

Study of Personal Commuters Leaning Reverse Trike

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Abstract— This paper presents a study of a very small and emerging sector of automotive industry, i.e. reverse trikes some are eco-friendly human powered vehicle with a compounded electric drive system and some are powered by I.C. Engines the focus has been laid on the simplicity in design, high performance, easy maintenance and safety at very reasonable prices. The incidence of accidental deaths has shown an increasing trend during the period 2003-2012 with an increase of 51.8% in the year 2012 as compared to 2002; The population growth during the period 2003-2012 was 13.6% where as the increase in the rate of accidental deaths during the same period was 34.2%. A total of 1,18,533 males and 20,205 females totaling 1,39,091 persons were killed during the year 2012 A total of 32,318 persons (23.2%) were died due to accidents of 'two-wheelers' [1]. Because of the fact that that these vehicles are very safe to drive and will be very less to become accident prone these three wheelers could be the future of the automotive sector, In the early 20th century three-wheelers gained in popularity as low-cost, lightweight vehicle that is, until about the late 1920s, when cars generally started going more along the four-wheel track. A TRIKE is a vehicle with one wheel in the front and two in the rear side of the vehicle It's relatively easy (and inexpensive) to build a steering setup with only one wheel. These setups are very common in Asian region. The second type of three-wheeler setup is called the tadpole or REVERSE TRIKE. The opposite of the delta, this formation has two wheels up front and one in the back. A reverse trike is basically a vehicle having two wheels in the front and one on rear side. Most cars have the engine driving the rear wheel and leave steering to the front ones.

Key words: Three Wheeled vehicle, Leaning Reverse Trike, Tadpole Design, Delta Design

I. INTRODUCTION

The idea of smaller, energy efficient vehicles for personal transportation seems to naturally introduce the three wheel platform. Opinions normally run either strongly against or strongly in favor Of the three wheel layout. Advocates point to a mechanically simplified chassis, lower manufacturing costs, and superior handling characteristics. The engine can drive the single rear wheel or the two rear wheels, and the steering can be done either way as well. Having one wheel up front and two in the back is known as the delta configuration. Opponents decry the three-wheeler's propensity to overturn. Both opinions have merit. Three-wheelers are lighter and less costly to manufacture. But when poorly designed or in the wrong application, a three wheel platform is the less forgiving layout. When correctly designed, however, a three wheel car can light new fires of enthusiasm under tired and routine driving experiences. Designing to the three wheeler's inherent characteristics can produce a high performance machine that will out corner

many four wheelers. A well designed three wheeler is likely to be one of the most responsive machines one will ever experience over a winding road. Superior responsiveness is primarily due to the three wheeler's rapid yaw response time.

And today's tilting three wheelers, vehicles that lean into turns like motorcycles, point the way to a new category of personal transportation products of much lower mass, far greater fuel economy, and superior cornering power.

II. LITERATURE REVIEW

There are different papers have been written in recent times on equivalent system. They are:

A. Stabilized Three-Wheeled Vehicle^[2]

A three wheeled motorcycle in which two front wheels are interconnected with a conventional motorcycle frame by parallelogram configured coupling assembly utilizing a pair of cross members pivoted connecting hubs of the front wheels and pivotal connected to the frame, Foot resting platforms are positioned on either side of the motorcycle, being fixedly connected to one of the cross members in the front and pivotally connected to the motorcycle frame at the rear.

B. Leaning Vehicle with Centrifugal Force Compensation^[3]

A three wheeled vehicle, with two steerable front wheels and a driven rear wheels which may be either rider or motor powered includes steering linkage disposed adjacent to the lower end of the steering column having a handlebar attached to its upper end. The steering linkage pivotally couples a forward frame to a rear frame which supports the rider and includes the rear wheels and its mean for propulsion. The steering linkage includes a pivot shaft, a bearing housing and a mechanical connection for leaning the rear frame in a direction of a turn so as to compensate for centrifugal force encountered in turning the vehicle. The mechanical connection causes the rear frame to lean in a controlled relationship to the amount of rotation of the steering shaft, within rotational limits, to emulate the leaning action of a conventional bicycle when making a turn.

C. Anti-Rolling Device for Vehicles^[4]

It is well known that currently in the field of Vehicles a substantial diversification of models has gradually been proposed, in particular there is a growing interest towards "hybrid" vehicles that combine the characteristics of motorcycles, in terms of handling, with the stability of four-wheeled vehicles. Such vehicles are, for example, represented by three-Wheeled vehicles equipped with two steered front Wheels and four-Wheeled vehicles Known by the name quad. The aforementioned three-Wheeled vehicles

can, advantageously, be driven like a motorcycle (in riding style) at the same time, however, offering the usual stability of four-Wheeled vehicles. In particular, such a vehicle is provided with two front steered Wheels and with one rear Wheel with fixed axis.

Two independent suspensions are also foreseen, one for each of the two front Wheels, equipped with shock absorbers, also independent, and a front steer system based upon an articulated quadrilateral kinematics. Such a kinematics allows the front Wheels, during Steering and/or “folding” operations of the motorcycle, to remain substantially adjacent to the ground. Due to the structural particularity of this type of vehicle it is possible that in particular travel conditions, for example at very low speeds or during stops and parking, the vehicle can fall over precisely due to the rolling movement caused by the articulated quadrilateral. In light of the above, there is clearly a need to be able to provide an anti-rolling device, like that according to the present invention, which allows a vehicle to be provided equipped with the handling of a two-Wheeled vehicle and with the stability of a four-Wheeled vehicle. Therefore, the purpose of the present invention is that of solving the problems of the prior art providing an anti-rolling device for vehicles that is reliable and safe and that ensures the stability of the vehicle in any travel condition thereof.

D. Accidental Deaths in India. [1]

The incidence of accidental deaths has shown an increasing trend during the period 2003 -2012 with an increase of 51.8% in the year 2012 as compared to 2002; however 0.2% decreases was observed in 2003 over previous year 2002. The population growth during the period 2003-2012 was 13.6% where as the increase in the rate of accidental deaths during the same period was 34.2%. The percentage change of accidental deaths is presented in Table-2.1 fatal road accidents State/UT wise and mode of transport wise distribution of deaths due to road accidents is presented in Table 1.8. Tamil Nadu, Uttar Pradesh, Andhra Pradesh and Maharashtra have accounted for 11.6%, 10.9%, 10.8% and 10.0% respectively of total ‘Road Accident’ deaths in the country. A total of 1,18,533 males and 20,205 females totaling 1,39,091 persons were killed during the year 2012 A total of 32,318 persons (23.2%) were died due to accidents of ‘two- wheelers’, ‘truck/lorry’ accounted for 19.2% (26,678 persons), ‘cars’ accounted for 10.1% (14,110 persons) and ‘buses’ accounted for 9.4% (13,076 persons) of accidental deaths during the year 2012.

Sl. No.	Mode of transport	Number of road accidental deaths			%share of total vehicles
		Male	Female	Total	
(1)	(2)	(3)	(4)	(5)	(6)
1	Truck/Lorry	23523	3155	26678	19.2
	Government	388	77	465	0.3
	Private	23135	3078	26213	18.8
2	Bus	10653	2423	13076	9.4
	Government	3708	716	4424	3.2
	Private	6945	1707	8652	6.2
3	Tempo/Vans	6556	1329	7885	5.7
	Government	100	30	130	0.1
	Private	6456	1299	7755	5.6
4	Jeep	7668	1605	9273	6.7
	Government	207	41	248	0.2
	Private	7461	1564	9025	6.5
5	Car	11986	2124	14110	10.1
	Government	354	63	417	0.3
	Private	11632	2061	13693	9.8
6	Three wheeler	5461	1276	6737	4.8
7	Two wheeler	28524	3794	32318	23.2
8	Bicycle	2871	198	3069	2.2
9	Pedestrian	9067	2504	11571	8.3
10	Others	12224	2150	14374	10.3
	Total	118533	20558	139091	100.0

Fig. 1: data of no. of road accidents

E. Overturning Stability of Three Wheeled Motorized Vehicles [4]

Three wheeled motorized vehicles are a major mode of public transport in many countries. These vehicles are prone to overturning even during normal turning and obstacle avoidance maneuvers. This paper presents a parametric analysis of a mathematical model of the vehicle and evolves guidelines for improving the overturning stability in terms of vehicle geometry and suspension properties.



Fig. 2: photograph of an autoricksha India

In this study, the dynamic behavior, in particular, the overturning stability, of three wheeled motor vehicles is analyzed. Based on a six degree of freedom model of a general three wheeler, differential equations governing the motion are derived and numerically simulated for different maneuvers. The variation of wheel reactions during turning maneuvers is studied for determining the onset of overturning. A parametric study is carried out to determine the effect of vehicle geometry and elasto-damping characteristics of the suspension on the overturning stability. The study indicates that there is an optimum position for the location of the center of gravity of the vehicle from stability considerations. While stiffer suspensions favor stability, the study shows that there may be a limiting value of suspension damping for better overturning stability.

F. Steady-state steering of a tilting three-wheeled vehicle. [6]

The design of a narrow-track enclosed vehicle for urban transport was the subject of the CLEVER project. Due to its narrow track and requirement for car- like controls, an

actively controlled tilting system was integrated into the chassis to allow for high lateral accelerations without rolling over. The cornering behavior of this unique vehicle concept is investigated and compared with the ideal Ackermann response. The steer kinematics of this 1F1T (one front wheel, one wheel tilting) configuration are assessed through the use of a steady-state steering model, with attention focused on how steer parameters such as tilt axis height and inclination can be tuned to provide the required response. A prototype vehicle was designed and built and the results of experimental testing are presented to illustrate the real balancing performance of the combined steering and tilting approach used for the CLEVER vehicle. The experimental results follow the trends demonstrated in the model.

G. The Piaggio MP3^[7]

The Piaggio MP3 500, features a special three wheel configuration which makes it significantly more stable than any other two wheel maxi scooter. The MP3 500 also features an aggressive style, a comfortable seat and an ergonomically designed handlebar. The MP3 500 is propelled by a single cylinder, MASTER, 4Stroke, 4Valve, 492.7 Cc engine which delivers a gas mileage of 55.7 Mpg. The unit cranks out a maximum power of 40 Hp and 42.23 Nm of torque at 5,550 Rpm which propel the scooter to a maximum speed of 89 mph. All this power is kept in leash by a CVT automatic transmission. The ride is kept in check by an innovative parallelogram front suspension and an electro hydraulic suspension locking system which combine to offer a 40degree lean angle. As far as prices are concerned, the Piaggio MP3 500 can be yours for no less than \$8,899. The Piaggio MP3 500, with aggressive styling and performance, are the three wheeler for people who want to stand out. Riding has never been this easy, enjoyable, secure and fast. When you take 20% less braking distance required and pair it with a lean angle of 40degrees, you get a perfect machine for impeccable road holding in all riding conditions

III. CONCLUSION

On studding various vehicles and developing concept vehicle we came to a conclusion that leaning reverse trike and that too electrically driven has a great potential to bring new changes to the existing vehicle industries.

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