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Design Methodology to Fabricate Foldable Bicycle

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Abstract: *In the present day regular bicycles occupy insufficient space to park and are not very easy to carry around and are much probable to theft. Transport has been one of the important issues to be dealt with in the present situations as commuting from place to place within city limits has become a tedious and very expensive job. One particular utility is the folding bicycle; its design allows users to easily transport from one place to another using less the bicycle in compact folded form. When using a folding bicycle haulage journey, it allows individuals ability to board transport vehicles. The bicycle is one which recognized as a transportation solution helping to improve various environmental conditions, economic factors and social aspects. We already saw many fold-able bicycles in the global market but the main idea of this project is to provide a light, rigid and safe design which is easy to handle and easy to maintain. Unlike the conventional bicycles, this type of bicycle will occupy very less space and also is very easy to carry around everywhere. The main objective is to design and develop a fold-able cycle which is economical and comfortable to ride.*

Keywords: *Bicycle, Compact Design, Handling, Parking Space, Pin Joint, Hinge Clamp*

I. INTRODUCTION

A folding bicycle that is designed to fold bicycle into a compact form for facilitates easy transport and easy parking. When folded, the bicycle can be more easily carried wherever we necessary. Folding mechanisms may vary, with each offering a distinct combination of folding speed and folding ease, compactness of frame, ride, weight, durability and price that changes with change in material specification. The choice of model, apart from cost considerations, is a matter of resolving the various practical requirements: a quick easy fold, compact folded size, or a faster but less compact model. While folding bicycles are generally smaller in overall size than that of conventional bicycles. The distances between centers of bottom bracket, the top of the saddle, the handlebars, are the primary factors in determining whether a bicycle fits its rider or not, are generally similar to that of conventional cycles. The wheelbase of many folding designs is also very similar to that of non-folding, bicycles. The material used for the folding bicycles are Carbon fiber, Aluminum, Steel etc. Selection of material depends upon the weight, cost, rigidity, stress. Etc. Different material have different property depending on the material is selected for the bicycle.

A. Why we should use this Type of Bicycle?

The bicycle is one of the most convenient ways of transportation or travelling from one place to another. There are different ways of travelling such as bike, train, bus, but this all is costly as the camper to bicycles.

The cost of a bicycle is nearly 10-12 times lesser than a bike. No doubt that bike required less energy than the bicycle but bicycle helps to make our self-fit & fine.

It do-not required fuel or any types of charges for its working. As the folding bicycle can be folded in a compact form, it is very easy to carry it in a bag from one place to another and it can be again unfolded in a shorter period of time. There are different countries that, using folding bicycles as the main source for travelling.

In this way, they are not only saving the quantity of the fuels but also the human resources. It also helps to be a fit and fine. Japan is one of the countries who are around 75-80% people's uses folding bicycles for travelling. The even different country such as U.S.A, France, and much more uses folding bicycles for travelling.

B. Need for the folding Bicycle?

We all are aware of the cost of fuels and at what speed it is increasing in such condition it is not possible for everyone to use the services which run on fuels.

In such condition, the folding bicycle plays a very important role it not only saves the fuels but also helps to keep our self-healthy and it does not affect the work which we will complete it by making the use of other travelling services such as the bike. As the weight of the folding bicycle is less than the conventional bicycle it is easy to carry from one place to another. Generally, the weight of the

bicycle is around 13-15kg. and the weight of the folding bicycles are around 6-8kg with same rigidity. This is due to the material used in the folding bicycle.

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C. Why we use folding bicycle for transportation?

- 1) Flexible: Not limited, by route maps or even street direction.
- 2) Efficient: The most efficient form of human transportation.
- 3) Low cost: No gas or tickets. Just a bike and the calories you eat.
- 4) Environmental: True zero emission vehicle.
- 5) Healthy: Consistent, a higher level of fitness, tailored to your needs and ability.
- 6) Foldable bicycles are available in the market but are expensive since the bicycles are imported from other countries for sale. There is very few recognized foldable bicycle manufactures in India. Hence, we ceased the opportunity to provide a low cost, locally manufactured foldable bicycle.

D. Why do folding bikes make the most sense for urban riding?

- 1) Gives you more flexibility.
- 2) Takes up less space when parked.
- 3) More convenient.
- 4) Reduce bike theft by parking inside or keeping the bike with you or fits into storage lockers for better security.
- 5) Takes up less space than non-folding bicycles.
- 6) With folding bicycles, parking needs are reduced because riders take their bikes with them.
- 7) Fit a folding bicycle in a car for commuting, leisure, or emergency use.
- 8) Smaller bikes are lighter and easier to carry.
- 9) They play well with other forms of mass transit –Trains, Subways, Buses, Boats, and even Cars.

II. LITERATURE REVIEW

Hajime Ishida (1977): This invention provides a folding bicycle which consists of the folding structure including a front support assembly having handle rods and arranged to be directed towards back after folding. According to the invention, the user can very quickly and easily fold by manually rearward folding the front support assembly which includes upper and lower section interconnected by the hinge.

Jaime Herder, Perth, Australia (1998): A folding cycle generally all the members are pivoted members. In this, the members have attached to horizontally pivot axes and in which members are indirectly or directly connected to a single collar that slides up and down a seat post. In order to achieve an open or closed state, the collar is made to slide along the post and is then secured by tightening a quick release lever on the collar. Two front tubes mending between the Steering head and the lower Part Of the seat post are parallel.

Stephen Augustin, Munich (1998): The invention relates to a two-wheel folding bicycle, Which can be folded together in the plane of the bicycle frame, having a main frame, on Whose rearward frame section a seat pillar can be fastened and on Whose forward frame section a front Wheel fork is rotatable disposed, and having a rearward rigid frame for receiving the rear Wheel Axle.

III. RESEARCH METHODOLOGY

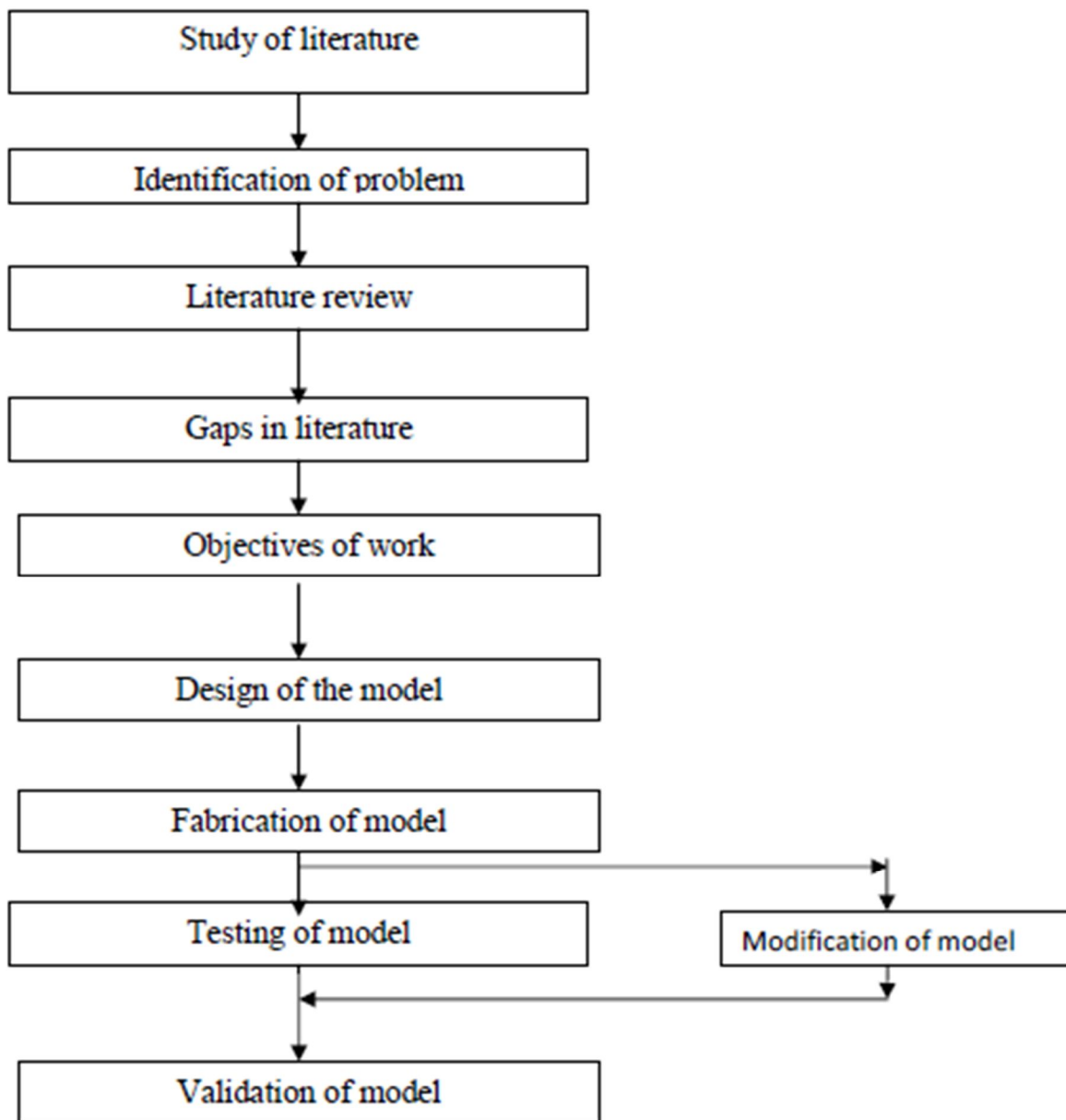


Fig 1 Research Methodology Process Chart

A. Construction And Working

Lugged steel frame constructed using steel tubing mated with socket-like sleeves, called lugs. For most of the bicycle's history, steel has been the primary material for bicycle frames, with lugged construction the primary assembling method. Lugged steel construction uses standard cylindrical steel tubes which are connected with lugs, external fittings made of pieces of steel (sometimes stainless steel) which fit over the ends of the tubing. But in the folding bicycle we need to fold the bicycle then we have attached the thick metal plates in place of lugs and the hole drilled to it to attached the rivet with the rod so it will act as the pivoted mechanism. Calculating the various dimensions of folding bicycle. Carry out the various analytical calculations to prove the stability and rigidity of chassis and chassis does not fail under the extreme conditions. Preparation of design on creo 2.0 and catia v5. Analyse the chassis in ansys 18.1 and ansys 18.2. Preparation of project seminar report. Folding bicycle will be made of quality parts

- 1) **FRAME:** A Frame consisting of five different frame parts: There are various parts for folding and there we also add the diagonal structure part for stability and for quick release on down tube.
- 2) **FOLDED DIMENSIONS:** 65x35x50cm folded
- 3) **GEAR:** Single-gear & fixed-gear.
- 4) **HANDLEBAR :** Straight handlebar.
- 5) **BRAKES:** Brake Calipers, rear and front.
- 6) **CHAIN:** KMC, half link chain.
- 7) **TIRES & RIMS:** Deep Profile, 43mm profile Rim 622, tire 23-622(700x23C)
- 8) **HUBS:** Formula 32H x 14G high flange, cartridge bearings with a rear flip-flop hub.
- 9) **BOTTOM BRACKET:** Conventional threaded, Square Taper

The frame of a folding bicycle is easy to fold without using any tool. It can be folded and unfolded within 10 to 15 second. .If used as a single gear (with freewheel) it rolls on both wheels.

The folding bicycle can be folded by first of all by removing the half cross diagonal frame after that by main diagonal frame from the fork end. After that, we move the wheel by rotating upside down. As we move the wheel the frame gets compacted and then both the wheel gets in front of each other and cycle gets folded. We also unfolded by taking the handle and move upward then place the diagonal frame at the fork end and then fix the half cross diagonal frame.

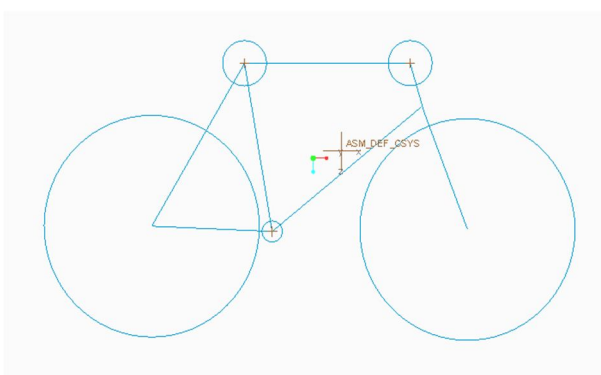


Fig 2 Initial stage complete lock frame

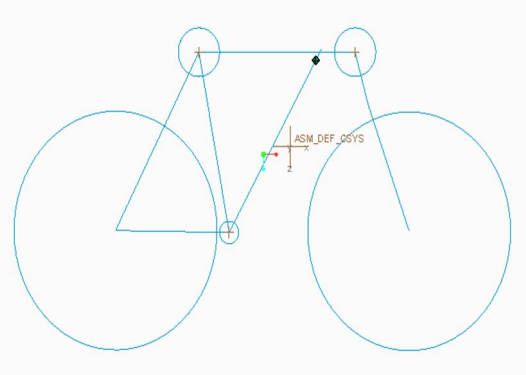


Fig 3 Second stage link moving towards seat

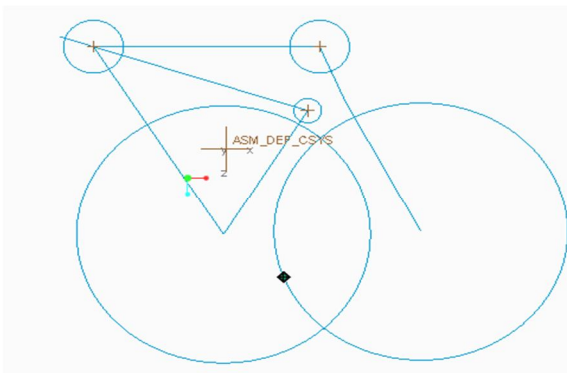


Fig 4 Third stage the frame starts compacting

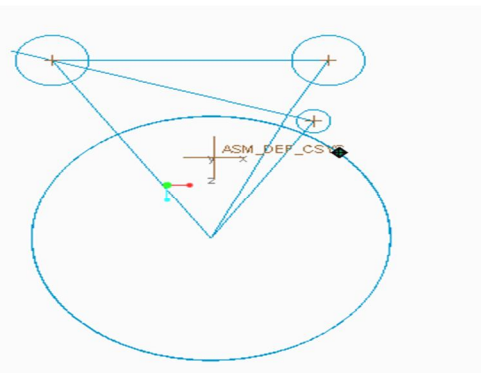


Fig 5 Final stage frame get completely compacted

IV. CONCLUSION

- A. There is one of the best use of the folding bicycle is that we can take the bicycle on the train and bus because it acquires less space.
- B. There is significant interest in folding bicycle among people with the regular-sized bike who already take their bicycle on the train.
- C. As the infrastructure of the folding bicycle get improved day by day so we will get the safety at very a very high level and that also promotes the folding bicycle.



- D. Most people understand the general concept of a folding bicycle but do not recognize the overall value of improved product designs given that few people are willing to pay for additional costs.

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