

# Design and Fabrication of Tilting Trike

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**Abstract-** Safety is the most crucial factor for two-wheelers. The tilting mechanism boosts the maximum speed along bends. The adoption of tilting mechanisms in automobiles would reduce the number of skid-related incidents. It will improve the vehicle's dynamic and directional stability, road grip, and passenger comfort. The tilting trike has a system that comprises a parallelogram connection, allowing it to tilt like any other two-wheeler. The tadpole form of the trike gives more stability than the delta design. The tilting mechanism is operably attached to the vehicle's frame by a series of vertically aligned bearings that hold it in place. The system guarantees that the independent wheels remain properly aligned during all motions.

**Key Words:** tadpole, trike, skidding, directional stability, parallelogram linkage

## 1. INTRODUCTION

A trike, or three-wheeled vehicle, is an automobile with one wheel for steering and two for power in the front, two wheels for steering and one for power in the rear, or any other arrangement of wheels. The delta layout is one wheel in front and two wheels behind. The tadpole, often known as the reverse trike, is the second kind of three-wheeler configuration. This arrangement, which is the reverse of the delta, has two wheels in front and one in the back. Because of its improved handling, the front-steering tadpole, also known as the reverse trike, is becoming more and more popular. Since the two wheels up front are used for steering and the back wheel drives the vehicle, tadpole designs are far more stable than delta configurations. Because of the vehicle's nearly teardrop-shaped design, which taper down at the back and is wide and spherical up front, there is also an aerodynamic benefit. As a result, air may pass over the car body with ease.

### 1.1 NEED OF THE PROJECT

These days, the majority of two-wheeler accidents are caused by cars skidding and becoming unstable in slick weather. Riding a bike during the winter or wet season is dangerous. The paramount consideration need to be the safety of the passengers. Trikes are made to offer

passengers the highest level of safety possible. Preventing jeers when riding is a crucial component of a bike. In these kinds of situations, trikes are crucial to ensuring passenger safety. In addition to being smaller and lighter than any car, the tilting trike is far safer than motorcycles and scooters. In addition to improving braking, the third wheel also increases stability. When the roadways are slick, it provides additional traction.

### 1.2 PRINCIPLE

The two separate suspensions with the tyres and the bike's body are connected by a parallelogram connection in the design. The tires can be tilted thanks to the parallelogram connection. Two bearings, which are mainly welded and fastened to the bike's body, are used to connect the link to the body. Parallelogram connection action causes tilting. The fork attached to the parallelogram link will also tilt as a result of the link tilting during rotation. As a result, the wheels tilt. Tilting is a vital component in preventing vehicle sliding.

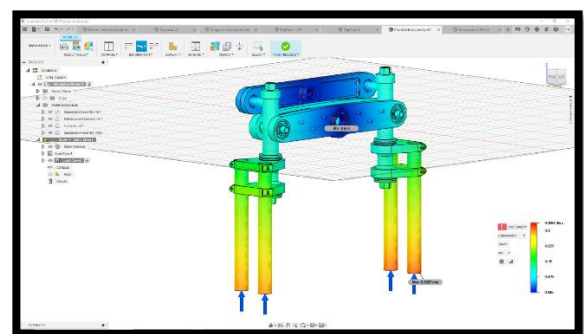


Fig -1: Parallelogram Linkage

## 2. LITERATURE SURVEY

### Deaths in India due to accidents [2]

There has been a noticeable rise in the number of unintentional deaths, with 51.8% in 2012 compared

to 2002; yet, there was a 0.2% drop in 2003 over 2002. While the rate of accidental deaths increased by 34.2% between 2003 and 2012, the population grew by 13.6% during same time. 2012 saw the deaths of 1,18,533 men and 20,205 women, for a total of 1,39,091 people. In all, 32,318 people (23.2%) lost their lives in incidents involving "two-wheelers," followed by "trucks/lorries" (19.2%), "cars" (10.1%), and "buses" (9.4%) in December 2012.[2]

### Stability Analysis of Three-Wheeled Motorcycles. [3]

This work explains the modal analysis of a three-wheeled tilting motorcycle. This vehicle can be driven like a typical motorcycle despite having a tadpole design with two front wheels and one rear wheel. Two models have been developed to study the stability of the system in straight running: a 14-degree-of-freedom model that accounts for the radial stiffness of tires and the stiffness and damping of suspensions, and a simplified motorcycle model with rigid and thin tires. The driver was supposed to be fastened to the frame in both models, which assumed the frame to be rigid. The tire behavior has been described using a linear model with transient behavior. examined and talked about in this book. The suspension and tire compliance has been taken into consideration or not in the setup of two distinct models of the vehicle. A model of a comparable two-wheeler has also been constructed in order to compare the stability analysis of the two vehicles. When compared to two-wheelers, the three-wheeled motorcycle's weave mode is more stable when operating in a straight line; in fact, it has been determined to be stable over the whole speed range under investigation. [3]

### Review on tadpole design – issues & challenges [4]

The vehicle's broad rounded surface is created by the two front wheels thanks to the three-wheel arrangement. The car can taper at the back because to its single rear wheel. Because there is less rolling resistance when one wheel is removed, fuel efficiency is also increased. A rear-drive, non-tilting three-wheel configuration's drawback is instability; unless the wheelbase is significantly broader or the center of mass is significantly closer to the ground than in a comparable four-wheel vehicle, the car will topple over in a turn before sliding. Certain three-wheelers are made to tilt, allowing them to lean like a motorcycle during a corner for increased stability. Either a computer or a manual controller can adjust the tilt. By positioning the bulky battery pack at the bottom of the vehicle, electric three-wheelers frequently

reduce their center of gravity. When taking into account a three-wheeler with two front wheels, this result becomes clear. When the vehicle's occupant assembly's center of gravity is low enough to lie beneath the pyramid, the car will not roll laterally when accelerating or tip forward when braking.[4]

### 3. DESIGN METHODOLOGY

For our tilting trike, we have devised one of the most understated yet sophisticated designs yet. The front end of earlier developed trikes included an intricate wishbone suspension system. Its tire span was about the same as that of a small automobile. It is therefore challenging to utilize in situations with heavy traffic. Additionally, it makes the time's turning radius larger. Additionally, it increased the vehicle's weight, which decreased its overall efficiency. Our trike is more user-friendly and compact than previous models. Compared to earlier tricycle designs, it is far more efficient because it adds very little weight. Its small size makes it suitable for usage in any kind of traffic. The two separate suspensions with the tyres and the bike's body are connected by a parallelogram connection in the design. The tires can be tipped thanks to the parallelogram connection. Two bearings, which are mainly weld fastened to the body of the bike, are used to connect the link to it. When suspension is applied, two forks are essentially employed as a single unit when they are side by side. The parallelogram link connects the two suspensions such that there is roughly 35 cm separating the tires.

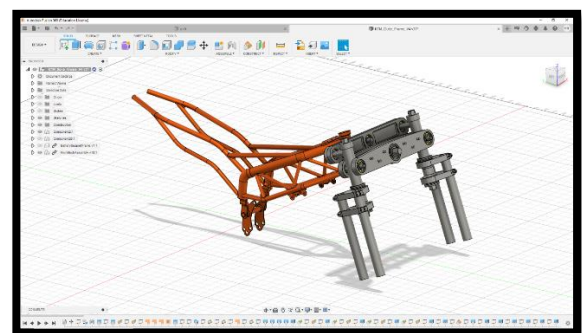


Fig- 1: Front view of Suspension

#### 4. FABRICATION

They disassembled the front suspension. Parts such as the head, forks, wheels, etc. are disassembled. There are two additional forks gathered. To create a single suspension, two of them are connected. When two forks are joined, they become stronger than when one is used alone. The wheels and dual fork suspensions are then attached. After that, the two front plates are securely fastened. With the aid of iron bars, the UCT bearings are now welded firmly one beneath the other. This is the bearing that the parallelogram link is fastened to. There are two vertical and two lateral linkages in the tilting mechanism. The vertical links are composed of the fork suspension. Every UCT bearing has two lateral link centers fastened to it. The entire assembly is fastened or welded when the caser and camber angles are correctly set.



**Fig —2:** 3D- Printed tilting trike.

#### 5. CONCLUSIONS

We have created a tilting trike prototype that successfully combines the benefits of a leaning mechanism and a reverse trike. According to the study, the majority of accidents occur when the front wheel skids during a sudden braking situation while making a turn. Because our design has two front wheels and the capacity to lean, it keeps the vehicle from skidding and losing control while driving. Compared to other three-wheelers sold in stores, the tilting trike offers far superior performance, handling, and safety.

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#### BIOGRAPHIES



**Chinmay Chaudhari**

A Mechanical Engineer exploring all aspects of life, from designing to practically executing. He hopes to give a new life in creative ways to everything in and around his reach. He exceeds with the ability to manage and communicate to larger audiences patiently and strategically.