

Design and Development of Bicycle Cum Wheelchair

¹ Prof. Parita Sheth ² Archan Bhatt ³ Chirag Pritmani ⁴ Dheeraj Rajput ⁵ Rohit Jaiswal

¹ Professor ^{2,3,4,5} B. Tech Student

^{1,2,3,4,5} Department of Mechanical Engineering

^{1,2,3,4,5} Indus Institute of Technology and Engineering, Indus University, Ahmedabad, India-382115

Abstract: A bicycle which can be converted into a wheelchair or vice versa, leveraging a mechanism which is provided to change the orientation of the frame. Various working parts of bicycle and wheelchair have been modified so as to make it suitable for functioning and easy transition. The front end and rear end of the bicycle are connected with each other via connecting rod. The ends of the connecting rod are welded so as to accommodate T joints. A locking mechanism is provided at the T joints, to firmly hold the rod. Locking mechanism can be tightened to maintain the orientation of the system and loosened to change the orientation of the system. Two caster wheels are provided, one is located at the front end through a link that is fixed at the centre of the front wheel and other is fixed to the rear tube of the bicycle. Caster wheels guide the wheelchair and give it a proper direction.

I. INTRODUCTION

1.1 Introduction to Bicycle

Bicycles are one of the world's most popular modes of transportation, with some 800 million bicycles outnumbering cars by two to one. Bicycles are also the most energy-efficient vehicle—a cyclist burns about 35 calories per mile (22 calories per km), while an automobile burns 1,860 calories per mile (1,156 calories per km). Bicycles are used not only for transportation, but for fitness, competition, and touring as well. They come in myriad shapes and styles, including racing bikes, all-terrain bikes, and stationary bicycles, as well as unicycles, tricycles, and tandems.

1.2 Introduction to Wheelchair

A wheelchair is a chair with wheels, used when walking is difficult or impossible due to illness, injury, or disability. Wheelchairs come in a wide variety of formats to meet the specific needs of their users. They may include specialized seating adaptation, individualized controls, and may be specific to particular activities, as seen with sports wheelchairs and beach wheelchairs. The most widely recognized distinction is between powered wheelchairs ("powerchairs"), where propulsion is provided by batteries and electric motors, and manually propelled wheelchairs, where the propulsive force is provided either by the wheelchair user/occupant pushing the wheelchair by hand ("self-propelled"), or by an attendant pushing from the rear ("attendant propelled").

II. PROBLEM DEFINITION

A detailed survey was carried out by our group in which we came to understand that many people can't afford wheelchair and bicycle individually. The major constraint turned out to be the price. Now, if you search in market, individual cost of both bicycle and wheelchair is very high. Thus, it would not be economically feasible to many people to have both the commodities simultaneously. The aim of the project 'BICYCLE CUM WHEELCHAIR' is to not only make the bicycle and wheelchair economically feasible to everyone but also to assist them during any devastating situation. This project also aims to help those who are physically injured.

III. LITERATURE REVIEW

3.1 Literature on 'Foldable Bicycle'

This invention teaches that a foldable bicycle is divided into a front frame part and a rear frame part. The front frame part and the rear frame part are hinged and are capable of being slid. They are connected together. A front fork and steering assembly are hinged to the front frame part. A saddle supporting assembly is hinge to the rear frame part. Locking structures are provided in operative association with each of the hinged connections.

3.2 Literature on 'Convertible Wheelchair'

A simple, durable, lightweight, economical wheelchair is disclosed, that offers full convertibility from rigid frame to folding frame and vice versa without sacrificing advantages of either design. In addition, it allows conversion to sports, companion, paediatric, front wheel drive as well as customizing to suit the end user's needs.

3.3 Literature on 'Foldable bicycle frame'

A foldable bicycle frame includes top and bottom connecting bars pivotally connected between first and rear top tubes of the bicycle respectively, a plurality of springs supported between the top and bottom connecting bars for pushing the top and the bottom connecting bars vertically away from each other, allowing the front top tube and the rear top tube to be turned relative to each other between an operative position and a non-operative position, and a locking mechanism controlled by a locking lever to lock the top and the bottom connecting bar in a position where the front top tube and the rear top tube aren't movable relative to each other.

3.4 Literature on 'Detachable Wheelchair Leg Rest'

An improved leg rest hinge structure for a wheelchair that is both strong and easily manipulated. The structure includes a hinge post, inversely mounted to a hinge cap which retains the leg tube and foot plate of the leg rest. The hinge part is removable and rotationally inserted into a cylindrical socket fixed to the frame of the wheelchair. A flat land is formed on the exterior circumstances of the cylindrical socket that engages either a matching land formed on the underside of the hinge cap or a spring-loaded pivot plate fixed on the hinge cap adjacent to the hinge post. The structure provides a rugged single post lunge point and an easily manipulated mechanism for releasing the leg rest for rotating it to the side and out of the way.

IV. OBJECTIVES

1. To develop a bicycle that can be converted into a wheelchair or vice versa.
2. To attain the advantages of both bicycle and wheelchair simultaneously at a lower cost.
3. In case of a natural disaster or emergency, the project can be utilized for saving people who are unable to walk or run.
4. To accommodate the bicycle cum wheelchair in a small enclosed space.

V. RESEARCH METHODOLOGY

1. Literature Review
2. Data Accumulation
3. Objectives of the research
4. 3D Wireframe Design
5. Bicycle/wheelchair components
6. Cost Approximation
7. Conclusion
8. References

VI. ADDITIONAL COMPONENTS

1. Frame with Seat Arrangement.
2. Castor wheel.
3. T- Joint.
4. Bush and collar.
5. Foot rest.
6. Cloth.

VII. CONSTRUCTION

While converting the bicycle into wheelchair, 3 T joints, 2 caster wheels, Foot rest mechanism and a wheelchair seat is used.

1. T joint – First two T joints are provided at the ends of the connecting rod of the bicycle and the third one is provided at the head tube of bicycle which is just below the handle bar.
2. Caster wheels – First caster wheel is located in the front of rear wheel of bicycle i.e. below the chain sprocket mechanism and second caster wheel is located above the front wheel, and connected at the centre of the front wheel via a link.
3. Wheelchair seat – A lightweight portable wheelchair seat is welded to the handle bar of the bicycle and a locking screw is provided at the hinge which can be tightened or loosened accordingly for folding or unfolding the seat.

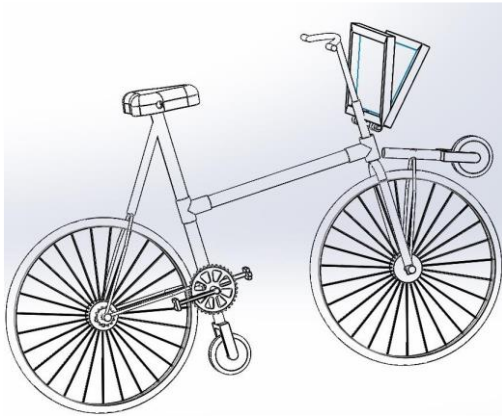
VIII. WORKING

The concept is to convert bicycle into wheelchair and vice versa, so in order to convert the bicycle into wheelchair the following three steps need to be followed.

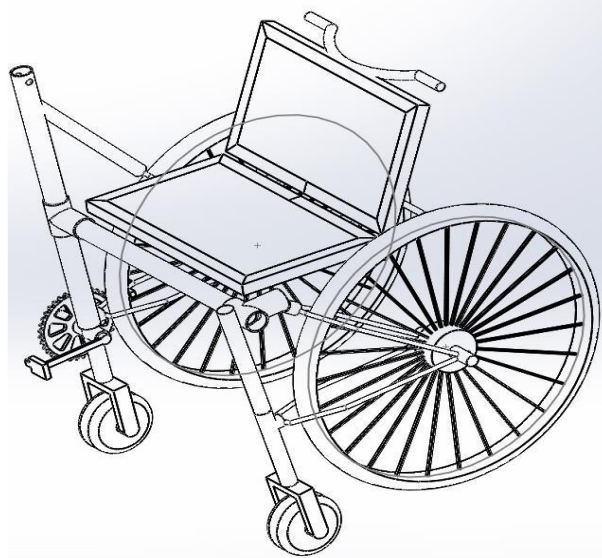
1. Loosening of T joint which is provided at the head tube of bicycle and removing of handlebar along with the wheelchair seat.
2. Loosening of remaining two T joints located at the ends of the connecting rod and rotating the head tube and the rear tube at a 90° angle with respect to the connecting rod, such that the centres of the wheels are on a same line parallelly opposite to each other and the caster wheels touch the ground. Hence, the wheelchair orientation is achieved. The locking screws are then tightened so as to maintain the orientation.
3. The foot rest and wheelchair seat which is attached to the handle bar are fitted into different bushing arrangements provided in the system.

IX. 3D WIREFRAME DESIGN

1. BICYCLE



2. WHEELCHAIR

**X. COST APPROXIMATION**

Sr. No.	Part Name	Cost	Qty	Total Cost
1	WHEELCHAIR SEAT	700	1	700
2	FRAME	1400	1	1400
3	BICYCLE SEAT	870	1	870
4	CASTOR WHEEL	450	2	900
5	FORKS	400	2	800
6	WHEELS	370	2	740
7	HANDLE	150	1	150
8	FOOT REST	800	1	800
9	JOINTS	250	2	500
10	BRAKES (PAIR)	400	1	400
11	Total			7260

XI. CONCLUSION

This project was prepared in various stages with mutual and equal coordination and contribution of each and every member in the stages of marketing, research work, designing and fabrication. Project “BICYCLE CUM WHEELCHAIR” is designed with the hope that it is economical in use, simple in construction and compact in size.

XII. FUTURE SCOPE

1. We can accommodate a battery and motor in the system, so that it is easy to run with less or no effort.
2. Solar panel can be used to run battery or motor.
3. We can add intelligent breaking system which can sense obstacles and apply brake automatically.

REFERENCES

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