WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Design and Development of Mountable Electrical Conversion Kit for a Motorcycle

Sumit Patil[a], A.D.Diwate[b], A.S.Patil[c]

[a]*Research Scholar, Department of Mechanical Engineering, JSPM's Narhe Technical Campus, Narhe, Pune-41, India*

[b,c]*Professors, Department of Mechanical Engineering, JSPM's Narhe Technical Campus, Narhe, Pune-41, India*

A B S T R A C T

This work is intended to design a mountable electric vehicle conversion kit based on existing Motorcycle Components. The conversion kit is checked for desirable power output & structural stability by performing calculations & finite element analysis. India has the greatest number of two-wheelers compared to the world and during this transition phase from gasoline vehicles to electric vehicles, the use of existing vehicles components for electric vehicles could be the best solution considering cost parameters. It is observed that new electric vehicles are expensive so there is a need to reduce the overall cost of electric vehicles to change from gasoline to electric conversion. It is observed that chassis & body covers a high proportion in a vehicle costing along with Battery, Motor & Transmission system cost. Considering the large number of available vehicles and the current vehicle scrappage policy of the government, conversion of current gasoline vehicles is the affordable option. This could be achieved by an adjustable mounting frame and electric conversion kit. The kit is designed for the most common lightweight bike in India i.e., Hero Splendor. The kit is designed to fit on chassis and to allow easy mounting of motor & battery pack sturdily and without causing any structural damage or change. This electric conversion kit will surely help in the direct conversion of current Hero Splendor motorcycles which are about to be scrapped due to India's vehicle scrappage policy into electric vehicles.

Keywords:Electric conversion, Mountable electric conversion kit, motorcycle chassis.

1. INTRODUCTION

This paper explores the role of electric vehicles in attaining the goal of sustainable mobility in India. Upon checking the mobility needs and patterns in Indian cities, two-wheelers have a major role to play in India's mobility. They provide an affordable and reliable means of transport as well as a means of livelihood for millions of people in urban and rural areas of India. In local transportation mostly used vehicle is a motorcycle. In India, the majority of the population has motorcycles and these all run on fossil fuels which contribute to pollution. Considering India's aim to convert to electric mobility and vehicle scrappage policy, we must search for an affordable way for electric mobility. Electric vehicles have limitations, but the most important factor is cost. Electric vehicles are more costly than gasoline vehicles.

This research aims to develop a kit that will consist of all-electric motorcycle components like motor, controller, batteries, etc. and it can be mounted on a motorcycle chassis directly at engine position to convert gasoline motorcycle in electric without any major chassis modification. The current prototype is designed for Hero splendor motorcycle considering its major presence in India. The Mountable kit has been tested for its structural strength and the overall kit (motor, controller, battery) has been checked for its rated output to provide sufficient power for transit.

2. PROBLEM STATEMENT

The electric vehicle is the future of the world where the use of the electric vehicle can reduce carbon emission on the earth. but in most cases, the electric vehicle has more in cost which is commercially more expensive so the common man cannot afford it. This problem can be solved by redesigning and redeveloping models to convert the old bike into an electric vehicle. we can simply create one kit which contains the battery, motor, and other electrical components. whenever any vehicle is going to be expired as per scrappage policy considering IC engine age, we can it with the electric kit. When the Indian government will desire to be trash all the old model and fuel bikes then an electric conversion kit will be helpful to directly convert Motorcycles into electric ones without any major structural or chassis modification.

3. OBJECTIVE

The main objective is that to create a ready-to-mount electric conversion kit to convert IC engine motorcycle torque to electric current.

4. METHODOLOGY

Phase 1- Literature Survey

In this, the literature on various factors was reviewed to know the previous work undergone and its results and conclusion. We intended to carry forward the work to implement a new aspect of research, which can be useful for modification in electric bike kits.

Phase 2- Measurement and Design

1. Measurement of battery size required new displacement of motor and their gear ratio.
2. Study of chassis deformation effect and load-carrying capacity
3. Study of types of batteries and their efficiency and life.
4. Conversion kit 3D modeling as per noted dimensions in SOLIDWORKS.
5. Design of the chassis mounting kit and analysis of its effects on FEA.

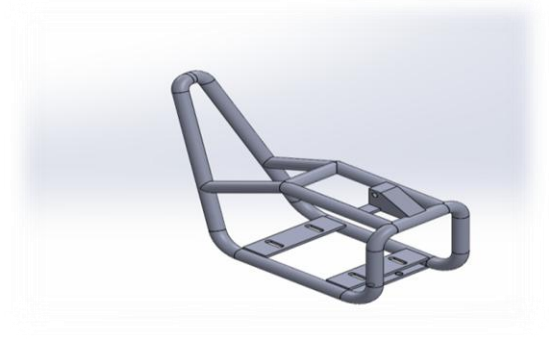

Figure 1. Mounting Chassis

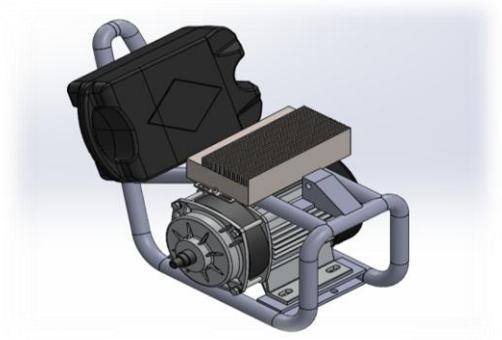

Figure 2 . Mounting chassis withMotor, Battery & Controller

Phase 3-FEA and Analysis

1. Meshing the CAD model of bike chassis and mounting kit frame in SolidWorks Simulation.
2. Existing material assignment to the frame.
3. Calculation of boundary conditions.
4. Apply the boundary conditions to the meshed model of the frame.
5. Static analysis of the existing cover model with boundary conditions using Simulation solver

Phase 4- Optimization

1. Change the frame and mounting hole design as per the analysis result.
2. Static analysis of frame with new selected thickness and hole sizes.

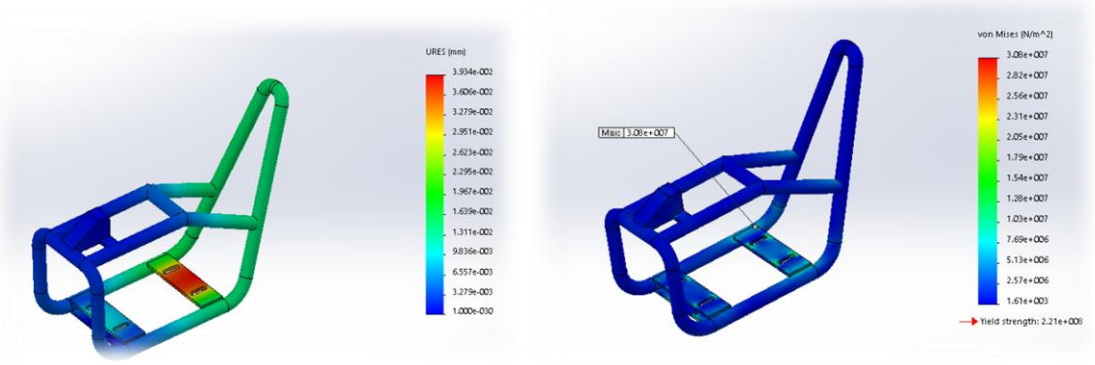

Figure 3. FEA Analysis of Mounting Frame

5. CALCULATIONS

5.1 Tractive Effort Calculations

Data Available:

Gross vehicle weight = 200 kg

Weight on each drive wheel = 100 kg

Radius of wheel / tire (R_w) = 0.2 m

Desired top speed (V_{max}) = 14 m/s

Desired Acceleration time = 5 sec

Max inclination angle (a) = 5°

Working surface = asphalt (fair)

Total Tractive Effort (TTE):

TTE = RR + GR + FA Eq.1

Where, TTE =Total tractive effort

RR = Force necessary to overcome rolling resistance

GR = Force required to climb grade

FA = Force required to accelerate

Step 1: Calculate Rolling Resistance

RR = GVW * C_{rr} Eq.2

Where, RR = Rolling Resistance, GVW = Gross weight,

C_{rr} = Surface Friction (Rolling Resistance Coefficient)

E.g. RR =200 * 0.017

RR= 3.4 kg

Step 2: Calculate Grade Resistance

GR = GVW * Sin (a) Eq.3

Where, GVW = Gross Vehicle Weight, GR = Grade Resistance

a = Angle

GR =200 * Sin (5)

GR=17.43 Kg

Step 3: Acceleration Force

FA= (GVW * V_{max})/(Acc * Ta) Eq.4

Where, FA = Force Acceleration

GVW = Gross Vehicle Weight

V_{max} = max speed

Ta = time required to actual max. speed

FA =200 * 14/ 10*5

FA =56 Kg

Step 4: Total Tractive Effort

TTE =RR + GR + FAEq.5

=3.4 + 17.43 + 56

TTE =76.83 Kg

Tw= TTE*Rw*RfEq.6

= 76.83*0.2*1.1

Tw =16.9

Where, TTE=Total Tractive Effort

Rw = Radius of Wheel Tyre

Rf = Resistance Factor

6. Outcome of the Project:

- A vehicle designed will be useful for traveling for all age levels of people easily to their respective workplaces, schools, offices, etc.
- The vehicle will result in a reduction in the cost of fuel, reduction in time and pollution, and safe handling.
- No structural changes in chassis for conversion.

7. Advantages of the Project:

- Conversion Kit is an affordable option compared to current available electric bikes in the market.
- A scrapped motorcycle can be used, so lesser scrap waste.
- Cost spend on fuel is lesser for Electric Vehicles as compared to gasoline vehicles.
- Special government schemes are available in the form of fewer tax incentives to the people who use Electric Vehicles.

8. Disadvantages of the Project:

- Less power as compared to the conventional vehicles and they are suited for city riding, not for speed and long-range.
- The presence of electrical components makes EV's expensive in case of maintenance.
- More batteries must be made which arises the problem for disposal of that batteries can be a hazard to the environment.

9. Future Scope for Project Extention:

- The electric conversion kit will surely help to revive gasoline motorcycles which could go as scrap allowing to use the available assets to the full extent.
- Awareness needs to be created among the people related to the easy conversion of gasoline motorcycles into electric vehicles.
- With the help of government and campaigns, we can contribute in a big way towards usage of these vehicles which will make our future well and will help us in sustaining in future fuel crisis.

10. Conclusion:

This project analysis is done to check the feasibility of a standard ready to mount kit on a conventional motorcycle chassis and it is found that a ready to mount kit having all necessary electrical components is the best option considering cost, reusage of current vehicles, and time considered to electrical conversion.

References

[1]. Motorcycle Handling and Chassis design - the art and science, Tony Foale

[2]. Bhandari V. B., "Design of Machine Elements", Tata Mc-Graw Hill Publishing Co. Ltd, 4th Edition- 1997.

[3]. Wolf,A.; Seebauer, S. Technology adoption of electric bicycles: A survey among early adopters. Transp.Res. Part A Policy Pract. 2014, 69, 196–211

[4]. Electric Bicycles: A Guide to Design and Use (Morchin and Henryoman, 2005)

[5]. V. Thiyagarajan and V. Sekar, Controlling of brushless DC motors in electric bicycles using electronic based circuit with 8-bit microcontroller, IJESET, pp.26-34.