
Design & Development of Hybrid Tricycle

Mr. Atul Anant Deshpande

*Assistant Professor, Department of Mechanical Engineering, Bharati Vidyapeeth College Of Engineering
Kolhapur*

1. INTRODUCTION

At present many exciting development in electric vehicle technology are taking place. Some of these have advanced sufficiently to be commercially available, whilst others remain for the future. The first demonstration electric vehicles were made in 1830s and commercial vehicles were available by the end of the 19th century. Today's concerns about the environment particularly noise and exhaust emissions, coupled to new developments in batteries, fuel cells, motors and controllers may swing the balance of electric vehicles. There are many types of electric vehicles such as railway trains, ships, aircrafts, cars, bikes, bicycles, wheel chair and many more. But in this project is focused on electrical powered tricycle which is categorized under Low Speed Vehicles (LVSs) are an environmentally friendly mode of transport for short trips. This vehicle is particularly targeted at fairly active retired people, who still want to get about to see their friends, but who do not travel so hurry and can be used inside a institution like large factories. The objective of the project is to design and develop a concept battery powered tricycle for multipurpose use and to choose the best concept to reduce the mass expensive batteries required. Besides that, to design a tricycle with high efficiency and greater flexibility to place components in tricycle to optimize weight positioning and minimize aerodynamic drag.

2. LITERATURE REVIEW

2.1 Introduction

The main purpose of this literature review is to get information about the project from the reference books, magazines, journals, technical papers and websites. One of that was from (www.pashley.co.uk/gallery/tricycle.html), where it helped us to generate ideas on new design. In this chapter, we want to discuss all the information that we found from many sources.

2.2 Common Problems Faced In Current Motorized Tricycle

The common problems faced by consumers by using current motorized or battery powered tricycles can be divided into:

2.2.1 Cost

Manufacturing of battery powered tricycle normally expensive and required lot of money. This is because the components that are used to produce a tricycle normally are very expensive. The components consist of electric cells, battery charger, electric motor (DC or AC), motor controller and power transmission system. If the performance is high, of course the cost will double up.

2.2.2 Weight

The mass of an electrical vehicle has critical effects on the performance, range and cost of an electrical vehicle. If the tricycle is too heavy, the electric motor will require more power to move. So it is important to design a light, strong and rigid tricycle framework which can reduce the total weight of the tricycle. Besides that it is also important to choose a better electric motor mass and proper battery mass that can reduce the weight of tricycle, increase transmission efficiency and double the vehicle range.

2.2.3 Vibration

Most tricycles have vibration problem due to inherent unbalance design. The unbalance may be due to faulty design or poor manufacture. Naturally, a frame of tricycle designed to support heavy load like motor and battery, are also subjected to vibration. In this entire situation, the structure or components subjected to vibration can fail because of material fatigue resulting from the cyclic variation of the induced stress. Furthermore, the vibration causes more rapid wear of tricycle parts such as bearings and gears and also creates excessive noise. It also causes fasteners such as nuts and bolts to become loose. Due to vibration, it also causes some electrical parts fail to work.

2.2.4 Stability

As well as being rigid and crash-resistant, it is clearly important that a tricycle design should also be stable. For maximum stability, wheels should be located at the vehicle extremities and the centre of gravity should be kept as low as possible. This is one area where the weight of the batteries can be beneficial, as they can be laid along the bottom of the vehicle, making it extremely stable.

2.3 Popularity

Electric rickshaws are most popular in Asia. The low cost Chinese version being the first to show up on streets. They are mostly used in China, India, Bangladesh and Nepal, also in low numbers other parts of Asia they have been showing up. China, Japan, India, and European countries (Switzerland, France and Germany) have researched and developed electric tricycles for commercial transport and are attempting to capture the growing market in Asia. Government has made efforts though to run them and made plans to issue licenses but there has been no action on this matter till date.

2.3.1 India

The first attempt to design electric rickshaws was done by **Nimbkar Agricultural Research Institute** in late 1990s they modified the cycle rickshaw and then converted to an electric one. In India they are popularly known as e-rickshaws and are widely spread all over India. They started to gain popularity in India since 2011. They have provided with service to city and have also contribution in providing livelihood to people in India. Due to their low cost and high efficiency they are accepted on the Indian streets ,but government policies have been threatening the e-rickshaw and banned them in the capital city Delhi, but due to increase in number failed to put them off the streets. They are still widely used in Delhi and other parts of India. The number in Delhi as per government officials by April 2012 was over 100,000 in Delhi. In India almost all claimed to be manufacturing the vehicle are merely importing it from China and assembling them[9]. Though the manufacturers in India are less in number,

manufacturers claim that in the vehicle production is less and cost is a little at higher but they offer higher quality products and also offer services and warranty, these manufacturers market the product as an Indian make and are also popular because of uniqueness in their product and providing a branded product. The FRP body e-rickshaws are also popular in India and are manufactured in India due to high shipment cost from China they are cheaper to Indian manufacturers, where a Chinese version of FRP Rickshaw will cost 0.5 times more than an Indian make. The cost varies from Rs.85000 to 125000. The cost is added due to battery (Lead Acid battery) which costs around Rs.17000-22000.

There are issues with services due to lack of established companies and just about everyone importing and selling them from China, resulting in problems to their customers, this is the reason consumers have started gaining knowledge and prefer more durable versions from well-established companies and Indian manufacturers. A lot of work and research on electric rickshaws by Indian companies have led to development of nearly all components of rickshaw. Indian parts of existing diesel two wheeler are also being used as an alternative to specially developed e rickshaw parts.

2.3.2 E Rickshaw law in India

Initially e-rickshaws were unregulated by any central law in India. However, the **Delhi High Court**, banned running of e-rickshaws in Delhi on 31 July 2014, over safety concerns raised through a public interest litigation. In a rally held for regularization of e rickshaws in Delhi transport minister Nitin Gadkari said that “municipal corporations would regularize e-rickshaws by registering them for a fee of just Rs.100. After registering the e-rickshaw, corporations will have to issue identity cards to drivers so they can earn their livelihood easily. Once the policy was in place, the corporation, along with **traffic police**, would have fix the amount of fine to be imposed for violation of the policy. However, the policy was never implemented. Certain states like **Tripura** had regularized the e-rickshaws through municipal bylaws or through state legislation. On 8 October 2014, the Ministry of Road Transport and Highways had notified the rules to regulate e-rickshaws by making necessary amendments under Motor Vehicles Rules, 1989. Under the new rules, the e-rickshaws must register the vehicle and obtain permit and driving license for the same[9]. Certain amendments were further made through Motor Vehicles (Amendment) Act, 2015 to facilitate regulatory relaxation to E-rickshaw drivers.

2.3.3 Bangladesh

Bangladesh imports electric rickshaws directly from China or via other countries, the well established cities prefer them as cheaper and better means of transport. The government in an inter-ministerial meeting on May 5 banned import and assembly of the vehicles and decided to send off-road those already plying, primarily on the ground that it consumes electricity mostly through illegal connections.

2.3.4 China

China is the largest manufacturer of electric rickshaws in the world, due to low labor cost, high production rates and encouraging government policies on foreign trade they import a large number on daily basis. Though large manufacturing plants and high export rates, the quality of electric rickshaws from China are based on cost of the product China also

manufactures a variety of cheap vehicles, but most of them require government approval to be used, so the electric tricycle known as Electric Rickshaw is the most popular in export of these vehicles. The beginning of new companies in India and Japan, restricting Government policies and low quality of product has been a reason for declining export beyond these countries and virtually no sale outside Asia. The part imported and valued the most from China is the low cost Chinese motor, which is the part difficult to develop as it requires high production rate to match cost of Chinese motors. They are used as passenger and loading vehicles in China, but being a mass producer other vehicles are popular in 4 wheelers and scooters powered by batteries. The electric rickshaws are exported in C.K.D condition due to low import overhead and less duty than on assembled vehicles in most countries. In Haikou, the capital of China's southernmost province of Hainan, electric rickshaws and some manual types completely replaced auto rickshaws after a change in the law. These may be heavy, purpose-built vehicles, or simple bicycles attached to a light chassis, with a small electric motor housed underneath.

2.3.5 How Does A Battery Powered Tricycle Works?

A motorized tricycle is a three wheeled bicycle with an attached motor used to assist with pedaling. Generally considered as a vehicle, tricycles are usually powered by electric motors or small internal combustion engines and have function as electric bicycles. Some can be propelled by the motor alone if the rider chooses not to pedal; while in others the motor will only run if the rider pedals. Electric bicycles are generally powered by rechargeable batteries. These are normally charged from the utility supply (mains), with perhaps the option of using the motor to effect regenerative braking or charging while being pedaled or rolling downhill. Electric motorized bicycles are either power-on-demand, where the motor is activated by a handlebar mounted throttle, or pedelec (from pedal electric), where the electric motor is regulated by pedaling.

3. PROBLEM DEFINITION

- Battery powered tricycle normally expensive and requires a lot of money.
- The mass of an electrical vehicle has critical effects on the performance, range, and cost of an electrical vehicle.
- Most tricycles have vibration problem due to inherent unbalance design.
- Most tricycles are unstable in braking turns.

4. OBJECTIVE

The main purpose of this project is to develop a battery powered electric motor tricycle which can be used as a simple transportation and for economy reasons.

The objectives are:

- Development of an ergonomic and improved mechanical design tricycle, particularly for rickshaw puller and passenger in general.
- To design and develop a battery powered electric motor tricycle having speed of 25km/h.
- To design a tricycle which is far more stable in braking turns by reducing the centre of the gravity.

- To design a battery powered tricycle particularly suitable for short distance use.
- To design and develop a tricycle which is economical and affordable to every person in society.
- To design a tricycle which is less in weight, ergonomically as well as aesthetically good

All these things necessitates preparation of such tricycle which is easy to operate and will be good for all the members of a society. Hence this project theme stands best in achieving the above listed objectives.

REFERENCES

- i Madie line.R. Hickman, “A Study of Power Assists for Bicycle Rickshaws in India, Including Fabrication of Test Apparatus,” BS, Mechanical Engineering Project Report, 2001, MIT, USA.
- ii Official handbook of Automobiles. National automobile association.p.180. Oclc 6360726
- iii A history of Industrial power in the United States, 1730-1930, Vol 3: The transmission of Power. Cambridge, Massachusetts, London: MIT press. ISBN 0-262-08198-9
- iv T.J.E. Miller, “Brushless Permanent Magnet and Reluctance motor drive”, Oxford. 1989
- v Merriam-Webster.com 2012-08-31. Retrieved 2014-04-29.
- vi J.J. Vicker; G.R. Pennock; J.E.Shigley(2003). Theory of Machines and Mechanisms
- vii en.wikipedia.org/wiki/welding.
- viii American Welding Society (2004) Welding handbook. ISBN 0-87171-729-8.
- ix <http://archievetheDailyStar.net/newDesign/news.details.php?nid=187825>