

MODIFICATION AND FABRICATION OF WHEELCHAIR CUM STRETCHER

Smit Patel¹, Yagnik Koli², Bhargav Talekar³, Vipul Rathod⁴, Jay Baria⁵, Mr. Parikshit Patel⁶

¹⁻⁵Department of Mechanical Engineering, Laxmi Institute of Technology, Sarigam

⁶H.O.D of Mechanical Department, Laxmi Institute of Technology, Gujarat, India

Abstract - The movement of a physically disabled person from one place to another during his/her unhealthy conditions becomes a tedious task. It is required to move the patient within the hospital campus for the basic necessities, physicians health check-up, medical tests etc. It causes inconvenience to both the patient and helping staff. For that purpose, wheelchairs are provided to the patients for the easy handling of above discussed tasks. One helping staff is needed always to be with patient for all these transitions. Sometimes it becomes a tough work when the patient is too heavy to be lifted by two or three members and also when the transition has to be done twice or thrice in a day. Now a-days automated wheelchairs have also come in some hospitals that reduce the need of nursing/attending staff. The patient can move themselves by their own hands with the help of some mechanism that is used to move the wheelchair which are having their own advantages and disadvantages. Somehow if the problem of transition of patient is solved then it will be a helping hand for both the patient as well as the nursing staff. It is thought to combine the concept of wheelchair and stretcher and design a system which serves the both purposes and hence in order to meet the patient requirement this paper aims at designing an electric wheelchair that can be converted into a bed/stretcher with variable adjustable positions with the help of electric motor.

Key Words: Automatic wheel chair, Electric wheelchair, Nursing staff, Stretcher, Wheelchair.

1. INTRODUCTION

A stretcher is a moving bed with wheels, designed to transfer patient who can't walk or stand with the help of others assistance. In accident cases and the people who are in critical stages are transfer in stretcher from one place to other place. It is simple in design with metal bed at top for lay Disabilities have affected thousands of families in the world. As of today 650 million people are suffering from disability. Their disabilities can be empowered and enable them to live a normal and independent life with the help of wheelchair. New and modified wheelchairs can satisfy the need of disable people rather than the old and conventional ones. To help the disabled various design changes have been done. One is by introducing a detachable defecation system to it. It provides ease to the patients and the staffs. Engineers are continuously applying their ideas to make these products more and more sophisticated so as to facilitate the doctors, patients and staffs more. Wheelchair is one of the easiest modes which serves the purpose of transportation for patient and is considered as basic necessities in hospital. Studies showed that 40% of the helpers who helped

physically challenged person for the translation from bed to chair and vice versa are suffering from the back and joint pains. To tackle this problem many people have designed wheelchairs with various applications which could be converted into a bed or visa-versa using mechanical linkages or with the help of an electrical motor.

2. AIM AND OBJECTIVE

The main objective of wheelchair is used by people for whom walking is difficult or impossible due to physical injury or disability and transferring the patients from wheelchair to stretcher is always an issue for the attendant or helper. The main problem is when person injured his leg and he or she can't fold her leg then previous stretcher is not useful but present stretcher work as per person requirement which position can be comfortable. Which can be controlled by himself.

3. REVIEW CRITERIA

Developed Stretcher Cum Wheelchair For Patients, P A Vaghela (2014)

Fabricated Pneumatically Powered Stretcher-Chair, Rashid Ahmed K, Safar Abdul Razack, Shamil Salam, Vishnu Prasad K.V, Vishnu C.R. (2015)

Design of Multipurpose Wheel Chair, Mohan R. Kumar (2016)

Electrically Operated Wheelchair Cum Stretcher, Akshay Hirudkar, Chetan Bhusari, Akshay Khedkar, Akshay Parerkar (2017)

Proposed CAD Model of Wheelchair Cum Stretcher, Roshan D. Ugale, Sanket N. Virulkar (2017)

Synthetic Trolley Cum Wheelchair, Ehsanullah Khan (2017)

Dual Purpose Wheelchair Mechanism Design, Meng-Hui Hsu (2018)

Development of Multifunctional Hospital Bed, Nenad Pavlovic (2018)

4. DESIGN AND CALCULATIONS

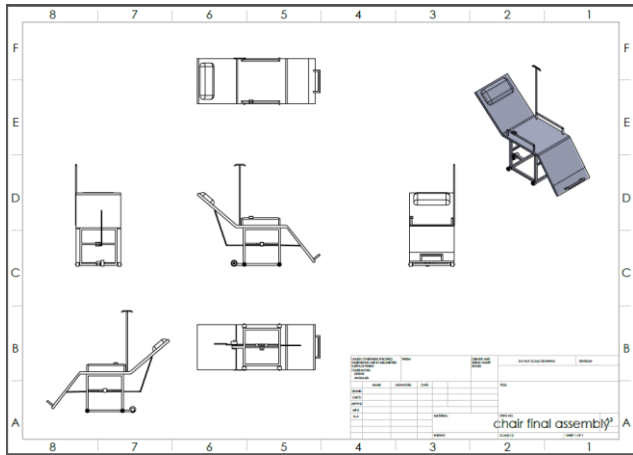


Fig 1: Wheelchair Final Assembly

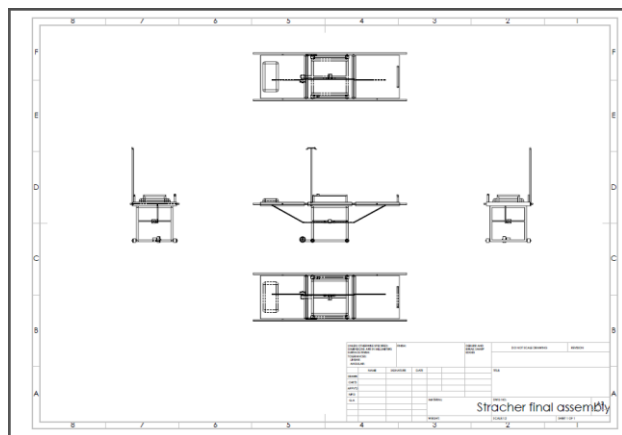


Fig 2: Stretcher Final Assembly

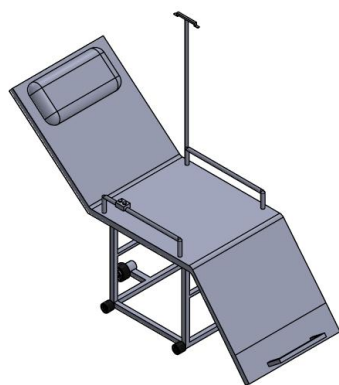


Fig 3: Isometric View of Wheelchair

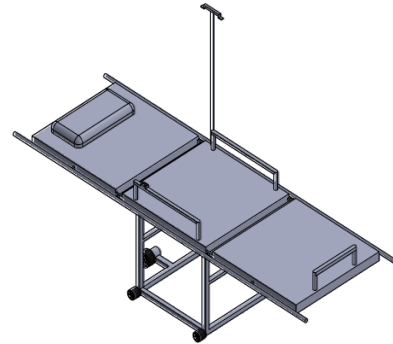


Fig 4: Isometric View of Stretcher

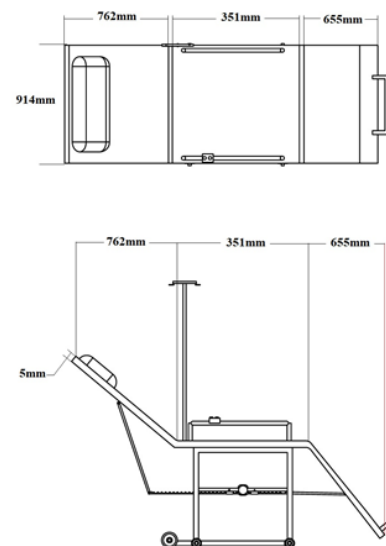


Fig 5: Dimensions of Wheelchair & Stretcher

4.1 DESIGN CONSIDERATION

The design of Chair cum stretcher is based on ergonomic consideration of human body. Generally the width of human body is 914 mm and the back portion from comb to neck is of 762 mm from comb to leg joints are of 351 mm and from leg joint to fit the length is of 655 mm. So in the present work the three plates of dimensions of 914 mm X 762 mm, 914 mm X 351 mm and 914 mm X 655 mm are considered respectively.

4.2 CALCULATIONS

Specification of Battery

Voltage (V) = 12 V Current (I) = 7 A

Specification of Motor

Voltage (V) = 12 V Speed (N) = 5 RPM

$$P = VI = 12 \times 7 = 84 \text{ W}$$

$$P = 2\pi NT/60$$

$$T = 152.86 \text{ N-m}$$

$$\text{Radius of pinion (R)} = 40 \text{ mm}$$

Force acting on rack which is connected with the seat of stretcher.

$$T = F \times R$$

$$F = 3281.65 \text{ N}$$

$$= 389.96 \text{ kg}$$

5. CONSTRUCTION DETAILS AND COST STRUCTURE

In the present work the main objective is design and fabrication of wheel chair cum stretcher. In the first phase the frame structure with above dimensions three plates are fabricated from 25 mm X 25 mm X 2 mm square pipes and with 1 mm thick MS sheet using arc welding and wheels of 6' diameter are attached on the both sides of chair. Afterwards 12 V DC motor is placed at the bottom portion which is connected with rack pinion mechanism in which pinion having 39 teeth and the length of rack is mentioned total length of stretcher and the pinion is connected with motor and rack is connected with neck end and feet end of wheel chair with link.

Sr. No.	Name Of Components	Quantity	Cost
1	12V DC Motor With Battery	1	2000 /-
2	Rack And Pinion Gear Drive	1	1000 /-
3	Bearings	4	1000 /-
4	Fabrication And Machining	1	8000 /-
5	Wheel	4	2000 /-
6	Frame(25mm X 25mm X 5mm)	1	1000 /-
7	Two Way Switch	1	200/-
Total			15200/-

6. WORKING PRINCIPLE AND FUTURE SCOPE

6.1 WORKING PRINCIPLE

The main purpose of this wheelchair cum stretcher is to convert wheelchair into stretcher for people whom walking is difficult or impossible due to physical injury or disability. In the present work the stretcher can be converted into chair using rack and pinion mechanism. In which the pinion is attached with motor and when we push switch button motor operation rack get operated and stretcher get converted into chair.

6.2 FUTURE SCOPE

This electric wheelchair can be changed to Omni wheels for that user can move one place to another place not to rotating the chair or stretcher. One more things total wheel mechanism may change in different mechanism for that user without any external help can climbed up the stairway.

7. ACKNOWLEDGEMENT

We are very much thankful to Gujarat Technological University for including this subject "User Defined Project", in our syllabus because without it, would not happen so early to develop such type of creativity. We are very grateful to our college especially to our Mechanical Department. We also thankful to our respected H.O.D. and project guide **Mr. Parikshit Patel** and Project Coordinator **Mr. Ashish Patel** for providing their immense support and valuable guidance whenever we needed. We also thankful to our all supporting faculties to give their important time to us and of course, we can't forget to thank to our Parents who is always with us to help and give full support to us in every good work we do.

8. CONCLUSION

The present proposed stretcher is having capacity to lift the weight of a person around 100kg which shows the ability of work.

REFERENCES

- [1] P A Vaghela, "Stretcher cum Wheelchair for Patients", International Journal of Futuristic Trends in Engineering and Technology, Vol. 1 (03), 2014.
- [2] Rashid Ahmed K, Safar Abdul Razack, Shamil Salam, Vishnu Prasad K.V, Vishnu C. R., "Design and Fabrication of Pneumatically Powered Wheel Chair-Stretcher Device", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Issue 10, October 2015.
- [3] Akshay Hirudkar, Chetan Bhusari, Akshay Khedkar, Akshay Parekar, "AUTOMATIC STRETCHER CUM WHEELCHAIR", International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue:

03 Mar -2017.K. Elissa, "Title of paper if known," unpublished.

- [4] Roshan D. Ugale, Sanket N. Virulkar, "Design and Development of Humanscale Wheelchair cum Stretcher," International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 03, Mar -2017.
- [5] Saurabh Jambhulkar, Nageshan Ramteke, Sagar Prajapati "Design and Fabrication of Wheelchair Cum Stretcher with Suspension", International Journal of Scientific Research and Review, Volume 8, Issue 3, 2019.
- [6] Richard C. Simpson Phd, "Smart Wheelchairs", Department Of Rehabilitation Science And Technology, University Of Pittsburgh,Pa (2005)
- [7] Sumedh. J. Suryawanshi, Dr. K. Janardhan Reddy "Product Development of Wheelchair For People Disabled In Legs", (2013) (Smbs 2013)
- [8] Roger Bostelman, James Albus "A Multipurpose Robotic Wheelchair And Rehabilitation Device For The Home" , (Nist Gaithersburg), (2007)
- [9] Prof.R.S.Nipani, Vinay Gaikwad, Chetan Choudhari, Ram Gosavi, Vishal Harne "Automatic Wheelchair For Physically Disabled Persons", (2013) (Ijarece)



Vipul Manoj Rathod
Department of Mechanical Engineering.
B.E. Final Year Student.
Laxmi Institute of Technology, Sarigam.



Jay Sanjay Baria
Department of Mechanical Engineering.
B.E. Final Year Student.
Laxmi Institute of Technology, Sarigam.



Mr. Parikshit Patel
Department of Mechanical Engineering.
H.O.D. of Mechanical Department
Laxmi Institute of Technology, Sarigam.

BIOGRAPHIES



Smit Jayanti Patel
Department of Mechanical Engineering.
B.E. Final Year Student.
Laxmi Institute of Technology, Sarigam.



Yagnik Jitendra Koli
Department of Mechanical Engineering.
B.E. Final Year Student.
Laxmi Institute of Technology, Sarigam.



Bhargav Sanjay Talekar
Department of Mechanical Engineering.
B.E. Final Year Student.
Laxmi Institute of Technology, Sarigam.