iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** IV **Month of publication:** April 2018

DOI: http://doi.org/10.22214/ijraset.2018.4626

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

Building an Engineered Involute Stretcher cum Wheelchair for EMS (Emergency Medical Services) Purpose

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Abstract: ***Nowadays, number of disabled individuals is increasing every year. The currently used wheelchair and stretcher design is not fulfilling the need of users. Currently wheelchairs and stretcher are the commonly used mobility aid for all patients. After the survey, the asset of a need of wheelchair cum stretcher was found out for the hospitals. For patients mobility aids are useful for transportation and a replacement for walking especially in indoor and outdoor condition. Wheelchairs and stretchers are commonly used medical equipment for the transportation during emergency medical services. The numbers of disabled individuals are increasing day by day as different kinds of accidents are being observed every year. From the survey new features like convertible wheelchair which can be converted into stretcher is introduced which can be controlled pneumatically. 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. Various kinds of research and surveys were helped to obtain more information about problems faced in hospital mobility aids. There is always an issue faced by the attendant or nurse of transferring the patients from wheelchair to stretcher or to the medical bed. Observing the various problems faced during emergency, introducing a better design will be an asset for the medical field during emergency medical services.***

Keywords: ***Disability, Concept and Design elements, Wheelchair and Stretcher for Emergency Medical Services.***

I. INTRODUCTION

DISABILITY is the term used from many decade now. The transfer procedure gets harder with increase in the patient's weight and with the degree of immobility. Paralyzed patients are highly dependent on their caretakers. The shifting of such patients to a wheelchair is a delicate process and in most of the instances, two or more caregivers is required. Most of them occurs due weight of the patient and anxiousness occurs during shifting. The term supplemental appears in regime documents, for example dealing with tax concessions of sundry kinds. Other avails can avail with mobility or transfer within a building or where there are changes of caliber. It refers to those contrivances whose use enables liberation of kinetics akin to that of unassisted ambulating or standing up from a chair. There are sundry ambulating avails which can avail with impaired faculty to ambulate and wheelchairs or mobility scooters for more astringent incapacitation or longer journeys which would otherwise be undertaken on foot. This poses the desideratum for ameliorating the available support contrivances to facilitate the effort of available caretakers. For people who are visually impaired or visually impaired the white cane and guide canine have a long history of avail. In this age of technology, the more minuscule number of available caregivers for paralyzed patients is a major quandary. Assistive technology for the mobility of impaired includes the wheelchair, hoist avail, stretcher and other contrivances, all of which have been around for centuries. The transfer of these immobile patients from bed to wheelchair is a delicate process and in most of the instances, two or more caretakers are required. Traditionally the phrase "mobility avail" has applied mainly to low technology mechanical contrivances. Out of which, the mechanical avails for physically impaired, especially for immobile patients are a major class. Technical advances can be expected to increment the scope of these contrivances considerably, for example by utilization of sensors and audio or tactile feedback. However, it is estimated that two out of five caretakers are injured back during shifting. A mobility avail is a contrivance to avail ambulating or to amend the mobility of people with mobility impairment. Engineering science have come up with numerous avails for the patients.

II. LITERATURE REVIEW

A. Patents Referred

1) *A Review on Development of Wheelchair cum Stretcher*: International Journal of Research in Advent Technology, Vol.3, No.2, February 2015 E-ISSN: 2321-9637

Ranjit P. Katkar1, M. V. Nagarhalli2, Pankaj S. Desle3
PG Student of Department of Mechanical Engineering, RMD Sinhgad School of Engineering, Pune.

2) *Automated Wheelchair Convertible Stretcher* : Smitesh Bobde, Shubham Deshmukh, Tejas Deshmukh, Rohan Damle Assistant Professor, Department of Mechanical Engineering, Dr. Babasaheb Ambedkar College of Engineering and Research, Nagpur, Maharashtra. India.
3) *Multipurpose Medical Bed***:** Jerin Joseph John, Jemin Johnson, Jeffin C Joy, Geo John, Asish Johnson Department of Mechanical Engineering, Jyothi Engineering College, Thrissur, Kerala, India.
4) *Design And Development of Conceptual wheelchair Cum Stretcher :* Sreerag, Gopinath, Manas Ranjan Mishra, School of Advanced Studies, Bangalore, (2011).
5) *Design Of The Wheelchair Bed :* Jingtao Chen, Bing Teng, Yali Yang Shanghai University of Engineering Science Shanghai201620, China, (2013).

III. OBJECTIVE

The objective of this project is to offer comfort and safety to both patient and caretaker and to reduce the vibration transmitted during shifting of patient from wheelchair to stretcher and vice versa. It ameliorates the balance and postural stability of senescence people. It can convert slumbering position from sitting position**.**

IV. METHODOLOGY

The goal of the project is to improve the functionality on a current emergency stretcher and wheelchair. Paul Cotnoir's work with vibration reduction and retrofitting a force plate into the bottom of an ambulance has proven that a redesign of the stretcher could potentially show paramount vibration reduction from what the patient encounters. There are no. of problems faced with emergency stretcher which include the vibrations a patient endures within the ambulance. Essentially each stretcher is design categorically for the comfort of patient from critical situation to the ambulance.

A. Concept

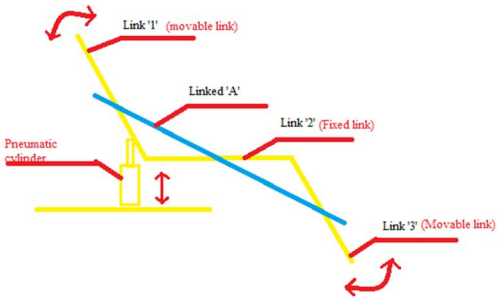

Fig. 1 Concept

Above Fig depicts the folding mechanism of product. "Link 1" is the back rest, "link 2" is seating area, and "link 3" is leg support. "Link '1' and Link '3' are movable links whereas Link '2' is fixed link. Link '1' and Link '3' are hinged together with Link '2'". Link 'A' is attached to all three links i.e. Link '1', Link '2' and Link '3'. Height adjustment is done with the help of pneumatic cylinder. Two pneumatics cylinder are used which are attached to Link '1' to provide the up and down movement required for the conversion. One end of both the cylinders are fixed in the wheelbase and other end is fixed with the Link '1'.

B. Calculations

Pressure is a physical quantity. Physical quantities describe measurable features of bodies or processes related to them. Pressure describes the ratio of force per area.

$[P] = N/m^2 = Pa$

In pneumatics, pressure specifications usually refer to a reference pressure, i.e. the atmospheric pressure. The atmospheric pressure depends on the weather and varies on sea-level between approx. 0.980 bar and at approx. 1.040 bar. In order to be able to do calculations containing the quantity atmospheric pressure, a quantity called standard pressure has been fixed:

Atmospheric standard pressure (DIN 1343) = 1.01325 bar

The SI unit (international system of units) of pressure P is the Pascal (Pa).

1 Pa = 1 N/m²

A further authorized unit is Bar (bar).

1 bar = 100.000 Pa = 105 Pa

Single Acting Cylinder

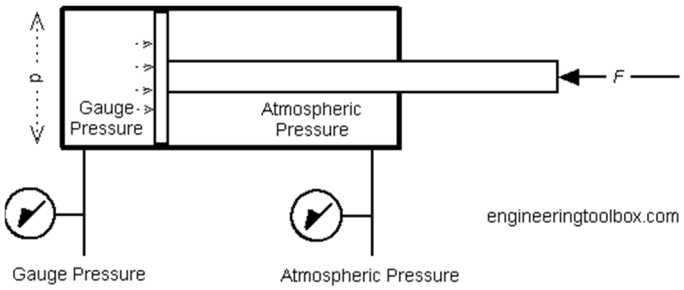

Fig. 2 Single acting Cylinder

The force exerted by a single acting pneumatic cylinder can be expressed as

$F = p\ A = p\ \pi\ d^2/4$ (1)

Where,

F = force exerted (N)

p = gauge pressure (N/m^2, Pa)

A = full bore area (m^2)

d = full bore piston diameter (m**)**

C. Design Elements of Cad Model

The design of the projects has emerged from the concept of the convertible wheelchair.

1) Main Design Elements

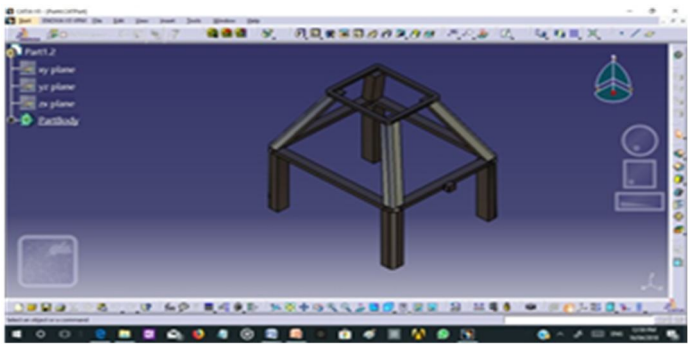

Fig. 3 wheelbase Section

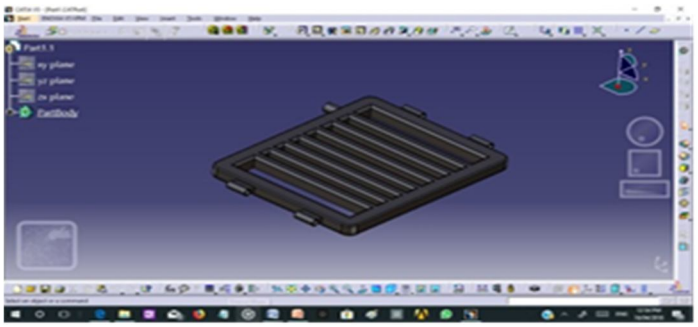

Fig. 4 Middle Seating Section

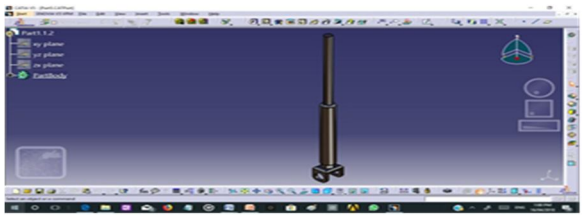

Fig. 5 Pneumatic Cylinder

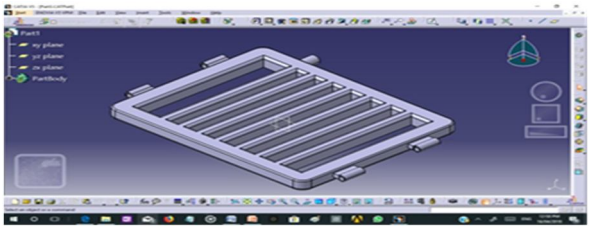

Fig. 6 Backrest Section

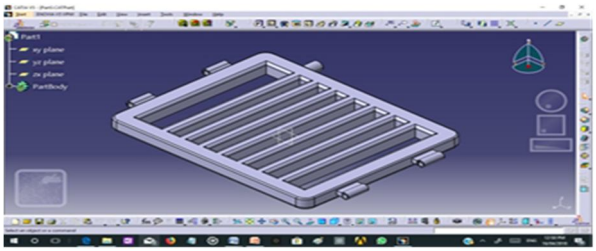

Fig. 7 Leg Rest Section

The convertible feature was added to the design at conceptual level. Since the main aim is to provide the comfort to the patients as well as caretaker, powered conversion between wheelchair and stretcher is focused. Then power source is decided. Though the hydraulic actuators have more advantages in terms of handling and stability, the relatively high cost and bulkiness of the unit we decided to go with pneumatic actuators.

After considering various space and accommodation factors, inverted slider crank mechanism was selected for both pneumatic cylinder. The compressed air supply could be some distance away from the contrivance. Pneumatic actuators provide high force and speed at relatively low cost. In next phase, type of pneumatic cylinder specification and actuating mechanism as well as link manipulation.

Fig. 8 Complete Assembly

V. FABRICATION

The complete fabrication of the project has been done around basic framework. The middle support forms the basic as far as assembling is concerned. The relative low cost, availability and properties like decent tensile, compressive strength and weld-ability favored the choice of mild steel over other materials. The frame has four main section, namely wheelbase, Backrest, Middle seating and the leg section (610 x 610mm each section). The movable support section are anchored in the middle and backrest section. Each leg is terminated into a flange on which a wheel is attached. The backrest section and leg rest section are hinged together with the middle section. The framework has been made by welding together mild steel pipes of square cross sections using Metal arc welding

and arc welding electrodes. The movable segments are given a cushion each. The leg of the fabricated prototype is integral to the middle section. Rear wheel and front wheel of 125mm diameter is used here. The wheels provide mobility in both stretcher and wheelchair mode. Each wheel has ability to facilitate steering.

VI. FURTHER ENHANCEMENT

A. Mini compressor can be attached in the wheel chair to provide easy movement and comfort in adjustment of the wheel chair
B. Solar energy can be used as alternative power source.
C. GPS system can be used in the device for outdoor condition.
D. Obstacle sensors can be used to predict the nearby objects to avoid collision.
E. We can operate the wheel chair movement by gesture control.
F. Human brain contains thousands of neuron and possess potential difference between each other. During the process of thinking, neuron emits 0 to 50 HZ electric signal, by interpreting the signal by modulation/demodulation, we can operate the chair using electric signal coming from brain**.**

VII. CONCLUSION

The main goal of the project is to make the helper life facile and to ascertain the patient is safe during process of treatment. The product eliminates the step of shifting patient from bed or stretcher to wheelchair and vice versa. Though some difficulties had occurred and remodeling is done. The project had some circumstances which we learned during the process of building, but at last the wheel chair cum stretcher is engendered very proximate to acclimated design philosophy.

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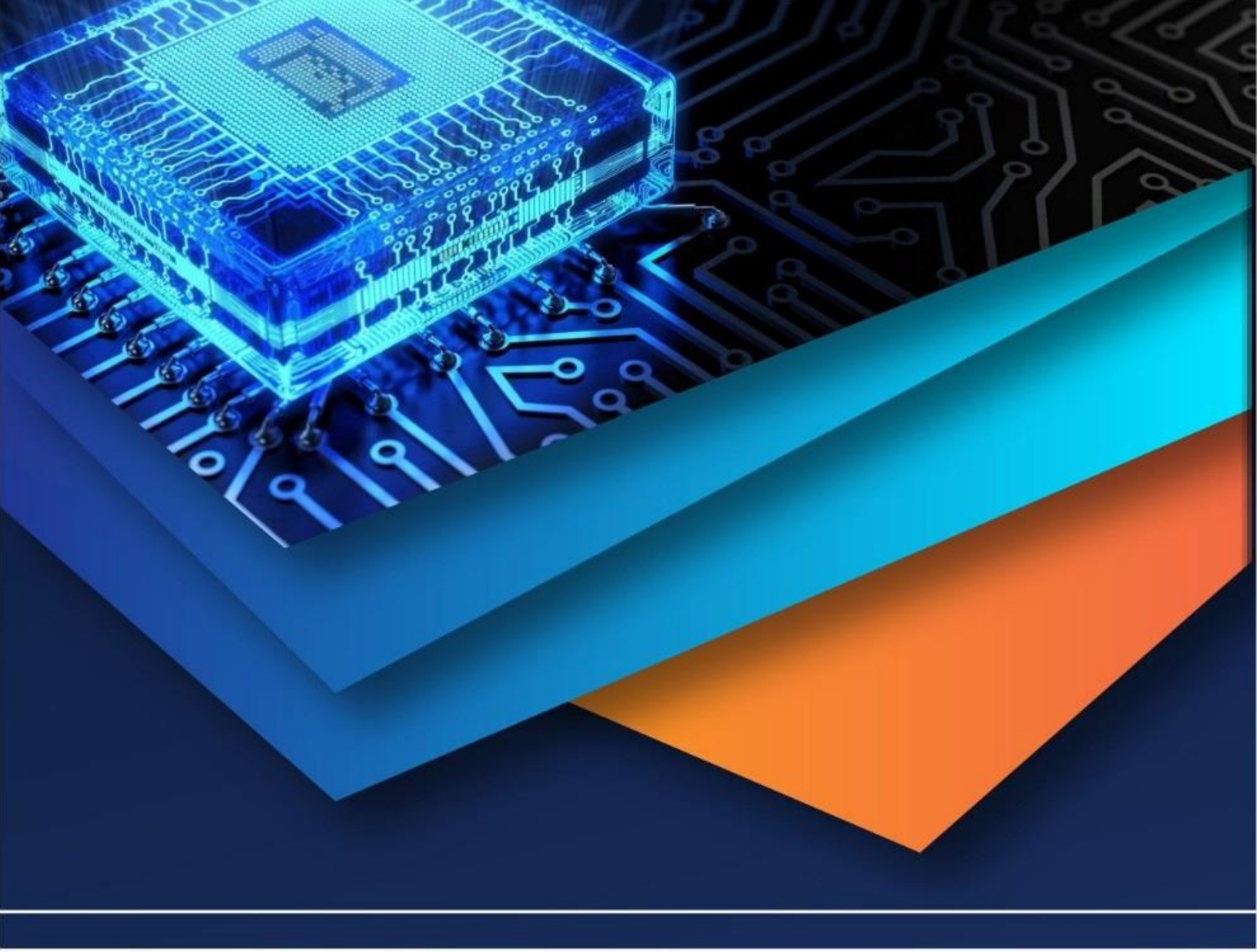
[7] A Review on Development of Wheelchair cum Stretcher International Journal of Research in Advent Technology, Vol.3, No.2, February 2015 E-ISSN: 2321-9637 Ranjit P. Katkar1, M. V. Nagarhalli2, Pankaj S. Desle3 PG Student of Department of Mechanical Engineering, RMD Sinhgad School of Engineering, Pune.
[8] Design and Fabrication of Pneumatically Powered Wheel Chair-Stretcher Device Rashid Ahmed K, Safar Abdul Razack, Shamil Salam, Vishnu Prasad K.V, Vishnu C. R. B. Tech Scholar, Department of Mechanical Engineering, KMCT College of Engineering, Calicut, India Assistant Professor, Department of Mechanical Engineering, KMCT College of Engineering, Calicut, India.



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