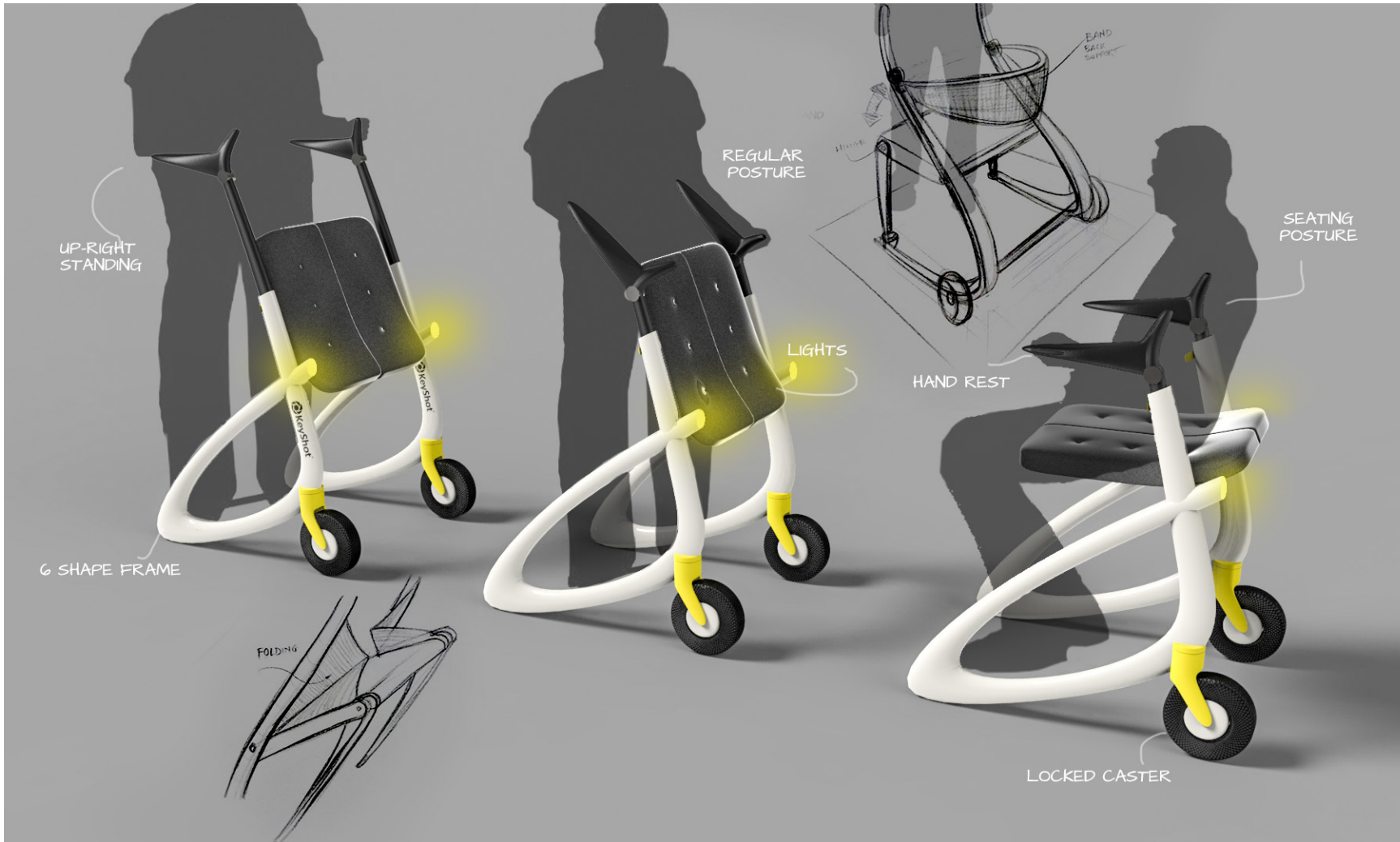
# Concept 1



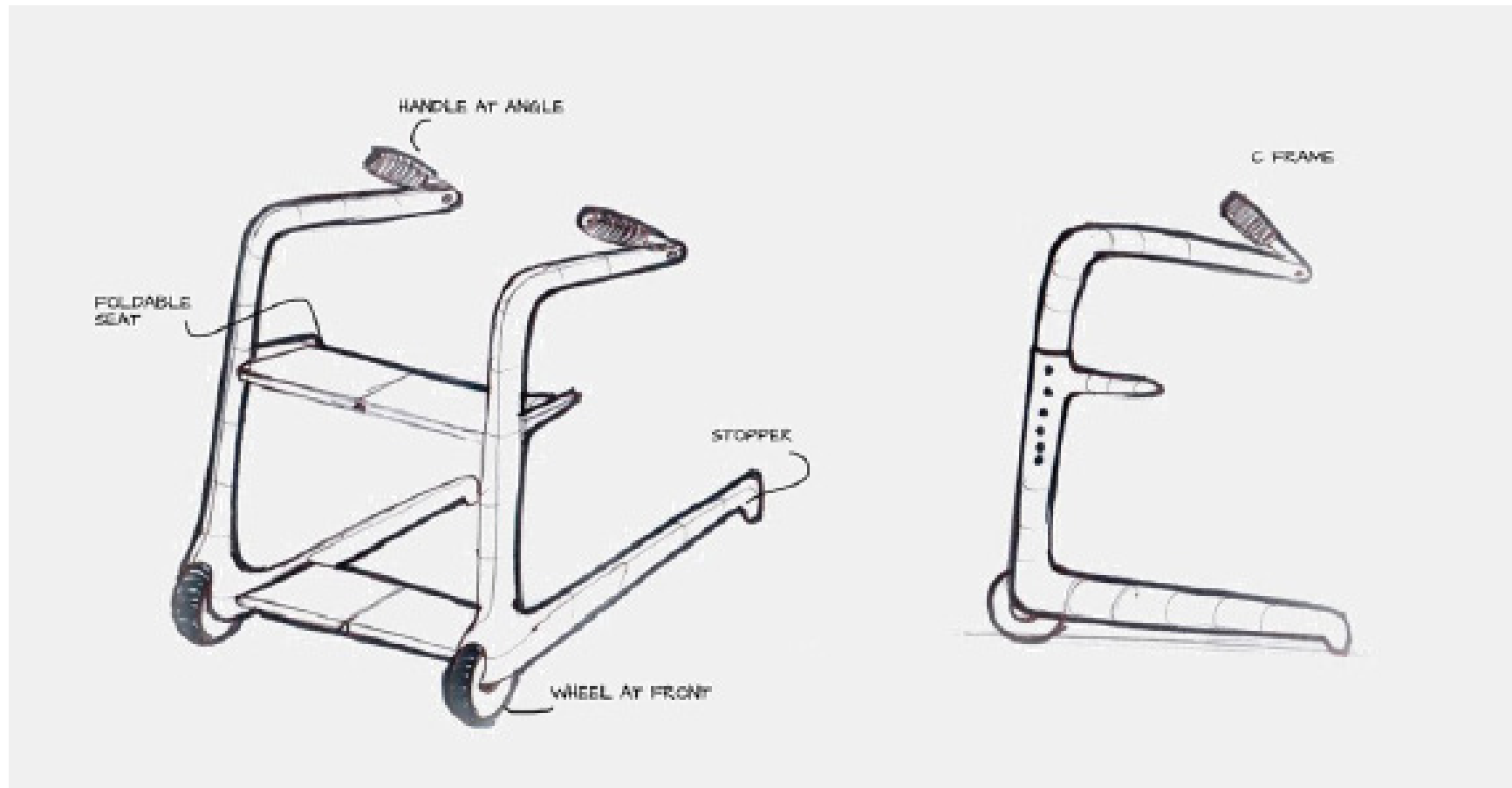
## Concept 2



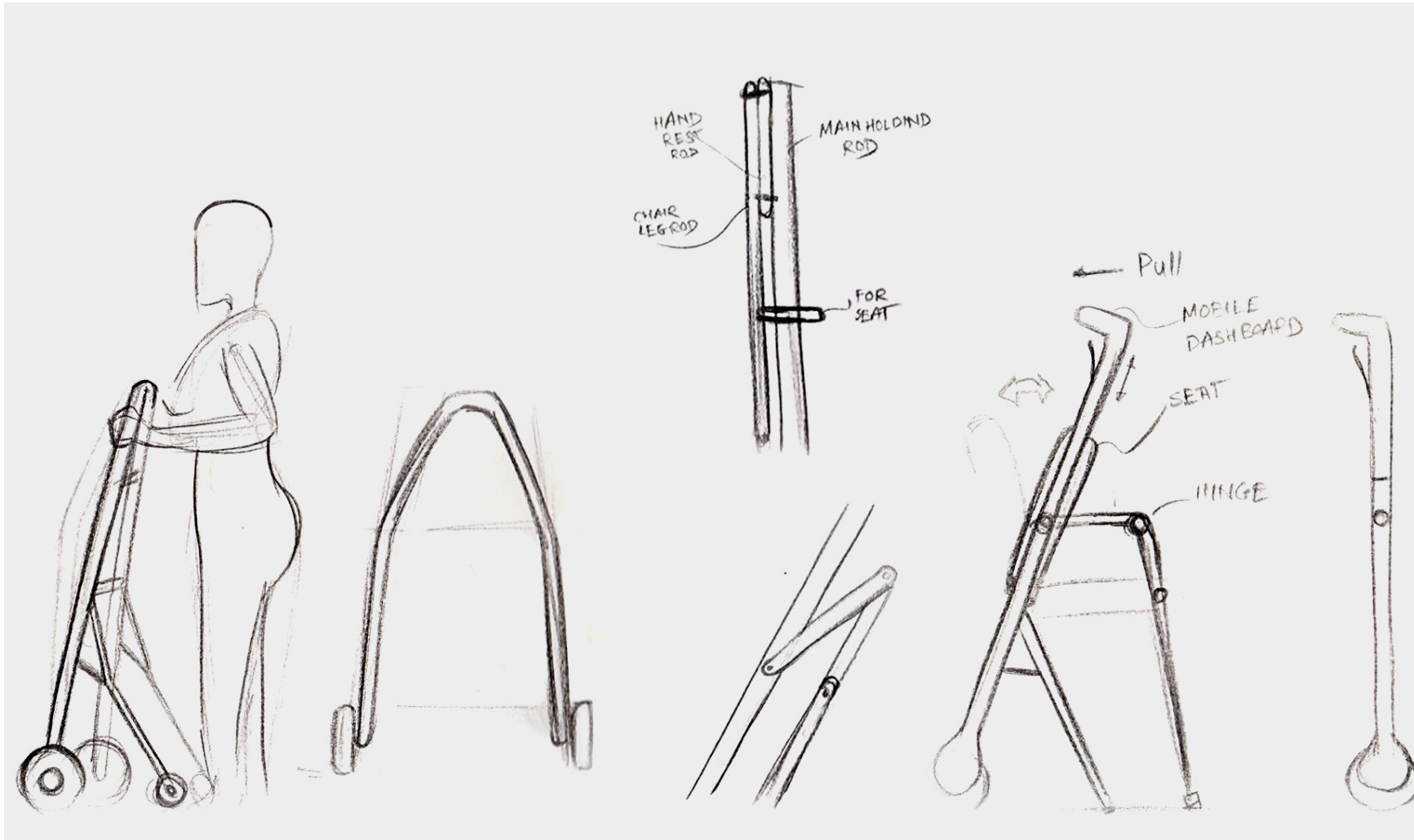
# Concept 3



# Concept 4



# Concept 5



# Summery

## Concept No.

### Concept 1



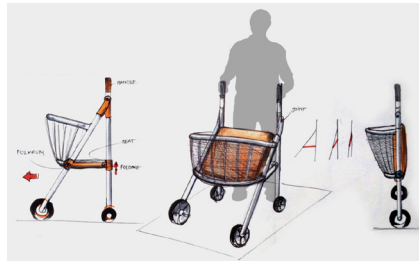
## Pros

- Up-right posture
- Better Sit to stand transition
- Wheels with Braking mechanism
- Comfortable Seat
- Proper back Support
- Height adjustable

## Cons

- No Folding not compact
- Doesn't allow user to put body weight
- Possibility of falling backward

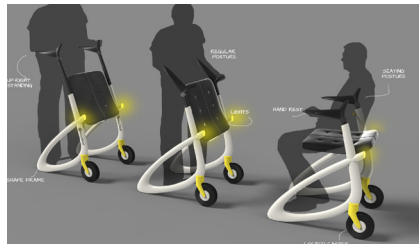
### Concept 2



- Up-right posture
- Wheels with Braking mechanism
- Comfortable Seat
- Proper back Support
- Height adjustable
- Folding/ Very Compact

- Doesn't allow user to put body weight
- Possibility of falling backward

### Concept 3

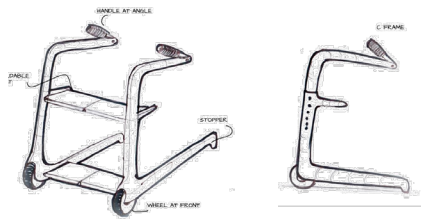


- Up-right posture
- Better Sit to stand transition
- Wheels with Braking mechanism
- Comfortable Seat
- Proper back Support
- Can use as regular walker
- Allows user to put body weight

- No Height adjustable
- No Folding not compact

## Concept No.

### Concept 4



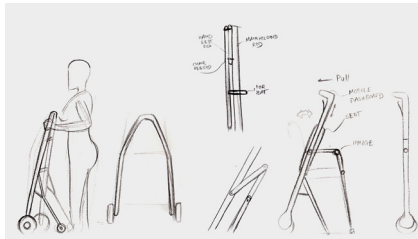
## Pros

- Moderate Up-right posture
- Better Sit to stand transition
- Wheels with Braking mechanism
- Height adjustable
- Foldable
- Allows user to put body weight

## Cons

- Not compact
- Possibility of falling backward

### Concept 5



- Up-right posture
- Wheels with Braking mechanism
- Comfortable Seat
- Proper back Support
- Height adjustable
- Folding Compact

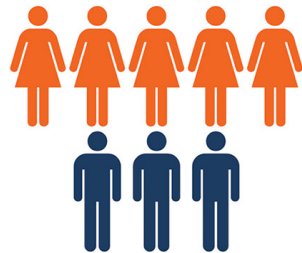
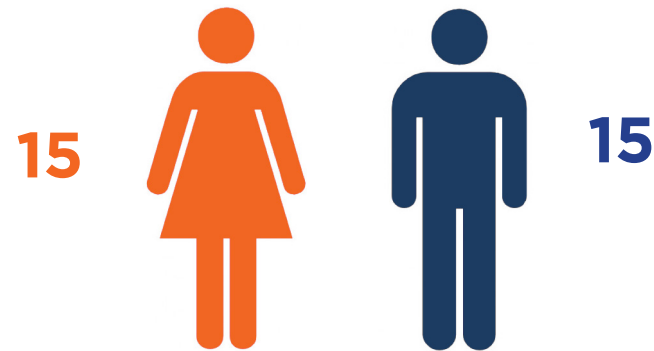
- Doesn't allow user to put body weight
- Possibility of falling backward
- Doesn't look stable

# Concept Validation

To evaluate all the concept of a Google Form was generated which consisted information about the issues were considered for walking aid design with all the 5 concepts designs and the feedbacks were asked for all the concepts. The form of shared online-offline with large number of people which were includes doctors, engineers, designers and the uses itself.

Google Form is attached in the appendix

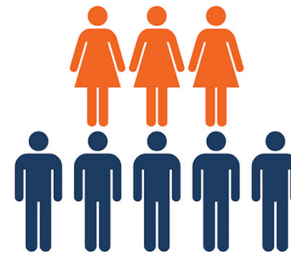
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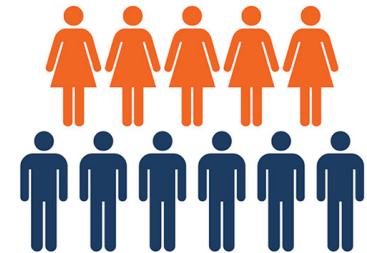
Users/Elderly



Doctors



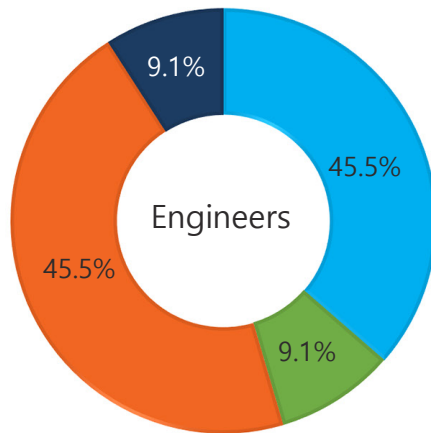
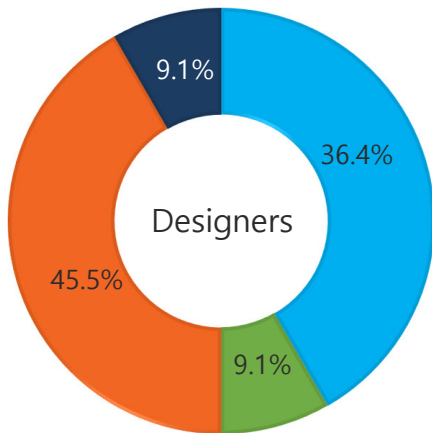
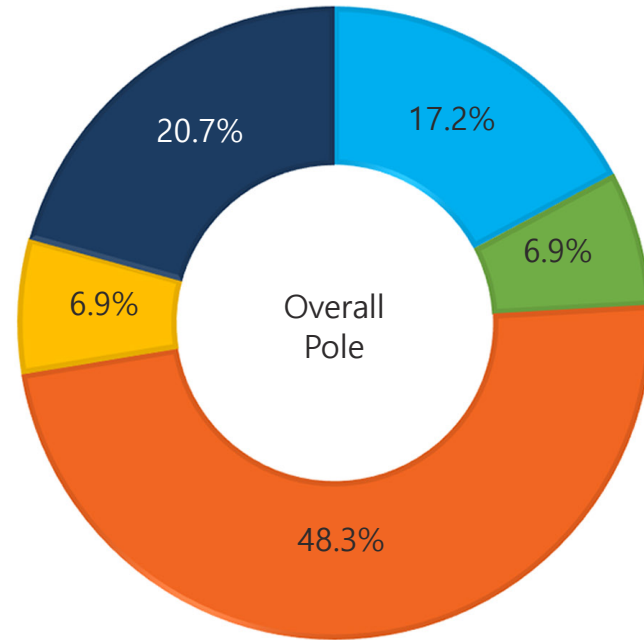
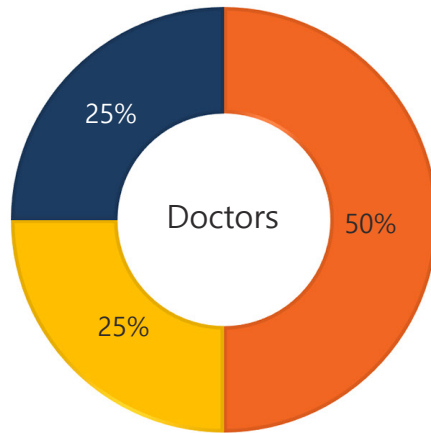
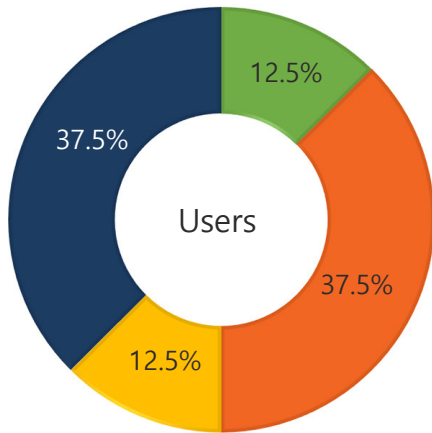
Designers



Engineers

# Poll

Which is the best design to go ahead with?



- Concept 1
- Concept 2
- Concept 3
- Concept 4
- Concept 5

After the concept evaluation from the Google form which was shared with people from different kinds of fields, the graph was made to find the best concept. Following shows that most of the people felt the concept 3 was good ahead with, which then chosen to make test model.

## Feedback

People were also asked to give feedback on each design. Total 157 feedbacks were received on all the designs amongst which few are listed here.

All these feedbacks from the people of various fields helped improved the designs further and it also made the decision making easier while deciding about features to be include.



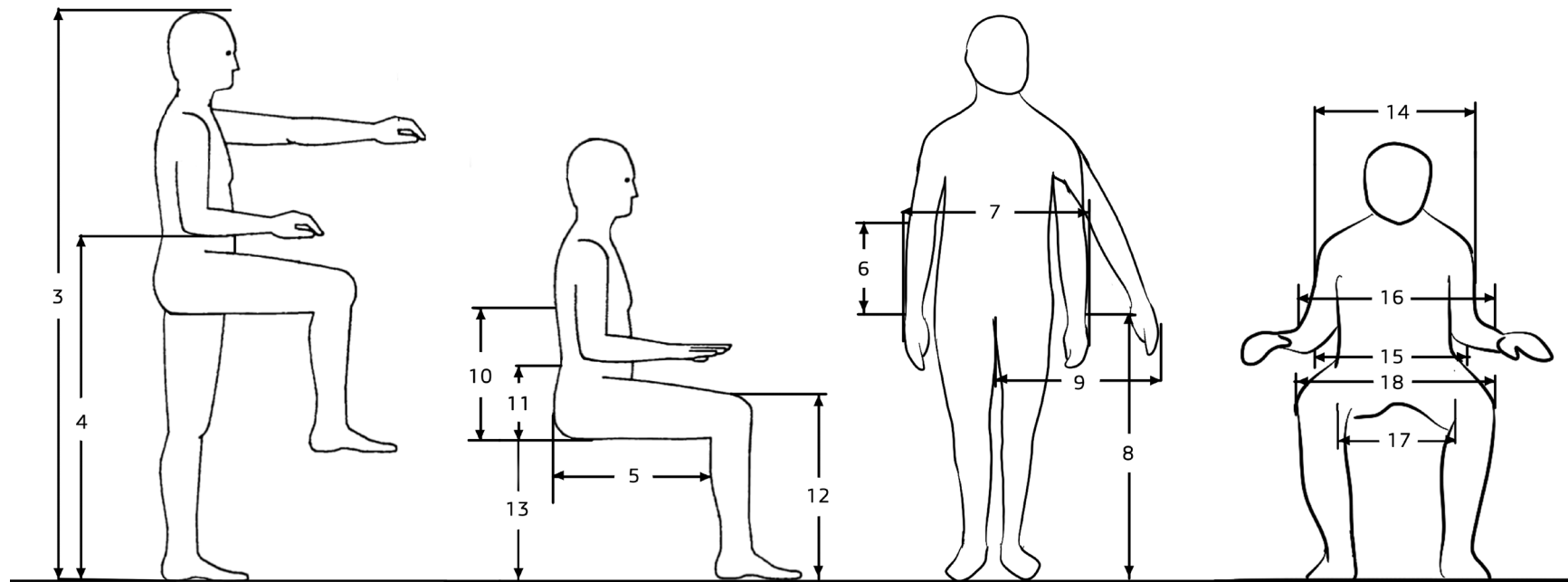


04

Development

# Anthropometry

## List of Body Dimension Considered<sup>10</sup>



1. Age
2. Weight
3. Stature
4. Elbow Height
5. Buttock-popliteal Length
6. Olecranon To Stylium Length

7. Maximum Body Breadth, Relaxed
8. Lower Position Height
9. Lower Position Length
10. Upper Lumbar
11. Lower Lumbar
12. Knee

13. Popliteal
14. Bi-deltoid
15. Elbow To Elbow, Closed
16. Elbow To Elbow, Relaxed
17. Knee To Knee, Closed
18. Knee To Knee, Relaxed

Figure 17 : Body Dimensions

## Anthropometry

	Min	5th	25th	50th	75th	95th	Max
1 Age							
2 Weight	30	40	47	53	60	74	118
3 Stature	1288	1465	1555	1619	1673	1771	1950
4 Elbow Height	791	908	970	1022	1061	1115	1405
5 Buttock-popliteal Length	340	394	429	451	474	509	595
6 Olecranon To Styliion Length	185	200	222	239	255	286	350
7 Maximum Body Breadth, Relaxed	364	405	499	494	539	619	795
8 Lower Position Height	510	649	719	779	839	939	1100
9 Lower Position Length	270	409	509	579	669	789	930
10 Upper Lumbar	189	246	277	298	317	352	427
11 Lower Lumbar	48	72	86	100	119	159	256
12 Knee	412	456	489	509	534	563	612
13 Popliteal	305	374	399	419	439	466	540
14 Bi-deltoid	276	349	393	417	443	479	672
15 Elbow To Elbow, Closed	257	311	366	396	430	479	746
16 Elbow To Elbow, Relaxed	330	389	451	494	539	632	821
17 Knee To Knee, Closed	138	159	177	189	201	243	360
18 Knee To Knee, Relaxed	191	252	314	369	419	529	681

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52

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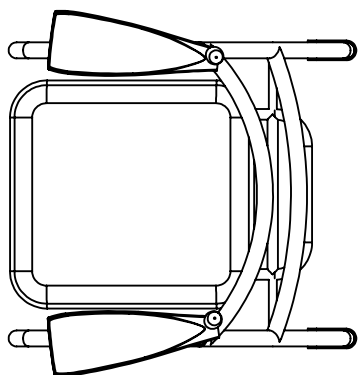
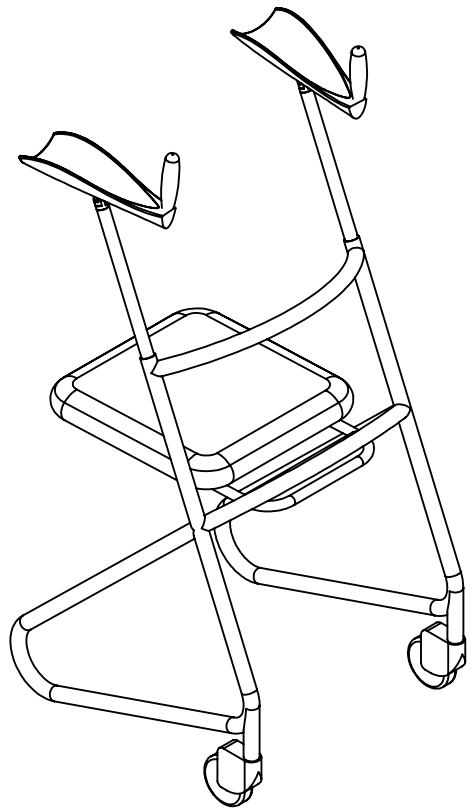
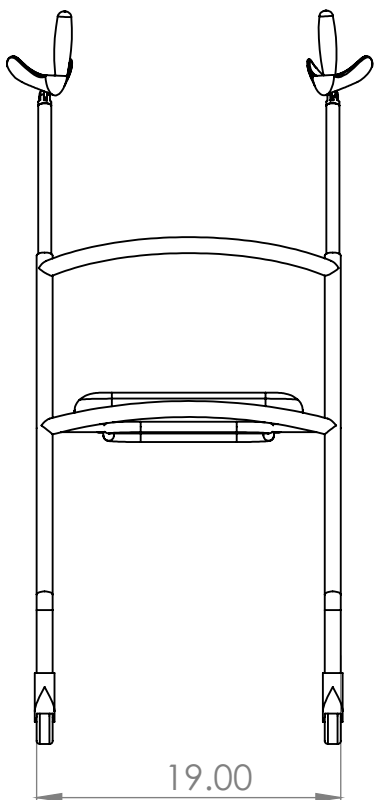
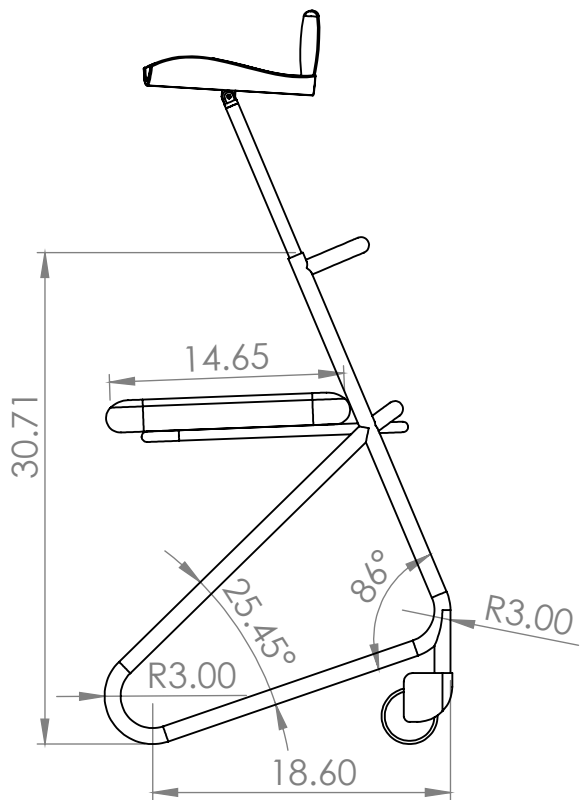
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Front View

Side View

Isometric View



Top View

**Engineering Drawing  
for Test Model**

DO NOT SCALE DRAWING	REVISION 3
<p>Symbolic text: ' &gt; ? c " fi f fl " - fl " ? φ · f ? " fl ? h fl / ' f ¶</p>	
<p>TITLE: <b>Walker for Elderly</b></p>	
DWG NO. <b>Assem2</b>	A4
SCALE:1:12	SHEET 1 OF 1

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A



Figure 18 : Computer Rendering

# Test Model

## Manufacturing Test Model

As per the result of the feedback form concept 3 was selected to make the life size model which can be tested with people. The idea behind making full size test model using inexpensive materials in order to verify design's form, scale and ergonomics.

Test Model made out of Stainless Steel Pipes which were bend as per the drawing given as Raju's Gala at Sakinaka. It was then welded to form in IDC PUC lab. 10 cm Caster wheels used to move the walkers. As this was a test model brakes and other additions design features didn't added at first.



Figure 19 : Welding



Figure 20 : Finishing

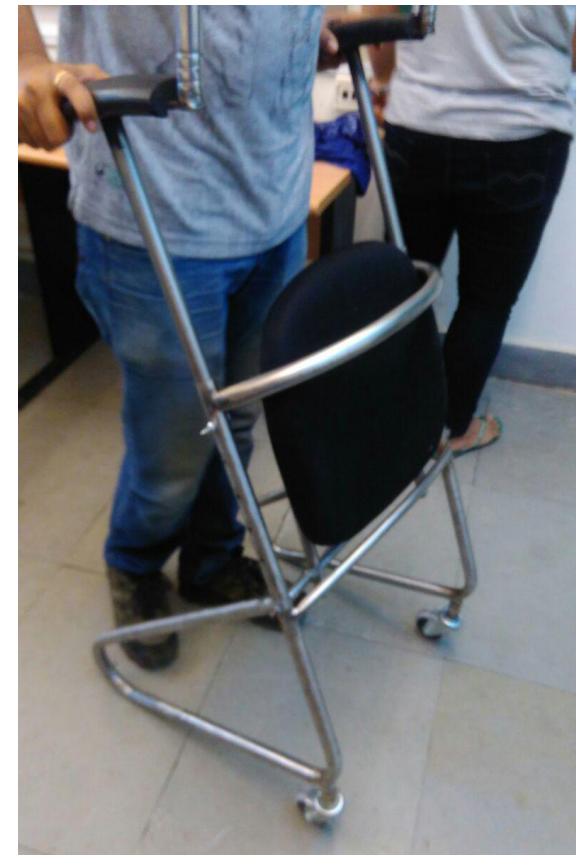


Figure 21 : Testing Model



Figure 22 : Seating Position



Figure 23 : Standing Position



Figure 24 : Part Names

### Materials

- Stainless Steel Pipes- Dia 1in, 0.75in, 0.5in
- 4in Caster wheels 2 Nos
- Cushion Seat
- Hand rest 2 nos
- 2 nut-bolts

### Processes

- Bending
- Gas welding
- Grinding/Finishing
- Other basic mechanical processes

### Cost

Approx. ₹4000

# User Testing

The test model was used to evaluate the physical interactions, scale and proportion of the product design concept. It used to replicate the mechanical action and to enable

physical property of the design, such as its strength, stiffness, comfort and durability.

User tasting was done inside the IIT premises with Prof. Rajan, Prof.

Athwankar, Prof. Bapat, all the studio assistance and fellow designers as well as physiotherapist Dr. Trimbak Kawdikar from BETIC Lab.



## Take Outs

- Hands should not slip off from handles, armrest should hold hands in position.
- Slanting of handle should be outward.
- Handles should not have any play
- Handles should be slightly inwards so that the frame won't topple if user puts his weight on it.
- Handles up-down adjustment should be easy.
- Seating length can be more.
- Seat should lock vertically when not in use.
- Seat might bend after long use due to cantilever structure.
- Unidirectional wheels instead of caster wheels
- 4 wheels instead of 2 wheels
- Rubber pads or small unidirectional wheels on rear side.
- Can attach rubber pads to the part of the frame touching the ground.
- Can attach unidirectional wheels pads to the part of the frame touching the ground.
- Space to keep extra things of elderly
- Space for lights and alarm.
- Back Rest cushion should be provided
- Walker should be foldable.
- Weight can be reduce.
- Handle grip should be provides.
- Easy interactions while height adjusting
- Hand rest Can be provided.

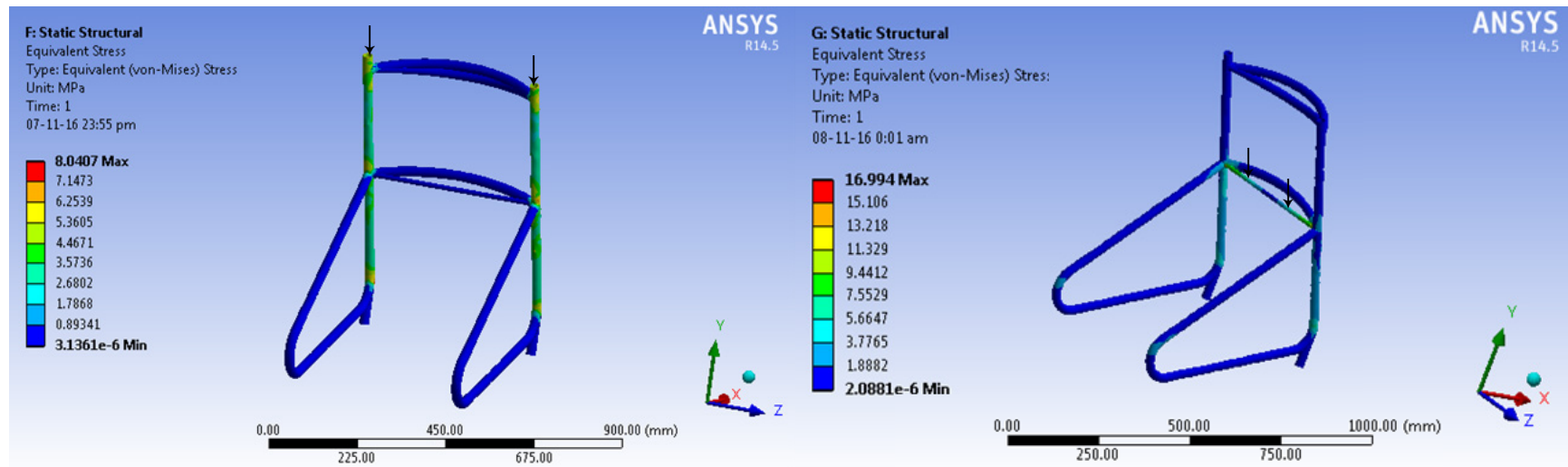
# Structural Analysis

Structural Analysis was done in ANSYS software to know if the structure can withstand the user weight and to find out the possibility for weight reduction. Computer modelling and analysis techniques

provided important insights into how product component might perform, based on assumptions and approximations of actual product behaviour.

## Max. Weight 150kg.

### Frame 1



### While Standing

Weight Applied = 150 Kg  
Von-Mises Stress = 8.04 MPa (Max)  
Tensile Yield Strength = 207 MPa for Stainless Steel

### While Sitting

Weight Applied = 150 Kg  
Von-Mises Stress = 17 MPa (Max)  
Tensile Yield Strength = 207 MPa for Stainless Steel

## Frame 2

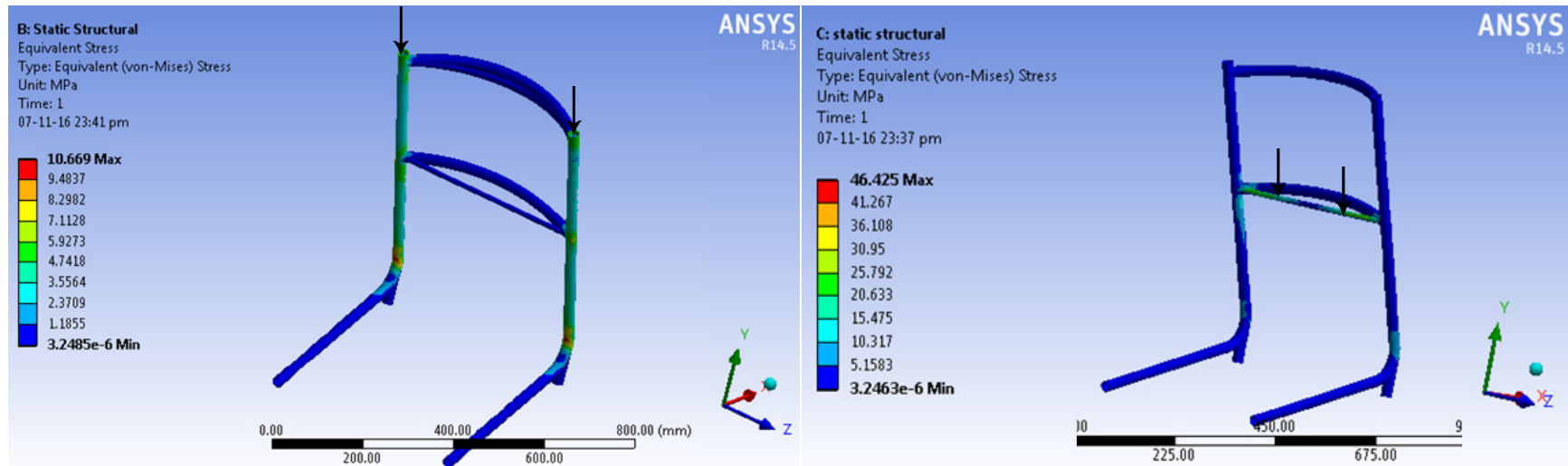


Figure 27 : Analysis on Frame 2

### While Standing

Weight Applied = 150 Kg

Von-Mises Stress = 10.69 MPa (Max)

Tensile Yield Strength = 207 MPa for Stainless Steel

### While Sitting

Weight Applied = 150 Kg

Von-Mises Stress = 46.42 MPa (Max)

Tensile Yield Strength = 207 MPa for Stainless Steel

### Conclusion

It can be seen by comparing the two frames that the maximum stress induce after removing diagonal member is e conclusion from the stress analysis for the two frames is 46.42 MPa Max which is quite low. So the diagonal member can be remove to minimise the weight of the overall structure and to optimise the use of material.



**05**

**Styling &  
Refinements**

# Image Board



# Handle

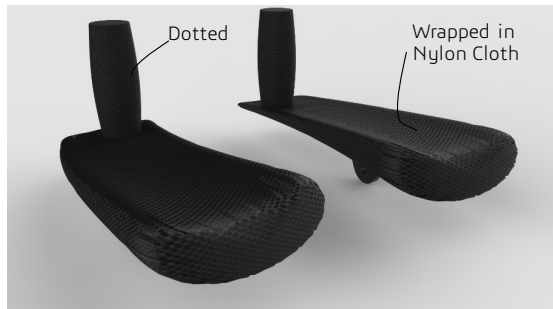
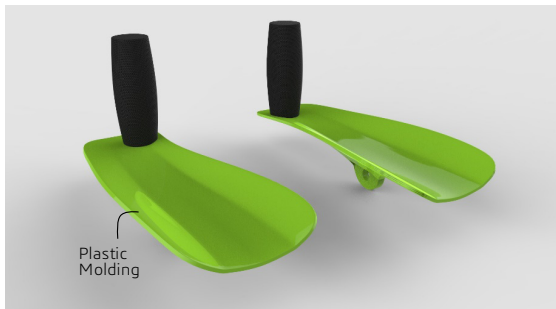
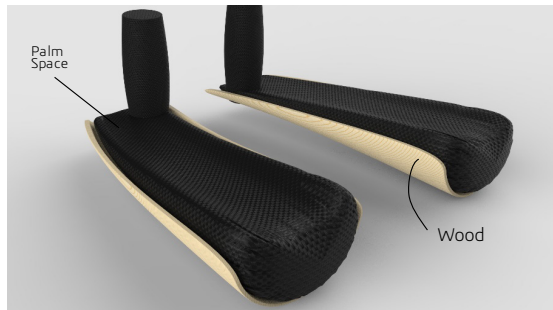
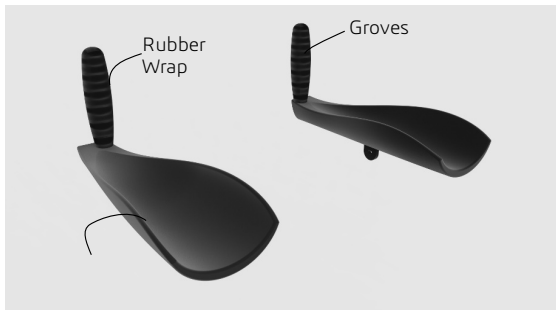
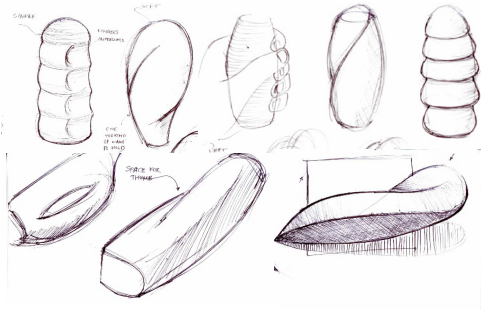


Figure 28 : Handle Form Explorations



Figure 29 : Selected Form

# Chair Mechanism

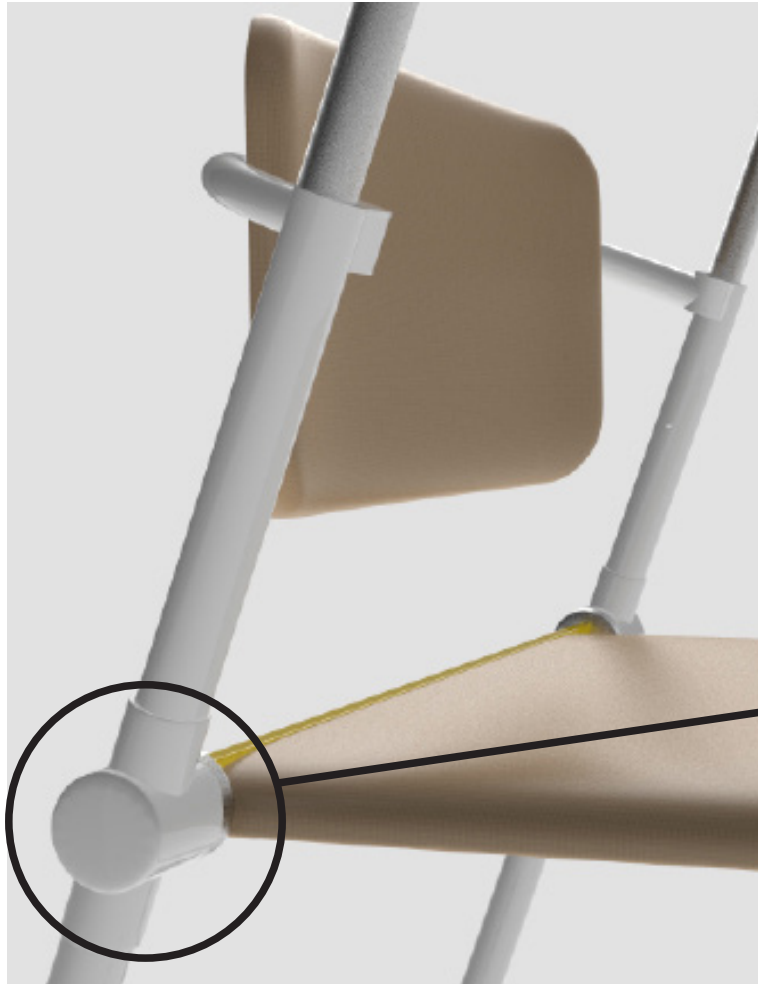


Figure 30 : Chair perspective view

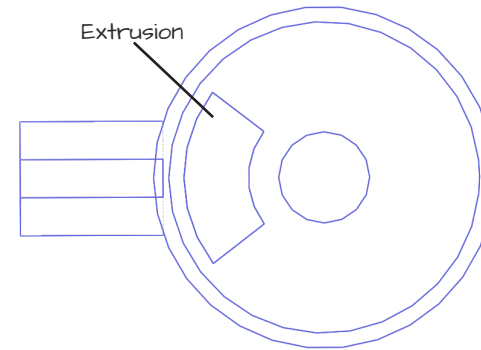


Figure 31 : Male Part

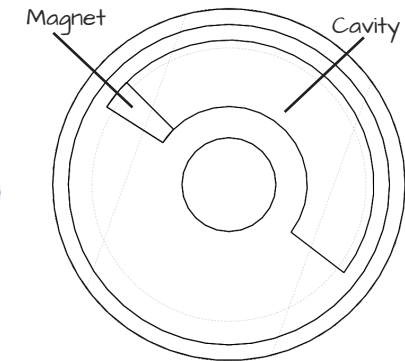


Figure 32 : Female Part

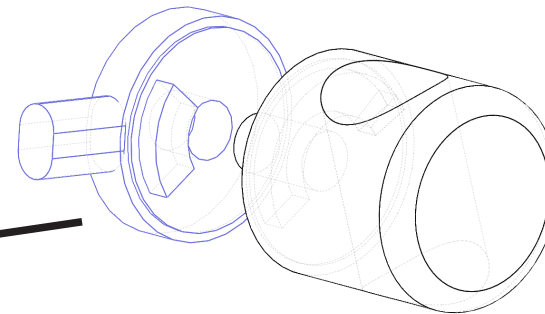


Figure 33 : Male-Female Assembly

Here Chair mechanism has been shown which has marked by a black circle in figure 30. Figure 31 & 32 shows the aluminium casted parts. Figure 33 shows the assembly. Extrusion part rotates in cavity and lock it at desire position.

# Auto-Brake Mechanism

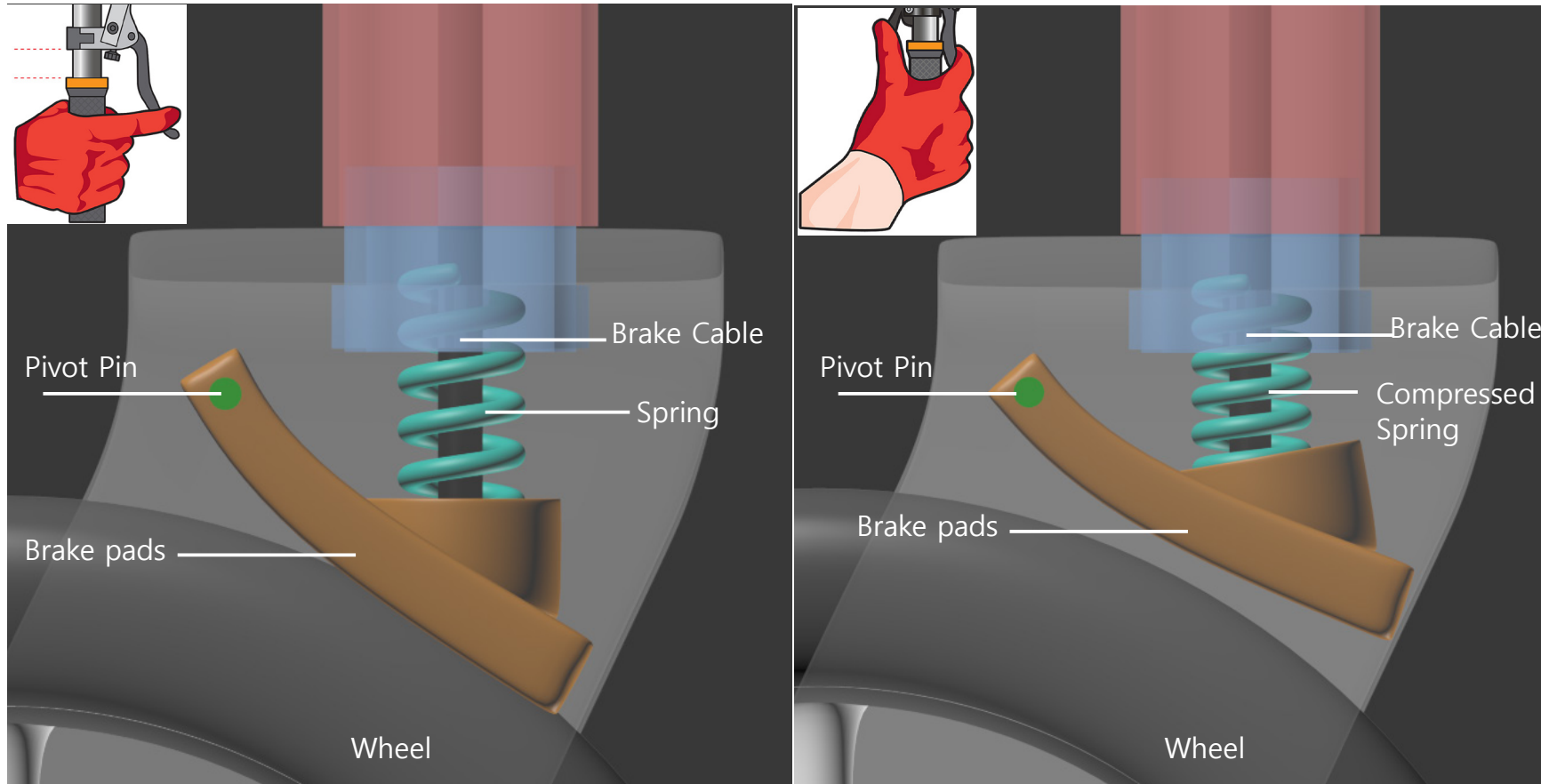


Figure 34 : Brake assembly when lever is not pulled

Figure 35 : Brake assembly when lever is pulled

Auto braking system has proposed so that walker will be at halt when handle lever is not pulled,i.e. when user is

relaxed or not walking. When he want to walk he can pull the lever so that braking will release and walker will move.

# Height Adjustment Mechanism

Height adjustment mechanism is inspired from the luggage trolley bag height adjustment mechanism. As user pull the lever (shown in figure 36) upward, due to pivot action plunger moves downward. Plunger pulls the pin inside allowing Dia 0.75in pipe to slide in Dia 1in pipe. As user release the lever, spring pushes the pin as well as plunger upward. As pin comes out of the Dia 1in pipe it locks the movement between both the pipes.

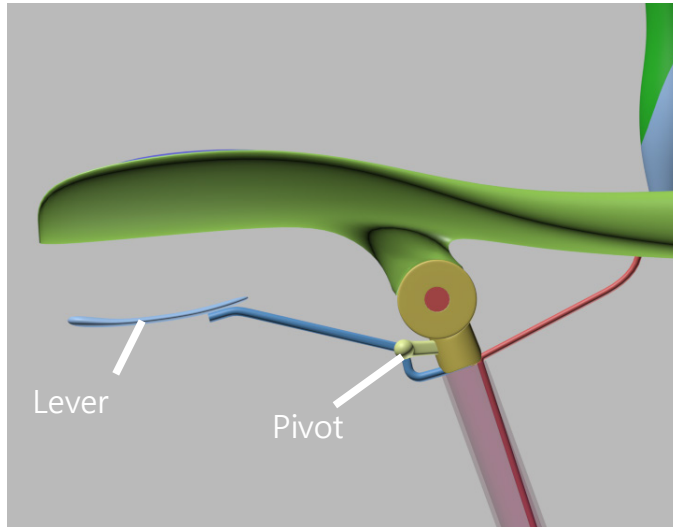


Figure 36 : Lever for height adjustment

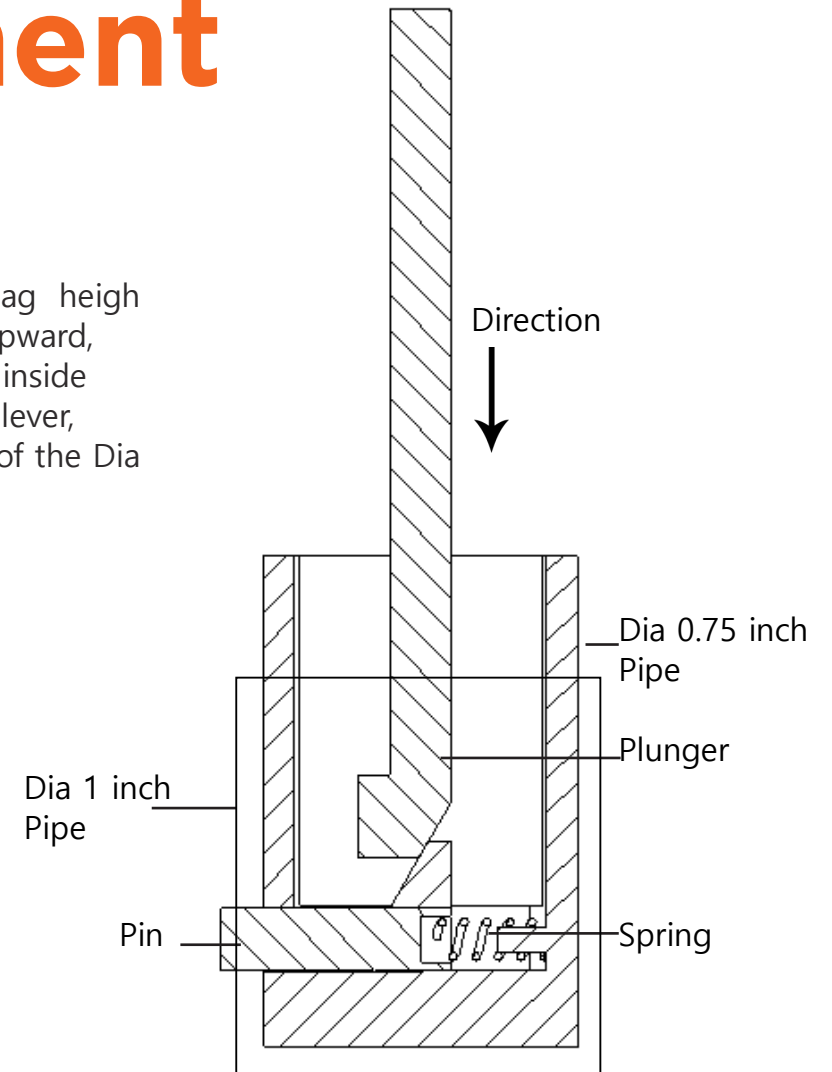


Figure 37 : Pin In-out Mechanism

# Final Design



Figure 38 : Final Design

## Product specifications

Height Adjustment: Min to 908mm to 1061mm

At for human of 50%

Length: 490mm

Width: 550mm

Height: 1050mm

Wheel Size: 152.4mm

Width Inside Hand Grips: 460mm

Dist. between front and rear legs: 385mm

## Lights

Figure 34 shows the lights integrated with the handle. Simply tapping on the surface of the light turns it on. Its is very useful feature in low light conditions. Figure 35 shows the existing lights in the market whose design has incorporated in the walker. The LEDs and the inside circuitry can be adjusted inside the handle.

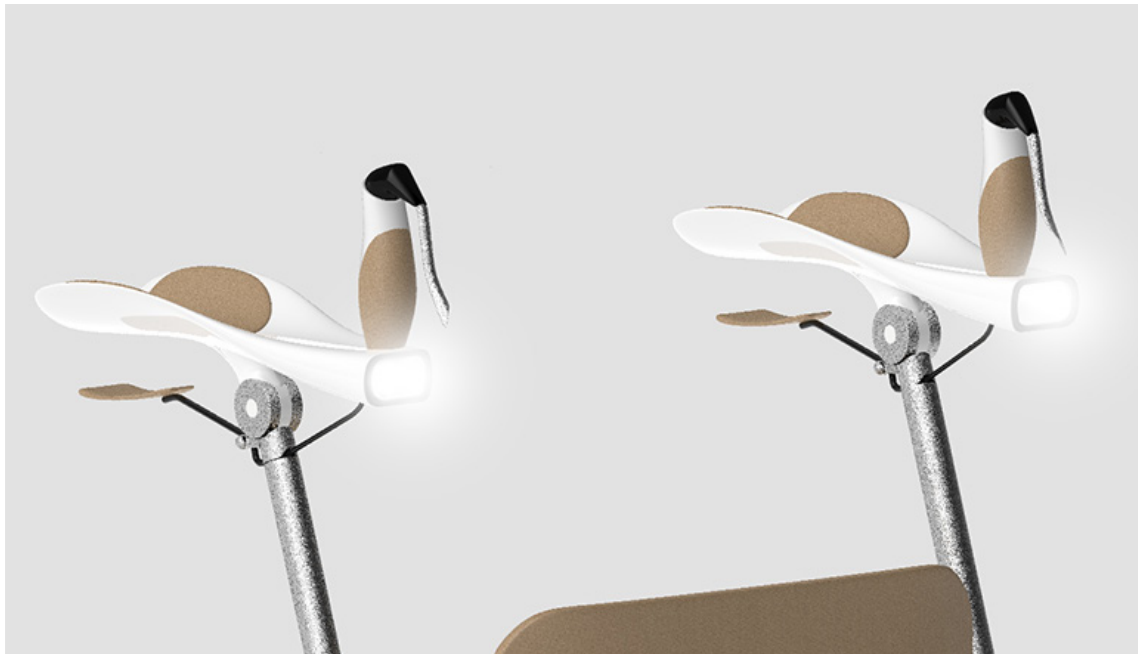


Figure 39 : Handle Lights



Figure 40 : Battery Powered Round White 3 LEDs Stick Tap Touch Lamp Night Light

Reference : Amazon.com

Link: [http://www.amazon.in/Battery-Powered-Round-White-Stick/dp/B013NUP98G?ie=UTF8&psc=1&redirect=true&ref\\_=oh\\_aui\\_detailpage\\_o01\\_s00](http://www.amazon.in/Battery-Powered-Round-White-Stick/dp/B013NUP98G?ie=UTF8&psc=1&redirect=true&ref_=oh_aui_detailpage_o01_s00)

## Accessories

Figure 36 shows the Bottle, small storage specially for medicines and walking stick attachments. All the attachments are snap on to the frame structure and are easily removable.



Figure 41 : Bottle, small storage space and stick attachments

These extra attachments are useful when user would go for long walk as well as to organise his accessories.

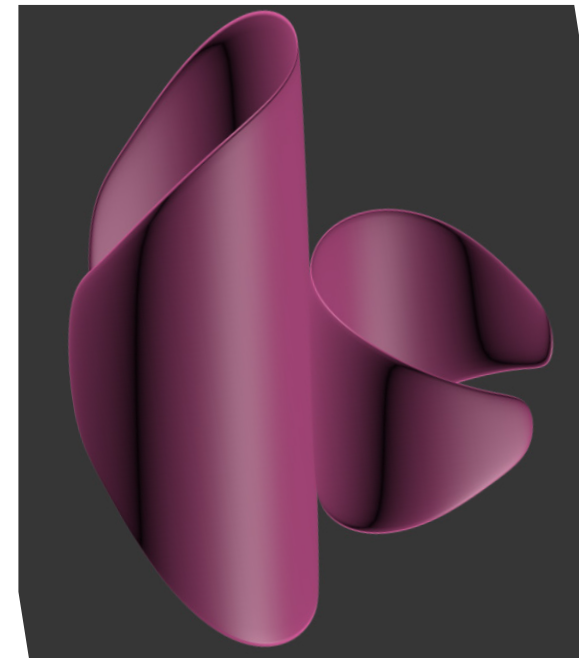


Figure 42 : polypropylene part for Walking stick attachment

## Visibility of walker

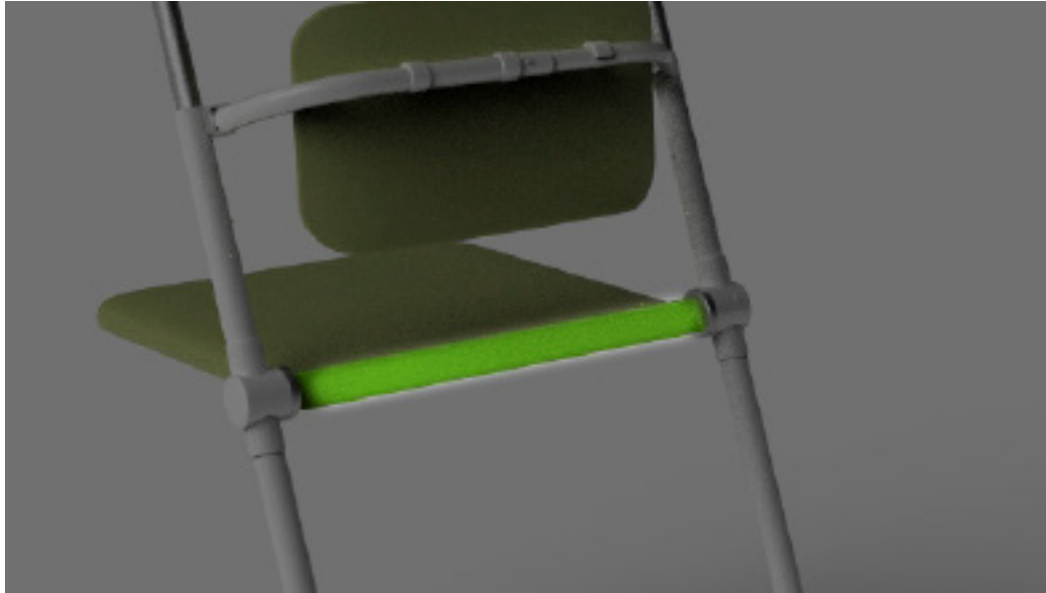


Figure 43 : Walker with glow vinyl

Many elderly people find hard time looking for walker in low light condition or in the middle of night when the lights are off. A glow vinyl self-adhesive tape has been applied on the walker as shows in figure 43 with yellow colour. It glows in dark environment making it easy to locate or find the walker.



Figure 44 : Glow vinyl self-Adhesive tape

Reference: Amazon.com

Link: [http://www.amazon.in/clickfor-sign-Glow-night-vinyl-Adhesive/dp/B017O5LBOM?ie=UTF8&psc=1&redirect=true&ref\\_=oh\\_aui\\_detailpage\\_o00\\_s00](http://www.amazon.in/clickfor-sign-Glow-night-vinyl-Adhesive/dp/B017O5LBOM?ie=UTF8&psc=1&redirect=true&ref_=oh_aui_detailpage_o00_s00)

# Folding



Figure 45 : Folded walker frame

Figure 45 shows the folded walker with front and side view. Whole walker after folded takes length 780mm x width 240mm space x height 1000mm space. Walker folding mechanism is same as regular no wheel walker folding mechanism. Figure 46 shows the way the folding mechanism works. User just has to push the pin inside and rotate the handles inside to fold walker.

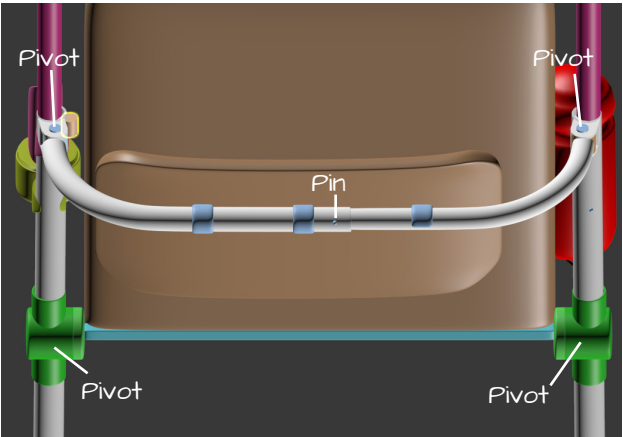
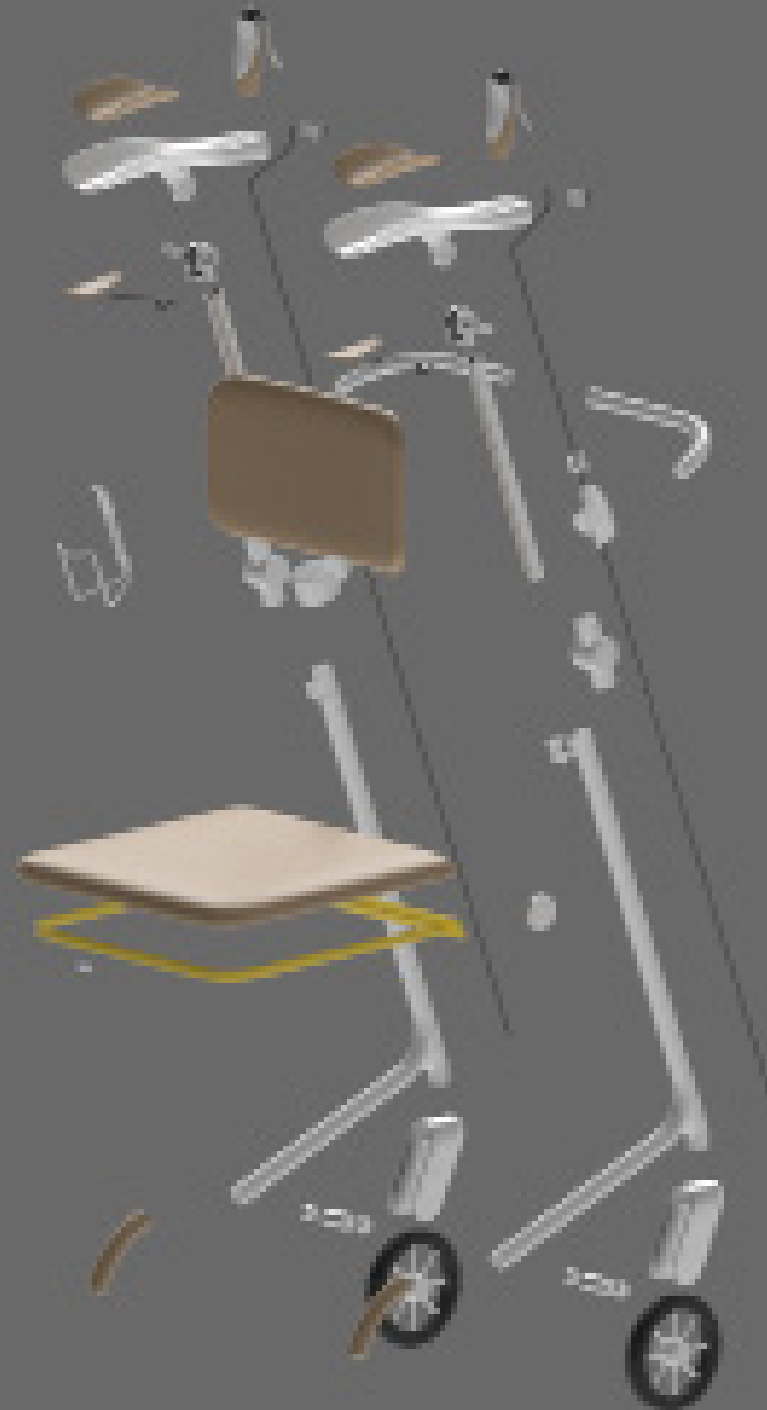


Figure 46 : Folding Mechanism

# Exploded View

Figure 47 : Exploded View of walker



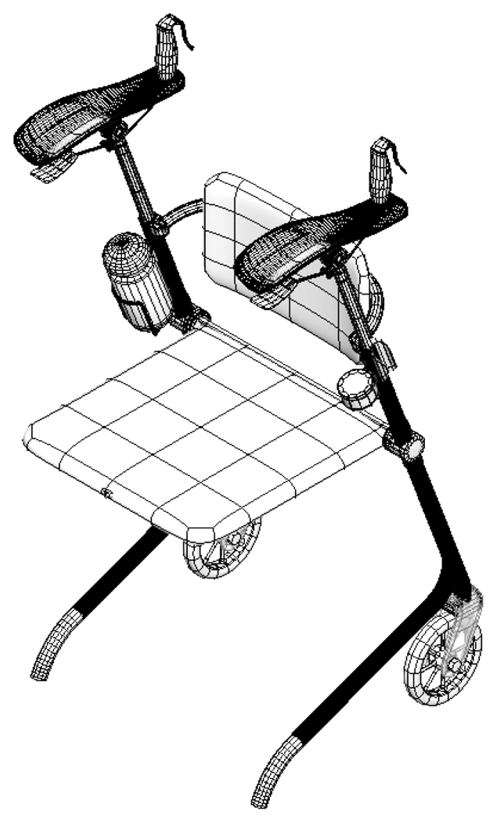
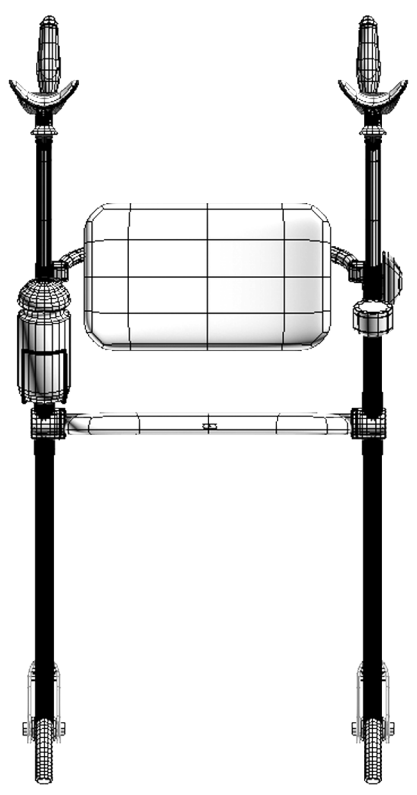
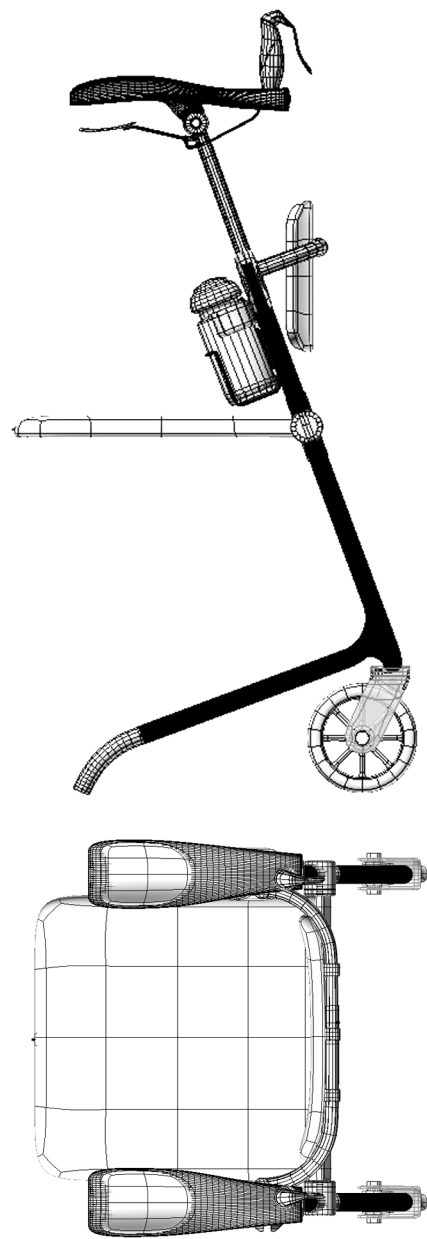
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DO NOT SCALE DRAWING		REVISION 2
All Dimensions are in Inches		
TITLE: Walker for Elderly		
DWG NO. Assembly 3		A4
SCALE:1:1		SHEET 1 OF 1

# Value Proposition

- Walker offers an ergonomic way of using the walker which helps avoid bad postures hence eliminates long term pains.
- It is designed not only to walk but to help in sit to stand & Stand to sit transition.
- It provides a fully padded seat and padded backrest for total comfort.
- Innovative braking system helps walker stand still on the slippery surfaces. Large 6" wheels give confidence on all terrains.
- The lighting system helps to manoeuvre in bad lighting conditions.
- Safety alarm to help get assistance in critical movements.
- This lightweight Walker design allows it to fold flat, making it even easier to store.
- Luminous Glowing Vinyl helps recognise the walker in darkness.
- Having all these features elderly can rely on MotiWalkr and get motivated to walk long distances.

# Appendix

## Questionnaire for User study

All the questions were asked while personally interviewing the elderly. All the activities in the User Study were carried out indoor only to simulate the daily way of working of user.

- What are the things you do in day to day life?
- Have you experienced any fall? If yes, then what did the last time you fall? Please explain the incidence?
- How much do you walk every day?
- Where do you go most often? Where have you stopped going to?
- Do you feel any pain while doing day today activities particularly walking?
- Have you undergone any operation? If yes then what? Has it affected on your walking?
- Do you use Walker? Why? Which one? No wheel/ two wheels/ four wheels? Please explain the experience of using it.
- Do you find any problem using them for day to day activities?
- Can you explain the features of your walker?

- Like handles, seat, manoeuvrability, braking, portability, foldability, gradability, other accessories?
- Where do you keep your walker when not in use? Like while sleeping, bathing, sitting?
- How do you locate your walker in the low light area? Like when you wake up in the middle of the night?
- Any Pain points due to the use of Walker?
- What do you do when you're out with a walker and it starts raining?
- How you handle other stuffs while using Walker?

### Exercises

- Sit to stand to walk
- Walk from places to places

# Google Form For Concept Evaluation

Walker Design - Concept Evaluation

Objective for designing walking aid for elderly:  
Encourage active mobility while creating a feeling of ease, safety, independence, and well being for the user.

Email address \*

Age \*

Sex \*

Lets look at the issues or problems elderly faces with regular walker:

## Safety Issues

Stability

- Introducing Simple rugged locking mechanism for walker

Fall

- Fall Detector
- Fall prevention System
- Help Alarm after fall

## Postural Issues

Sit to Stand Transition

- Provision of Handle Bar to lift the body properly to stand

C-Curve of backbone

- Increased height of walker handle bar to prevent bad posture
- Different walker structure to prevent bad posture in all conditions

Neck pain due to curved back

- Encouraging upright position while using walker

## Fatigue Issues

Lifting of walker

- Button press push
- Controlled Speed Mobility

No rest arrangement

- Provision of seating arrangement

## Health Related Issue

Lack of exercise making susceptible to other health related issues

- Providing ease of walking
- Inspiration to walk long distances
- Giving confidence by increasing safety

## Space Related Issue

Using walker in small spaces as home or vehicles

- Making walker compact and foldable

So people what do you think of the most appropriate walker design from the following concepts?

Concept 1



Rating for Concept 1 \*  
 Worst 1 2 3 4 5 Best  
 What is Good or Bad about Concept 1?\*

Concept 3



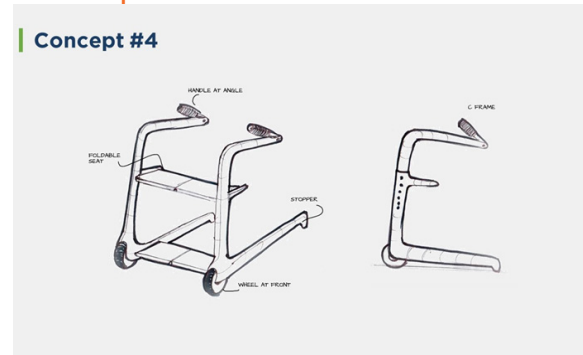
Rating for Concept 3\*  
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 What is Good or Bad about Concept 3?\*

Concept 2



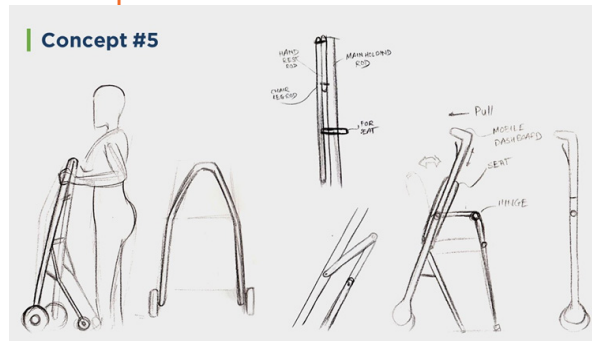
Rating for Concept 2 \*  
 Worst 1 2 3 4 5 Best  
 What is Good or Bad about Concept 2?\*

Concept 4



Rating for Concept 4 \*  
 Worst 1 2 3 4 5 Best  
 What is Good or Bad about Concept 4?\*

## Concept 5



Rating for Concept 5 \*

Worst      1      2      3      4      5      Best

What is Good or Bad about Concept 5?\*

Which is the best design to go ahead with? \*

Please Tick mark the option.

- Concept 1
- Concept 2
- Concept 3
- Concept 4
- Concept 5

Please give your feedback.

# Bibliography

1. Asian J Gerontol Geriatr 2014; 9: 33–40  
Falls in Indian older adults: a barrier to active ageing  
by SA Dsouza<sup>1</sup>, PhD, B Rajashekar<sup>2</sup>, PhD, HS Dsouza<sup>3</sup>,  
PhD, KB Kumar<sup>4</sup>, PhD
2. Shanthi GS, Krishnaswamy B.  
Risk factors for falls in elderly. J Indian Acad Geriatr  
2005;1:57-60
3. Myageingparents.com  
<https://myageingparent.com/health/medical/walking-aids-help-elderly-avoid-falls/>  
Referred on 2 Aug 2016
4. Assistive Technology For The Frail Elderly: An  
Introduction And Overview  
by Robert Elliot University of Pennsylvania  
<https://aspe.hhs.gov/basic-report/assistive-technology-frail-elderly-introduction-and-overview>  
Referred on 15 Sept 2016
5. 10 Best Walkers | November 2016  
<https://wiki.ezvid.com/best-walkers>  
Referred on 2 Sept 2016
6. Released Nov 2013, Version  
Choosing Walking Equipment  
DLF Factsheet
7. Walking Aids: Benefits of Using Walking Stick for  
Elderly Care  
By Sam Genius  
referred on 2 Sept 2016
8. Walker Factsby walker-facts.com  
<http://www.walker-facts.com/Which-Walker-is-Right-for-me.asp>  
Referred on 5 Sept 2016
9. After Hip Surgeryby Great River Health Systems  
<http://greatrivermedical.org/orthopaedics/frequently-asked-questions/after-hip-surgery>  
Referred on 1 Oct 2016
10. Indian Anthropometric Dimensions for Ergonomic  
Design Practice  
Debkumar Chakrabarti  
National Institute of Design
11. 2 PCS Battery Powered Round White 3 LEDs Stick Tap  
Touch Lamp Night Light  
by STCKTL  
<http://www.amazon.in/Battery-Powered-Round-White-Stick>
12. clickforsign Glow in the Dark night glow vinyl self  
Adhesive tape 2 inch X 4 Ft  
by clickforsign  
<http://www.amazon.in/clickforsign-Glow-night-vinyl-Adhesive/>