

Design and Fabrication of Tricycle Fold Around the Bag and Utilized as a Trolley

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Abstract - Transportation has been one of the most important issues to be dealt with. Short distance traveling is tedious, time consuming and expensive task. It is very difficult to reach the nearest public transport facility and in many cases the destination will be very far from the main roads. To overcome this common problem an idea is conceptualized to design and fabricate a foldable cycle, which can be used to reach nearest public transport facilities, easy to fold around the bag and carry or can be utilized as a trolley. Unlike the conventional cycles, it will be light weight and less space consuming. The main objective is to design and fabricate a foldable cycle which is comfortable to ride and economical.

Key Words: Folding tricycle, Tricycle fold around bag, Compact tricycle, Tricycle utilized as a trolley

1. INTRODUCTION

The transport has been major issues in present day situation which faced by people in routine life in Developing countries like Gujarat, Bangalore, and Delhi. Generally, people face many problems while using public transport services like - they have to walk to the station, stations are far away, walking to the station is time consuming and tedious task, low frequency of public transport vehicles, costly short distance travelling.

Due to these problems with public transportation, people suffer in many ways. Mostly, they are unable to reach their destination in time, they feel tired and irritated. So the people are forced to use personal vehicles. This in turn leads to issues with parking, traffic, pollution etc. Also, not all can afford having own vehicles as it is expensive. Thus, personal vehicles do not solve the problem.

So there is a solution required which solves all the above mentioned problems, and makes travelling by public transport comfortable. Other advantages of such a solution are cheaper transportation, less traffic, less use of personal vehicle so less fuel is used and low amount of pollution.

2. LITERATURE SURVEY

[1] A Typical Approach in Conceptual and Embodiment Design of Foldable Bicycle Author name: Arunachalam M., Arun Prakash R., Rajesh R. PSG College of Technology, Coimbatore, India. This study aims at generating different concepts for a foldable bicycle product using a systematic concept generation method and the best generated concepts have been selected using various concept selection methods. Various design concepts have been generated from a range of available possible solutions to each product function by which was developed based of function tree.

The first phase understanding the opportunity deals with the identification of customer needs which define the problem to be addressed various tools like customer survey interviews and interviews are used to understand the customer needs. The next stage conceptual design deals with finding the solutions to solve the problem. The concept engineering is generally considered as the final outcome of developing a concept, where the concept generation and concept selection activities are done. The final stage implementing a concept deals with the embodiment design, design for x etc. It is the phase where the material selection, dimensions & tolerances for the product is finalized. In this study, the modern product development process has been followed to address the market study. A new foldable bicycle has been designed based on the limitations of the current design.

[2] Designing and Fabrication of 4-Fold Foldable Bicycle Author Name: Dr.A.K.Jouhri, Kushal Sharma, Vibhum Dixit, Baashi Abbas, Vanshaj Shukla. Amity University, Lucknow, India. Cycle is the most efficient and most feasible vehicle in all the respect. The only drawback with the cycle is the space requirement and to fix this issue the foldable cycles came into use. The most important things in foldable cycle are the joints, material used and the type of joining techniques such as welding, brazing etc. done for the fabrication of the folding bicycle. The four-fold foldable bicycle is the bicycle which consists of the four folds. 1st Fold: Handle Sliding fold, which is used to adjust the height of the handle according to our need, provided with an interlocking clamping system, to tighten the handle at desired height. 2nd Fold: It is also provided in the handle of the foldable bicycle. It is used to partially disassemble the handle from the main frame of the bicycle. It is provided with a spring loaded clamping system. 3rd Fold: It is the fold provided in the seat bar of the bicycle, it is used to raise or lower down the height of the

seat according our need. It is provided with a clamp interlocking system.4th Fold: It is the most important type of fold of the bicycle. It is used to fold a bicycle from 180 degree to 360 degree. It is provided with a bolt clamping system in which a bolt and the holes of the same, diameter form the interlocking system. It is the most important type of folding system.

From the above analysis we can see that four-fold foldable bicycle is of great use. It is not only economic feasible but also very eco-friendly and in addition to this it also proves to be a one of the best way to maintain the health and fitness. Variable height of the handle bar and padded seat bar, makes it available for the users of every age and sex. One more factor which makes foldable bicycle so popular is it's very less space requirement that is it requires a very less space to accommodate itself and can be carried easily by any person to any place.

[3] Design and Fabrication of Foldable Bicycle Author Name: Shishir S, Manjunath P, Pavanasudan R, Ravi Sathyajith SJB Institute of Technology, Bangalore, Karnataka, India. In the present day lifestyle man is not able to dedicate specific time for his health, importance is least given to exercise and body fitness due to time shortage and stressful life. Obesity is one of the common issues seen in the society, which leads to many health hazards. With the petrol and diesel prices increasing day by day, almost all the modes of transport are becoming expensive. It is difficult to reach the nearest public transport facility and in many cases the destination will be far from the main roads and due to the small roads, the public transport might not be able to reach there. To avoid this most people use vehicles of their own, this leads to issues with parking, traffic, etc. But not all can opt for having own vehicles as it is expensive. With such issues in health, transport, space for parking, etc. One obvious solution that comes to mind is bicycle.

First the designs of the existing foldable bicycles were studied. It was found that almost all the bicycles have a very similar frame design and also improve the folding mechanism by making it simple. Once all the survey on the existing designs was completed, few hand sketches were drawn. The feasible ones i.e. the ones that were having proper ergonomics and were easy to manufacture were selected for comparison. The bicycle frame concepts developed were based on the ergonomics of the conventional bicycle frame.

The hinge being a very important member of the frame required utmost attention. The hinge is the load bearing member. After a long survey of the existing hinge mechanisms used in the foldable bicycles, it was found that most of the bicycles used similar kind of hinge and locking mechanism. The mechanism used was simple, but manufacturing something similar with available resources turned out to be expensive. But the hinge mechanism or the simplest hinge mechanism used in Brompton bicycle caught our interest.

[4] Concept of User Friendly Modified Folding Bicycle Author Name: A.K. Singh, A.S. Bobade, A.K. Ghodmare, B.C. Bisen, H.H. Walmik, P.C. Padole V.U.Gaikwad, N. K. Mandavgade, C.K.Tembhurkar. Priyadarshini College of Engineering, Nagpur, India. A folding bicycle is a bicycle designed to fold into a compact form, facilitating transport and easily park. When folded, the bicycle can be more easily carried into buildings and workplaces or on public transportation and more easily parked in compact living quarters or aboard a car, boat or plane and it is very easy to carry it in a bag from one place to another and it can be again unfold in a shorter period of time. Folding mechanisms vary, with each offering a distinct combination of folding speed, folding ease, compactness, ride, weight, durability and price. The various practical requirements: a quick easy fold, compact folded size, or a faster but less compact model. Carbon fiber, Aluminum, Steel etc. are the material used for folding bicycles. Material selection depends upon the weight, cost, rigidity, stress etc. Different material has different property depending on the material is selected for the bicycle.

The folding bicycle plays a very important role as it not only saves the fuels but also provides exercise to our body and it do not affect the work which we would complete by making the use of other travelling services such as bike. In addition, many public transportation systems do not allow unfolded bicycles, but allow use of folded bicycles. Japan is the one of the country who's around 75-80% people use folding bicycles for travelling. Even people from different countries such as U.S.A, France, and many more are using folding bicycles for traveling. Normally the weight of the conventional bicycle is around 13-15 kg and with same rigidity the folding bicycle would only weigh around 6-8 kg. This is due to the material used in folding bicycle is light weight.

There is significant interest in folding bicycle among park-and-riders provided they can take their bike on the train. There is significant interest in folding bicycle among people with regular-sized bike who already take their bicycle on the train. Improved bicycle infrastructure is positively and significantly correlated with higher rates of commuting by bicycle that could include promotion of folding bicycles. 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.

2. TECHNICAL SPECIFICATIONS AND FOLDING MECHANISMS

[1] Front Wheel and Rear Wheel –

Wheel size - $\Phi 28$ inches, Width - 1.5 inches

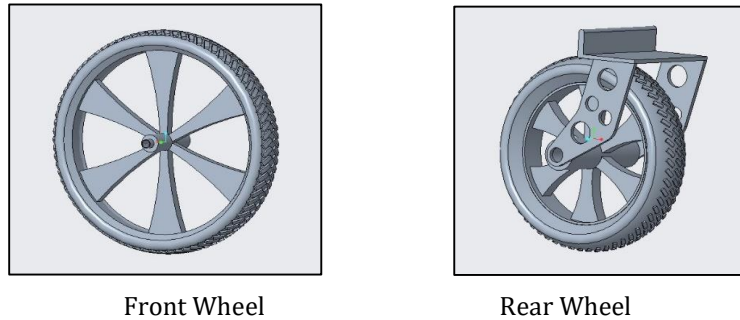


Figure-1: Wheel

[2] Clamp Mechanism - Numbers of clamps are found in existing folding bicycle but overcoming excessive use of fold the design is made in such way that it require only one clamp at top tube.

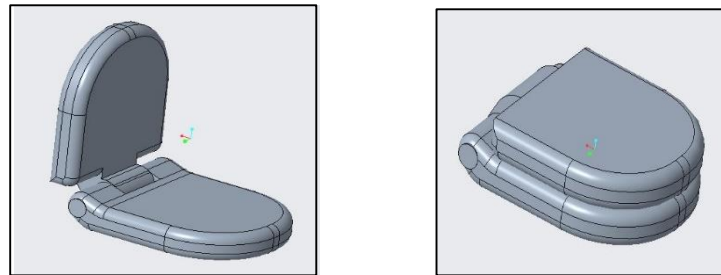


Figure-2: Clamp

[3] Folding Mechanism -

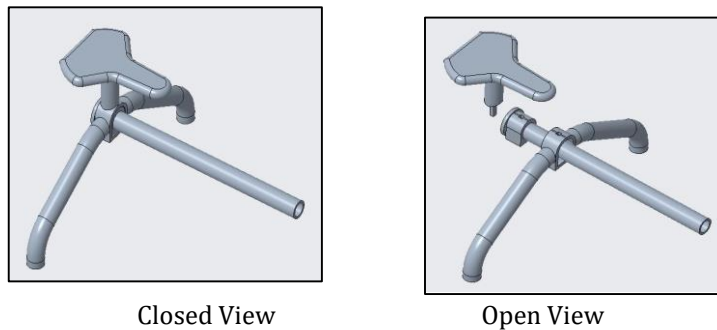


Figure-3: Folding Mechanism

[4] Brake –

Front

Disc brake is used at the front because it provides incredible stopping power in all weather conditions and it consumes less time to stop the tricycle.

Disk Size - 6 inch

Thickness - 2 mm

Material - Stainless Steel 421

Rear

Rim brake is provided at the rear wheel because of its simple design and much lighter than disc brake. It is best suitable for the small tire.

[5] Folding Steps

Folding is done by the following 3 steps:

Step-1: Rotate handle bar along with front wheel by 90 degree.

Step-2: By releasing the clamp, the key is removed from its slot along with seat. So top tube is free to move.

Step-3: Drag the top tube towards back side. This causes top tube to turn from center towards the bottom.

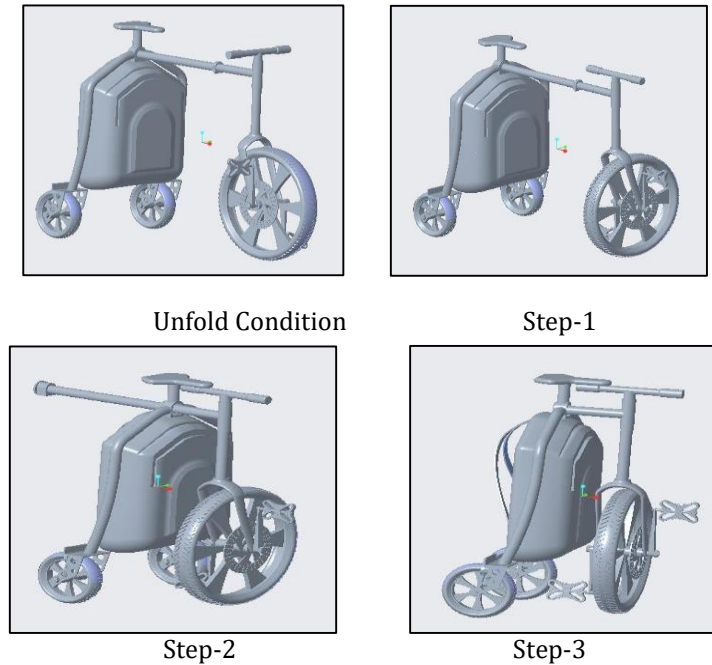


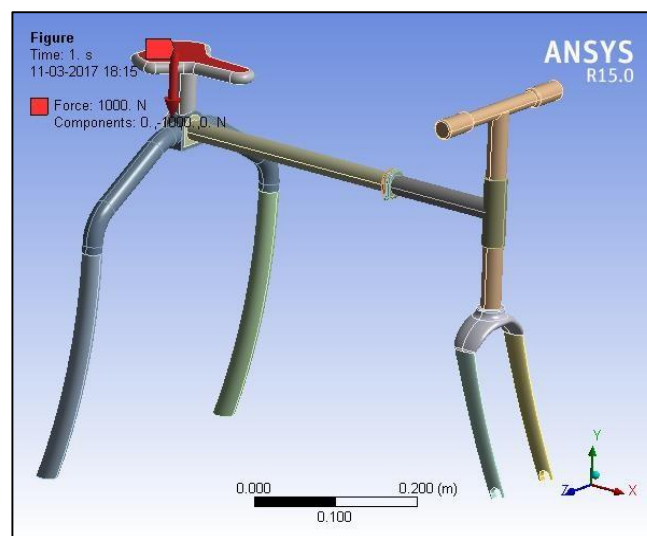
Figure-4: Folding Steps

VideoLink-https://drive.google.com/file/d/17Vda_GqwQkD_iNGpc97K3GuFmXLsSOY8/view

3. EXPERIMENTAL RESULTS [DESIGN EVALUATION BASED ON LOAD AND STRESS

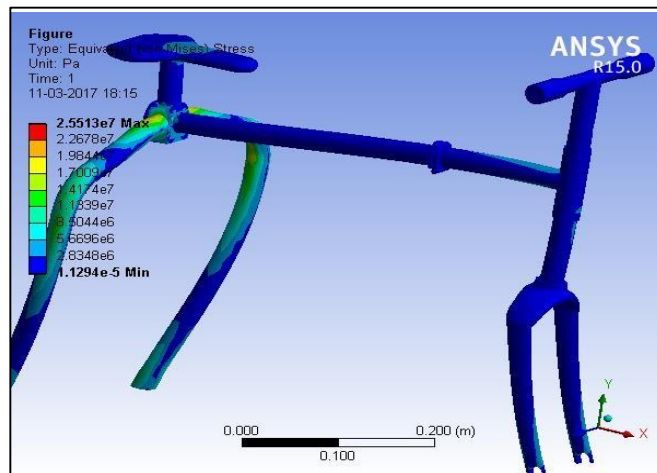
[1] Load Applied-

Here the load applied in downward direction is 1000 N on seat of tricycle for design evaluation



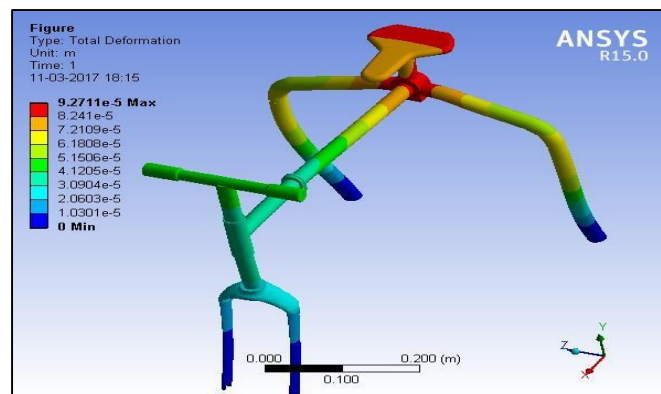
[2] Stress Generated –

When the force is applied, Maximum stress generated in Frame is 2.5513×10^7 pa which is under in safe limit.



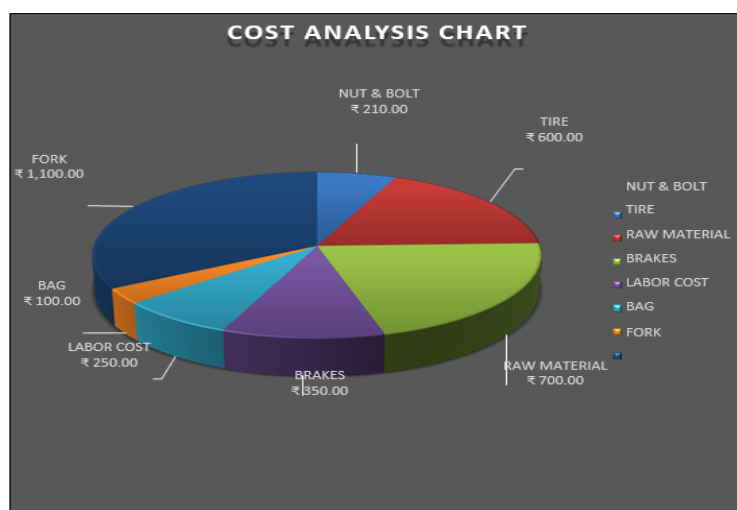
[3] Total Deformation-

When force is applied, maximum deformation of frame is 9.2711×10^{-5} m which is under safe limit.



From above analysis, we have concluded that our design is safe against applied load.

4. COST ANALYSIS VS EXISTING FOLDING CYCLES –






Cost Analysis Chart
 Total Cost = Rs.3310

Table -1: Properties


CHEMICAL COMPOSITION		MECHANICAL PROPERTIES
Component	wt%	
C	0.28-0.33	
Cr	0.8-1.1	
Fe	97.3-98.22	
Mn	0.4-0.6	
Mo	0.15-0.25	
P	Max 0.035	
S	Max 0.04	
Si	0.15-0.35	

Existing Folding Cycles:-

Sr No.	Product	Specifications
1	<p>A-Bike</p> 	<ul style="list-style-type: none"> - Price: Rs 20,000 - Weight: 5.70 kg - Folded Size: H×W×L = 67×33×17 cm - Fold Time: 12-15 sec - Capacity: 85 kg - Wheel Size: 6" - Not Available In India
2	<p>Dahon</p> 	<ul style="list-style-type: none"> - Price: Rs 61,000 - Weight: 12 kg - Folded Size: H×W×L = 80×30×65 cm - Fold Time: 15-20 sec - Capacity: 90 kg - Wheel Size: 19" - Not Available In India

<p>3</p>	<p>Brompton</p> 	<p>-Price: Rs 65,000 -Weight: 10-12 kg -Folded Size: H×W×L = 57×27×54 cm -Fold Time: 30-40 s Capacity: 100 kg Wheel Size: 16" -Not Available In India</p>
<p>4</p>	<p>Yike Bike</p> 	<p>-Price: Rs 3,32,000 Weight: 15.4 kg Folded Size: H×W×L = 66×19×55 cm -Fold Time: 15-20 s Capacity: 100 kg Wheel Size: Front = 20" Rear = 8" -Not Available in India</p>

<p>5</p>	<p>If Mode Folding Bike</p> 	<p>-Price: Rs 1,79,900 -Weight: 14.7 kg -Folded Size: H×W×L = 101×27×66 cm -Fold Time: 25-30 sec Capacity: 90 kg Wheel Size: 26" -Not Available In India</p>
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<p>6</p>	<p>Hummingbird</p> 	<p>-Price: Rs 1,91,600 Weight: 6.50 kg</p> <p>-Folded Size: H×W×L = 84×35×90 cm</p> <p>-Fold Time: 12-15 sec Capacity: 80 kg Wheel Size: 16" -Not Available In India</p>
<p>7</p>	<p>Strida</p> 	<p>-Price: Rs 53,000 -Weight: 9 kg -Folded Size: H×W×L = 114×51×40 cm</p> <p>-Fold Time: 15-20 sec -Capacity: 100 kg Wheel Size: 16" -Not Available In India</p>
<p>8</p>	<p>Suitcase Folding Bike</p> 	<p>-Price: Rs 28,000 -Weight: 8 kg</p> <p>-Folded Size: H×W×L = 76×30×53 cm</p> <p>-Fold Time: 15-20 sec Capacity: 80 kg Wheel Size: 16" Not Available In India</p>

4. CONCLUSION

In this study, a foldable cycle conceptual design has been developed. The proposed design has good portability and foldability when it is compared with the existing bicycles. By evaluating the existing designs, the limitations in the designs were found out which cover ways for exploring new foldable cycle designs which overcome all those limitations. The new design and analysis have been done by using software.

5. REFERENCES

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