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DESIGN AND FABRICATION OF 3 WHEEL HANDICAPPED STEERING PROPULSION CYCLE

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ABSTRACT

Mobility of physically disabled persons is a concerning social issue nowadays. Various hand driven tricycles, wheelchairs, retrofitted vehicles etc. are commonly available for disabled people as a mode of transportation. The basic Tricycle is a three-wheeled design, pedaled by disabled persons in the side and seat in the middle for sitting arrangement. They use only one hand to steer the handle because other hand is used to rotate the pedal. Our aim is to design and fabricate a low cost tricycle for the handicap people to be propelled by the novel link mechanism attached to the steering column converting into cranking, using the advantage of leverage, with proper balance and distribution of mass and center of gravity to crank the wheel shaft for propelling. As he can use both the hands on the steering, better control of the vehicle is ensured.The design and development of a 3-wheel handicapped steering propulsion cycle represent a groundbreaking endeavor aimed at revolutionizing accessibility and mobility for individuals with disabilities. This abstract provides a concise overview of the innovative features, design considerations, and objectives of this pioneering project. Our cycle embodies a commitment to inclusivity, with a focus on empowering users to navigate their surroundings with independence and ease. Through adaptive steering mechanisms, customizable propulsion assistance options, and ergonomic design features, we have created a vehicle that prioritizes user comfort and usability.Accessibility is at the forefront of our design philosophy, with thoughtful considerations such as a low step-in height and spacious seating area catering to individuals with diverse mobility needs. Safety is paramount, with integrated features ensuring a secure riding experience in various environments. By combining innovation, accessibility, and safety, our 3-wheel handicapped steering propulsion cycle redefines the possibilities of inclusive mobility solutions. This abstract invites further exploration into the transformative potential of this project and its implications for enhancing the quality of life for individuals with disabilities.

Keywords: Design, Cycle, Propulsion System, Handicapped Person.

1. INTRODUCTION

Introducing the design and development of a 3-wheel handicapped steering propulsion cycle marks a significant milestone in the realm of inclusive mobility solutions. This innovative vehicle is not merely a means of transportation; it embodies a commitment to empowering individuals with disabilities to navigate the world with newfound freedom and independence. Let's delve into the unique features and thoughtful design considerations that define this pioneering project.There are lot of technological advancement, in wheel chair propulsion other than manual wheel turning. A normal wheel chair used for handicap and the tricycle users for normal people use hand drive or propulsion or foot pedal propulsion. The manual propulsion has become increasingly important because the population of propulsion of individuals using wheelchairs is growing and requires efficient mobility to maintain a quality of life equivalent to the general population. Several attempts have been made at improving manual wheel chair propulsion, such as changes in the wheels and tires, adding gears and designing alternative propulsion systems. Still, experts and consumers generally agree that innovation in propulsion is still needed. Improved propulsion technologies will reduce physical fatigue and effort maneuverability. Pain and upper extremity injury is common among manual wheel chair users. Shoulders related injuries have been shown to be present in up to 51% of manual wheel chair users. In addition, the prevalence of elbow, wrist and hand pain has been reported to be 16% . During wheel chair propulsion, users must exert large forces in order to propel the chair forward. In addition, the component of force that is directed in towards the hub does not contribute to forward motion but is necessary in order to provide friction between the hand and the push rim. There are two popular types of propulsion assist devices on the market today. One is a manual assist that uses gear rations to reduce the effort required to propel the vehicle and the other is a power assist that uses a battery powered motor to reduce the effort. Mechanical advantage is a measure of the force amplification achieved by using a tool, mechanical device or machine system. Ideally the device preserves the input power and simply trades off forces against movement to obtain a desired amplification in the output force. An ideal mechanism transmits power without adding to or

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subtracting from it. This means that ideal mechanism does not include a power source, and is frictionless and constructed from rigid bodies that do not deflect or wear.

2. AIM OF PROJECT

The aim of the design and development of the 3-wheel handicapped steering propulsion cycle is to create an innovative and inclusive mobility solution that addresses the unique needs of individuals with disabilities. This project aims to achieve the following overarching objectives:

Enhanced Accessibility: The primary aim is to design a cycle that provides individuals with disabilities greater accessibility to transportation, enabling them to travel independently and participate more fully in various aspects of life.

Improved Mobility: By developing a specialized cycle with adaptive steering and propulsion assistance, the project seeks to enhance the mobility of users, allowing them to navigate urban and rural environments with greater ease and confidence.

Innovation and Technology Integration: The project aims to integrate innovative technologies and engineering solutions to create a cycle that not only meets the functional needs of users but also exceeds their expectations in terms of usability, comfort, and safety.

User-Centric Design: Central to the project's aim is a user-centric approach that prioritizes the needs and preferences of individuals with disabilities. By actively involving users in the design process, the aim is to ensure that the final product aligns closely with their requirements and desires.

Promotion of Inclusivity: The project aims to promote inclusivity by designing a cycle that caters to a wide range of disabilities and mobility impairments. This includes considerations for individuals with physical, sensory, and cognitive disabilities, as well as those who require the use of mobility aids such as wheelchairs or walkers.

Safety and Reliability: Another key aim of the project is to prioritize the safety and reliability of the cycle, ensuring that users can travel with confidence knowing that the vehicle is equipped with robust braking systems, stability features, and visibility aids to mitigate potential risks.

Sustainability and Environmental Impact: The project aims to consider the sustainability and environmental impact of the cycle's design and development process. This includes exploring eco-friendly materials, energy-efficient propulsion systems, and recyclable components to minimize the vehicle's carbon footprint.

By pursuing these aims, the design and development of the 3-wheel handicapped steering propulsion cycle seeks to make a significant contribution to improving the quality of life and enhancing the independence of individuals with disabilities, ultimately fostering a more inclusive and accessible society.

3. LITERATURE REVIEW

A. Literature on “Handicapped Steering Cycle” Ajit Tiwari, Rahul Mishra, Abhishek Sharma, Amitesh Sharma, Purushottem Mishra : Handicapped Steering Cycle 1) Conclusion: Traditional manual wheelchairs require considerable use and control of both arms for operation, thus adaptations are required for individuals with asymmetrical use of their arms. The Handicapped Steering Cycle Building upon previous projects the goal of this project was to create an accessory to be installed on a standard wheelchair, which allow full control of the wheelchair with only one Hand while addressing areas lacking in commercial products and previous designs, such as manufacture ability, attendant control, user comfort and ergonomics. After preliminary testing and analysis of three one-arm International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887 Volume 7 Issue II, Feb 2019- Available at www.ijraset.com ©IJRASET: All Rights are Reserved 47 propulsion designs, the project team developed a design for a removable, leveroperated accessory which could be adapted to fit a range of the most popular standard wheelchair models. The propulsion system, connected to the main lever by a coupler link, consists of a dual gearpawl assembly in which the desired direction of motion is chosen by moving a shifter to Joint one of the two gears press-fit around clutches, each of which allows motion in only one direction, either forward or reverse..

B. V. B. Vaidya: Design and Fabrication of Wheelchair cum Tricycle for Physically Challenged and Elder People (2016) 1) Conclusion: This paper is about the development of traditional manual operated wheelchair cum tricycle is rear wheel drive in which chain drive mechanism replaced with single slider drive mechanism Design and Fabrication of Wheelchair cum Tricycle for Physically Challenged and Elder People concept of this model is taken from manually operated tricycle and railroad car. This wheelchair cum tricycle is useful for handicapped person and modified tricycle gives the both advantages of wheelchair (for short distance or in-door use) as well as tricycle (for long distance use) in

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one machine.. The Design and Fabrication of Wheelchair cum Tricycle for Physically Challenged and Elder People paper provides the details of components used & designing parameters takes in consideration while designing tricycle. The wheelchair cum tricycle is very efficiently design and can be proved as better replacement for tricycle having chain drive mechanism.

C. P.R. Jawale, Mr.A.R.Gabhane, Ms.K.G.Baje, Mr.D.B.Lakade, Mr.D.N.Patil: Modern Hybrid Tricycle for Handicapped Person(April 2017) 1) Conclusion: In rural and city areas, tricycle is cheap for transporting purpose for short distance. Tricycle is generally propelled by human energy. The disabled person generally used the Hand Powered Tricycles in this community, but some most of the hand powered tricycles do not have the physical strength or coordination to propel themselves on the tricycles with their arms and hands. The design factors of all are considered by analyzing the problems of handicapped persons. This paper gives the idea about the research papers related various technologies of tricycle. Various kinds of technology of tricycles are here discussed as well as compared also. I

Method and analysis which is performed in your research work should be written in this section. A simple strategy to follow is to use keywords from your title in first few sentences.

4. MANUFACTURING PROCESS

Once the design is finalized, a complete 3-D CAD model was developed in SOLID WORKS. An effort has been made to use off the shelf parts, but the fact that this hasn't ever been done means that it is still a very manufacturing-intensive project. Prior to manufacturing, the final design met all of the specifications and requirements. Since there were no problems with the 3-D CAD model, we proceeded on to manufacturing. The final design incorporated many parts that were available off the self, but it also included a lot of custom machined and fabricated parts. Manufacturing was split up between the front hand cycle attachment and the rear wheelchair section. The most important part of the tricycle is the structured base frame, which links the components together in the proper geometric configuration. The frame provides strength and rigidity to the tricycle and largely determines the handling of the tricycle. The square pipes are assembled into a frame by arc welding

5. THE WORKING PRINCIPLE

The working principle of the 3-wheel handicapped steering propulsion cycle involves the integration of innovative design features and propulsion technologies to provide individuals with disabilities a reliable and user-friendly mobility solution. The following outlines the key components and their functions within the cycle:

Frame and Chassis: The frame and chassis form the structural foundation of the cycle, providing stability and support for the rider. The design incorporates lightweight yet durable materials to optimize maneuverability and ease of use.

Steering Mechanism: An adaptive steering mechanism enables intuitive control of the cycle's direction, accommodating users with varying levels of upper body strength and mobility. This mechanism may utilize a handlebar, joystick, or alternative control interface tailored to the user's preferences and abilities

Propulsion System: The propulsion system comprises various technologies to assist with forward movement. This may include pedal-assist systems, electric motors, or a combination of both. Users can adjust the level of assistance based on their physical capabilities and desired exertion level.

Power Source: Depending on the propulsion system, the cycle may be powered by rechargeable batteries, pedal power, or a hybrid power source. Efforts are made to optimize energy efficiency and range to accommodate longer journeys without frequent recharging.

Seating and Ergonomics: The seating arrangement is designed for optimal comfort and support, incorporating ergonomic principles to minimize fatigue and promote proper posture. Adjustable features allow users to customize the seating position to their individual needs.

Safety Features: Robust safety features are integrated to ensure a secure riding experience. This includes reliable braking systems, anti-tip mechanisms to prevent rollovers, and visibility aids such as lights and reflectors for enhanced visibility in various conditions.

Accessibility Considerations: Accessibility is a fundamental aspect of the design, with features such as a low step-in height, spacious seating area, and easy-to-use controls catering to individuals with mobility aids such as wheelchairs or walkers.

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Modularity and Customization: The design incorporates modular components to allow for customization and adaptation to meet the diverse needs of users. This may include the integration of assistive technologies, storage accessories, and seating adjustments based on user feedback and preferences.

By combining these elements, the 3-wheel handicapped steering propulsion cycle offers individuals with disabilities a versatile and empowering mobility solution that promotes independence, inclusivity, and freedom of movement.

6. CRANK MECHANISM

A crank is an arm connected at the right angles to the rotating shaft by the reciprocating motion is a imparted to or received from shaft. it's used to convert circular motion into reciprocating motion, or vice-versa. The arm may be a bent portion of the shaft, or a separate arm or disk connected to it. connected to the end of the crank by a pivot is a rod, usually known as a connecting rod. the top of the rod attached to the crank moves in a circular motion, while the opposite end is typically constrained to maneuver in a linear slippery motion.

The term often refers to a human-powered crank that is used to manually flip an shaft, as in a bicycle crank set or a brace and bit drill. during this case a person's arm or leg serves as the connecting rod, applying reciprocating force to the crank. The displacement of the top of the rod is around proportional to the function of the angle of rotation of the crank, once it's measured from high dead center (TDC). therefore the mutual motion created by a steady rotating crank and rod is around straightforward periodic movement. Technically, the mutual motion of the rod departs slightly from curved motion due to the dynamic angle of the rod throughout the cycle. This distinction becomes vital in high-speed engines, which may would really like balance shafts to scale back the vibration due to this "secondary harmonic imbalance". The magnitude relation of a crank, the magnitude relation between the force on the rod and thus the force on the shaft, varies throughout the crank's cycle. the link between the 2 is about.

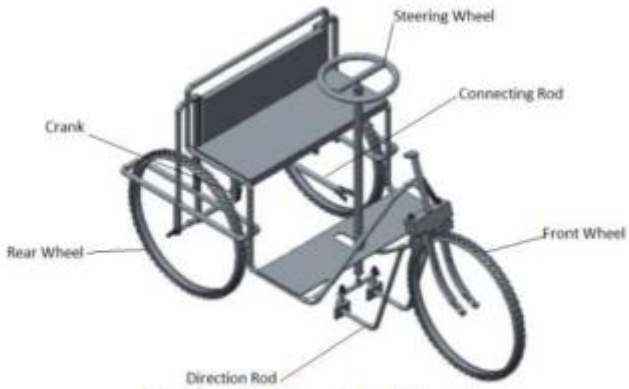

Fig.1: A CAD model of tricycle

Vehicle Mechanism

When we apply the force on steering in forward and backward direction, liver and crank give the motion to wheel by changing the rotary motion into motility. The direction of tricycle is controlled by steering rod. The device is operated by to and fro motion of steering that facilitates to rotate the wheel. The turning action happens by tilting the steering forward and backward direction.

Fig. 2: STEERING ROD

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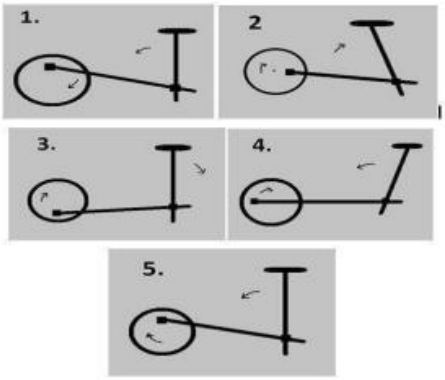
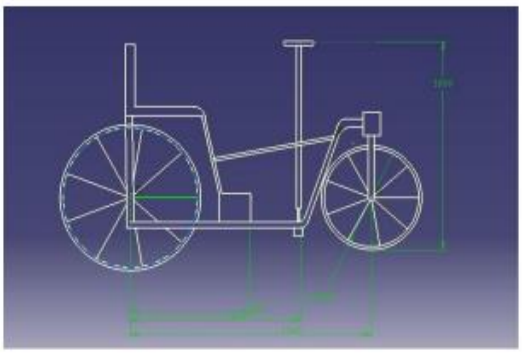


DIFFERENT POSITION OF SLIDER CRANK MECHANISM

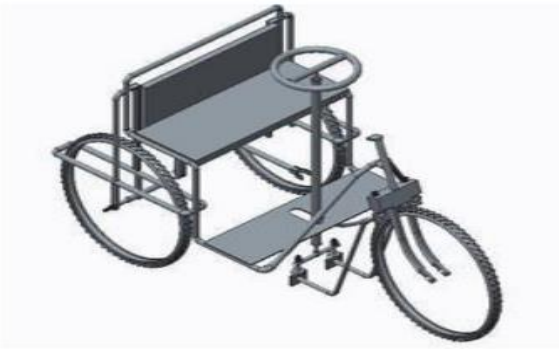
When we have to go into forward in direction then just move steering from backward to forward with little effort which move the tricycle in forward direction and when we have o go in reverse direction then we have to first stable the tricycle and then move steering from forward to backward in direction that move tricycle in reverse direction. The steering is provided for giving direction and for too & flow motion that move wheeled vehicle in forward & reverse direction. a whole mechanical system during which the single slider mechanism is that the main part. on that single slider mechanism a steering is mounted for operating the wheeled vehicle, which outline the direction to tricycle and used to take turning to the left or right



LAYOUT OF HANDICAP TRICYCLE

STEERING SYSTEM

The user should be able to steer the chair at all times, unless associate degree attendant is pushing the Chair. Maintaining control of the direction of the chair at all times is essential not only for user safety, but additionally to maximize the independence of the individual. once there is not an attendant pushing the chair, the user should have full management to be able to safely maneuver it. The modification accent cannot interfere with an attendant's ability to push/control the chair. this can be accomplished by providing a means of disengaging the steering to allow free motion of the casters. Some current models of one-hand propelled manual wheelchairs have steering mechanisms which management the position of the front casters.



0. Soils having heavy substances may have values above 3.0.

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7. ADVANTAGES

Accessibility: Three-wheel designs often offer better accessibility, especially for those with limited mobility. The design can accommodate different levels of physical abilities, making it easier for individuals with disabilities to mount and dismount the cycle.

Maneuverability: Three-wheel designs typically provide enhanced maneuverability compared to traditional four-wheel models. This can be particularly beneficial in crowded or tight spaces, allowing users to navigate through doorways, hallways, or other obstacles with greater ease.

Stability: With three wheels, the cycle can offer a stable platform for users, reducing the risk of tipping over. This stability is crucial for individuals with balance or coordination issues, providing them with a safer mode of transportation.

Compactness: Three-wheel cycles can be designed to be more compact, making them easier to store and transport. This feature is advantageous for individuals living in small spaces or those who need to transport their cycle in a vehicle.

Customization: The design can be tailored to accommodate specific needs and preferences of individual users. This customization may include adjustable seat heights, handlebar configurations, or other features to optimize comfort and usability.

Efficiency: Propulsion systems can be optimized for efficiency, allowing users to travel longer distances with less effort. This can be achieved through lightweight materials, aerodynamic designs, or the integration of electric assist technologies.

Cost-effectiveness: Depending on the materials and compo

8. CONCLUSION

In conclusion, the design and fabrication of a three-wheel handicapped steering propulsion cycle offer numerous advantages for individuals with mobility impairments. By prioritizing accessibility, maneuverability, stability, compactness, customization, efficiency, cost-effectiveness, and overall quality of life, these cycles can significantly improve the mobility and independence of users.

Through careful engineering and design considerations, such as incorporating lightweight materials, optimizing propulsion systems, and tailoring features to individual needs, these cycles can be tailored to meet the diverse requirements of users with varying levels of physical abilities.

Ultimately, the development of three-wheel handicapped steering propulsion cycles represents a meaningful step towards creating more inclusive and accessible transportation options for individuals with disabilities. By providing them with greater freedom of movement and enhancing their ability to engage in daily activities, these cycles contribute to a more equitable and inclusive society.

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