

Conceptual Design of Multipurpose Wheel Chair equipped with Baby Stroller

Sangameshwar¹, SanjeethJ², Syed Abrar Ahmed³, V Dinesh⁴, Sreenivas H T⁵

UG Scholar, Department of Mechanical Engineering, Vijaya Vittala Institute of Technology, Bangalore, India^{1, 2, 3, 4}

Assistant Professor, Department of Mechanical Engineering, Vijaya Vittala Institute of Technology, Bangalore, India

ABSTRACT: A physical disability is a limitation on a person’s physical functioning, mobility. To cater the requirements of the physically disabled (women), a new customized wheel chair design is developed in this work. Wheel Chair is a mobility device designed for shifting patients, moving physically challenged people from one place to another with the help of attendee or by means of self-propelling. Our work mainly focuses on developing a multifunctional, cost effective, flexible, ergonomically and easy to use.

“Mother-Infant Wheel Chair” can be used for facilitating the person for check-ups during emergency. This work follows with Conceptual Design, Development and 3D modelling of the multipurpose wheel chair.

KEYWORDS: Concept Design, Concept Generation, Concept Selection.

I. INTRODUCTION

The wheelchair is one of the most commonly used assistive devices for enhancing personal mobility, which is a precondition for enjoying human rights and living in dignity and assists people with disabilities to become more productive members of their communities. The first wheel chair was invented in the 1595 called as invalids chair was made for the king of Spain called Phillip. Later in the year 1655 Stephen Farfler built a self-propelling chair on a three wheel chassis. In the year 1783 John Dawson of Bath Town England invented a wheel chair named as bath wheel chair. The chair was with two large wheels and one small one. In the year 1869 patent for a wheel chair with rear push wheels and small front casters were invented, in the year 1881 the push rims for self-propulsion wheel chair was invented. In 1900 the first spokes wheel chair was invented and in the year 1916 first motorized wheel chair was invented by British Engineers. In the year 1932, Harry Jennings built the first foldable wheel chair.

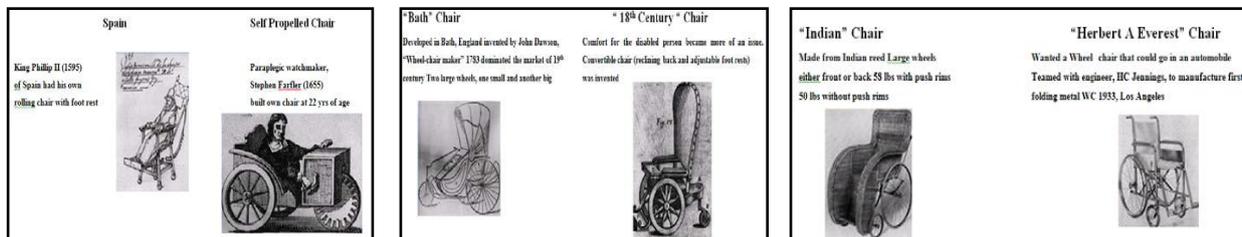


Fig 1.1: History and Development of wheel chairs

Various methods of baby transport have been used across different cultures and periods and for different ages of child. Methods can be divided between wheeled devices including baby carriages (carrycots in British English), strollers (pushchairs), slings, backpacks, baskets, infant car seats and bicycle carriers. The larger and heavier perambulators or prams, which had become popular during the Victorian era, were replaced by lighter and more flexible designs during the latter half of the 1900s.

Different types of baby strollers,

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

1. Umbrella stroller: Get their name from the curved double handles and from the fact that they fold up easily and compactly like an umbrella. It is the smallest, lightest and most basic baby strollers available.



Fig 1.2: Umbrella stroller

2. Lightweight stroller: It is a single mid-sized stroller. Provide a seat for your child and somewhere for you to push. Can have many more features depending on the price.



Fig 1.3: lightweight stroller

3. Multi-child strollers: Built for transporting twins, triplets and also good for two children who are close in age. Have storage compartment.



Fig 1.4: Multi-child strollers

4. Carriage stroller: Essentially a traditional solid backward-facing bassinet on a frame with four large wheels or a more modern bassinet attached to a frame with swivel wheels.



Fig 1.5: Carriage stroller

Anthropometry Data:

The study of human body measurements especially on a comparative basis, the workplace should be designed to accommodate the body size of the user.

Anthropometry is the measure of physical human traits that is applied to determine allowable space and equipment size and shape used for the work environment. Factors that are considered include agility and mobility, age, sex, body size, strength, and disabilities. Engineering anthropometry applies these data to tools, equipment, workplaces, chairs and

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

other consumer products, including clothing design. The goal is to provide a workplace that is efficient, safe and comfortable for the worker.

An early tool of physical anthropology, it has been used for identification, for the purposes of understanding human physical variation, in pale anthropology and in various attempts to correlate physical with racial and psychological traits. Anthropometry involves the systematic measurement of the physical properties of the human body, primarily dimensional descriptors of body size and shape.

Ergonomics:

Ergonomics is the study of people's efficiency in their working environment. Ergonomics is also known as comfort design, functional design, and user-friendly systems, is the practice of designing products, systems or processes to take proper account of the interaction between them and the people who use them. It is relevant in the design of such things as safe furniture and easy-to-use interfaces to machines and equipment. Proper ergonomic design is necessary to prevent repetitive strain injuries and other musculoskeletal disorders, which can develop over time and can lead to long-term disability.

Ergonomics is concerned with the "fit" between the user, equipment and their environments. It takes account of the user's capabilities and limitations in seeking to ensure that tasks, functions, information and the environment suit each user.

Ergonomics draws on many disciplines in its study of humans and their environments, including anthropometry, biomechanics, mechanical engineering, industrial engineering, industrial design, and information design.

II. CONCEPT DEVELOPMENT

A Concept development process is the sequence of steps or activities which an enterprise employs to conceive, design, and commercialize a product. Many of these steps and activities are intellectual and organizational rather than physical. Some organizations define and follow a precise and detailed development process, while others may not even be able to describe the processes. Furthermore, every organization employs a process at least slightly different from that of every other organization. In fact, the same enterprise may follow different processes for each of several different types of development projects.

The Concept development process includes the following activities as shown in block diagram,



Fig 2.1: Concept Development process for a Product block diagram.

III. CONCEPT GENERATION (SYSTEM LEVEL DESIGN)

1. Concept A:

The schematic representation of the conceptual model A for Multipurpose Wheelchair with baby stroller is as shown through a 2-D drawing in Fig 3.1

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

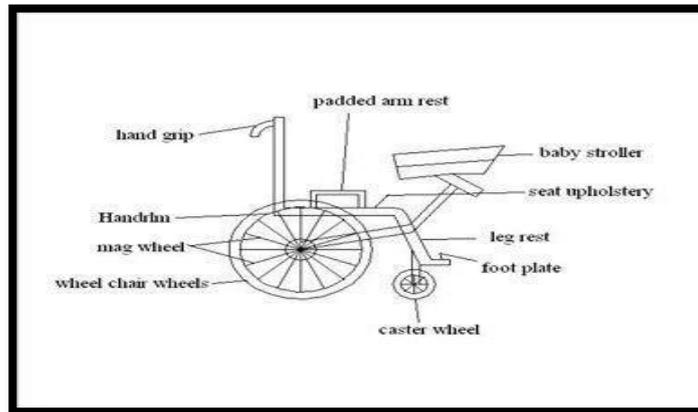


Fig 3.1: First conceptual model (A) for Multipurpose Wheelchair with Baby stroller

2. Concept B:

The schematic representation of the conceptual model B for Multipurpose Wheelchair with baby stroller is as shown through a 2-D drawing in Fig 3.2

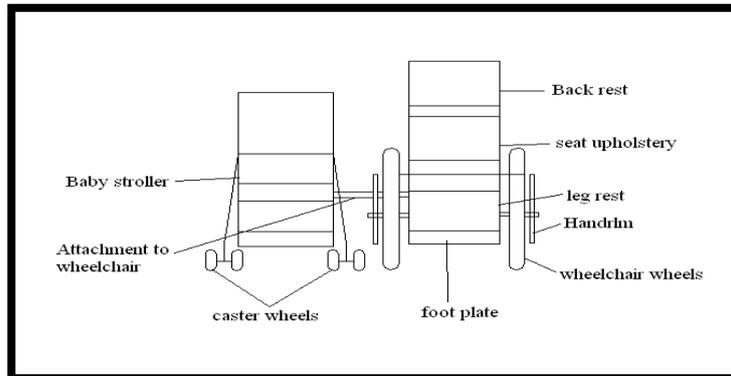


Fig 3.2: Second Conceptual model (B) for Multipurpose Wheelchair with Baby stroller

3. Concept C:

The schematic representation of the conceptual model C for Multipurpose Wheelchair with baby stroller is as shown through a 2-D drawing in Fig 3.3

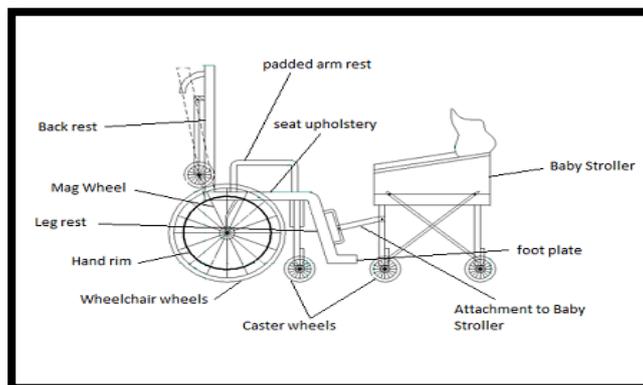


Fig 3.3: Third Conceptual model (C) for Multipurpose Wheelchair with Baby stroller

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

IV. CONCEPT SELECTION

Concept Selection is the process of evaluating concepts with respect to customer needs and other criteria, comparing the relative strengths and weakness of the concepts, and selecting one or more concepts for further investigation, testing or development.

Concept Screening or Pugh’s method for Concept Selection

- a. Prepare the Selection Matrix: Decision matrix we evaluate concepts based on their Ease of Design, Aesthetics, Cost, Portability and Ease of use, multipurpose function, Durability, Safety, and Weight. Considering these matrices for Concept A, Concept B, & Concept C.
- b. Rate the Concept: Rated as better than with (+), same as with (0), worse than with (-) to the reference model.
- c. Rank the Concept: concept A has 4+, 4-, 1zero, concept B has 1 zero, 1+, 7-, and concept C has 7+, 1-, 1 zero. From above rating concept A is ranked 2, concept B is ranked 3 and Concept C is ranked 1, which indicates concept C is more suitable for further designing.
- d. Reflect on the result and the process: The outcome of the result by selecting Concept C meets all the requirement of the customer, cost wise as well as economically. Hence the concept selected is further carried with detail designing of the Multipurpose Wheelchair equipped with Baby stroller.

Selection Criteria	CONCEPT SCREENING		
	Concept A	Concept B	Concept C
Ease of Design	-	-	+
Ease of use	+	-	+
Safety	-	-	+
Weight	+	+	-
Aesthetics	+	-	+
Cost	-	-	+
Portability	+	-	+
Durability	0	0	0
Multipurpose Function	-	-	+
Sum +’s	4	1	7
Sum 0’s	1	1	1
Sum -’s	4	7	1
Net score	0	-6	6
Rank	2	3	1
Continue?	No	No	Yes

Table 4.1: Concept Screening Table

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015



Fig 4.1: 3-D model of multipurpose wheel chair with Baby stroller concept selected in Pugh's method

V. CONCEPT TESTING

Concept testing (or market testing) is the process to evaluate consumer response to a product idea prior to the introduction of a product to the market.

Method for Concept Testing:

- a. Define the purpose of the concept test: To "define the purpose" in prototyping.
- b. Choose a survey population: Various sectors such as Railway stations, NGO's hospitality and hospitals potential customers were identified and survey was conducted.
- c. Communicate the concept: 3-D model figure was shown and explained the idea to customer.
- d. Choose a survey format: Set of questionnaires
 - Do you prefer the idea of combining Wheelchair and Baby stroller function in a single Product?
Yes- 70% b. No-30%
 - Are you satisfied with the product concept design which has been designed?
Yes- 70% b. No-30%
 - Are you facing any problem with current product in market?
Yes- 65% b. No-35%
If yes specify?
Safety and Design
Cost more.
 - Are you satisfied with the 'look' of our product?
Yes- 75% b. No-25%
 - Do you think the Product can be used easily?
Yes- 80% b. No-20%
 - Is the Product safe for use?
Yes- 70% b. No-30%
- e. Measure the response: The most commonly used purchase intent scale has five response categories:
 - ✓ Definitely would buy.
 - ✓ Probably would buy.
 - ✓ Might or might not buy.
 - ✓ Probably would not buy.
 - ✓ Definitely would not buy.
- e. Interpret of the result: Shown in bar chart

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015



Fig 4.1: Bar chart measuring customer response for multipurpose wheel chair with Baby stroller product

VI. CONCLUSION

Integration of Wheelchair and Baby stroller adds huge advantage to disability of human in a single product. Cost effective compared to the current market product. Wheelchair with stretcher for emergency purpose adds multifunctional feature to the design, hence achieved. Providing detachable Baby stroller to Wheelchair gives ease handling of baby during working (Women). Simple in design, hence meeting all customer needs to buy a product.

REFERENCES

- [1] Grunewald G., 1992, "New Product development", NTC Business Books, Illinois.
- [2] "Product Design and Manufacturing" A C Chitale and R C Gupta, PH1, - 3rd Editions, 2003.
- [3] Glen L. Urban. John R. Hauser, "Design and Marketing of New products", A Prentice Hall, Englewood cliffs, New Jersey, 1993
- [4] William L. Moore & Edgar, "Product Planning and Management", A. Pessemier.
- [5] "Product Design and Development" - Karl.T.Ulrich, Steven D Eppinger – Irwin McGraw-Hill - 2000.
- [6] Debkumar Chakrabarti, "Indian Anthropometric Dimension", Data Hand book for Ergonomic design, National Institute of Design-1997.
- [7] C. A. Warme, B. L. Belza, and J. D. Whitney, "Corelates of physical activity in adults with mobility limitations," Family and Community health, Vol 30, Supplement 2, pp. S5-S16, 2007.
- [8] A. M. Karmakar, D.M.Collins, A. Kelleher, D. Ding M. Oyster and R.A. cooper, " Manual wheelchair related mobility characteristics of older adults in nursing homes", Disability and Rehabilitation vol. 5, no. 6, pp. 428-437, 2010.