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Design and Implementation of Automated Staircase for Handicap Person

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Abstract- The stair a case lift is a mechanical device that helps lifts persons and wheelchairs up and down stairs when they may have trouble doing so on their own. A rail is attached to the stair treads of adequately wide stairs. The rail has a chair or raising platform attached to it. The primary goal of this project is to create on both an indoor and outdoor stairlift. A chair that moves up and down a staircase on a motorised rail is known as a stair lift. Elements that maximise ease of use, comfort, and attractiveness in the house, a secure and inexpensive place to live method to address the specific requirements and difficulties that on the stairs, individuals have experiences. The portable stair-lift a mobility aid in the shape of a chair affixed to one side of Stairways facilitates elderly access between floors.

Keywords- Mechanical device, wheelchairs, rail, stair lift.

I. INTRODUCTION

Stair into buildings is one of the most challenging barriers for users of wheeled mobility devices and those with mobility limitations associated with ageing. The significance of this problem should not be underestimated. In Bangladesh, thousands of people aged 65 and older face difficulty climbing steps without resting and many of them uses wheelchair. Traditional solutions for this inaccessibility have typically involved either installation a lift if possible or moving to alternate housing includes a lift. These solutions are costly and sometimes installation of lift is not possible.

Elevators have been identified as effective solutions in terms of speed, capacity, rise and usability; however, the need for adequate space, and the high costs associated with their purchase, installation, and maintenance are significant drawbacks, thus limiting their use in typical home settings. Platform lifts and stair glides remain the 'devices of choice' for small elevation changes in existing homes; however, these also have their limitations. For platform lifts, limitations relating to use, size, speed, capacity, and rise have been identified. The stair-lift found in online and market is much expensive. This work aimed to develop a stair-lift for the disabled persons at low cost which is easier to install and does not affect the aesthetics of the home much. This paper explores the development of a stair-lift which run by chain drive and also design process of the lift.

The need for stairlifts arises from a confluence of demographic trends and the increasing desire for independent living among people with mobility limitations. Here's a breakdown of the key factors:

1. Aging Population

A significant driver is the growth of the global elderly population. As people age, their physical capabilities often decline, making stairs a challenging obstacle. Stairlifts provide a safe and convenient solution to navigate their homes and maintain their independence.

2. Mobility Limitations

Stairlifts address mobility challenges faced by individuals due to various conditions such as: Arthritis Neurological conditions Musculoskeletal impairments Recoveries from surgeries

3. Safety Concerns

Stairs can be hazardous for people with mobility issues, increasing the risk of falls and serious injuries. Stairlifts significantly reduce these risks by providing a secure and controlled ascent and descent.

4. Maintaining Independence

Stairlifts empower people with mobility limitations to maintain their independence and access all levels of their homes. This fosters a sense of dignity and control over their daily lives.

II. LITERATURE SURVEY

Siegwart, R., Lauria, M., Mäusli, P., Winnendael, M., 1998, "Design and Implementation of an Innovative Micro-Rover," International Journal of Computer Vision & International Journal, April 26-30, Albuquerque, New Mexico. This lift runs on electric power and consists of a motor, reduction gear box, rope drive, two rails a sliding chair. [1]

Hsueh-Er, C., "Stair-climbing vehicle, IEEE/RSJ Conference, 2008 In this studying we present the designing and implementation of an electric chair for disabled persons, has the ability to rise on stairs with automatic controlling. It is also economically suitable comparing with that in markets as the cost of normal wheelchair walk only on the planes exceed 1300$, while our chair cost is about 600$ for one piece and this cost may be halved for a line of production.[2]

III. PROBLEM IDENTIFICATION

Imagine a college campus bustling with activity. For many students, navigating between classes, dorms, and social gatherings is a breeze. But for students with disabilities, especially those who use wheelchairs, stairs can present a significant obstacle. Traditional staircases can limit their ability to access different parts of campus independently. Automated staircases could be a game-changer. Cost Considerations for Campuses: Installing automated staircases can be expensive. Budgetary constraints of many colleges might make widespread adoption difficult. Retrofitting existing buildings to accommodate these systems can be particularly challenging due to structural limitations and potential disruptions to campus operations.

IV. DESIGN CALCULATION

1. Maximum Load that can be Carried by Motor

Efficiency of the motor ηm =78%
Maximum Speed =3100 rpm
Gear Ratio = 1:6
Actual Speed = 3100/6 =516.67 rpm.
Gear reduction ratio by worm = 14:1
Speed at carriage = 516.67/14 =36.9 rpm
Now,
Maximum load that can be carried by motor:
$P \times \eta m \times \eta g = F \times v$
$750\ W \times 78 \times 934 = F \times$
$\pi \times d \times N$
60
$46.39 = F \times$
$\pi \times 61 \times 10-3 \times 36.9$
60
F=4638.285 N
F=mg=4638.285N
m=4638.285/9.81=472.91Kg

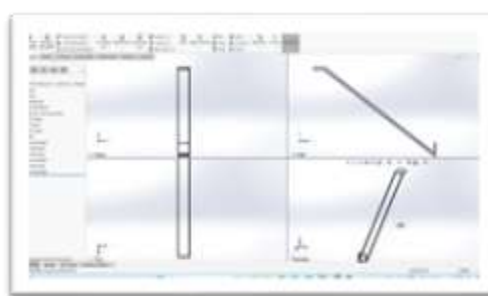

Figure 1: CAD Model of Carriage

V. CONCLUSION

Though making a cost friendly Stairlift had some limitations, it was a good and challenging project for us. Making a stairlift with roller bearing is not a complicated process and all the components are widely available in market. DC motors with control box are now being manufactured for auto rickshaw and this can be directly used in the stairlift. During the test run of this project, it was realized that it would capable of carrying heavy load without suffering any deformation or local fractures if it would go into real world production at an ideal scale. Though the initial cost of the project seemed to be a little bit higher but more accurate manufacturing would shorten this.

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