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Design and Analysis of a Wheelchair for Physically Disabled Individuals

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Preface

Abstract

Numerous senior people and individualities with disabilities live in the world. Some of them are not suitable to move fluently as normal people." This paper proposes the design of a compact, automatic wheelchair aimed at helping individualities with disabilities or the senior move more fluently in confined spaces."
Stair climbing medium is employed substantially for two purposes one is for move on bottom face wheel president and second is for climbing the stair. Elevators and pitches are needed specific space in structures structure. The cost of elevators & lift is so much advanced than this wheelchair.
It's provident & threat evidence operation. It's further helpful for the physical impaired or hindered persons and the persons who are unfit to climb the stairs. So the freedom of mobility for a hindered person increases. This design involves the design of an ergonomically designed electric wheelchair for domestic as well as marketable use by Indian old aged people. The design incorporated stair climbing Functionality through its structure and medium which is primarily composed of three modules. Seat, links and frame.

INTRODUCTION

Overview

Stair climbing medium is employed substantially for two purposes one is for move on bottom face wheel president and second is for climbing the stair. In so numerous government associations, seminaries, and structures have no special installations give like elevators, ramp, lift and pitches for physical impaired or hindered persons. Elevators and pitches are needed specific space in structures structure. The cost of elevators & lift is so much advanced than this wheelchair. When carrying a person in a light weight wheelchair the number of sidekicks may not bear on bottom face. Means for stair climbing and descending requires single person for support and maintain the balance.

The electric section has DC motor of high necklace, power window motor and batteries. The electronic section has a Joystick to guide the movement of the wheel president. It's provident & threat evidence operation. It's further helpful for the physical impaired or hindered persons and the persons who are unfit to climb the stairs. So the freedom of mobility for a hindered person increases. Numerous kinds of models had been designed, extending into broad range of products. This design involves the design of an

ergonomically designed electric wheelchair for domestic as well as marketable use by Indian old aged people. Stair climbing functionality is bedded in the design through its structure and medium. The product substantially consists of 3 modules viz. seat, links and frame. The design is validated by developing CAD models of individual corridor are generated in CREO PARAMETRIC 3.0 and are assembled to form the final product. Necessary simulations of the product are generated in virtual terrain of creo.

TYPES OF WHEELCHAIRS

The wheelchair are used for physically disable person for moving one place to another.

Electric Wheelchair

The first electric wheelchair was constructed by George Klein to help wounded dogfaces during. World War II. With time, it has evolved into numerous designs and forms. The power chairpersons comprise a range of functions like reclining, tipping, seat elevation, chin regulator, hand regulator and numerous further. Some of the models are movable that's they can be disassembled and carried along while travelling. The electric wheelchair is characteristically distributed into three orders.

The frontal wheel powered president it's a power president for inner purposes. This is a four- wheel driven president and is most flexible among the lot. The hinder wheel powered president it's a power president eased for outdoors. Being reverse wheeled, they're applicable for rugged roadside wheel powered president. This electric wheelchair is relative for indoors but it has sturdy steering functions.

The Heavy Duty Wheelchair

The heavy- duty power wheelchair. It's designed to be used for out-of-door explanation and can be customized on the base of individual musts. It can be used for travelling over coarse shells. These power chairpersons can only be transferred with the backing of lifts and ramps.

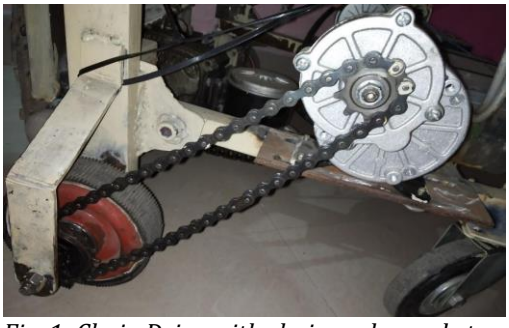

Fig. 1: Chain Drive with chain and sprocket

Transmittable Wheelchair

This type of power wheelchair can be fluently conveyed by virtue of its light weight and therefore it can be disassembled presto and hassle free. Because of its compact size, it's apt for slender doorways and halls.

Powerbase wheelchair

These power wheelchairs are substantially unique because of their advanced battery array. Being unfold suitable, it requires lifts during trip. It's suitable for both out-of-door and inner trip.

Sports Wheelchair- These chairpersons are acclimatized for sports – similar as basketball, or tennis or bowling etc.

Mobi Electric Folding Wheelchair

This wheelchair is operated like a habitual homemade wheelchair. While the stoner pushes on the hand skirting's, force detectors in the skirting's perceive the stoner's physical trouble and adjoin supplementary power to the bus. The physical movement can be likened to power steering in an auto. A tone- balancing technology is integrated that places the stoner in the center of graveness while balancing on two bus. The annihilation of the demand for castor bus leads to further condensed and maneuverable medium. The lithium ion batteries which power the electric servo motors are positioned in the base of each of the mecca less bus and are rechargeable, giving the vehicle a range of roughly 20 km with one charge.

DESCREIPTION OF COMPONENTS

The project consists of following main components:

Chain Drive: The chain drive is used for the transmission of power from middle shaft to the shafts on both front and backside of the wheelchair. The chain used is of Simplex type and the pitch between them is ½ inch (12.7 mm). The chain drive used consists of one bigger sprocket and one smaller sprocket. The sprockets are mounted on the shaft with the help of bushing.

Ball Bearings : A ball bearing is a specific type of rolling-element bearing that employs spherical balls to maintain space between its races. The primary function of a ball bearing is to minimize rotational friction and to support both radial and axial loads. This mechanism consists of at least two races that house the balls and facilitate the transfer of loads through these balls. Typically, one race remains stationary while the other is attached to a rotating assembly, such as a hub or shaft. When one of the races rotates, it causes the balls within to roll, significantly reducing friction compared to sliding surfaces. This rolling action results in a substantially lower coefficient of friction, enhancing efficiency and longevity in various applications..

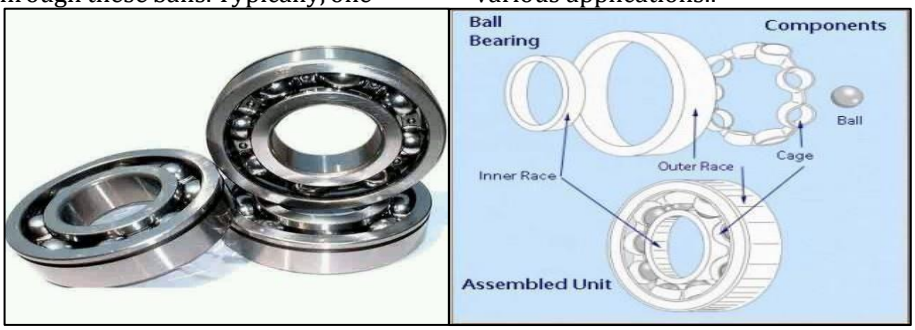

Fig.2: Ball Bearing

Ball bearings are commonly utilized in various applications that involve moving components, each with its own specific features and requirements.

- Hard drive bearings used to be highly spherical and were considered the best manufactured shapes, but this is no longer the case, as an increasing number are being replaced with fluid bearings. During World War II, German ball bearing factories were frequently targeted in Allied aerial bombings due to the critical role that ball bearings played in the
- In horology, the company Jean Lassalle designed a watch movement that used ball bearings to reduce the thickness of the movement. Using 0.20 mm balls, the Caliber 1200 was only 1.2 mm thick, which still is the thinnest mechanical watch movement.
- Aerospace bearings, utilized in various applications such as pulleys, gearboxes, and jet engine shafts in commercial, private, and military aircraft, are made from several materials including M50 tool steel (AMS6491), carbon chrome steel (AMS6444), corrosion-resistant AMS5930, 440C stainless steel, silicon nitride (ceramic), and titanium carbide-coated 440C.Skateboard wheels each contain two bearings, which are subject to both axial and radial time-varying loads. Most commonly bearing 6000ZZ is used (a deep groove ball bearing from series 60 with 14 mm bore diameter).

Fig 3 3: Step-Shaft

Shafts: The shafts are used for transmitting the power from one component to other. The output power in the form of rotation is to be given to the other part of machine to do the required work. In our project, the motion from motor is to be transmitted to the chain drive, which in result makes the rotation of wheels. In addition, the powered high torque rotation from the industrial motor is to be transmitted with the help of shaft to make the profile work to climb the stairs. A typical type of step shaft is shown in figure below.

Worm and Worm Gear Arrangement: The worm and worm gear arrangements is used and has the major role of interlocking the profile transmission .

Fig 4: Worm and Worm Gear Arrangement

Nut & Bolt: For fastening two different mechanical parts the nut and bolts are used. The different size of nut & bolt are available in market today. The threading on bolt is external while that in the nut is internal. The nut and bolt are mated by screwing one or the other or both The strength of nuts and bolts depends on the ratio of size of nut and bolt to the threads in/on them. Hence, proper selection of nut and bolt is very important.

Gear DC Motor: The motor is an electrical component which converts the electrical power into mechanical rotation of the shaft interlaced centrally into the core windings. There are many types of electrical motors which runs on DC circuit or on AC circuits. A DC gear motor runs on a voltage DC battery whereas AC motor runs on AC circuit directly. As in our project, the DC gear motor is used which runs on DC supply. Also, the motor produces high capacity torque with the speed of 2800rpm. This high capacity torque is used to rotate the conveyer belt to make the wheel chair climb the stairs easily. Fig 3.6 shows dc gear motor .

Fig 6: Gear DC Motor

CONSTRUCTION & WORKING

Construction: As we discussed earlier the problem associated with the use of other mechanism like try wheel mechanism causes a problem of limitation of stair type and hence the purpose of climbing of stairs is not properly done. To overcome this problem; we introduced a new mechanism. Which helps to climb the stairs without occurrence of climb .The introduction of climbing mechanism into this wheelchair reduces a many problems associated with other wheelchairs.

The construction associates for the fabrication of stair climbing wheelchair consists of following:

1 Mild Steel Frame 4 Battery 7. Chain
2 Gear Box 5 Belt 8. Shaft
3 Geared DC Motor 6 Wheel 9. Joystick

Body is fixed using Welded and bolted Joint. The seat is designed ergonomically as per the human comfort. The backrest and bottom of the seat is cushioned for providing comfort to the person sitting on it. The seat is mounted on the frame of the wheelchair.

The DC gear motors are used for the working of profile, which is used to climb the stairs mechanism.

A separate motor is provided for rear portion consisting of conveyor belt.

These motors are of speed of 2800 rpm. The power consumption of the motor at load condition is 250 watts and that of at unload condition is 125 watts. The motor shaft is connected to worm wheel, which is then further used for power transmission

Motors and controllers are mounted on the body. Two motors are provided for forward and reverse motion. The motors transmit power through chain drive. The bearings are mounted on the shaft .The bearing used is ball bearing 6202zz which is mounted on a shaft on which worm gear is mounted. The profiles are mounted on this same shaft. The bearing housing are used for the supporting the bearing.

The sprocket is attached on the both side of the shaft symmetric to the centre of shaft with the help of bush. The two simple motors of 2800 rpm are used for

Driving the wheel normally. These motors are assembled side on the seat frame so that wheels can easily drive. For the transmission of power from middle shaft to main shaft, chain drive is used. Four chain drives are used for the power transmission. The chain drive consists of one bigger sprocket and one smaller sprocket driven by a chain. When the Joystick is operated motion of the wheel chair is obtained Forward, Backward, Right Left & 360 Degree Rotation.

Gear box is provided to reduce the speed and multiply the torque .The worm and worm gear are used for locking the profile while climbing and down staring the stairs. The worm wheel is mounted on the shaft of DC gear motor and the worm gear is meshed with it which is mounted on the profile shaft and which provides interlocking while climbing and down staring purpose.

Battery used is lead acid storage batteries which can be recharged. The lead acid DC battery of 24 volts is used to supply the necessary voltage to the necessary components. This battery is attached at the bottom of the seat. Bluetooth control system is also provided for operation. Wheels are mounted at the base of the legs which gives it the required mobility.

Working: In the working of Design & Analysis of Wheel Chair Physical Disabled person initially power transmit from 24 V battery to motor having rpm 2800 help to drive wheelchair smoothly on plane floor. The power is transmitted to the wheel through chain drive. While running wheelchair on plane floor to provide turning motion two small wheel are attached to wheel in front, which able to turn wheel chair in any angle and can provide turning effect 360 degree. The power is supplied to the motors through a joystick. It provides four degree of freedom to the chair. The main purpose of "DESIGN & ANALYSIS OF WHEEL CHAIR FOR PHYSICAL DISABLED PERSON" Is to climb stair with only one human support. In these chair only physical disable or handicap person which sit on chair he can easily operate that wheel chair easily. While climb stair the profile which connect to wheelchair help to mount on stair in proper way and with the help of gear DC motor which provide rotary motion to the mechanism. A separate motor and gear box is provided for climbing mechanism. For climbing the motor on one staircase, the rear attachment is opened. This jacks the wheel a little upward and brakes the contact between ground and wheels. A firm contact is obtained between rear belt and stairs. When the button is pressed belt starts rotating and make one chair to climb the stairs. In case motor is stop during the climbing the stair the worm and worm gear arrangement is attached to the motor, which will restrict the reverse motion of chair and lock the chair in its position, which protect the handicap person from dangerous accidents. In wheelchair seat arrangement also play an important role in stair climbing wheel chair .The arrangement of seat is made in such a way that handicap person feel comfort in sitting when chair climbing stair. While climbing stairs to keep the position of set in such a way that centre of gravity of wheelchair in centre and whole weight of wheelchair in centre of wheelchair. To keep the position of set with respective to maintain centre of gravity in centre and maintain set in straight position that makes the balance of handicap person, avoids accident, and misbalanced of person.

RESULT & CONCLUSION

"Design & Analysis of Wheel Chair for Physical Disabled Person" was analyzed and it shows the fulfilment of all the parameters considering before designing such as stability of wheelchair while climbing stairs, by balancing centre of gravity. The chair can be used on road as well as on stairs with control in the hand of person seated i.e. the handicapped person can operate this chair by his own, that it fulfilled the independence parameter. The chair is economical with multi-feature which shows the fulfilment of ergonomic principle.

FUTURE SCOPE

The future enhancement of our project is to help major sector of medical. In this wheel chair can used for therapist like steam, cooling, vibration on upper body or back side of physical disabled patient.

- The seat can be adjusted using the actuators and hence the system can be work as a stretcher, if extra actuator will be provided.
- The chair can made fully automatic if we use different sensors for its operation instead of

joystick.
From economically view the solar panel used for charging the batteries no need to go outside for charging the battery & also wheel work on standby time.

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Kulkarni S. B, Thakare A. J , Tamann S. H , Roman G. S, Karankoti S. V **Design and Fabrication of Wheelchair-to-bed System Using Fluid**