

Design and Optimization of Multipurpose Bicycle's Frame

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Abstract-There are many bicycles and wheelchairs available in market and every bicycle and wheelchair have its unique design of frame. People like the bicycle as per their choice and uses. This paper represents the design and optimization of multipurpose bicycle's frame. Only one model that work in all 3 mode (bicycle, wheelchair , folding bicycle) by converting from one to another by some mechanical movement. In this frame when it is in the bicycle mode we can ride a bicycle as a simple bicycle and any time we want to convert into wheelchair so it can be easily convertible , and also it can be folded into compact size (almost half of bicycle). It will take a very less time to convert into each other.

Keywords: Two hinge joint , wheelchair support wheels , wheelchair seat , symmetric frame.

I. INTRODUCTION

There are many bicycle and wheelchair used by people's choice and their uses. In market many types of bicycle , wheelchair and also now a days folding bicycle and wheelchair available, also it's combination are available.

Bicycle: A bicycle also called a cycle or bike , is a human power, pedal-driven having two wheels attached to a frame, one behind the other. In this fastest world people go with the engine powered vehicles even this situation people's selection of bicycle is increase rather than reduce.

Wheelchair: 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.

Folding bicycle/wheelchair: This type of bicycle/wheelchair facilitate for easy transportation and easy carry , less storage space required. In this type so many design available in market , and in all of them method of folding may be different.

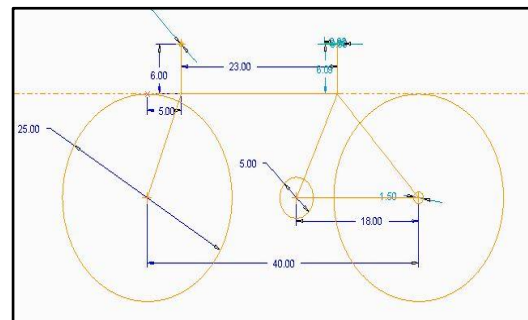
2. PROBLEM IDENTIFICATION

In wheelchair bicycle converter external wheelchair attached to the bicycle so that will be required two no. of frame, while in folding bicycle/wheelchair it can folded only not any extra use. Some folding bicycle will be complicated to fold due to so many linkage.

3. DESIGN METHODOLOGY

Design done on the basis of the general size of wheelchair (by u.s. manufactures standard) so as per wide adult size of seating in wheelchair 22' so that main cycle frame top tube size is taken as 22'. So every people can use that bicycle.

General bicycle dimension:



(Fig 1: general bicycle dimension)

Analytical design:

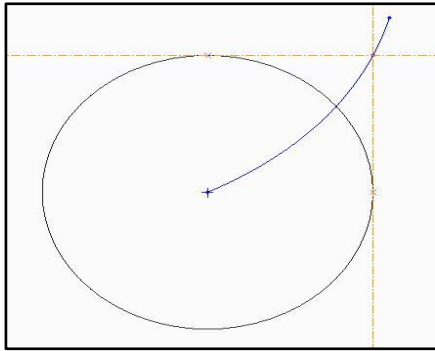
Design steps and calculation for Multipurpose (3in 1) bicycle.

- 1) Remove of down tube for converting or rotate both wheels at 90'.
- 2) In existing bicycle some portion of wheel is back side from the hinge/rotating point , as shown in fig.



(Fig.2 : Existing bicycle front wheel and hinge)

but, for wheelchair it require to wheel take ahead from the hinge/rotating point as shown in following 2D design.



(Fig.3 : wheel move to the hinge point)

Similarly for rear wheel.

Symmetric design required for wheelchair.

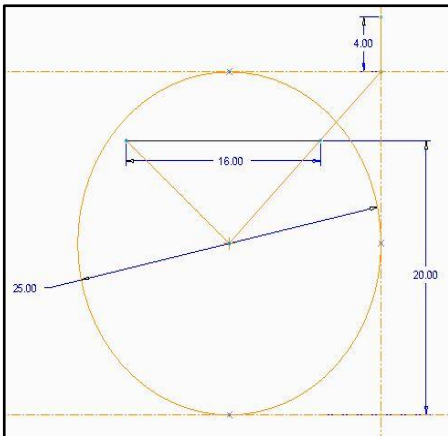
3) Calculation for wheelchair frame.

Seat width and height for wheelchair by taking from u.s manufactures standard and all dimension in inch .

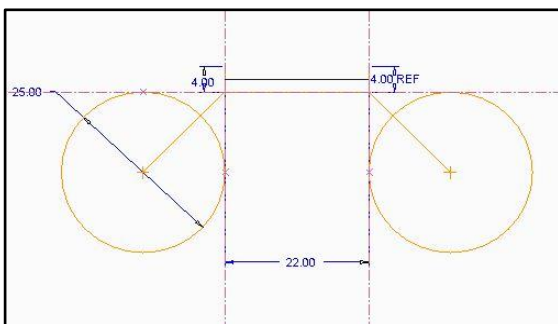
Seat hight from floor = 19.5-20.5.

Seat depth = 16-17.

Seat width = 20-22.

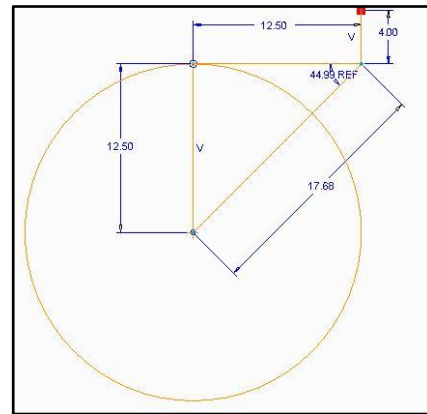


(Fig.4 Wheelchair seat hight and depth)



(Fig.5 wheelchair seat width)

4) Fork Length.



(Fig.6 fork length)

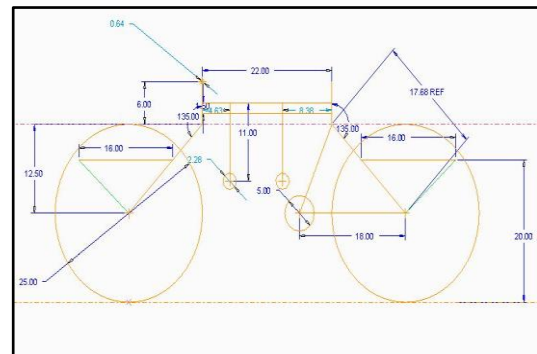
By, Pythagorean theorem:

$$a^2 + b^2 = c^2$$

$$12.50^2 + 12.50^2 = 312.5$$

$$c = 17.68$$

5) Final model dimension of bicycle after calculating all dimensions.



(Fig.7 bicycle dimension)

4. MODEL FABRICATION AND IT'S WORKING

A prototype model of bicycle made as per final model dimension of bicycle after calculating all dimensions.

Working:

- 1) As a bicycle.



(Fig.8 bicycle)

2) As a wheelchair

For converting bicycle into wheelchair as shown in fig.8 at hinge point(1) and (2) turn both wheel , front wheel in anticlockwise direction at 90° and lock that , and turn rear wheel in clockwise direction at 90° then wheelchair support wheels (3) move to ground by open lock and than lock it. Now wheelchair seat(4) which is folded on the front frame , open it and attach on the rear frame by velcro tap. wheelchair is ready to use.



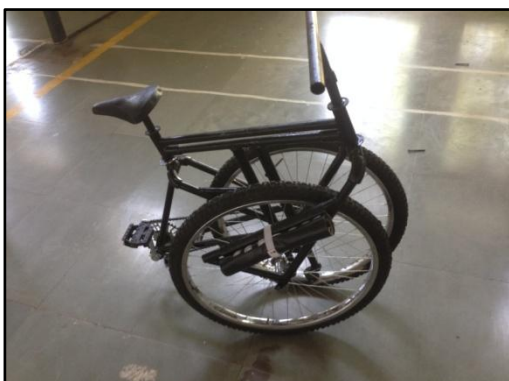
(Fig. 9-a wheelchair)



(Fig. 9-b wheelchair)

3) As a folding bicycle

For folding bicycle turn front wheel in clockwise direction nearly 180° and rear wheel in clockwise direction nearly 180°. Folded bicycle is as shown in fig 10.



(Fig. 10 folding bicycle)

5. CONCLUSION

After calculating all dimension and making it's prototype model it works for three functions(bicycle, wheelchair ,

folded bicycle). It can be easily convertible without use of any external tool and required less space while folded and also useful for emergency situation.

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