“Design and Fabrication of Stairs Chair Lift”

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Submitted By

Name	Roll number
Muhammad Ishaq	19F-SCET/UET-ME-032
Aizaz Bacha	19F-SCET/UET-ME-028
Hanif Shah	19F-SCET/UET-ME-036

Supervisor:

Dr. Zaheer ul Hassan

DEPARTMENT OF MECHANICAL ENGINEERING

SWEDISH COLLEGE OF ENGINEERING AND TECHNOLOGY, WAH CANTT

(Affiliated with University of Engineering & Technology Taxila

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‘Design and Fabrication of Stairs Chair Lift’

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Project Supervisor	**Project Co-Supervisor**
Dr Zaheer Ul Hasasn	Engr.Hassan Kazmi

Head of Department

Dr. Liaquat Ali Najmi

DEPARTMENT OF MECHANICAL ENGINEERING

SWEDISH COLLEGE OF ENGINEERING AND TECHNOLOGY,

WAH CANTT

(Affiliated with University of Engineering & Technology, Taxila)

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Abstract

A stair chair lift is a motorized mobility aid created to help people with restricted mobility climb stairs. A comfy chair or seat that safely and easily transports the user up or down the steps is often fitted along the rail or track of a staircase. A stair chair lift's main goal is to give those who have trouble ascending or descending stairs because of physical restrictions including age, disability, accident, or other health issues, a workable and simple option. Stair chair lifts enable users to keep their independence, move freely inside their homes, and reach various levels of the property without exerting excessive physical effort by removing the need for this. The stair chair lift's fundamental design employs a safe and comfortable ride technology, allowing the user to regulate movement using simple controls on the armrest or a portable remote. These elevators are offered in numerous variants to meet a range of stair patterns, including straight, curved, and even outdoor stairs. Overall, stair chair lifts are an excellent form of assistive technology that greatly improves the quality of life for people with limited mobility by allowing them to have more accessibility and flexibility in their own homes.

Declaration

We declare that the work contained in this thesis is our own, except where explicitly stated otherwise. In the addition this work has not been submitted to obtain another degree or professional qualification

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Muhammad Ishaq

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Aizaz Bacha

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Hanif Shah

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Abbreviations

P: Power

I: Current

V: Voltage

N: Newton

m: mass

W: Weight

G: gravity

F: Force

Fr: Fraction Force

IF: Inertial Force

mm: mille meter

Kg: kilogram

η: Rolling Friction

ω: omega

Chapter 1:

Introduction

1.1 Introduction

A stair chair lift, also known as a stair lift or chairlift, is a motorized device that is installed on a staircase to transport people up and down the stairs. It consists of a chair or a platform that is attached to a rail on the staircase, which allows it to move up and down the stairs smoothly.

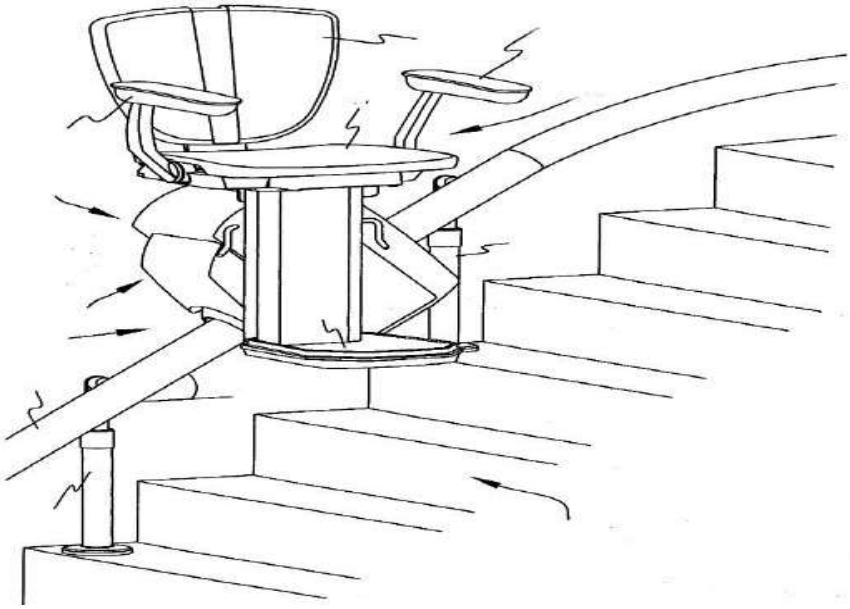


Figure 1.1 Schematic Diagram

Stair chair lifts are commonly used by people who have difficulty climbing stairs due to mobility impairments, such as the elderly or individuals with physical disabilities. They are also useful for people recovering from injuries or surgeries that limit their mobility. To accommodate various stair types and user needs, stair chair lifts are available in a variety of forms and styles. Others are made for curved or spiral staircases, while some are made for straight staircases. While some stair lifts are built only for indoor usage, others are made for outdoor use. People can conveniently reach various floors of their houses without the need for help by using stair chair lifts, which are safe and simple to operate. They can also assist people in preserving their freedom and enhancing their standard of living.

1.2 Aim & Objectives

The aim of this project is to produce a stair chair lift that can bear maximum load at 80kg to a height of 7ft safely at an angle of 25 degree.

- Design and fabrication of chair with electromagnetically operated mechanisms.
- Design of wall mounted rail for lifting of chair.
- Design and fabrication of low cost environment friendly stairs chair lift.

1.3 Historical Background

Since the early 20th century, the idea of using a chairlift to help persons with mobility issues climb stairs has been around. C.C. Crispen, a businessman from Pennsylvania, created the Inclinator, the first stair lift intended for private use, in 1923. It was manually operated with a hand crank and was made of a wooden seat that was fastened to a rail on the stairs.

In the 1930s, stair lifts became more popular in Europe, and companies such as Stanch Stair lifts and Acorn Stair lifts began producing and selling them. In the United States, stair lifts gained popularity in the 1950s, and companies such as Bruno Independent Living Aids and Harmer Mobility began producing and selling them. [1]

Over the years, stair lift technology has evolved to include motorized and battery-operated lifts, as well as designs for both straight and curved staircases. Modern stair lifts are equipped with safety features such as seat belts, swivel seats, and sensors to prevent accidents and injuries.

Today, stair lifts are widely used by people with mobility impairments, including the elderly, individuals with physical disabilities, and those recovering from injuries or surgeries. They provide a safe, convenient, and reliable means of transportation on stairs, helping people to maintain their independence and improve their quality of life.

1.4 Theoretical Studies

Theoretical research on stair chair lifts includes studies on the biomechanics of stair climbing and the design of stair lifts to suit various staircase types and user requirements.

Biomechanics studies have focused on the stresses and strains placed on the body during stair climbing and how these can be minimized through the use of assistive devices such as stair chair lifts. These studies have examined factors such as joint loading, muscle activity, and energy expenditure during stair climbing, and have shown that stair chair lifts can significantly reduce the physical demands of climbing stairs for people with mobility impairments.

Design studies have focused on the development of stair lifts that are safe, comfortable, and convenient to use for a wide range of users. These studies have examined factors such as seat design, control mechanisms, safety features, and ease of installation and maintenance. They have also explored the use of different materials, such as aluminum and steel, to optimize the strength and durability of stair lifts while minimizing their weight and bulk. Other theoretical studies related

to stair chair lifts include studies on the economics of stair lift installation and use, as well as studies on the psychological and social effects of using assistive devices on stairs. These studies have shown that stair chair lifts can be a cost-effective solution for improving accessibility and mobility for people with disabilities, and that they can also have positive effects on user confidence, independence, and social participation.

1.5 Problem statement

A stair chair lift is a device that is designed to assist individuals who have difficulty climbing stairs. The problem statement for a stair chair lift could include a variety of considerations, such as:

- Accessibility: The primary problem that a stair chair lift aims to solve is to provide easy access to different levels of a building for people with mobility challenges.
- Safety: A stair chair lift needs to be safe and secure to use. This means that it should be designed with safety features such as seat belts, sensors, and emergency stops.
- Comfort: The stair chair lift should be designed with comfort in mind, so that users can ride comfortably up and down the stairs.
- Reliability: The stair chair lift needs to be reliable and efficient, so that it can be used on a regular basis without any problems.

Overall, the problem statement for a stair chair lift would focus on providing a safe, reliable, and comfortable means of accessing different levels of a building for individuals with mobility challenges.

1.6 Installation

A stair chair lift's installation procedure can change depending on the lift's design and the staircase's layout. However, the general procedures for a straight stair chair lift installation are as follows:

- Assessment and measurement: The first step is to assess the staircase and take accurate measurements to ensure that the lift fits properly. The installer will also evaluate any obstructions or obstacles that may affect the installation process.
- Mounting the rail: The installer will mount the rail of the lift on the stairs using brackets and screws. The rail is typically mounted on the stairs, not the wall, to provide stability and support.

- Installing the chair or platform: Once the rail is mounted, the installer will attach the chair or platform to the rail using the provided hardware. The chair or platform is typically attached to the rail with brackets or clips.
- Wiring and power: The installer will then connect the electrical wiring and power source for the lift. Some lifts operate on battery power, while others require a direct electrical connection.
- Testing and final adjustments: Once the installation is complete, the installer will test the lift to ensure that it is functioning properly. They may also make final adjustments to the lift, such as adjusting the speed or the position of the chair or platform.

The installation of a straight stair chair lift is often a quick and easy process that can be finished in a few hours. On the other hand, installing a curved or specialised lift might be more difficult and time-consuming. To make sure the lift is built correctly and is safe to use, it is advised to hire a professional installer.

1.7 Experimental Setup

Depending on the experiment's goals, different stair chair lift experimental setups may be used. But a few of the elements that might be present in an experimental setup are as follows:

Staircase: A set of stairs is required to conduct experiments on stair chair lifts. The stairs can be straight or curved, and their dimensions may vary depending on the experiment's objectives.

Stair chair lift: The stair chair lift itself is a critical component of the experimental setup. The lift may be a standard straight or curved lift or a customized version designed for specific research purposes.

Sensors. A sensor is a device that detects and responds to some type of input from the physical environment.

1.8 Components of chair stair lifting

1. Track or Rail

The component of the stair lift that directs the user's travel between floors is the track. The chair is moved along the track or rail by use of cables or a gearing system.

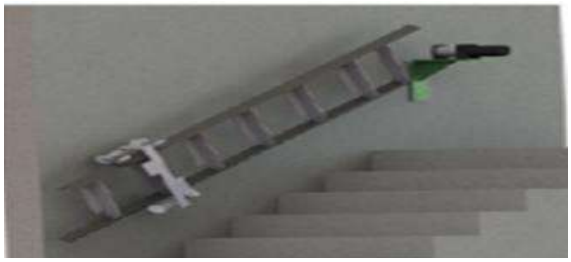


Figure 1.2 Rail

2. Motor

The component of the stair lift that directs the user's travel between floors is the track. The chair is moved along the track or rail by use of cables or a gearing system.

Figure 1.3 Motor

3. Chair

The component of the stair lift that holds the user while travelling from one location to another is the chair, which is also referred to as a carriage at times. The seats themselves have various designs and functions to maximise comfort, safety, or use for users as they are the component of the stair lift that they contact with most directly.

Figure 1.4 Chair

1.9 Working

The working of a stair chair lift can vary depending on the specific design and manufacturer of the lift. However, the following is a general overview of how a typical straight stair chair lift works:

The user sits on the chair or platform, buckles the seatbelt, and places their feet on the footrest. The user uses the control panel to start the lift, which activates the motor and begins moving the chair or platform up or down the rail. As the lift moves along the rail, it maintains a stable and level position using a system of sensors and stabilizers. When the lift reaches the top or bottom of the stairs, it automatically stops, and the user can use the control panel to get off the lift. When the lift is not in use, it can be folded up and out of the way to allow others to use the stairs.

Some stair chair lifts may have additional features or capabilities, such as the ability to turn corners or to adjust the speed of the lift. Curved stair chair lifts, for example, use a different type of rail and a more complex system of sensors and motors to navigate curved staircases.

Stair chair lifts are designed with safety features such as seatbelts, emergency stop buttons, and sensors that detect obstructions on the stairs to ensure the safety of the user. It is important to follow the manufacturer's instructions for proper use and maintenance of the stair chair lift to ensure its safe and efficient operation.

1.10 Advantage

Stair chair lifts offer several advantages for people with mobility impairments. Some of the main advantages include:

Increased mobility: People with mobility issues can move between levels of their houses or businesses securely and easily using stair chair lifts instead of climbing steps.

Independence: Stair chair lifts allow users to maintain their independence and continue living in their homes or buildings, rather than having to move to a new location that may be more accessible.
Safety: Stair chair lifts have safety features such as seatbelts, sensors, and emergency stop buttons that ensure the safety of the user while using the lift.
Convenience: Stair chair lifts are easy to use and can be operated with simple controls. They also do not require any major modifications to the structure of the building.
Cost-effective: Stair chair lifts are generally more cost-effective than installing an elevator, especially for straight staircases.
Customizable: It is possible to customize stair chair lifts to meet the unique requirements of the user and the design of the staircase.
Overall, stair chair lifts provide a safe, convenient, and cost-effective solution for people with mobility impairments to move between floors of their homes or buildings. They also offer users the independence and freedom to live their lives without limitations.

1.11 Disadvantage

While stair chair lifts offer many advantages, there are also some potential disadvantages to consider, including:
Limited mobility: Since stair chair lifts are made to transport people up and down straight or curved steps, they might not be appropriate for all kinds of stairs, including spiral stairs or stairs with unique curves.
Installation requirements: Installing a stair chair lift may require modifications to the home or building, such as installing electrical outlets, reinforcement of the staircase walls, or building a platform at the top or bottom of the stairs. These modifications can be expensive and time-consuming.
Maintenance: Stair chair lifts require routine maintenance and servicing, just like any other mechanical gear, to guarantee their safe and dependable operation. When parts need to be replaced, maintenance can be expensive and time-consuming.
Cost: Even though stair chair lifts are frequently less expensive than elevators, they can still be costly, particularly for curved or intricate staircases.
Access for others: It may be difficult for other people to utilize the stairs if there is no room for stair chair lifts on the staircase. In the event of a fire or other emergency, they might also restrict entrance for first responders.

Overall, while stair chair lifts offer many benefits, it is important to consider the potential limitations and drawbacks before deciding to install one. It is also important to work with a reputable and experienced installer who can help you select the right type of lift for your needs and ensure it is installed and maintained properly.

1.12 Result Expected

The expected results of installing a stair chair lift are increased mobility, independence, and safety for people with mobility impairments who have difficulty climbing stairs. By using a stair chair lift, individuals can move between floors of their homes or buildings more easily and safely, without having to rely on others for assistance. This can help to improve their quality of life and allow them to remain in their homes for longer periods of time.

1.13 Works Schedule Plan

Phase	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Jun
Data Collection												
Design and Fabrication												
Experimental Work												
Results												
Analysis												

1.14 Project plan

The total duration of the project is 12 months which is further divided into following four phases.

Phase 1 (Collection of relevant literature and data)

The estimated time for this phase is 3 months in which different literatures will be studied.

Phase 2 (Design and Fabrication)

Design and fabrication phase we can act or process of fabricating and Design.

Phase 2(Experimental Work)

Experiments will be performed on test rigs for analysis under fretting fatigue. The estimated time for this phase is 4 months.

Phase 3 (Compilation of Results)

The Estimated time for this will be 2 Months.

Phase 4 (Analysis of Data)

The estimated time for this will be 3 months.

1.15 Things learnt while working on project

Technical knowledge: Working in stair chair lift requires a good understanding of the technical aspects of the lifts, such as the mechanics, electronics, and electrical components.

Safety protocols: Safety is of utmost importance when it comes to stair chair lift installation and operation. Employees must be well-versed in the safety protocols and regulations to ensure that installations are completed safely.

Customer service skills: Stair chair lift installation companies must provide excellent customer service to ensure customer satisfaction. Employees must be friendly, approachable, and able to answer any questions or concerns that customers may have.

Attention to detail: Installing a stair chair lift requires a keen eye for detail. Employees must ensure that the lift is installed correctly and in the proper location.

Time management: Stair chair lift installations often require multiple steps, and employees must manage their time effectively to ensure that projects are completed on time.

Physical fitness: Stair chair lift installation can be physically demanding, requiring employees to be able to lift heavy objects and work in tight spaces.

Communication skills: Employees must communicate effectively with customers, as well as with other members of the installation team, to ensure that the installation process runs smoothly.

1.16 Details of project SDGS

A stair chair lift can contribute to several Sustainable Development Goals (SDGs), including:

Good Health and Well-being (SDG 3): A stair chair lift can help individuals with mobility impairments to move around safely and independently, which can improve their physical and mental health and well-being.

Reduced Inequalities (SDG 10): A stair chair lift can help reduce inequalities by providing individuals with disabilities or mobility impairments with access to public spaces, buildings, and services that they might not otherwise be able to access.

Sustainable Cities and Communities (SDG 11): Installing stair chair lifts in public buildings, such as hospitals, government buildings, and commercial spaces, can help create more accessible and inclusive communities.

Decent Work and Economic Growth (SDG 8): The installation and maintenance of stair chair lifts can create employment opportunities for people in the construction and manufacturing industries, contributing to economic growth.

Innovation and Infrastructure (SDG 9): The development and installation of stair chair lifts requires innovative technology and infrastructure, which can drive progress towards sustainable and inclusive communities.

Chapter 2

Literature review

2.1 Mechanism to Lift Load over Stair

(Shen Yuan and Paolo Boccotti) (January 1988)

There is no possibility of harm due to the design's extreme safety failure of the wheels and frame under typical circumstance. Because of how easily and cheaply it may be used, stair case sliders are adaptable. Making a low-cost stair lift was a good and challenging project for us because it has some limitations but also has a lot of benefits. The procedure of building a stair lift with roller bearings is simple, and all the necessary components are readily available in market, we bought it. Produced DC motors with control boxes for auto rickshaws, and this utilized right in the stair lift. This project's test run revealed that it would be capable of hauling without any difficulty, a hefty load. [1]

2.2 Mapping wheel chair function and their associated functional elements for stair climbing

(Abhishek verma, siddhant shrivastava, janakarajan Ramkumar) (25 May 2022).

The accessibility and assistive requirements of a person with a locomotors disability are taken into consideration while designing wheelchairs. An examination of the literature on WC functions reported for both stair climbing and plane surface movement is necessary in order to undertake a comprehensive design for a stair climbing wheelchairs. Reviewing the literature on wheelchair prototypes and products reveals a design gap for users' functional needs. The literature on stair climbing technology focuses mostly on the capacity to climb stairs rather than on other functional requirements like safety, riding comfort, seat comfort, manoeuvrability, etc. [2]

2.3 Design Analysis of Stair-Climbing Planetary Wheelchair

(Lixin Fang, Tao Wenhao and Kui Yuan)(June 2012).

According to the Globally Disabled Report, the number of patients with impairments is rising daily and accounts for around 15% of the global population. According to the Census of 2001, there are about 21 million people in India who are either completely or partially unable to move (27.9%). All members of a civilized society, including those with disabilities, should have access to decent living conditions In comparison to other types of stair climbing wheelchairs; planetary wheel mechanisms offer a significant advantage due to their flexible movement, superior stability, and

Minimal center of gravity fluctuation. As a result, we decided to use a planetary wheel mechanism in our design for our walking mechanism. [3]

2.4 Development of Stair Case Ramp

(Prashant Rahate, Swapnil Choudhary, Bharat Chede) (19 June, 2020)

There are many elderly and physically disabled people in the world, and they have a harder time climbing stairs than regular people do. The assignment is designed in order to help them and those who are unable to raise money since their dwellings are modest. The most extreme circumstance for this project is to create a mechanism that will allow them to be raised and lowered whenever necessary and at a very low cost. A stairway with an escalator is a mechanical device for raising and lowering people. On the steps, which have a platform attached to them, rail is laid. Through a simple mechanism comprising a rope and pulley, the platform is raised by kilometers. Person The wheelchair is small in size because to its design, therefore it able to move around on practically every step that we encounter in buildings such as businesses, enterprises, and some houses. The design is made very safe and there is no chance of failure of the wheels and frame under typical circumstances. The experiments that were done showed that the stair ascending wheelchairs can support loads of up to 100 goons an even surface. It is capable of ascending a flight of a flight of 40-degree steps pulling a 55-kg load. The wheelchair is small in size because to its design, therefore it able to navigate practically all of the stairs we encounter at institutions, workplaces, businesses, and even some residences. [4]

2.5 Design of stair climbing cart mechanism for heavy load lifting

(Vimlendu vatsavan, Survakat kumar, Deep Ambat) (12 March 2021)

Stair climbing mechanism is primarily used for two reasons, one is to make wheelchair climbing stairs and the other is to move heavy objects. It is more important for the mentally disabled and the individuals who cannot climb the stairs. While the range of movement for a disabled person improves and heavy items can be moved by stairs from the ground floor to the top floor. Details of the design mechanism for a cart that climbs stairs while carrying up-heavy items have been covered in this study. As the human effort required lifting big weights approximately linearly increases with the mass to be lifted, our proposed design is safe, affordable, and efficient for hauling up stairs, particularly the heavier goods. As our design is independent of the physical environment and state of the stairs, our calculations may work effectively in all scenarios. This may make our design

Universal in nature for actual practical applications, such as in academic institutions, in particular. [5]

2.6 Design and Analysis of Motor Operated Load Carrying Stair Climber

(Vivekananda Swamy, Abdul Khurshid, and Nagendrappa) (April 2021)

At our daily lives, we may have to transport a lot of different kinds of products up and down stairs, especially in offices, schools, and universities. Hotels, businesses, flats, and other buildings where there may not be lift service, may be overcrowded, or may be undergoing maintenance. Manually carrying various goods up stairs for a higher floor repeatedly is highly exhausting. The majority of buildings do not have lifts built; therefore carrying materials there requires only human work. The cost and time of labor are rising, and the growth rate is turning negative. If a trolley can hoist loads while moving through steps, this difficulty can be overcome. In this work, a brand-new approach of carrying loads up stairs is presented. The car is built in such a way The load carrier is made to support loads of up to 150 kg.The load carrier may be used to ascend or descend stairs. The load carrier can ascend stairs with a height of up to 7 inches. The load carrier is simple to use. In comparison to the items on the current market, the load carrier is economically viable. Hospitals, public spaces, institutions, offices, businesses, and homes all use it. The load on the load carrier doesn't experience any jerks or imbalances because the motor speed is modest. Additionally, the design of the elevator reduces vibrations caused by stair climbing and descending. [6]

2.7 Design of an Anti-Slip Mechanism for Wheels of Step Climbing Robots.

(Bishakh Bhattacharya, Harutoshi Ogai, and Kohei Tatsumi)(30 Oct 2021)

In this article, an anti-slip mechanism for the wheels of step climbing robots is designed. An array of proposed mechanisms is attached to the wheels of the robot to eliminate the possibility of slipping while maneuvering on stairs. The mechanism enables the robot to clamp on the edges of stairs to prevent the slipping while climbing stairs. This will make it capable of providing efficient and safe climbing operations. Furthermore, using the relationships obtained for the proposed mechanism, a 3D model of the mechanism is developed for a wheel of diameter 580 mm. The performance of the model is found to be satisfactory and verified through Von-Misses stress and deflection analysis under an applied load up to 250 N. The factor of safety in the stress analysis of the mechanism is found to be 3.025. The proposed mechanism may be attached to the wheels of wheel-based robots. This will reduce the risk of the slipping of wheels on the edges of a stair, which in turn improves the climbing capabilities of the robot on the stairs. Such robots may be used for the

Door-to-door delivery robots, where robots need to climb up/down the stairs of a building to deliver goods at the door. Another application of such a system is to use it in exploration or rescue robots where human deployment is a risky operation. In the future, optimization analysis may be performed to optimize various link parameters. A prototype will be developed and experiments will be carried out to ensure the safe operation of a step climbing robot while climbing up or down the stairs. [7]

2.8 Electrically operated stair lift for differently abled person.

(Naresh, Arunkumar, Suriya Vinodh and Radjaram) (16 March 2019)

As for how the project functions overall, the structure was built in accordance with the calculations, which makes operation smooth and vibration-free. The effectiveness and performance meet expectations, and it operates admirably. The material chosen tends to be resistant to heat and electricity, which is an additional benefit. The calculations are used to determine and set the belt's inclined angle. The belt's angle improves overall. Types of stairs that fall inside the prescribed boundaries. Consequently, the overall effectiveness and efficiency are as follows: As expected, it makes it easier for the user to ascend and descend the stairs. [8]

2.9 Portable Stair Lift System

(Madison Nawi, Faiq Irfan, and Sayed Azman) (24 Sept 2021)

The population of the United States has been moving in large numbers from rural to urban areas in recent decades, with younger generations being the most affected. The answer has been to build vertically because so many people are relocating to cities that, in comparison, have a lot less area for homes. People are relocating into high-rise residences, many of which lack elevators. The need for moving companies has increased as a result, and they now routinely charge exorbitant rates for carrying large things up numerous flights of stairs. The time, labor, physical strain, and liability involved in moving are the main causes of these high costs. Our response is to develop a tool that could help movers move heavy objects up flights of stairs quickly, effectively, and safely. There is a concern about how heavy furniture and appliances will be hauled up to an upper-level apartment when moving into multi-level buildings without the use of an elevator. Due to the time, liability, and physical strain involved in carrying furniture, beds, pianos, and other large items up several flights of stairs, moving companies charge exorbitant charges. Without professional assistance, moving into a home on any story above ground, however, is not realistic. [9]

2.10 Proof-of-concept of a Stair-climbing Add-On Device for Wheelchairs

(Manish Prajapat, Vishwajeet Sikchi, and Javeed sheikh Muhammad) (November 2020)

Accessibility for people in wheelchairs is still a major issue in developing nations. In these nations, many public and private areas are inaccessible to wheelchair users due to congested surroundings and a lack of attention to building rules. Many wheelchair users are forced to stay inside due to this inaccessibility, which reduces their independence, causes psychological problems, and makes it harder for them to integrate into society. Climbing stairs is one of the accessibility issues wheelchair users' encounters, particularly in underdeveloped nations where many buildings lack elevators or ramps. Wheelchairs that can climb stairs have been created to solve the accessibility issue. The two main types of stair-climbing wheelchairs (SCWs) are electrically driven by motors and manually operated. The technologies for stair climbing used by motorized SCWs include track-based. Wheelchairs that can ascend stairs have intricate mechanics for performing sporadic tasks. This paper adopts a new strategy and describes the theoretical underpinnings and creation of a prototype for a novel add-on device for wheelchairs that can climb stairs. The gadget uses a chain-sprocket-activated Hex-wheel mechanism. [10]

2.11 A Novel Human Vital Sign based Wheel Chair Cum Stretcher for Disabled Person

(Kalimuthu kumar, Sakthivel, Pradeeba,and Thavamani) (Nov 2020)

A wheel chair is a type of mobility aid that has been used to allow people with physical limitations or injuries to move around without restriction. Stretchers are the type of equipment that is also utilized for people who need medical attention. Every healthcare professional has challenges when transferring patients from a stretcher to a wheelchair for diagnostic purposes. As a result, numerous studies have been conducted in an effort to find a solution to this issue that affects healthcare professionals. Linkage or mechanical systems are used to connect numerous wheels or stretchers. This approach has a significant drawback because it requires a lot of mechanical strength to change. A literature review on the project's primary topics has been done to help with comprehension. We have examined numerous journal articles about current techniques that are connected to our suggested system in this survey work. The majority of the time, mechanical techniques is used, which are carried out manually by a person in the contemporary health care industry. As a result, we propose a solution based on this survey research, combining mechanical and electrical systems to provide an automated way for transporting wheelchairs and stretchers. It overcomes all shortcomings and offers a special remedy. This automated approach operates in

Accordance with each and every patient's heart rate and is based on that idea. When an irregular heartbeat continues for a predetermined amount of time, medical practitioners can identify the condition. [11]

2.12 Design and Manufacturing of Manually Operated Stair Climbing Mechanism

(Omkar Babar, Dhananjay Godse, Suraj Kadate, and Rahul Patil) (December-2019)

According to this paper, maintaining elderly people's mobility is becoming more and more crucial as other aspects of quality of life, such autonomy or social engagement, are linked to mobility. In this work, a catalogue of functions is offered, which serves as the basis for a methodology platform to design user-adapted modular mobility-supporting systems. The paper starts with an examination of senior people as users, paired with the analysis of mobility and mobility scenarios. Elderly persons face certain unique challenges when using technological systems and accessing both public and private settings. In order to ensure that the product is accepted, it is important to take into account issues of stigmatization as well as uncertainty and fear of using technical systems. The various mechanisms were examined, and the best ones were carefully examined. Their benefits and drawbacks were contrasted. The greatest alternative to an electrically powered chair lift, it might be determined, is a manually controlled stair ascending device. [12]

2.13 Chair stairs lift with the help of phone.

(Rohan Ingle, Bhagyashri Choudhary, and Chinmayee Kawale,) (May 2019)

That he suggested an IOT-based system, which offers the simple means for elderly and physically unable people to navigate stairs. Once your phone is connected to the system, you may effortlessly climb or descend the steps using the app on your phone. In automatic mode, the sensor's clever location makes it possible to navigate stairs with the least amount of human effort. Architecture is portable and affordable, and it takes less time. A battery backup could be added to this system in the future in case of power outages. Only straight staircases can use this technique, which can also be changed to accommodate even turns. [13]

2.14 Design of stair-climbing wheelchair using tri-wheel mechanism

(Vaddeswaram, Guntur, abd Andhra Pradesh) (Aug 2018)

According to "the internationally disabled report," the number of disabled people is rising daily and accounts for close to 15% of the global population. People who are physically disabled have smaller homes, a life that is significantly disrupted, and difficulties interacting with their families. Wheelchairs that can climb stairs are crucial in the lives of individuals with disabilities.

Elevators are being developed and built with the physical disabled and elderly in mind by society today, however they cannot be built everywhere. Even with assistance from others, disabled people find it challenging to move from one location to another because utilizing a regular wheelchair is cumbersome for them. Due to a lack of services, physically challenged people typically stay in their homes. The tri-wheel system, which has a compact structure and can handle flat or incline terrain, stairs, and obstacles, is used in the design of the stair-climbing wheelchair. To increase frictional force and offer a smooth power transmission for climbing stairs, the quasi-planetary wheel frame was chosen as a tri wheel frame. The shaft diameter is calculated theoretically by taking into account several factors. Wheelchair parts were software ANSYS was used to examine the model created in Solid Works. [14]

2.15 Design of Stair lift for Curved Path

(Ruturaj Kulkarni, Bhumin Patel, Chinmesh Mulay, and Rohit Bhaskar) (May/June 2018)

A system is divided into smaller components known as modules or skids that may be independently built and then used in multiple systems using the modular design, also known as modularity in design. Functional division into distinct, scalable, reusable modules; strict usage of well-defined modular interfaces; and adherence to industry standards for interfaces are characteristics of a modular system. Modularity gives other advantages like augmentation (adding new solution by just plugging in a new module), exclusion, and cost reduction (due to less customization and quicker learning time). Remanufacture engineering is employed in this design concept for the stair lift. The company can cut costs by employing the remanufacturing plan towards the end of the product lifecycle. And significantly increase competitiveness. It will be challenging to remanufacture a product towards the end of its lifecycle if the remanufacturing process is not taken into account while it is being created, as some of the components and parts may have been worn out severely and left unusable. Therefore, in order to simplify product reuse, upgrade, and maintenance as well as to make it simpler to disassemble and recover, remanufacturing characteristics must be taken into account throughout the product design phase. [15]

2.16 Metabolic effect of breaking up prolonged sitting with stair climbing exercise snacks

(Hossein rafiei, Omidian, Mytee-cote, and Little JP)(Jan 2021)

Cardio metabolic issues are linked to extend sitting. The goal of the study was to determine whether short bursts of stair climbing exercise may reduce postprandial insulin, glucose, and free fatty acid responses after extended periods of sitting. Twelve young males of healthy weight and

Eleven adults with overweight/obesity participated in two experimental conditions. I Sitting for Nine Hours and Snacks for Stair Climbing, eight minutes and thirty seconds every hour. The same high-glycemic index meals were ingested under each circumstance at 0, 3, and 6 hours. In this studies have shown that stair climbing had no favorable effects on attenuating glucose or insulin levels or improving insulin sensitivity assessed by an oral glucose tolerance test in healthy participants. For example, it has been suggested that healthy, insulin-sensitive individuals have limited capacity to respond to short bouts of activity because of the exercise being of too low intensity/volume, relatively good baseline glycemic and insulin control, and as in our study, higher baseline physical activity levels. Because the participants of the two studies herein were not age and sex matched. It is also possible that the activation of sympathetic nervous system and release of counter regulatory hormones after stair climbing could have increased hepatic glucose production and blunted any insulin-lowering effects in HW participants, who did the stair climbing snacks faster than did participants with overweight. Higher energy expenditure of stair climbing in participants with over weight (because of higher body mass) could be another potential mechanism of improved postprandial metabolic profile. Taken together, our finding suggests that even short bouts of relatively intense exercise performed as stair climbing may improve insulin sensitivity in adults with overweight/obesity. [16]

2.17 Design and Fabrication of Pedal Powered Stair Climbing Trolley

(C.Gnanave, Sivaganesan, and Gopalakrishnan,) (4 March 2018)

To transport small, heavy loads from one location to another, use a hand trolley. Many different sectors that convey physical goods use it as a highly common tool. The hand trolley, which is also known as a hand truck or dolly, is frequently used by stock people who organize and replenish merchandise in retail stores. Trolleys, when used appropriately, can shield users from back injuries and other health issues that can arise from lifting large objects. The stair climbing trolley is made to lift heavy objects with less effort from the user. The stair climbing trolley is made to move over rough terrain. In a pedal-powered stair climbing trolley, the trolley is pedaled on flat surfaces to move the trolley. We had a great opportunity to leverage our knowledge and gain experience through this assignment. While working on this project, our batch members gained more practical skills in areas like planning, assembling, buying, and even machining. With the short time available, we have finished the work. Successfully work is being done on "Design and production of pedal-powered stair climbing trolley. “Satisfactory circumstances we are able to comprehend the challenges in

Upholding tolerances and also excellence. The design and construction of a pedal-powered stair climbing cart is the result. [17]

2.18 Lower Extremity Exoskeleton for Stair Climbing Augmentation

(Zongwei Zhang, Yanhe Zhu, Tianjiao Zheng, and Sikai Zhao) (20 July 2018)

Both humans and robots have limitations. Through an external framework covering human body components, exoskeleton robots can increase human muscle strength and provide them mechanical power. Many prototypes have been published and tested over the past few decades, particularly in the field of low limb exoskeletons, such as the individual-soldier fighting system, worker labor assisting system, earthquake rescuing system, paralysis and senior citizen auxiliary systems, and worker fighting system. The focus of the research has shifted from military to civilian applications. Healthy individuals, the elderly, and people with disabilities are the target demographics, and the aiding joints are mostly the hip, knee, and ankle joints. Stair climbing is a strenuous everyday activity. Climbing stairs or even stepping over barriers is difficult labor for an elderly person or someone who has lower limb disabilities. In this study, a novel exoskeleton robot and its related hybrid control system are presented. In order to meet the severe moment requirements on the knee joint when climbing stairs, a slider crank topology construction is created. When a leg is elevated, the spring-based quasipassive hip joint is used to help balance the force of gravity. Even when burdens are carried, the suggested hybrid control system improves human mobility when climbing stairs. Future research will examine a blending control approach to decide when and how the exoskeleton should aid the human in order to increase the effectiveness of the support and conserve robot energy during routine walking and climbing actions. Additionally, machine-learning techniques will be used to enhance how well the exoskeleton adapts to diverse wearers and circumstances. [18]

2.19 Design and fabrication of pneumatically operated wheelchair convertible ambulated stretcher

(Arun Kumar, Shanthini, Karthik, Prakash and Sagarika) (16 Feb 2018)

One of the most challenging chores in hospitals and at homes is moving a patient from a wheelchair to a stretcher or bed. Thus, the goal of the proposed project is to design and construct a wheelchair cum stretcher that is pneumatically powered. By doing this, the patient will have less physical strain throughout the transfer process and the downside of patient transfer will be resolved. A compressor, two pneumatic cylinders, a 5/2 solenoid direction control valve, and push buttons are

all parts of the proposed system. The compressor's initial needed pressure, which ranges from 5 to 10 Bars, is applied. Air is supplied from the compressor to the 5/2 Solenoid Direction Control Valve, which will then guide the air in that direction. Depending on the kind of conversion that is required, the cylinder. The device will function in three different modes, including raising the wheelchair, converting it to a stretcher, and then converting it back to a wheelchair. At the hand rest area, there are two push buttons. The elevating mechanism operates when one button is pressed, and the wheelchair conversion occurs when the other button is pressed. When cylinders C1 and C2 are activated, the vertically positioned Cylinder C1 will move to elevate the wheelchair, while the horizontally positioned Cylinder C2 will move to convert the wheelchair into a stretcher or vice versa. The elderly can use this prototype. [19]

2.20 Automatic staircase climbing platform

(Sayal Kakade, Ankit iKohare, Somen Rakhunde, and Kiran Borkar) (Mar-2018)

There are no elevators in the older buildings found in densely populated urban regions. Because of their age-related reduced mobility, people with physical disabilities or the elderly find climbing stairs to be a significant burden. Even for a regular individual living in old, tall buildings without elevators, moving a material from the ground floor to the upper floors presents a challenge. Consequently, a platform for stepping up the stairs is essential, at least in less developed areas. The platform functions as the chassis. Depending on the item constructed on the platform, many variations, such as a stair climbing wheelchair, stair climbing trolley for material transporting, or stair climbing stretcher, can be generated. These platforms can be helpful in buildings with elevators as well, especially if there is no power backup. There are numerous rehabilitation tools on the market or in development. The microcontroller ATMEGA 32 is used to control this platform. Mechanical preparations are being made to the model's body, and suitable electronic components are being chosen. This model's movement is managed by a DC motor controlling the directions. [20]

2.21 Design and fabrication of multi-purpose wheelchair for differently-abled person

(Ganapathy, Charles Mohammed, Ashik, Monishraam, and S.Anandan) (Jun 2017)

Ernesto Blanco created a self-moving stair-climbing wheelchair in 1962 while he was an employee at Massachusetts Institute of Technology but a scale model was never produced. In any event, a small scale model of Blanco's design was created to demonstrate how his wheelchair would function on flat ground as well as when climbing and descending stairs. The wheelchair's compact size makes it possible to navigate practically all stairways found in businesses, offices, organizations,

and some houses. Under normal circumstances, the frame and wheels have little risk of failing because of the design's high level of safety. The stair climbing wheelchair can support a load of 100 kg on a flat surface, according the tests that were done. It has the ability to climb a 35-degree stairwell while towing a 55-kg load. [21]

2.22 Designing and analyzing stair case lift system

(Timur choban khidi,Abbas Mohammed Ismael, and Ayaz Aydin Abdul) (2017)

A mechanical device for raising people and wheelchairs up and down stairs, stair lifts are a safe and secure way to transfer people. As far as we are aware, there were numerous advancements made to elevators before they reached the state that we see them in today's marketplaces and other places. Sometimes placing an elevator below requires more depth, particularly in tall structures with multiple floors. People started debating elevators using basic rope or chain. The main driver behind today's advancements in elevator technology is the growth of industries and beam building. After the lifts are installed, changes will be very difficult to make, which will drive up the cost. The platform is essentially pulled or pushed by mechanical means by the elevators. The Solid works software does the device analysis for the rail and chair, as seen above. For a maximum weight of 95 kg, these analyses display the von Misses, strain, deformation, and factor of safety (FOS). The maximal von Misses stress is 4.196e+007 N/m2, and the deformation is 1.548e+002 mm. The rail portion is square-shaped. Additionally, we looked at the rack and pinion gear. As we can see from the study, our design, using the aforementioned parameters, is within safe limits. [22]

2.23 Design and Structural Analysis of Platform Stair Lift Using Finite Element Method.

(Chougule , Wadia , and S.Kotecha) (Jun 2018)

More welfare measures and consideration for the handicapped are given in today's industrialised society. In order to increase the outside movement area for the disabled who can only move long distances in wheelchairs, elevators, wheelchairs, and rail-type stair climbing support equipment are being built in public spaces and railway stations. However, not all public spaces, such as tiny stations, theatres, or hospitals, can accommodate the installation of such equipment due to cost and space constraints. On the other hand, almost every public area has additional little steps or impediments in addition to the usual lengthy stairs. To help the disabled move across these types of barriers easily, the development of a kind of safe, simple, automatic, inexpensive, cable drive platform, or, in other words, an attempt to create a mobile vehicle that can help people move across obstacles and climb stairs simply by sitting on it, or that can carry people in wheelchairs up stairs,

can be considered a significant contribution to society. A mechanical device called a platform stair lift is used to lift people up and down steps. The lift assembly contains a chassis that holds a platform or a seat that can sustain weight. The major element of the chassis is where the platform with a horizontal frame is placed. This frame keeps the platform level as the lift assembly moves along the guide. Over time, several mechanisms have been created in the business for various goals. [23]

2.24 Automatic stair climbing wheelchair with bed

(waseemrahees, RohithRaj,Sajithgopi, and Sandeep Vineeth) (May 2017)

A wheelchair can be defined simply as a device with a set of wheels attached to a chair. A wheelchair is a tool that enables a person with a disability to live a normal, independent life. One of the innovations for such physically disadvantaged people is the wheelchair. It is advantageous to them. The wheelchair has undergone constant improvement since its creation in order to increase comfort and provide as many features as feasible. Many diverse wheelchair types have been encountered, each with unique shapes, sizes, mechanisms, sources, and materials. A wheelchair that is suitable, well-made, and well-fitted can be the first step toward inclusion and social participation for many people. The wheelchairs mentioned above that can climb stairs are all quite pricey and out of reach for the average person. Therefore, our goal was to create a wheelchair that could also be used as a stretcher and climb stairs. With its inexpensive cost, it can be helpful for those who are disabled. [24]

2.25 Design and Development of Light Weight Mechanical Staircase Climbing Trolley with Better Stress Distribution

(Adhyanth Ajay, Harikrishna, Bharatharajan and M Karthik) (May 2017)

Many times in daily life, heavy objects like books, travel suitcases, etc., will need to be transported between two sites. These things can typically be carried in the hand in the majority of these instances. However, the popularity of escalators over elevators in recent years has made it more challenging for people to carry large objects in their hands, such as while shopping in malls or moving heavy research equipment between different levels of a university, etc. In these circumstances, the use of traditional trolleys (Figure.1) will be drastically decreased, and baskets and other hand-carriage able techniques will be preferred. While this strategy might be effective for small objects, it will be time-consuming when heavy objects are taken into account. The goal of the current effort is to create a lightweight trolley that can ascend stairs with a considerably more efficient stress distribution than those suggested by earlier models. The Tri-Star wheel's mechanism has been the

subject of experiments. Cero 3.0 Modelling Software has been used to create a 3D model of the product, and Auto Desk Fusion 360 software has been used to do a thorough stress and displacement analysis. It is possible to conduct additional study on this mechanism to alter the existing stress distribution, and lighter and more durable materials may also be utilized to enhance the product's overall design. [25]

2.26 Step-Climbing Power Wheelchairs

(Andrea Sundaram, Hongwu Wang, Dan Ding, and Rory) (2017)

Power wheelchairs that can navigate obstacles in the environment like curbs, stairs, and uneven ground have been under development for more than a decade. The devices were found through a comprehensive review of the engineering and scientific literature, and we describe each one's mechanism and mode of action in brief. We compare their abilities in terms of step climbing and common wheelchair functions in the data that we also present. Results: While all of the devices presented enable the crossing of obstacles that are inaccessible to traditional power wheelchairs, some are only moderately effective in the fundamental area of efficient transport over level ground, while others are restricted in their ability to man oeuvre in small spaces due to their size and configuration. Conclusion: In order to compare the clinical efficacy of advanced wheelchairs with step-climbing and other environment-negotiating features, we propose that safety and performance test methods more thorough than the International Organization for Standards (ISO) testing protocols be developed. [26]

2.27 Designing and analyzing stair case lift system

(Timur choban khidir, Abbas Mohammed Ismael and Ayaz Aydin Abduljabbar) (2017)

As far as we are aware, there were numerous advancements made to elevators before they reached the state that we see them in today's marketplaces and other places. Sometimes placing an elevator below requires more depth, particularly in tall structures with multiple floors. People started debating elevators using basic rope or chain. The main driver behind today's advancements in elevator technology is the growth of industries and beam building. After the lifts are installed, changes will be very difficult to make, which will drive up the cost. The platform is essentially pulled or pushed by mechanical means by the elevators. Solidworks programmed does the analysis of the device (chair and rail) as demonstrated above. For a maximum weight of 95 kg, these analyses display the von Misses, strain, deformation, and factor of safety (FOS). The maximal von Misses stress is 4.196e+007 N/m2, and the deformation is 1.548e+002 mother rail portions are square-

shaped. Additionally, we looked at the rack and pinion gear. As the analysis shows, that our design falls within the above-mentioned safety standards. [27]

2.28 Design and fabrication of stair case climber for physically challenged person

(Urvashi singh, Aditya Singh Fernandes, OlindaNoronha, and Rishi Parvanda)(1 Jan2016)

India is a thriving nation, but some areas are still underdeveloped, with few escalators and lifts and wheelchairs that are too expensive for middle class people to afford. This research will open up new possibilities for physically disabled people's stair mobility. Their personal mobility will be improved, which is a requirement for exercising human rights. The available stair climbers and related systems have received enough research. Experimental evidence shows that the effort required to lift a wheelchair is nearly comparable to that predicted theoretically. The medical aid circuit sends a message from a GSM module that is connected to an Adriano and tracking a pulse sensor to provide its results. Any time an abnormal heartbeat is detected, a message asking for help is sent to the caregiver, and the buzzer activates. Due to the project's significant human–machine interaction, every ergonomic consideration has been made to ensure machine usability. [28]

2.29 Stair climbing wheel mechanism: alternate for lifting goods

(Roshan alaspure, Chaitali Barmase, Snehal Chambhare, and Manish) (May-2016)

Research's objective the goal of this research is to give people who depend on mobility aids more autonomy while lessening the burden on caregivers to provide that mobility. This research set out to design and tests a stair-climbing hand truck for the general public. It was thought of several designs that would make it easy for a nonindustrial hand truck to move over obstacles like stairs, curbs, or uneven ground. These other design possibilities need to be more thoroughly looked at in order to create a successful product. The design and construction of additional prototypes that use various stair-climbing techniques should be part of future work on this product. Additionally, it is important to look into the viability of a design without an electrical power source. The project's primary goal is to develop a load-carrying device that can ascend stairs with little effort. The main goals of humans in every field have been to produce greater results with less effort. With the primary project as a foundation, we want to demonstrate a load carrier for mechanized stair climbing with reduced effort. The stair climbing mechanism in the load carrier for the stair case assists to carry the loads up the stairs. We gave the job our best effort. [29]

2.30 Design of a novel wheel chair lift

(Aeman Aead Alazhar, Nadia Rayes Alazhar, and Rawan Temraz) (2016)

The main objective of this study is to design and produce a wheelchair lift that will make it simple for individuals with disabilities to move between floors of buildings. The most common way to provide access between levels is through elevators. They take up a lot of room and are highly pricey. There are small lifts available that are designed for home use and can be manually or electrically operated. A temporary need for wheelchair access has led the company in to create and sell a portable platform lift that offers a workable and adaptable alternative. The small lift is simple to transport and store when folded down. It is the ideal option for stages and mezzanine levels in public buildings like village halls, theatres, and schools .The study of aimed to increase the autonomy of people who depend on mobility aids while lowering the burden on caregivers who must provide that mobility. We have created a practical, disabled lift wheelchair that uses track-based technology and is semi-autonomous. The poor people of nations like Palestine may afford this suggested plan. [30]

2.31 Design and Fabrication of Stretcher cum Wheel Chair.

(Jyothish K Sunny, Kiran P Karunakaran, Thomas Paul) (April 2016)

The journal articles and patents examined here are connected to the intended field of study, which is the design and development of a wheelchair/stretcher, either directly or indirectly. These papers are intended to aid and clarify the entire design process in the given field. A wheelchair is a chair with wheels created to assist people with disabilities. Stretchers are transportation tools used to move patients from one location to another. The emphasis on usefulness and cost effectiveness, the project's goal was to design and produce a wheelchair cum stretcher that can address the drawbacks of a traditional wheelchair. The current method is only capable of transferring patients from a wheel chair to a stretcher. The paralyzed will benefit from this product. Patients, people with mobility impairments, and senior citizens. Our product will do away with the need for individual wheelchairs. Hospitals, in order to avoid the procedure of transferring patients from bed or stretcher to wheelchair and vice versa. The wheelchair will take up less room and is made at a modest price. These tools can promote self-reliability and gratification among users. We used engineering to help us reach our objectives. [31]

2.32 Design and Fabrication of Stair Climbing Trolley

(Jey Praveen Raj, .Mohamed Fuge. and Paul Caleb)(5 May 2016)

In modern life, carrying numerous items up and down stairs may be necessary, particularly in places like workplaces, schools, colleges, hotels, industries, flats, etc. where elevators may not be

working, be overflowing with passengers, or be undergoing maintenance. Manually carrying various items up stairs for higher floors repeatedly is really exhausting. The numerous uses could include transporting stacks of test answers in a school or a college, furniture in various structures, equipment in hospitals, colleges, etc., and technological devices in homes and workplaces. Therefore, there should be a means to carry the things up the stairs more easily and without having to exert extra force from the user. Here is where a stair climber would be used. As a result, the stair climbing trolley was created in a way that it could transport big goods up and down stairs as well as across flat surfaces with little effort from a human. This reduces the human effort required to lift large objects up stairs and on flat surfaces, which shows to be more advantageous everywhere such as in businesses, colleges, and schools. [32]

2.33 Fabrication of Stair Climbing Wheel Mechanism:Alternate for lifting goods

(Roshan Alaspure,Chaitali Barmase,Snehal Chambhare, and Manish)(May 2016)

The goal of the research this study aims to increase the independence of people who depend on mobility aids while lowering the burden on caregivers who must provide that mobility. The goal of this thesis was to construct and test a consumer-grade hand truck that could climb stairs. A number of designs were considered that would enable a nonindustrial hand truck to move over stairs, curbs, or uneven ground with the least amount of effort on the operator. These other design alternatives need to be looked at more thoroughly in order to create a successful product. Future work on this product should include designing and building further prototypes that employ various stair-climbing techniques. Further research should be done on the feasibility of a design that is independent of an electrical power source. The project's primary objective is to develop a load carrier stair ascending system with reduced effort. The main goals of humans in every field have been to produce greater results with less effort. [33]

2.34 Development of an integrated staircase lift for home access

(Johanne Mattie, Jaimie F Borisoff, and Willian Miller)(July 2015)

According to reports, stairways into buildings are among the most difficult environmental barriers for those who use wheeled mobility devices and those who have mobility issues related to ageing. It is important not to undervalue the importance of this issue. According to data from the National Health Interview Survey and the Census Bureau's Survey of Income and Program Participation, 1.7 to 2.3 million Americans (US) use wheeled mobility devices, and an additional 6.1 million people use other devices like canes, crutches, or walkers. Merisel et al. report on these

statistics. According to data from the National Centre for Health Statistics from 2006, Merisel et al. also mention that 11.5 million Americans 65 and older reported having trouble ascending 10 steps without stopping in the US. Home accessibility provides a substantial barrier for those with mobility disabilities and those wishing to age in place, with estimates of home inaccessibility UN the US reaching up to 90%. Traditional remedies for home accessibility issues have usually entailed either moving to alternative accommodation or making modifications to the home to remove accessible obstacles. 3 People with mobility issues face major consequences as a result of the complicated moving-related obstacles and the widespread neglect of house modifications. Accessibility issues have been linked to early institutionalization, higher costs for care, declining health and wellbeing, strained family ties, and a need for higher dependency housing. [34]

2.35 Circulatory Responses to Weight Lifting, Walking, and Stair Climbing in Older Males

(Sally Benn, Neil Carney, and Robert Kelvin) (Feb 1996)

Large muscular groups are frequently used by elderly adults in daily tasks like walking, climbing stairs, lifting, and weight carrying. Weight lifting and stair climbing are being used more often in fitness training programmers, but relatively little is known about how these types of exercise affect older people's circulatory systems. The majority of studies have concentrated on the metabolic reactions to treadmill and cycle aerometry exercise, and to a lesser extent, stair climbing. Sphygmomanometer and auscultation, which may be suitable for constant workload exercise but are insufficient for activities like weight lifting that produce significant palatial swings in arterial pressure, have been used to measure arterial pressure intermittently. The goal of this study was to constantly record the heart rate and intra-brachial artery blood pressure responses in older, healthy guys while they were lifting weights, climbing stairs, walking on a horizontal treadmill with and without a load, and walking uphill. The outcomes provide fresh perspectives on the variations in cardiovascular responses during various tasks. During the lifting phase, there was a significant increase in pressure; this decreased during the lowering phase, and peak pressures increased with additional repetitions. Pressures fell to nearly resting levels right after the last lift. The SAC, SLP, and DLP heart rate and blood pressure values in this study are similar to those previously reported in older guys of similar ages. [35]

2.36 Kinematic Model of a New Staircase Climbing Wheelchair and its Experimental Validation

(Morales Feliu , González , and Pintado) (Jan 2006)

This paper describes a novel wheelchair prototype that can climb stairs, including its mechanical components, movements, and related kinematic models. The use of two decoupled mechanisms in each axle, one for negotiating steps and the other for positioning the axle with respect to the chair to accommodate the overall slope is the key element of the mechanical design. Numerous different climbing techniques are made possible by this decoupling, making the entire mechanism incredibly adaptable from a control perspective. For the many mechanical configurations that show up during all ascend/descend operations, kinematic models have been constructed. In order for the wheelchair's centre of mass to be able to follow any spatial trajectory, these models must be able to operate the actuators of the wheelchair. This is crucial since it's necessary to create very smooth spatial trajectories and maintain a nearly constant seat inclination to ensure the comfort of the passenger, who is typically a disabled or injured person. An actual prototype is shown, and experimental findings that demonstrate the effectiveness of the mechanism and the precision of the created kinematic models are described. It has been reported how a new mechanical device can go up and down stairs. Its key characteristics are that it is exceptionally stable since its weight is always transferred to horizontal surfaces and that its mechanism maintains the chair's verticality. It has more degrees of freedom that permit motions and control techniques that take into account the least amount of control effort; taking the passenger's comfort into consideration (i.e. maximum acceleration and inclination of the wheelchair).[36]

2.37 Conceptual design of a manual stair-climbing wheelchair

(Nguyen, Gemunu Happawana, and Walter Loscutoff) (December 2013)

After performing a thorough analysis of the literature, it was discovered that wheelchairs with the ability to climb stairs can be divided into two categories: battery-powered and manual-powered. Although there are several powered wheelchairs on the market, manual or battery-powered wheelchairs have received very few scholarly reviews. Instead, wheelchair descriptions, operating instructions, and patent certificates are available. In fact, no peer-reviewed material on manual wheelchairs could be discovered. Although some researchers have constructed scale models or full-size prototypes of their inventions, there isn't much public information on this kind of wheelchair. Both categories were examined in this study to inspire creativity to complete the task. The wheelchairs with the ability to climb stairs can be divided into two categories: battery-powered wheelchairs and manual wheelchairs. Although there are several powered wheelchairs on the market, manual or battery-powered wheelchairs have received very few scholarly reviews. Instead,

wheelchair descriptions, operating instructions, and patent certificates are available. In fact, no peer-reviewed material on manual wheelchairs could be discovered. Although some researchers have constructed scale models or full-size prototypes of their inventions, there isn't much public information on this kind of wheelchair. Both categories were examined in this study to inspire creativity to complete the task. [37]

2.38 Design And Fabrication of chair stair lifting

(Tiwari Raj, Kumar Vijay, Rajpoot Yogesh, Yadav Aman, and Deepak) (December 2013)

Many manufacturers and researchers from all around the world have previously expressed interest in building and creating wheelchairs that can climb stairs to improve the mobility of those who have paraplegia. Several motorized wheelchairs that can climb stairs in the marketplace. Despite best efforts, there is not a single manual wheelchair that can available on the market at the time of this study on climbing stairs. [38]

2.39 Design and development of adjustable stair climbing robot

(k.Narendra Kumar, A.Gopichand. and Gopala Anjaneyulu) (Apr-2013)

One of the most alluring performances of robot in legged and wheeled is adjustable stair climbing robot. A variety of stair climbers have undergone developments in order to increase their capacity for ascent as well as make their mechanical complexity reasonable and usable. The research takes into account that negotiation is a significant step. Reduced energy intake and body weight are also crucial components of development. We present a few ways to implement the stair climbing machines we invented. Each of them performs admirably in an area of their own, such as the numerous wheeled shape categories. The construction of an adjustable high-grip mover is then discussed. This is, in our opinion, one of the greatest options for a stair climber. A mechanism is a grouping of stiff or constricting bodies that are connected and structured in such a way that they move upon one another in a clear relative motion. A machine is a group of mechanisms that transfer force from a power source to a load that needs to be overcome in order to carry out productive mechanical work. Robotics is a branch of automation that combines technologies from many other domains, including embedded systems, artificial intelligence, sensors, and electronic control systems. Depending on the application, the initial step in each robot design is the synthesis of mechanisms. [39]

2.40 Development of cad software for wheel chair design

(Ayodeji and Adej uyigbe) (Dec 2008)

A software package that can be installed on a Windows platform has been successfully designed, marketed, and packaged on a Compact Disc recordable CD. Given that the anthropometric information for this group of paraplegics in Nigeria has been successfully taken into account, this software would enable manufacturers too quickly build wheel chairs for this demographic. Additionally, the software has several features that allow for strong interactivity and user friendliness, which is a key component of contemporary software. [40]

2.41 Coordinated motion of a new staircase climbing wheelchair with increased passenger comfort

(Morales, Feliu, A.Gonzalez and Pintado) (19 May 2006)

The mechanical components, motions, and trajectory development of a revolutionary wheelchair prototype capable of climbing stairs are described in this research. The employment of two decoupled systems for each axle, one for negotiating steps and the other for positioning the axle with relation to the chair to accommodate the overall slope, is the important element of the mechanical design. Due to this decoupling, a wide variety of climbing techniques are now feasible, making the whole mechanism incredibly controllable. To enable the wheelchair's centre of mass to follow any spatial trajectory, a control system must coordinate the movements of all of its actuators. To ensure passenger comfort, various trajectories have been developed to maintain the seat as upright as feasible. The effectiveness of our mechanism, the precision of the created kinematic control models, and the comparison of comfort for two alternative spatial trajectories is demonstrated in experimental findings using the actual prototype. [41]

2.42 Actualization of Safe and Stable Stair Climbing and Three-Dimensional Locomotion for Wheelchair

(Jianjun Yuan and S. Hirose) (Aug2005)

This study covered the implementation of secure stair climbing and three-dimensional movement. Based on the developed eight leg-wheels hybrid mobile vehicle, Zero Carrier I, mechanical sensor system and control. Experimental verification established the framework for creating a Safe, convenient, and affordable personal wheelchair. As part of our ongoing work, we intend to do additional study. On developing and enhancing the stair negotiating movement the speed at which a wheelchair moves both up and down stairs, such as attempting to mechanically solve the issue of adding a multistage transmission to the legs or wheels control strategy. Some are still being developed. [42]

2.43 Step climbing using power assist wheel chair robot with inverse pendulum control

(Yoshihiko Takahashi, Ogawa, and Machida) (April 2000)

The power assist wheelchair robot was created so that a person could get over the step. The wheel chair robot was able to lift its front wheels and keep control of the inverse pendulum. The wheel chair robot may be moved forward and backward with a person controlling the inverted pendulum with his body inclination. The wheel chair robot was able to climb over the step once the front wheels were placed on it with the help of a DC motor torque. [43]

2.44 Limitations of passive earth pressure theory for cage wheel lug and tine force predictions

(M. Salokhe, Rajaram, and Gee-Clough) (1989)

When a cage wheel lug was used to compress moist clay soil, the pattern of deformation was very different from what was typically predicted in soil mechanics. Therefore, in such soils, lug forces cannot be calculated using standard models. Therefore, a suitable new theory must be created or existing theories must be modified for lug force prediction. It has been demonstrated unequivocally that lug force predictions in such soils cannot be made using the passive failure theories currently in use. [44]

2.1 Reference Model

A Stair Lift has a fixed chair attached to a rail system. You sit into the chair and drive yourself up and down the rail system with the controls on the arm of the chair. The drive system can be something as simple as a screw driver for a straight staircase or a something more complex such a rack and pinion or a drive sprocket for a curved stair lifts. There is a very, very big time and price difference between straight stair lifts and anything which is not straight. Anything which is not straight is called a curved lift even if it has but a single turn. Right Left. Up or down anything but straight is curved. All curved stair lifts are custom to your staircase and take about a month from order to installation. In contrast a stair lift which is straight up and down is a commodity. A curve stair lift is custom will take a month or more to obtain and then install and will cost 3 to 4 times what a straight stair lift cost. That's correct, on average, the high teens to low twenties for a curved stair lift. Here is the primary reason why one cost so much less than the other. We don't even have to measure the staircase for a straight chair lift. We place your order and receive the product in a week or so and then come to the house to install. Once on site our employees cut the stair lift to fit your staircase and complete the installation. It is far less expensive because it is a commodity. Essentially we take it off the shelf and install it. A curved lift is custom. We measure the steps with photo-

telemetry collaboration between computer design and photography... The manufacturer then develops the exact design to fit your staircase. Once approved by us the manufacture builds the curved lift. It is usually delivered to us about one month after we have approved the final design. Signature Elevators & Accessible Design has historically represented and installed only one stair lift company Harmer. They are the eight hundred pound Gorilla within the stair lift industry. They have been consistent and great to work with. We historically have never considered an alternative because the time frame and the price of the other eight hundred pound gorilla as well as the other smaller brands were not appreciable different. However, we have recently added Up Stair lift to our product line up. They brought a difference not in price but in time. We can now install a curved stair lift solution within two weeks. Because they have taken the custom out of a curved stair lift. We order a standard package and assemble it curves and all in the field. No cameras no custom manufacturing. We essentially take it off the shelf and assemble it to fit, curves and all in one or two days within two weeks of taking your order. Extrusion process produces thin filaments which is suitable for 3-D printing process. In the extrusion of PET plastic, raw PET material in the form of flakes is fed into the hopper mounted on the barrel of the extrusion machine. The PET fakes get transported by the action of gravity as it passes through the hopper.

Figure 2.1 Reference Modal

Chapter 3

Design and Fabrication

3.1. Design Methodology

Designing a stair chair lift necessitates a methodical approach that considers numerous aspects of user needs, safety, functionality, and compliance with laws. Here is a design process for developing a stair chair lift:

Track System: The track system is the primary component of a stair chair lift, and it is what guides the chair up and down the stairs. The track system is typically installed directly onto the stairs or adjacent to them, and it can be customized to fit the specific configuration of the stairs.

Chair: The chair is the component that the individual sits on while they are being transported up or down the stairs. The chair is typically designed with a comfortable seat, a backrest, and armrests, and it can be adjusted to accommodate the user's specific needs.

Drive System: The drive system is the mechanism that powers the stair chair lift, and it is typically located at the base of the track system. The drive system may be powered by electricity or batteries, and it may be controlled by a joystick or other input device.

Safety Features: Stair chair lifts are designed with several safety features to protect the user from harm during operation. These features may include seat belts, footrest sensors, emergency stop buttons, and obstacle sensors that detect any obstacles on the stairs.

Installation: Stair chair lifts must be installed by a qualified technician to ensure that they are safe and functional. The installation process typically involves anchoring the track system to the stairs, mounting the chair onto the track, and connecting the drive system and other components.

Overall, the methodology of stair chair lifts involves a combination of mechanical engineering, ergonomics, and safety engineering to provide a safe and reliable mobility solution for individuals with mobility impairments.

3.2. Major component are the following

Chair

The chair is the part of the lift on which the user sits. It is designed to be comfortable and secure, with a safety belt to keep the user in place during the lift.

Rails

The rails are the tracks on which the chair travels up and down the stairs. They are installed on the stair treads or the wall and come in various lengths depending on the length of the stairs.

Motor

The motor powers the chair and moves it up and down the rails. It is typically located at the base of the stair lift.

Battery

Many chair stair lifts are powered by batteries, which allow them to operate even during power outages.

Control unit

The control unit is usually located on the armrest of the chair and allows the user to operate the lift. The user can control the lift's movement and speed using buttons or a joystick.

Swivel seat

The swivel seat allows the user to turn the chair at the top of the stairs, making it easier to get in and out of the lift safely.

3.3. Construction of stairs chair lift

A stair chair lift is a type of mobility aid that is designed to help individuals with mobility issues to travel up and down the stairs safely and comfortably. The construction of a chair stair lift involves the following steps: Evaluate the Staircase: Before starting the construction of a chair stair lift, it is important to evaluate the staircase to ensure that it is suitable for a chair stair lift. The staircase should have a minimum width of 32 inches and a landing at the top and bottom of the stairs to allow for safe entry and exit. Select the Chair Lift: There are many different types of chair stair lifts available in the market. The selection of the chair lift should be based on the user's needs and the specific requirements of the staircase. Some factors to consider when selecting a chair lift include weight capacity, speed, and safety features. Install the Chair Lift Track: The next step is to install the chair lift track along the staircase. The track is usually made of aluminum and is attached to the staircase using brackets. The track should be installed securely and level to ensure the smooth and safe operation of the chair lift. Install the Chair Lift: Once the track is installed, the chair lift can be installed on the track. The chair lift consists of a seat, footrest, and armrests. The chair lift is attached to the track using a carriage that travels up and down the track. The chair lift should be tested thoroughly to ensure that it is safe and operates smoothly. Test the Chair Lift: Once the chair lift is

installed, it should be tested thoroughly to ensure that it is safe and operates smoothly. The user should be trained on how to use the chair lift safely. Maintain the Chair Lift: Regular maintenance of the chair lift is important to ensure its safe and smooth operation. The maintenance should be carried out according to the manufacturer's instructions. Overall, the construction of a chair stair lift requires careful planning and installation to ensure its safe and effective use. It is recommended to consult a professional for the installation and maintenance of a chair stair lift.

3.4. Design and Calculation

Our project name is “Design and fabrication of stair chair lift”

3.5. Motor Calculation

Number of rotation (N) =50 RPM

Voltage=24 v

Current =4A

Input power

We know that P=VI

Putting valve of V and I

In the above equation P=24×4 P=96 w (input power)

Output power

Power=speed (N) ×torque (M)

$Torque$ = $power$/speed

$Torque$ = 13.67Nm

and ω = rpm × 2Pi 60

ω = 50 × 2Pi 60 ω = 5.269 rad/s

Now power output

Pout =τ×ω Pout =13.67 × 5.269=72.027 w

Efficiency

Efficiency = Pout

Pin Efficiency = 72.027 96

Efficiency=0.75=75%

Forces calculation:

Force

Force is an external agent capable of changing a body's state of rest or motion. It has a magnitude and a direction. The direction towards which the force is applied is known as the direction of the force, and the application of force is the point where force is applied. The Force can be measured using a spring balance. The SI unit of force is Newton (N).

Frictional force

Friction is the force that resists motion when the surface of one object comes in contact with the surface of another. The mechanical advantage of a machine is reduced by friction, or in other words, the ratio of output to input is reduced because of friction. An automobile uses one-quarter of its energy on limiting friction. Yet, it is also friction in the tires that allows the car to stay on the road and friction in the clutch that makes it possible to drive. From matches to machines to molecular structures, friction is one of the most significant phenomena in the physical world.

Frictional Force

$$Fr = \eta w$$

$$M = 70kg$$

$$W = mg$$

$$W = 80 \times 9.81$$

$$W = 686.46\ N$$

$$Fr = 0.0012 \times 686.46$$

$$Fr = 0.823N \qquad (\because \eta = \text{Rolling Friction})$$

Retarding Force

A retarding force causes the acceleration of an object to be negative. In $F = ma$ where F is the resultant force, the force acts against the direction of the object's current velocity is the retarding force

Retarding Force

Retarding force w.r.t weight

$= W \sin\theta$ Angle of Stair $= 25^o$

$RF = mg\ (\sin 25^o)$

$RF = 80 \times 9.81 \times \sin 25$

$RF = 331.67\ N$

Inertial Force

Inertial force, also called Fictitious Force, any force invoked by an observer to maintain the

Validity of Isaac Newton's second law of motion in a reference frame that is rotating or otherwise accelerating at a constant rate.

Inertial Force

$$IF = ma$$

$$IF = 70 \times 9.81$$

$$IF = 686.7N$$

Total Retarding Force

$$TRT = Fr + IF$$

$$TRT = 0.823 + 686.7$$

$$TRT = 687.523N$$

3.6. Speed with a specific angle:

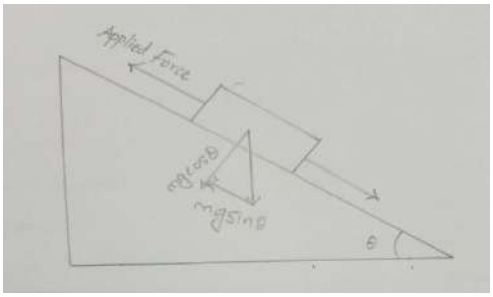


Figure 3. 1

Normal Components:

$$N = mg\cos\theta$$

$$N = 70 \times 9.81 \cos 25$$

$$N = 622.35N$$

• Along the Surface:

$$Fx = mg\sin\theta$$

$$Fx = 70 \times 9.81 \times \sin 25$$

$$Fx = 290.19N$$

• Frequired = μN + FX

$$Frequired = 0.03 \times 622.35 + 290.19$$

$$Frequired = 327.6705N$$

Calculation on Stair (Rolling):

$$Frolling = \mu N + mg\sin\theta$$

$$Frolling = (0.05 \times 622.35) + 290.19 = 321.30N$$

3.7. Dimensions of all parts

Main frame	
Height	7 ft
Length	3 ft

Width	20 inches

Chair	
Height	27 inches
Length	22 inches
Width	20 inches

3.8. Modelling

1. Pulley Plate

Pulley system is very popular and simple machine. It use to change movement direction of cable and can reduce heavy object. A pulley system has a wheel with a groove on an axle or shaft that is designed to support movement, and a rope in the groove.

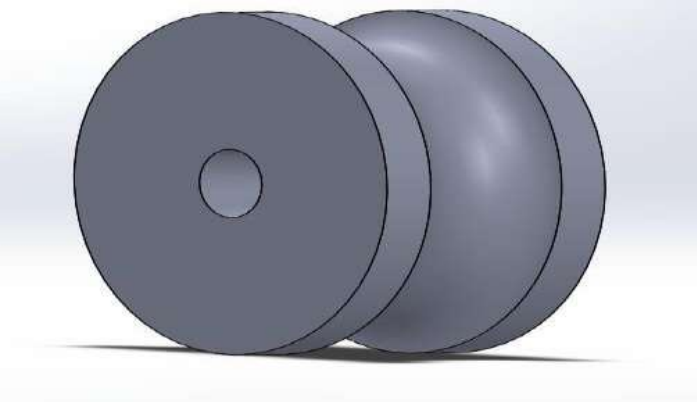


Figure 3. 2 Pulley Plate

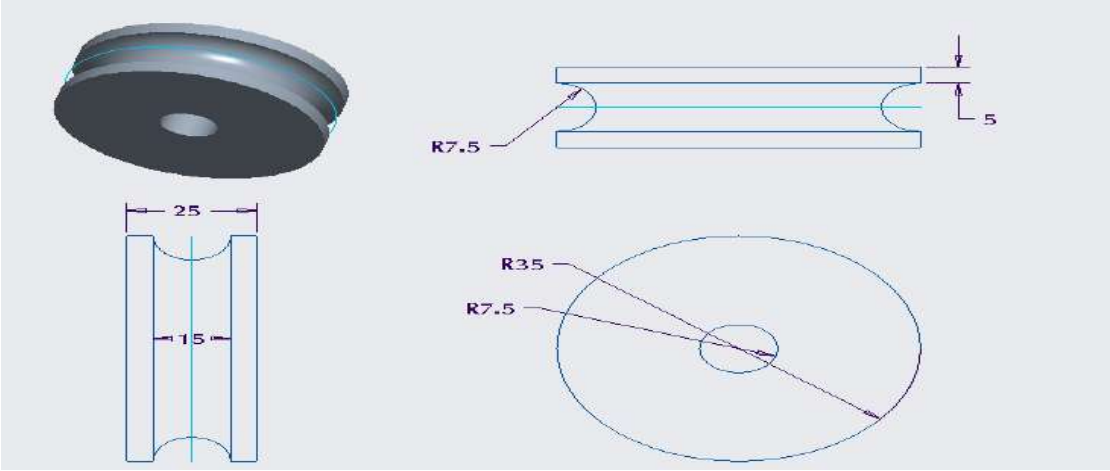


Figure 3. 3 Pulley Plate

2. **Bearing**

Bearings are "parts that assist objects' rotation". They support the shaft that rotates inside the machinery. Machines that use bearings include automobiles, airplanes, and electric generators and so on.

3. **Chair**

A chair is a type of seat, typically designed for one person and consisting of one or more legs, a flat or slightly angled seat and a back-rest.

They may be made of wood, metal, or synthetic materials, and may be padded or upholstered in various colours and fabrics. Chairs vary in design.

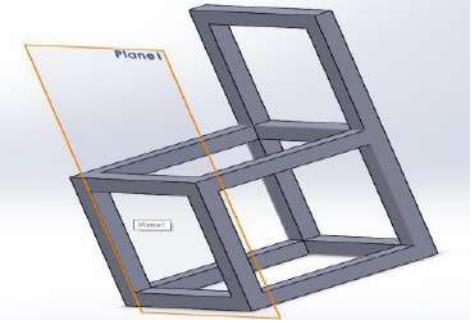


Figure 3. 4 Chair

4. **Gear Pulley**

Pulleys are used singly or in combination to move an Object from one place to another. Gears can be used in combination to change speed and direction of movements. Students will design and build pulley systems and gear systems, and will explore the advantages of each kind of system.

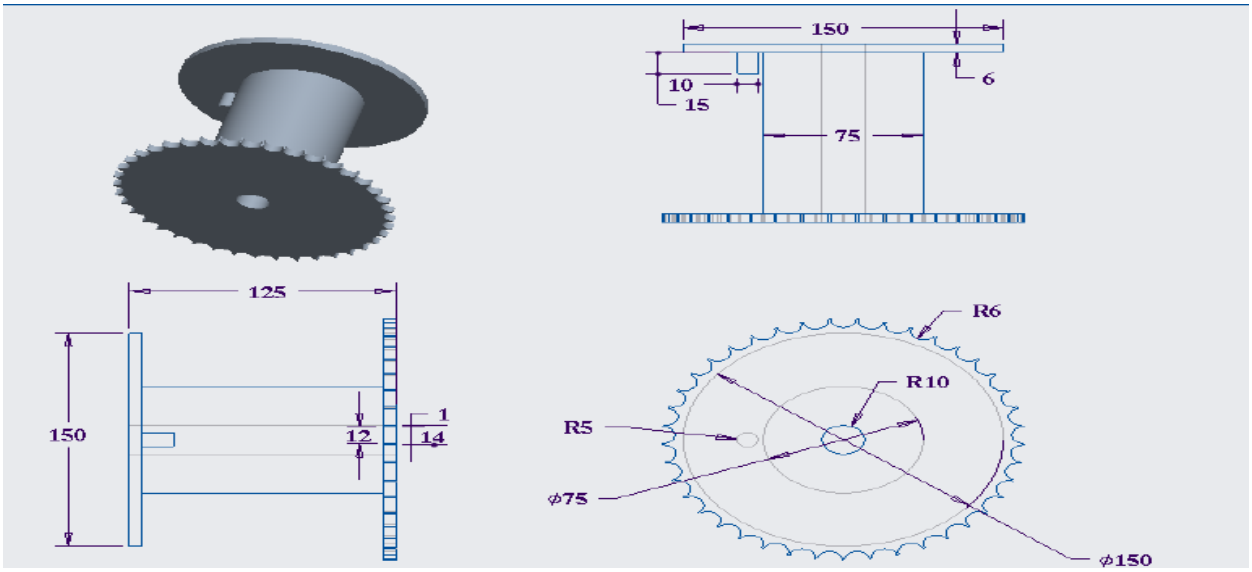


Figure 3. 5 Gear Pulley

5. **Frame**

A frame is a basic shape or structure, especially one that outlines or surrounds a door or window. If you slam your bedroom door hard enough, the whole frame might shake.

Figure 3. 6 Frame

3.9. Fabrication review

1. Measuring pulley

Pulley can support the shaft that rotates inside the machinery. The dimension of a pulley is 6mm.

Figure 3. 7 Measuring Pulley

2. Cutting

Grinders are frequently used to cut steel for numerous industries and do-it-yourself tasks. The general procedures to follow while using a grinder to cut steel are as follows:

Safety strategies: Make sure you have the required safety gear before you start. This includes protective gear including gloves, a face shield, safety goggles, and earplugs. Additionally, make sure the space where you're working is well-ventilated and, if necessary, use a respirator.

Figure 3. 8 Cutting

3. Welding

Permanently connecting steel elements requires the usual procedure of welding. It entails melting the steel components in order to fuse them together using a filler material, frequently a consumable electrode or welding wire.

Figure 3. 9 Welding

4. Checking stability of chair and frame

Examine the chair's connections and joints. Verify that any screws or bolts are secure and not loose. Look for any damage or cracks in the frame of the chair by inspecting its material and workmanship make sure the chair is appropriate for the intended user's weight by taking into account its weight capacity. If you are unsure of the chair's stability, test it again or get professional assistance.

Figure 3. 10 Checking Stability

3.10. Coast analysis of project

Components	Cost(PKR)
Frame rolling + cover	18000
Motor	7000
Roller	10000
Bush	8000
Battery	8000
Total cost	51000

Chapter 4

Experimentation and Results discussion

4.1. Methodology of experimentation

- Check all the components and wires connections of the project.
- Based on the design, proportions, and needs of the user, evaluate the staircase and choosethe best type of stair chair lift.
- For the stair chair lift to fit properly, the staircase must be measured precisely.
- Remove everything that can restrict the installation process from the stairs.
- Install the chair lift unit onto the track, making sure it is level and firmly fastened.
- Connect the electrical cabling, taking care to include the control panel and power source.
- To ensure seamless functioning, test the stair chair lift's performance.

4.2. Operation manual

- Please read this manual before using stair chair lift.
- Before starting the lift, ensure that the pathway is clear of any obstructions or objectsthat might interfere with the chair's movement.
- When ready to begin, press the appropriate button to start the stair chair lift's ascent ordescent. The chair will start moving along the track or rail.
- Maintain a firm hold on the armrests or grab handles throughout the ride for stabilityand safety.
- Observe the chair's movement carefully and adjust your position accordingly to avoidhitting any walls, railings, or other objects along the staircase.
- If the stair chair lift encounters any obstacles or if you need to stop the lift for anyreason, press the stop button immediately to halt the motion.
- Once the chair reaches the desired floor or landing, ensure that it comes to a completestop before attempting to exit the chair.
- If the stair chair lift operates using a key or lock system, ensure that it is properly lockedwhen not in use to prevent unauthorized access.

4.3. List of experimental parameters

Depending on the manufacturer and model, the precise specifications of a stair chair lift can change, but the following typical specifications should be taken into account:

Weight capacity: There is normally a maximum weight that stair chair lifts may safely sustain. The model will determine this capability.

Track length: How far the stair chair lift can move along the staircase depends on the length of the track. The track can be made to match a specific staircase, including one with straight steps, curved steps, or even more than one flight of stairs.

Speed: Stair chair lifts typically travel along the stairs at a predetermined speed that makes it safe and comfortable. Although the speed can change, it is often made to travel slowly and steadily.

Stair chair lifts normally use electricity to operate, which is supplied by either a battery or a direct connection to the electrical grid. In the event of a power outage, battery-powered lifts are advantageous because they can continue to run for a while.

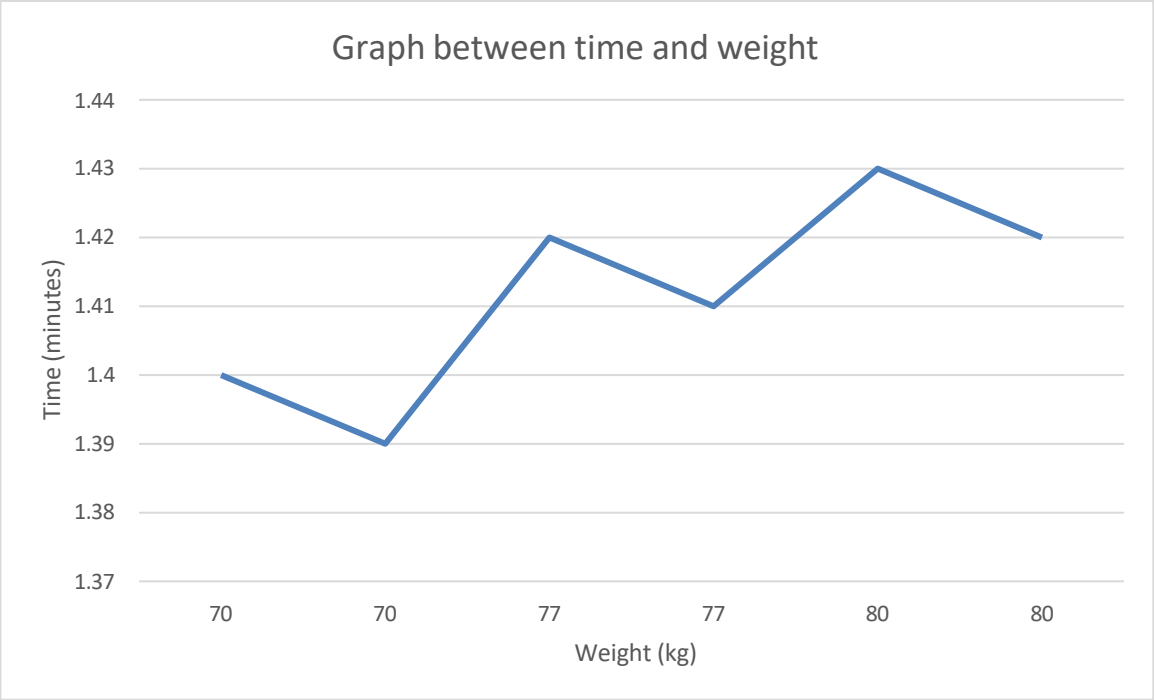
4.4. Calculation table

Table 1

Weight	Time	Speed	Direction
70	1.40	0.0254	Upward
70	1.39	0.0257	Downward
77	1.42	0.0250	Upward
77	1.41	0.0252	Downward
80	1.43	0.0248	Upward
80	1.42	0.0250	Downward

4.5. Graph Analysis

Graph between time and weight



Graph between speed and weight

4.6. Comparison with Reference

Table 2

	Reference model	Manufactured model
Weight (kg)	90	80
Time(minutes)	0.50	1.42
Speed	0.08128	0.0250
Distance(feet)	8	7

4.7. Analysis

Figure 3. 12 Reference Modal

Figure 3. 11 Project

4.8. Analysis with Reference model and manufactured model

- Analysis of the above table we see that the difference of time can occur because diameter of warm gear is small and also create frictional force.
- This changes of times can change the speed of chair.
- The Change of time also depends on the load of the persons.
- And also depends on the charge of the battery**.**

4.9. Safety precaution

Read the Manual: Familiarize yourself with the manufacturer's instructions and operation manual for the specific stair chair lift model you are using. Follow the guidelines and safety recommendations provided.

Proper Installation: Ensure that the stair chair lift is installed correctly by professionals or qualified technicians. Improper installation can compromise safety and functionality.

Weight Capacity: Respect the weight capacity specified by the manufacturer. Do not exceed the maximum weight limit as it can affect the lift's stability and safety.

Seat Belt Usage: Always fasten the seat belt when using the stair chair lift. The seat belt helps secure the user in place during the ride and prevents accidents or falls.

Clear Pathway: Ensure that the staircase and surrounding areas are clear of any obstacles or clutter that could obstruct the movement of the chair lift. Remove loose objects, rugs, or other items that may pose a tripping hazard.

Secure Footrest: Before using the stair chair lift, ensure that the footrest is properly positioned and secured. The footrest provides support and stability for the user's feet during the ride.

User Positioning: Sit upright and cantered on the chair seat while using the stair chair lift. Keep your arms and hands inside the chair during the ride to avoid injury.

Operating Controls: Familiarize yourself with the control panel or handheld remote control. Use the controls as instructed by the manufacturer to ensure smooth and safe operation.

Chapter 5

Environment and Sustainability

5.1. Positive effects of stairs chair lift on environment

The installation and use of stair chair lifts can indeed have positive effects on the environment. Here are some key points to consider:

Energy Efficiency: Stair chair lifts are generally energy-efficient devices. They typically use electric motors or rechargeable batteries to power the lift. Compared to the energy consumption of elevators or escalators, stair chair lifts consume significantly less energy, contributing to lower electricity consumption and reduced greenhouse gas emissions.

Reduced Construction Impact: Installing a stair chair lift usually requires less structural modification to a building compared to installing a traditional elevator. This means less material and resource consumption during the installation process, resulting in a smaller carbon footprint associated with construction.

Preservation of Green Spaces: In some cases, when buildings are expanded to accommodate elevators or ramps, green spaces and outdoor areas might be sacrificed. Stair chair lifts can help preserve existing green spaces by minimizing the need for such expansions.

Improved Accessibility: By making multi-story buildings more accessible to individuals with mobility challenges, stair chair lifts promote social inclusion and equality. This can encourage more people to participate in public life and contribute to sustainable communities.

Longevity and Durability: Stair chair lifts are designed to be durable and long-lasting, requiring minimal maintenance over their lifespan. This reduces the need for frequent replacements and minimizes the waste associated with regularly replacing less durable alternatives.

Space Saving: Stair chair lifts are compact and do not require much space. This contrasts with the construction and energy demands of building ramps or larger elevators to accommodate people with mobility challenges.

5.2. How stairs chair lift solved any existing problem

The stairs chair lift has solved several existing problems in a simple yet effective manner:

- Stair chair lifts provide a safe and comfortable means for these individuals to access different levels of their homes without the need for strenuous effort or assistance from others.

- Stair chair lifts take up minimal space on the staircase, allowing others in the household to use the stairs comfortably. This is particularly advantageous in homes with limited space.
- Stair chair lifts offer a more cost-effective solution, as they can be installed on existing staircases without major renovations.
- Stair chair lifts can be installed relatively quickly compared to more extensive accessibility modifications like ramps or elevators. This means that individuals with immediate mobility needs can have a solution in place without enduring a lengthy construction process**.**

Overall, stair chair lifts have provided a straightforward and effective solution to the challenges posed by stairs for individuals with mobility limitations. By promoting accessibility, safety, and independence, these devices have significantly improved the quality of life for many people.

5.3. Discussion of stairs chair lift reliable and sustainable

A discussion of stair chair lifts in terms of reliability and sustainability.

Reliability:

Stair chair lifts are generally considered reliable when properly installed, used, and maintained. Modern designs incorporate safety features such as seat belts, obstruction sensors, and emergency stop buttons to enhance user safety. The reliability of a stair chair lift depends on the quality of components, installation by trained professionals, and regular maintenance to address wear and tear.

Maintenance: Regular maintenance is crucial to ensure the continued reliability of a stair chair lift. Routine checks, lubrication of moving parts, and prompt addressing of any issues can prolong the lifespan of the equipment.

Energy Efficiency: Stair chair lifts are typically powered by electricity. The energy efficiency of a stair chair lift can vary depending on factors such as the design, motor efficiency, and usage patterns. Some models are designed with energy-saving features, like standby modes to reduce energy consumption when not in use. As sustainability becomes a more prominent concern, manufacturers may focus on developing more energy-efficient models to minimize their environmental impact.

Environmental Impact: Stair chair lifts, like any electrical appliances, have an environmental impact due to their energy consumption during use.

Longevity and Durability: The reliability and sustainability of a stair chair lift are closely tied to its longevity and durability. Well-constructed and well-maintained lifts can serve users for many years, reducing the need for frequent replacements and associated resource consumption.

User Benefits: Stair chair lifts play a significant role in enhancing the quality of life for individuals with mobility challenges. By allowing them to move between different levels of their homes or public spaces, these devices contribute to independence and accessibility.

Chapter 6

Conclusion and Future Recommendation

6.1. Conclusion

A stair chair lift, also known as a stairs chair lift, is a mechanical device designed to assist individuals with mobility challenges in traversing a staircase. These devices are particularly useful for individuals who have difficulty climbing or descending stairs due to age, injury, or disabilities. In conclusion, stair chair lifts offer an effective and convenient solution for individuals facing mobility challenges in navigating stairs. They promote independence, safety, and accessibility, enabling individuals to remain in their homes and enjoy a higher level of autonomy.

6.2. Future Recommendation

Certainly, here's a summary of future recommendations for stairs chair lifts:

- Autonomous Navigation: Develop chair lifts in sensors to navigate stairs independently.
- Gesture Control: Enable users to control chair lifts with hand gestures.
- Predictive Maintenance: Implement systems that proactively maintain and prevent breakdowns. Wireless Charging: Incorporate wireless charging to keep the lift always ready.
- Biometric Authentication: Enhance security with fingerprint or facial recognition.
- Health Monitoring: Include sensors to track user's health while on the lift.
- Modular Design: Make components easily replaceable for longer lifespan.
- Sustainable Materials: Use eco-friendly materials for construction.
- Remote Assistance: Allow remote troubleshooting using augmented reality or video. User Experience Personalization: Adapt settings and movement based on user preferences.
- Emergency Evacuation: Include a safe evacuation system during power outages. Smart Home Integration: Integrate with smart home systems for seamless control.
- Enhanced Safety Measures: Improve collision avoidance and obstacle detection.
- Multi-User Profiles: Enable personalized settings for different users. These recommendations aim to make future stairs chair lifts safer, more accessible, user-friendly, and environmentally conscious.

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