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Design of Modified Wheel Chair

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ABSTRACT : Wheelchair is a mobility gadget designed to be replacement for walking, moving physically challenged people from one place to other with the help of attendee or by means of self-propelling, It comes in variations allowing either manual propulsion by the seated occupant turning the rear wheels by hand and electric propulsion by motors. This project focuses on modify of manually driven wheelchair can move the disability people upward position, by up and down movements of itschair. Every manually operated wheelchair comes in two major designs. There are rigid chairs type and flexible chair type so; in this project flexible chair is designed. The design of wheelchair happened by means of literature review to know it's evaluation from past to present. Different methodologies have been proposed based on human ergonomic data and tested for sitting and lying as well as standing mechanism of the wheelchair to maximize the utility of chair by including flexible wheels, lifting of wheelchair. It is not only for those who disabled to move, but also they can perform their daily activities in their life. This work provide ergonomic constraints for user's maximum comfort while dealing with various body movements like sitting, lying, moving, turning and lifting The final output is a wheelchair with very simple mechanism which gives facility to move up and down the disabled users, with the use of some added components like sprockets, nut chain and screw. And also the scissor jack that attached to the wheel chair on other.
The wheel chair designed with sprocket, screw and nut as power transmission has capacity to raise the users up to fifty centimeter (50cm), and while the wheelchair with scissor jack can raise the users up to one meter (100 mm).

I. INTRODUCTION

Doing work above the head or height position for disability people of lower parts of body and cannot walk is not ergonomic to human body. In different times, different scholars have been trying to solve the problem of disability peoples through creating and modifying a lot of Wheelchair and other related devices for the sake of movement of indoor and outdoor. Importance and usage of wheel chair exponentially increased as a number and different kinds of disabilities increased. Present time wheel chair with different applications are designed and demanded on the market and answer the questions of disability peoples. However, in many developing countries like Ethiopia still adequate of usage of wheel chairs are observed. As a result many disable people suffers a lot. Not only this, but also involving or participating in community is another desire. While wheel chairs have already proven the movement of some disability peoples, the current challenge is to make these people productive through participating on different activities. So in different areas in Ethiopia this problem does not get solutions due to economy and not manufactured internally. So overcome this vital problem uplifting wheel chair will be designed highly focusing on ergonomics to ensure that the design complement with ability of people to perform some activity that require highly participate in community. In achieving this aim it becomes necessary to understand and design for the variability represented in the community,spanning attributes such as age, size, cost, availability, strength and goals. While designing and discussing about wheelchairs criteria such: energy cost, availability, comfort and adjust ability are important consideration. Due to existing wheelchair does not enables the user to move upward and cannot perform flexibility operation, and if the newly wheelchair manufactured it can be used by most of disable people and can participate in social activities. The most widely known term "energy cost", this indicates the minimal energy throughout the day to propel through various activity condition. The rotational force that applied on the handle then throw sprockets and chains passed to the main parts that is chair that carry the users to be move up so, the more the energy cost the less the comfort, fed up, energy losses of users and vice versa.

Wheeling in the new millennium the history of the wheel chair and the driving forces in wheel chair

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today.Man's two earliest inventions, chair, wheel in 400 B.C originate in eastern Mediterranean basin.First record of combining wheels to furniture with image on Greek vase of wheeled child's bed in 530 B.C. In china, spoked wheels on chariots 1300B.C and oldest evidence of wheeled chair. At 525 A.D engraving of one of the earliest representation of wheel chair. Wheeled barrow is third century invention from china used for moving the sick or disabled to the "fountain of youth".

Gestations, Greek and Roman physicians prescribed a gestations or transportation for the sick or disabled (1553). Get people out into fresh air and help work with whatever they could do in the fields which carried on a sedan or push on a chair with wheels.In Spain, King Phillip II (1595) of Spain had his own rolling chair with foot rests. And self-propelled chair paraplegic watch maker, Stephen Farfler(1655) built his own chair at 22 years age.Bath chair, developed in Bath, England and invented by John Dawson wheel chair-chair maker in 1783, dominated the market of 19^{th} century thathas two large wheels on small wheel.Seating is comfort for the disabled person becomes more of an issue and convertible chair (reclining back and adjustable foot rests) in 18^{th} century.In 1867 change wooden wheel to iron& in 1875 added hollow rubber tires. In1881 push rims were added for propulsion and in 1900 wired spoked wheels adopted by wheelchairs.In 1912 with $^{3}/_{4}$ horse power engine was attached to an invalid tricycle.In 1916 London produced first motorized wheel chairs.The Light weight wheel chair made from Indian reed and it was large wheels either front or back, with 58lbs, also push rims that have 50lbs without push rims.Finally, Light weight chairs that are really light weight 20lbs- 25lbs and its purpose is to decrease energy cost, reduce shoulder and wrist injuries due to repetitive strain and easier to transport. Herbert A.Everest wanted a wheel chair that could go in and automobile teamed with engineer HC Jennings to manufacture first folding metal wheel chair in 1993 in Los Angeles.Samuel Duke in 1934 independently of Everest and Jennings responded to demand in Chicago, developing the second manual Light weight folding wheel chair for market.

According to the latest global reports on disability, more than one billion individuals,who nearly constitute 14% of the worldpopulation, live with a form of disability [1]. Studies also indicate that approximately10% of these individuals have lower limb disabilities, andare dependent on manually propelled wheelchairs for ambulation and performing activities of daily living (ADLs).About 20 million of the disabled, however, do not haveaccess to wheeled mobility devices [2]. Moreover, theprevalence of severe forms of disability, with considerable functional limitations, is estimated to be around 200million worldwide and an alarming increasing trend hasbeen highlighted by the recent global health statistics [1].Injury is the number one public health problem in theUSA, with a price tag of over $260 billion annually [3].People with impaired mobility and balance, includinglower limb amputees, those with spinal cord injuries, osteoarthritis, degenerative muscle and neurologic diseases are typical users of wheeled mobility devices. Thereis a growing body of evidence on the vital importance ofphysical activity among these individuals and having anactive lifestyle is an essential part of successful rehabilitation programs [4-6]. Furthermore, the adverse consequences of physical inactivity and the wide range of secondary complications among the disabled are well studied [7-10]. Manystudies have reported how low physical activity exacerbates cardiovascular risk factors including hypertension [7, 9, 10], type-2 diabetes [11] and obesity [12].In addition, evidence is accumulating on the association of a sedentary lifestyle and the increased risk of osteoporosis in people with physical disabilities [13, 14].The link between physical inactivity and development ofpsychiatric disorders, particularly depression and stress,is also well established in this population [8]. Some studies have stated that lower physical activity might triggerthe vicious cycle of less fitness and debilitating dependence in wheelchair dependent individuals [15-17].The influence of physical activity on quality of life(QOL) and psychological well-being has been thoroughly investigated among those with mobility disorders [18-21].

II. DESIGN ANALYSIS OF SCISSOR JACK

Main components of Mechanical Scissor Jack and their functions

The general analysis includes all geometric analysis, force analysis, stress analysis and selecting for machine elements based on those analyses. After selecting the material we have select the elements on standard size. This topic also includes the assumptions of the analysis and it includes the mechanism of the mechanical scissor jack.

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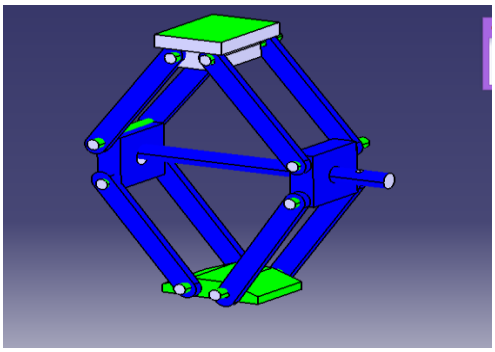

Screw Jack Design

Design Considerations

1. Factor of safety for the assembly is taken **5** due to the nature of the design. Actually the factor of safety is taken 1.5 to 2 in static loading of ductile material. A higher factor of safety is considered due to the consequences of the failure.
2. Selection of Material for the screw and nut is of great importance. There are common materials used in the design of screw jacks like steel for the screw and cast iron, bronze or plastic for the nuts. Mild steel or hard steel is considered for different screw designs. In order to prevent friction cast iron or bronze is preferred for the design of the nut. Cup and frame are made of Grey cast iron which is cheap and has good machinability. Material is selected as following: The effective lifting height is chosen to be **0.5m (500 mm).**

3. Average coefficient of friction between the material soft steel and cast iron is taken 0.10when it is lubricated. But for this specific design, it is taken **0.18** assuming it dry for safe operations.(1)
4. Limiting values for bearing pressure between steel and cast iron is taken **15.05 MPa**.(2)
5. According to agronomists the force of the hand is about 150 to 200 N. In this design we assume that is the handle is rotated by two hands which give **400 N** hand forces for the design of the handle.

Result and Discussion

The design was focused on all processes of conception, invention, visualization, calculation, refinement and specification of details that determine the form of the product. Hence, the said modified wheel chair for disable peoples operates efficiently and effectively, specifically the scissor jack fixed to wheel chair has gone under force analysis so that its performance criterion willnot fail in any sense.

The main physical parameters of the design are determined through the appropriate calculations and some observation considerations with reasonable assumptions. From the force and stress analysis, it was discovered that at the maximum raising of 154.2° the horizontal, tensile force in the opposite direction are the same. It is also the same for minimum raising height of 15°.

The vibration effect from the wheel chair frames and jacks both are welded and also to other parts to avoid vibration during rising and down ward movement operation.

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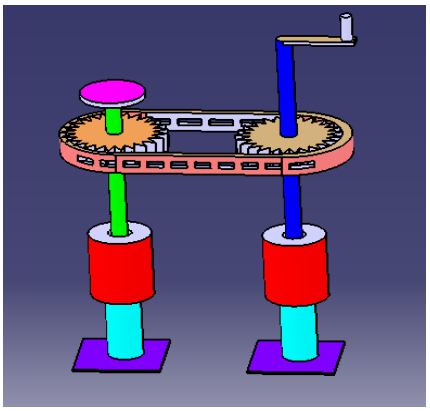

III. CONCLUSION

The existing design was modified by wheel chair with mechanical scissor jack. The jack is attached or fixed to frames and beneath the wheel chair seat of it 150N power or force is applied as a source to generate rotational rotation in order to make load (user weight) lifting easier.

In this modified design, the power screw is rotated through by handle and power transmitted to to connecting members such as arms, pins, to raise the user load. The main advantage of modified wheel chair design over existing design are that the modified designed scissor jack is fixed to wheel chair and it will save energy of users, save time, make simple operation of wheel chair, be faster, easier to operate height required tasks for users and motivate disability people to perform some activity that make them to have opportunity to be help themselves.

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