Design And Fabrication Of Stair Climbing Cart With Lifting Bucket

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Abstract :- our goal is to reduce human effort to carry heavy loads over stairs. We plan to do this by developing a mechanism for easy transportation of heavy loads over stairs. The need for such a system arises from day to day requirement in our society, so we made a "stair climbing hand cart".A stair climbing hand cart can carry heavy object up the stair with less efforts. It is light in weight. It can travel over stairs, flat surface or uneven terrain which reduces the human efforts. It has tri-lobbed or tri-star wheel which enable us to carry loads on stairs. It also comfort the movement of trolley in irregular surface like holes, bumps etc. It can be used as a handicap carry cart, for lifting the handicap up stairs.

Keywords: - stair climbing hand cart

I. INTRODUCTION

With the increase in trouble to carry so many goods and objects through stairs. It is becoming essential to find a viable alternative to carry loads on stairs.

The project introduced by our group can be used in various fields such as to carry luggage's on stairs, used for industrial applications, used in hospital. It has total six number of wheels, three on each sides, they are set in a triangular pattern.

This report present the design and manufacturing of stair climbing hand cart which include tri-wheel arrangement, pulleys, bucket design and lifting arrangement.

II. SYSTEM MODEL

A stair climbing cart has two pairs of tri-lobbed frame in which six wheels are attached. These wheel and tri-frame is important part of trolley which rolls over the stairs. These distance and height are accurately match with the standard stair size.

The cart has a moving bucket which can be lifted up and down on the frame with the use of wire rope and pulley arrangement. It is a manual mechanism. A cart has made strong enough which can carry up to 100kg of load, so that it can carry handicap and also heavy loads. It is cheaper than other trolley. Suitable bearing, pulley and wheels are used. It is accurate, safe and affordable trolley for the customer use.

Fig No.1 Stair Trolley Setup

Working principle of stair climbing trolley

This cart major principle is its tri-frame and tri –wheel which runs on the stair without slipping. Pulling force is given by the person so that the trolley moves forward. It has lifting arrangement, the wire rope is used with the pulley to lift up the load at suitable height and a handle is provided a back to stop the bucket at particular height.

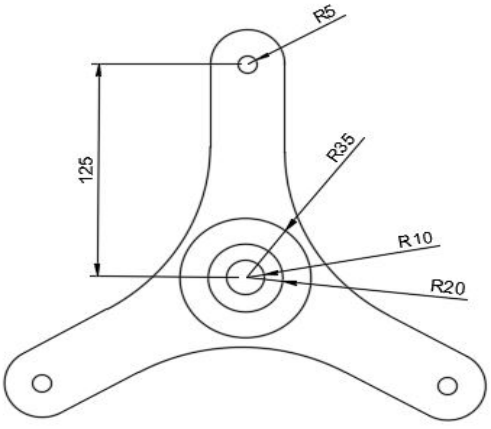

Fig No. 2 Tri-wheel frame

III. PREVIOUS WORK

There are a number of rehabilitation devices currently available or in development. The most well-known device is the MANUS (1), which is a wheelchair-mounted seven axis (plus gripper) robot. The MANUS, a Dutch project, was designed with the disabled person in mind. It was a unique collaboration between the engineering and rehabilitation worlds, which rendered a well-engineered, quiet, and aesthetic device. The MANUS folds up into an unobtrusive position at the side of the wheelchair and folds out when commanded. Its present inputs include a 16 button keypad, trackball and joystick. The MANUS allows task space control. In other words, the user may directly control the motion of the end effectors in Cartesian coordinates (translations along and rotations about Cartesian axes). This is in addition to the less sophisticated joint space control mode in which each joint is controlled independently. There are currently approximately fifty users of the MANUS, mainly in the Netherlands

In an article (44) published by MSNBC on 25th May 2009, it is mentioned that "By using the stair climbing chair we feel comfortable but while buying the chair we feel miserable". According to this article, the first ever practicable staircase climbing wheelchair is launched in 2009 in USA. A stair climbing wheelchair "VARDAAN" (45), recently developed by four students of IIT, Kanpur, is a low cast solution to the problem, but operation of that wheel chair is purely manual. So, substantial driving force is needed to operate the chair. Considering the health and weakness of the elderly people, it may not be useful all the time. Totally new Design consisting with the Simple construction and thereby with less cost is proposed in our paper (46) whereas the idea of conjugate profile for the wheels is put forth in our second paper (47). In our project we have completely used a new idea and extra lifting arrangement in added in our project.

IV. PROPOSED METHODOLOGY

Making of trolley frame:-

Prepare a design of a trolley.
Select a suitable material for manufacturing.
Measure the material accurately and then cut the material.
Welding is done by joining the sections.

Making of tri-wheel frame:-

Prepare a design of tri-wheel frame by use of design software.
Cut the material according to design.
The angle between the wheel is $360^0/3 = 120^0$.
Weld it properly.
Check the joint properly.

1) ASSEMBLY OF STAIR CLIMBING CART

- Now trolley frame is connected through tri-wheel
- The entire wheel is connected properly through nuts and bolts.
- Pulleys and wire ropes are placed in right position.
- Bucket is placed and is slide on the wheel which is connected on frame.
- Preliminary testing is done by checking the movement of trolley.
- Then by applying the weight on the trolley testing will be done.
- After testing it is forwarded for painting and finishing.

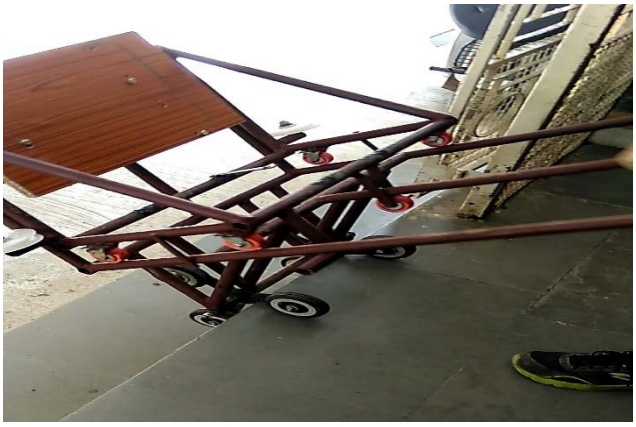

Fig No.3 Main body fixed constraints

Load

Type	Force
Magnitude	1000 N
X Value	0 N
Y Value	839.3 N
Z Value	543.7 N
X Angle	0 deg
Y Angle	90 deg
Z Angle	0 deg
Force Per Entity	No

Table No.3 Applied Load

2) ANALYSIS

6.1 MAIN BODY

Material of study: - Steel

Density	7.85E-06 kg / mm^3
Young's Modulus	210000 MPa
Poisson's Ratio	0.3
Yield Strength	207 MPa
Ultimate Tensile Strength	345 MPa
Thermal Conductivity	0.056 W / (mm C)
Thermal Expansion Coefficient	1.2E-05 / C
Specific Heat	480 J / (kg C)

Table No.1 material study

Mess: -

Type	Nodes	Elements
Solids	121397	60682

Table No 2. Messing

Fixed Entities: - (in blue)

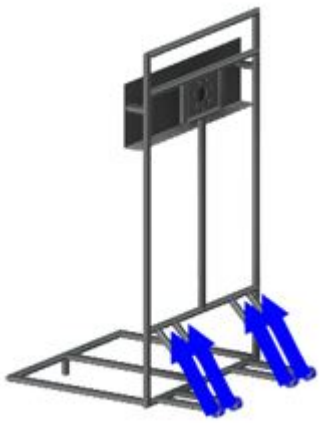

Fig No. 4 Main body applied load

Displacement:

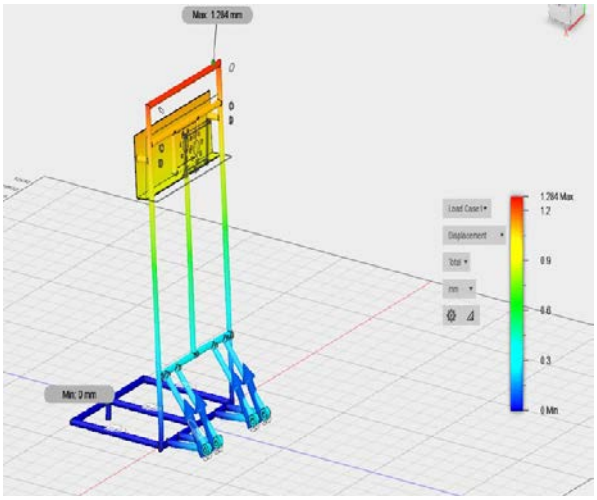

Fig No. 5 Displacement of main body

6.2 TRI WHEEL:-

Material of study: - Steel

Density	7.85E-06 kg / mm^3
Young's Modulus	210000 MPa
Poisson's Ratio	0.3
Yield Strength	207 MPa
Ultimate Tensile Strength	345 MPa
Thermal Conductivity	0.056 W / (mm C)
Thermal Expansion Coefficient	1.2E-05 / C
Specific Heat	480 J / (kg C)

Table No.4 Material of study

Mess:

Type	Nodes	Elements
Solids	2159	1014

Table No. 5 Messing

Fixed Entities: - (in blue)

Fig No. 6 Tri wheel fixed constraints

Loads: -

Type	Force
Magnitude	100 N
X Value	90.63 N
Y Value	42.26 N
Z Value	0 N
X Angle	0 deg
Y Angle	0 deg
Z Angle	0 deg
Force Per Entity	No

Table No. 6 Applied load

Displacement:

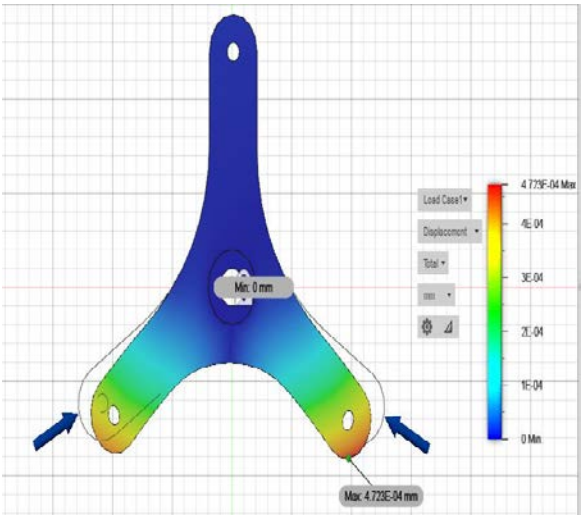

Fig No.7 Displacement of tri wheel frame

V. EXPERIMENTAL RESULT

The trolley can lift up to 100 kg weight up the stairs or uneven tracks.
It is light in weight up to 30 kg.
Cost of the trolley is reduced.

The stair climbing cart can be used on plane surface or even on rough terrain and to climb the stairs. It can be used for carrying patients up stairs, for carrying luggage's up stair , as a shopping trolley. Used in various public places like hospital, railway station, bus stops, school building etc.

VI. CONCLUSION:

Thus the stair climbing trolley was fabricated in such way that it could carry the heavy loads over stairs and also used for carrying loads on flat surface from one place to other place with less human effort. This decreases the human effort to carry heavy loads over stairs and also on flat surfaces and proves to be more advantages in all places like industries, schools, college etc. Our project helps the

people in greater way it is efficient, less costly and carry heavy loads over stairs.

1) The main aim of the project is stair climbing mechanism for load carrier with decreasing effort.

2) Doing better work with lesser effort has been the main objectives of human beings in any field.

3) The main project as platform we try to present mechanized stair climbing load carrier with reducing effort.

4) Stair climbing mechanism in stair case load carrier which helps to carry the loads with help to carry the loads with stair case.

VII. FUTURE SCOPES

Firstly, the material of the stair climber parts can be changed because now we are used mild steel as material as it will increase the weight of the stair climber. Instead of using steel as material we can use composite materials to reduce weight.

Secondly, the mechanism motor system can be used instead of manual syatem.

Thirdly, the power range produced to carry loads could be modified as per loading conditions .

Finally, the size of the Tri-Star plate could be made as adjustable one to climb all sort of stairs by using bolt and nuts or another adjusting mechanisms.

REFERENCE

[1] Stair trolley. Retrieved from https://www.google.co.in.

[2] Stand up Wheelchairs. *Product Literature*, Levo Inc. Switzerland.

[3] Design and fabrication literature http://www.ijsrd.com/articles/IJSRDV5I10761.

[4] R. Walli, DOE technology to develop TRANSROVR -- Omnidirectional wheelchair, *DOE News Brief*, October 10, 1996

[5] MEX Riser Wheelchair. *Product Literature*, Imex Medical Inc., San Jose, CA

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