International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 03 | Mar -2017 www.irjet.net p-ISSN: 2395-0072

AUTOMATIC STRETCHER CUM WHEELCHAIR

Akshay Hirudkar#[1] , Chetan Bhusari#[2] ,Akshay Khedkar#[3],Akshay Parekar#[4] , Prof.S.P. Daf#[5]

[1234]*Student, Dept. Of Mechanical Engineering, PBCOE, Maharashtra, India*

[5]Asst. Professor, *Dept. Of Mechanical Engineering, PBCOE, Maharashtra, India*

Abstract - *Nowadays, in India the number of disabled individuals is increasing every year. For patients mobility aids are useful for transportation and a replacement for walking especially in indoor and outdoor environment as well. Wheelchairs and stretchers are commonly used medical equipments for the transportation. There is always an issue faced by the attendant or nurse of transferring the patients from wheelchair to stretcher or to the medical bed. Understanding the various issues regarding the mobility equipment and introducing a better design will be an asset for the medical field for disabled individuals. The need for a wheelchair cum stretcher to facilitate the disabled patient's mobility and to provide a novel medical equipment for use in the hospitals. Adopting various kinds of research were helped to obtain more information about hospital mobility aids and for data collection. The numbers of disabled individuals are increasing by different kinds of accidents are being observed every year. Presently wheelchairs and stretcher are the commonly used mobility aid for all purpose wherever needed. After the user study the asset of a need of wheelchair cum stretcher was found out for the Indian hospitals. The presently used wheelchair and stretcher design is not meeting the user's need. From the identified need, new features like convertible wheelchair which can be converted into stretcher is introduced which can be control by electrical system.*

Key Words: ***Latest inventions in wheelchair and stretcher, Mobility aid device, Wheelchair cum Stretcher, Convertible type, Safety.***

1.INTRODUCTION

A wheelchair is a wheeled by mobility device designed especially for disabled individuals. The device is propelled either manually or via various automated systems. Wheelchairs are used by that people for whom walking is impossible due to some problems physiological or physical. Huge amount of people have congenital disabilities, so the percentage of the victim of accidents and that is the inevitable part of their life. Mobility scooters for more severe disability or longer journeys are used. Mobilizing or shifting of patient from wheelchair to stretcher or vice versa causes discomfort. With the help of this wheelchair cum stretcher a patient can be seated on wheelchair on which he can also be operated by converting it to stretcher also it will be convenient for hospital staff to move a patient, also it will be easy if we provide a electrical system to control the overall movement and functioning of stretcher cum wheelchair. Understanding various issues regarding mobility equipment, the better design will be an asset for medical field and helping hand for disabled individual. The present project proposes a development of wheelchair cum stretcher with ability to transfer patients from normal staircase also with automated electronic control over stretcher cum wheelchair for movement and functioning. Self proceed wheels invention was created enormous demand in the market and it was better helping aid for the disabled individuals..These will be one of the walking aids which can help with impaired ability to walk using wheelchairs for the disabled peoples.

Figure 1. Wheelchair

2. LITERATURE SURVEY

[1] Jerin Joseph John…, ettal "MULTIPURPOSE MEDICAL BED" Our country, India is seeing a tremendous rise in the number or disabled personalities. Mobility aids are useful for patients for transportation and it's a substitute for patients for walking in environments both indoor and outdoor. Wheelchairs and stretchers or medical beds are usually employed medical equipment for the transportation of patients..Thus a need arises for a wheelchair cum stretcher cum medical bed to facilitate the disabled patient's mobility and to provide a simple cheaper and an efficient medical equipment for use in the Indian hospitals. Hence our project "MULTIPURPOSE MEDICAL BED" is introduced to solve problems related to the conventional medical care equipment and would be cheap and affordable and could be efficiently used in hospitals to save space, time and to provide better care to the required.

[2] G. Mamtani…, ettal "AN INTEGRATED DECISION MAKING MODEL FOR EVALUATION OF CONCEPT DESIGN" The Conceptual design phase generates various design concepts and these are then evaluated in order to identify the 'Best' concept. Identifying the Best concept is important because much of the product life cycle cost is decided in -making. Different criteria are weighted against concepts for the this phase. Various evaluation techniques are performed so as to aid decision comparison. This paper describes the research being carried out at the University of Glasgow on design evaluation.

[3] Kulkarni S…, ettal "DESIGN AND FABRICATION OF WHEELCHAIR-TO-BED SYSTEM USING FLUID POWER" Wheelchair is a chair with wheels used to move a person/patient from one location to another due to their inability to move. This may be due to the user/patient being physically disabled, weakness due to their disease or old age. Hence after they arrive back to or when they are moving away from their beds, there is a transition from wheelchair to bed or bed to wheelchair. This transition is tedious and is proved to be harmful to both the patient and the helper by many studies and surveys. A provision can be provided to convert the wheelchair into a bed using hydraulics

[4] Nomula Srinivas…, ETTAL "IMPROVE THE PERFORMANCE OF SMART WHEELCHAIR FOR MULTIPURPOSE APPLICATIONS BASED ON ARM7" These days, power wheelchairs are available to seniors and the disabled people, and they have expanded the active range of these people. The purpose of our study is to develop a power wheelchair that gives the aged and disabled the same degree of mobility that healthy people enjoy, enabling users to rejoin society fully and heartily. To accomplish this, we adopt a holonomic Omni-directional mechanism that provides three DOF mobility, the same as healthy people have. In addition, we propose a novel steering interface for holonomic Omni-directional power wheelchair that observes user's body action such as tilting an upper body or twisting a waist in order to get user's intention. To design a new wheelchair, we made a large omni wheel and decided measurements of a seat referring to values of standard Japanese physical constitutions. We also made a model of human who ride on wheelchair to analyze a movement of his upper body. The developed wheelchair has high acceleration and speed enough to play a sport such as tennis.

3. PROPOSED STATEMENT

Journal papers are explored here which are related directly or indirectly to the proposed area of that work, is design and development of a **Automatic Stretcher cum Wheelchair**.

3.1 Wheelchair and Stretcher

A wheelchair is chair with wheels, designed to help the disabled individuals.Mobility devices are the stretcher used for transport. These both medical mobility aids are used in hospitals and clinics for the patients.In construction stretchers are simple and the patient needs the assistant as a support to transport from one place to other. The purpose of wheelchair to be designed in such a way that the patient can control the device manually or with the help of someone's assistance. The device consists of proper handle with cushion in hand rest.. When it comes to emergency situation the direction movement is a critical part. Proper selection of caster wheels is easier to overcome the situations.

3.2 Smart Power Assisted Wheelchair

Mr. Richard Simpson, says almost 10% of all individual who are legally blind also have a mobility impairment, the majority is dependent on others mobility. A SPAM (smart power assistance module)is being developed for manual wheelchair for providing mobility for this population independently. The power assist wheelchair that provides for obstacle detection and avoidance for those with low vision. The control will be carried out by the microprocessor and also allow the SPAM to provide a smoother and nuanced control of a wheelchair.

3.3 Patients Transfer System

Dr. Daniel E. Jolly, says proper preparation should be taken before transferring the patient from bed to wheelchair or vice versa. For paraplegic patients use of sliding boards will be helpful. The best sliding board is made of hard wood, smooth, tapered on ends. Support of belts, two assistance, support straps etc will facilitate easy transfer. Slide into chair of patient should not be there, the optional and safety method for patient transfer is to lift from the wheelchair.

3.4 Structure of a common stretcher

The common transportation devices in hospitals is stretcher, in order to carry a patient who can't walk or stand with the help of others assistance. It is a simple design with tubular frame fixed with swivel caster wheels and metal platform form on the top side for lay the patient.

Figure 2. Structure of stretcher

3.5 Wheelchair Mechanisms

Kinds of mechanism are incorporated with useful wheelchairs and stretchers. This helps to get more accessibility and usability to the product. Some of the commonly used mechanisms in the wheelchairs are explained below:

- **Cross Brace Bar Mechanism**

To form an "X" shape cross bracing is a construction technique in which braces are crossed to support a frame. The main feature of this mechanism is the folding facility, which helps to fold a product. This folding technique helps the wheelchair a portable type and can be carried easily with less weight and less space consideration.

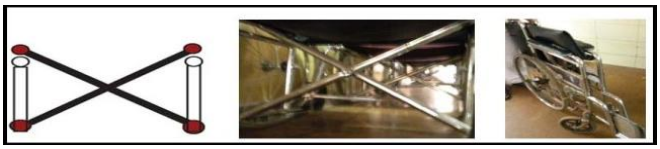

Figure 3.Cross brace bar mechanism

- **Caster wheel mechanism**

The angular displacement is a caster angel from the vertical axis of the suspension of a steered wheel in a vehicle measured in the longitudinal direction. The pivot line and vertical will be the angles. Car racers sometimes adjust caster angle to optimize the characteristics in particular driving situations for handling the car's. It is applied to ensure by means of stability of direction of a special arrangement. θ is the caster angle, rthe pivot line is in red, the tire area is grey. A positive caster angle is shown with the front of the vehicle being to the left.

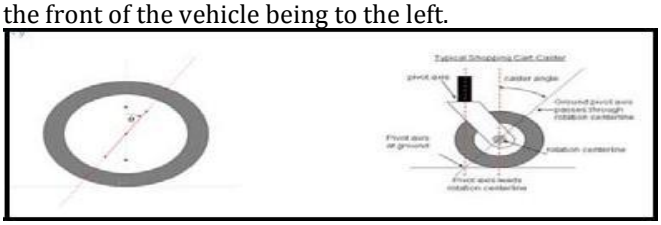

Figure 4. Caster wheel mechanism

3.6 Bench Marking

The wheelchair cum stretcher type of medical equipments in the hospitals are commonly used. Some of the features are like foldable frame, foldable arm rest, foldable and detachable foot rest, dual brake system and detachable and adjustable type of head.

rest. The product is manufactured with high quality of materials like stainless steel, carbon fiber etc.

Figure 5. Bench marked product

4. RESEARCH AND ANALYSIS

4.1 Gemba Study and User Survey

In order to experience the user and its environment user study needs to be conducted. This may help the designer to design an appropriate product which suits the environment. To find the user experience and various issues regarding wheelchair and stretcher user study has been conducted around in 8 hospitals. Initially all the stake holders are considered and study has conducted in order to get more information.

The study of Ethnography helps to identify the product environment, need of product and users experience. This technique helps to gain more knowledge about the wheelchair/stretcher which affect their working environment usage in various situations. Wheelchairs and stretchers are useful to transport the patients from one place to other by the mobility equipments and various problems are identified by the user study. Medical equipments, hospital environment and the stake holders related to the product are considered for conducting the gemba study.

Observations from the Gemba study are,

- The patients have to wait in the wheelchair if they need to transfer to the stretcher due to availability of numbers of stretchers are less comapared to wheelchair.
- With the help of 2-3 people transferring of patients from vehicle to the stretcher can be done .
- Transferring of patient from stretcher to the bed also a problem for the patient.

4.2 Ergonomic details

According to Indian anthropometric data all dimensions are considered. Human dimensions are considered for both male and female and there is a 95th percentile of elbow to elbow, hip breadth and buttock to popliteal is taken for the sitting posture. Elbow rest and popliteal dimensions are being taken as 50th percentile and combined that dimension into 210mm and 419mm
respectively for the design. Stature dimension is taken as 95th percentile and the dimensions as 1771mm.

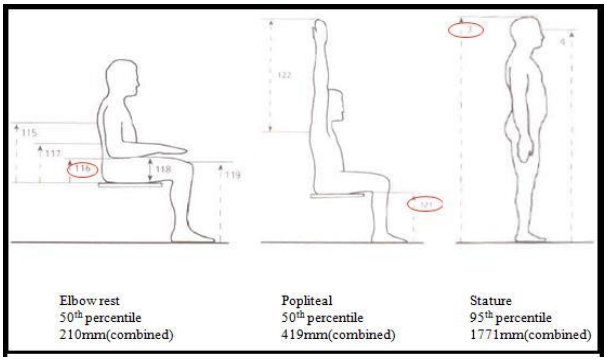

Figure 6. Anthropometric data

5.CONCEPT GENERATION

Visualization of various ideas mind mapping technique is used. So this classification considered all the aspects for the concept design.

5.1 Concept I

This concept is main criteria considered to be the convertible wheelchair and stretcher. So in order to convert the wheelchair into stretcher, some sort of mechanism needs to be added. In this concept at the back rest of the wheelchair a sliding tubular frame is attached. A handle is provided in the back rest so that the user can be pulled the stretcher easily .So a proper balance should be maintained in the back side .A caster wheel support is given to achieve the proper balance. A pair of bigger wheels is provided in the middle of the wheelchair, so that more strength will be attained. The provision for oxygen cylinder is another demand which has observed during the user study and the drip holder location is provided . The hand rest is designed in such a way that, it can be rotated and a removable type so that it will act as a support side for transferring patents.

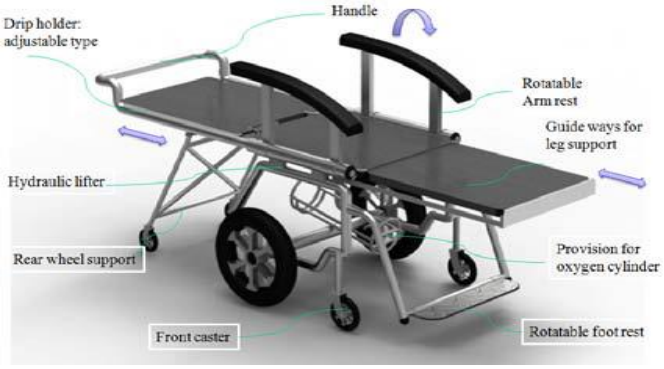

Figure 7. Concept I

5.2 Concept II

This concept is different from the concept one. The back rest is providing with an adjustable handle with a comfortable holding position. The length can be maintained by adjusting the knob and can be adjusted. The frame design is made in such a way that proper strength is provided to the wheelchair.

Figure 8. Concept 2

5.3 Concept III

This is the concept which is operated with hydraulic mechanism, so that height can be adjusted according to the user's convenience. The user won't get any difficulty while handling the product in such a way that it is designed to handled . A simple design of oxygen cylinder holder is provided below the seat so that it can help to withstand stretcher with a supporting element for
adjusting the weight.

Figure 9. Concept III

Figure 10. Concept III Wheelchair

The mechanism ,hydraulic scissor lifter lifts the entire wheelchair into stretcher. The telescopic arrangement supports the back rest so that weight of the body will be evenly distributed in the stretcher.

5.4 Concept IV

A more strength is given by a double caster wheel mechanism to the design, so that weight of the body can be evenly distributed. Front portion is lifted with the help of hydraulic mechanism so that the patient won't get trouble while lifting.

Figure 11.Concept IV

6. CONCLUSION

The present study was intended to develop a concept for a automatic wheelchair- cum- stretcher, with the motivation of saving space and precluding exertion by the patient. By provide remote control for the ease of patient to move without being dependent on anyone or applying extra force for movement. Also to remove difficulties for shifting patients from stretchers to wheelchair.

7. REFERENCES

1] Cooper R, Corfman T, Fitzgerald S, Boninger M. Spaeth D, Ammer W, Arva J., "*Performance Assessment of a Pushrim Activated Power* SASTECH 86 Volume 10, Issue 2, Sep 2011 *Assisted Wheelchair",* IEEE Trans Control Sys Tech, Volume 10, ISSN: 1063-6536, Jan 2002.

[2] Anonymous, "*Wheelchair history and development*", www.newdisability.com, retrieved on 27th Sept. 2010.

[3] Mr. Daniel E. Jolly., "*Wheelchair transfer",* The Ohio state university college, Columbus, ohio, retrieved on 24th Sept. 2010

[4] Mr. Amos Winter, "*Mechanical principle of wheelchair design"*, Graduate Student, Department of Mechanical Engineering, Massachusetts Institute of Technology, US, retrieved on 24th Sept. 2010.

[5] Anonymous, "*History of the wheelchair"*, www.inventors.about.com, retrieved on 27th Sept. 2010.

[6] Unknown, "*wheelchair, stretcher, hydraulic lifting*", www.googleimages.com, retrieved on 8th 2010

[7] James J. Kauzlarich., "*Wheelchair caster shimmy II: Damping",* Journal of Rehabilitation Research and Development, Volume. 37, No. 3, pp 305- 313, May/June 2000.

[8] Debkumar Chakrabarti, "*Indian Anthropometric Dimensions for Ergonomic Design Practice",* National Institute of Design, Ahmedabad, 1999.

[9] Dr. Rory A. Cooper., "*Wheelchair selection and configuration",* ISBN 1-888799 – 18 – 8, March 1998.

[10] Peter Axelson., "*A guide to wheelchair selection"*, paralyzed veterans of America, 1994.

*****