Electric Powered Wheelchair

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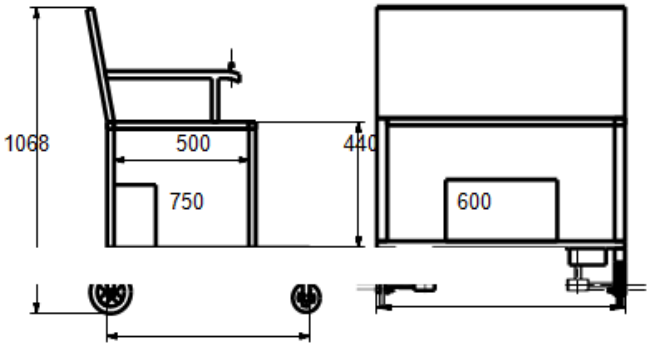
Abstract- *First wheelchair model evolved long back in 18th century, but rapid development in this field initiated since mid of 20th century. Since then, many varieties of models had been designed, extending into broad range of products. This project involves the design of an ergonomically designed electric wheelchair for domestic use by Indian old aged people. Stair climbing functionality is embedded in the design through its structure and mechanism. The product mainly consists of 3 modules viz. seat, links and frame. Anthropometric measures are considered in the dimensioning of seat. The frame and wheels are designed and developed through the equations generated from the statistical data of dimensions of staircases in Indian houses. Focus is laid on different parameters such as form, functionality, technology and architecture of the product. The design is validated by developing Digital Mockups generate in CATIA and are assembled to form the final product. Necessary simulations of the product are generated in virtual environment of CATIA.*

Keywords- Design and Development, bar linkage, mini-motor, motorized locomotion, confiscation, zero emission

I. INTRODUCTION

A motorized wheelchair or electric-powered wheelchair is a wheelchair that is propelled by means of an electric motor rather than manual power. Motorized wheelchairs are useful for those who are not able to impel a manual wheelchair or who may need to employ a wheelchair for distances or over terrain which would be strenuous in a manual wheelchair. They may also be used not just by people with conventional mobility impairments, but also by people with cardiovascular and fatigue based conditions. Electric wheelchairs have enhanced the quality of life for many people with physical disabilities through the mobility they afford. The selection of power chair will rely on many factors; including the kind of surface setting the chair will be driven over, the need to settle thresholds and curbs, and clearance widths in accustomed environment. The most fundamental job of the chair is to take input from the user, usually in the form of a small joystick, and decipher that motion into power to the wheels to move the person in the preferred direction. The last few years have seen abundant improvements and models that give the user unmatched control of the wheelchair in terms of both user effort and vehicle aptitude



II. LITERATURE REVIEW

The research and analysis of motorized wheelchairs dates back in time with several scientists and researchers evaluating the stair climbing mechanism. Ghana et al [1] investigate the control of a stair climbing wheelchair used for indoor purposes. This paper evaluates different stair climbing mechanisms viz. crawler type, leg type, hybrid type and wheeled type. The model of a stair climbing wheelchair based on two wheels is generated using MSC Visual Nastran 4D (VN) design software. The humanoid model is developed using requisite anthropometric data. Various forces and torques acting on the wheelchair while climbing the stairs are evaluated. Preferably, the outer support assembly comprises wheels on either side of the chair. An inner support assembly, closer to the centreline of the chair, also supports the seat assembly. Franco et al [2] did work related to development of a stair climbing wheelchair that can move in structured and unstructured environments, climbing over obstacles and going up and down stairs. The wheelchair design is vividly elaborated. The wheelchair consists of a frame, seat and a linkage mechanism connecting the same. The frame consists of a chassis embedded with two motorized locomotion units, a support for two electrical gear-motors, two idle triple wheels units and a battery pack. The seat is a tubular structure that consists of a chair and a pivoting wheel. The linkage mechanism is responsible for

relative motion between frame and seat during stair climbing operation. To successfully climb the stairs, it is required to move the seat backwards, then reorient it and finally lift up the pivoting wheel. When the seat is moved backwards, the centre of mass of the wheelchair shifts to a safe position, and toppling is thus prevented. A four bar linkage is appointed for the same. The linkage mechanism is actuated by a mini-motor connected to a lead screw device. When the seat reaches the desired position the motor is turned off and no extra energy is required to maintain the position. The customer requirements were studied and evaluated after referring them from the DLF (Disabled Living Foundation) factsheet. . This proposed concept is numerically modelled and power calculations for linear actuator are made. Stair ascent and stair descent operations are described along with figures and equations. The control system and the stair edge sensor system are also investigated. The stepping algorithm is discussed in detail. The influence of external factors like cost, weight, aesthetics, range of operation, safety, operational efficiency, comfort are evaluated.

III. PROCESS CYCLE

The foremost electric wheelchair was invented by George Klein with the purpose to help the wounded soldiers of the World War II. With time, it has evolved into many designs and forms. The power chairs comprise a range of functions like reclining, tilting, seat elevation, chin controller, hand controller and many more. Some of the models are portable that is they can be disassembled and carried along while travelling. The electric wheelchair is characteristically categorized into three categories this wheelchair is operated like a habitual manual wheelchair. While the user pushes on the hand rims, force sensors in the rims perceive the user's physical effort and adjoin supplementary power to the wheels. Thus the physical movement is analogous to power steering in a car. A self-balancing technology is integrated that places the user in the centre of gravity while balancing on two wheels. The obliteration of the requirement for castor wheels leads to more condensed and manoeuvrable medium. The lithium ion batteries which power the electric servo motors are situated in the base of each of the hub less wheels and are rechargeable, giving the vehicle a range of approximately 20km with one charge. Wide and ergonomically viable push rims allow an easier grip.

Access is the biggest obstruction for wheelchair users. Despite of the growing market of wheelchairs, utility for users still remains an issue. Healthcare entree for disabled is the principal trial in the India

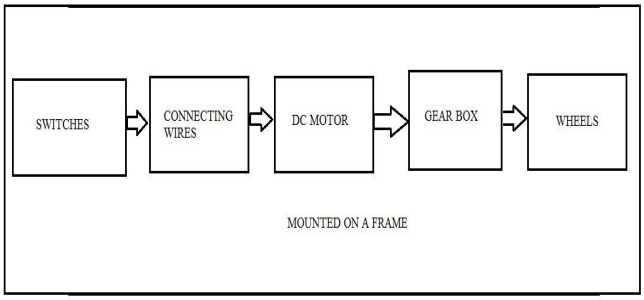


Figure: Construction and Operation

Presently, in India, buildings, toilets, hospitals and other places are not locomotors disabled person friendly. Unpaved, poorly maintained sidewalks that are crowded by vendors are common across Indian cities which impede the movement of people bound to wheelchairs. However the scenario is rapidly altering e.g. some malls have taken initiative by constructing washrooms which are suitable for disabled masses.

IV. CONCLUSION

This project involves the design of an ergonomically designed electric wheelchair for domestic use by Indian old aged people. Stair climbing functionality was the main focus in its structure and mechanism. The product covered 3 modules viz. seat, links and frame. Seat dimensions were calculated following the Indian Anthropometric standards. The frame and wheels are designed and developed through the mathematical calculations based upon from the statistical data of dimensions of staircases in Indian houses. Form, functionality, technology and architecture of the Digital Mock-ups of individual parts were developed in CATIA and assembled to form the product.

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