REVIEW ON DESIGN AND DEVELOPMENT OF THREE WHEELED CAMPUS MOBILITY VEHICLE

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Abstract—In today’s world, infrastructure of College and Industries are becoming large so if one has to travel or visit from one place to another he has to walk long distance and sometimes it becomes very hasty and inconvenient. The growing environmental consciousness and seeing the adverse effects of climate change, the governments in India are supporting initiatives for development of eco-friendly mobility solutions including electric vehicles.

Keywords—Electric vehicle, Campus Transport, Personal Mobility, Campus Mobility Solution, Campus Vehicle, Three Wheel Campus Vehicle, Front wheel drive.

I. INTRODUCTION

Our research is about the design and development of an economical, compact and eco-friendly electric vehicle for the large campuses where walking consumes a lot of time. The campus environment especially that of the more established universities has entered the public consciousness as being a haven for electric vehicle use. It is a front wheel drive battery operated vehicle, specially designed in Solid Edge 3D designing software for indoor mobility in large campuses. It is front wheel drive with In-wheel hub motor mounted on front of the vehicle. Simultaneously this arrangement reduces Front wheel is provided with a drum brake. Four batteries are used (each of 12 volts 20 Ah) total 48 volts 20 Ah is supplied to the front hub motor of 250 watts. [1]The campus environment, especially that of the more established universities, has entered the public consciousness as being a haven for bicycle use [2]: not necessarily for reasons of their environmental credentials, but because their low cost suits the student budget. However many university campuses are notorious for parking problems [2], and it may also be asserted that the fossil-fuel led vehicles affordable to students are likely to be among the most polluting of their kind. Much research worldwide has been conducted on electro-mobility solutions, especially during recent years of increased awareness of CO2 emissions and the environmental consequences of profligate consumption of fossil fuels.
Another important and integral part of this project is that it will contribute in the ‘MAKE IN INDIA’ concept. Project is primarily designed for green mobility thus it will also help to control the pollution which is one of the major crises nowadays. Our research consists of following methodology:
1) Study of various applications of campus vehicles.
2) Literature Review
3) Formulate the design requirement and specification of Campus Vehicle.
4) Part modelling and assembly of Campus Vehicle in Solid Edge.
5) Strength and stress analysis of Campus Vehicle.
6) Fabrication of Campus Vehicle.
7) Testing of Campus Vehicle at different conditions.
8) Evaluation and suggestion of further action/research. [1]

II. LITERATURE REVIEW

1) Design And Development Of Three Wheeled Campus Vehicle, SharAd Patel, Parth Jadhav, Rinkesh Vasava, Vivek Roghelia, Anup Gehani, Dhwanit Kikani

It is in this seen that the researchers choose to develop an electric scooter that can help ease the problems of conventional transportation by being a much cheaper alternative than gas powered scooters. The study aims to underscore the importance of tapping alternative and clean energy sources to address various energy issues confronting the global environmental landscape. Which is to design and develop an Electric Tri-Wheel Scooter. Increasing interest from large manufacturers and decreasing battery costs offer an opportunity to drastically change the current market landscape for electric motorcycles and electric scooters.[01]

2.1.1 Frame

First of all, we fabricated the frame. A frame is made up of mild steel pipe of 38 mm diameter. Compare to other available frame structures such Solid bar section, square section, I section the hollow pipe structure has minimum weight and enough strength. Following image shows the fabricated frame. [01]
Battery cage is welded below the platform so that more floor space available. This arrangement also helps in lowering the center of gravity which is advantageous while fast turning. Back axle is 20mm dia. of solid bar.

2.2.2 Wheels
The front wheel is Brushless DC hub motor (Fig 3) and also a power source to drive the vehicle. It is also called as an In-wheel motor in which the motor assembly is comes inside the wheel itself. So there is no need of extra chain sprocket mechanism as motor is inside the wheel. This way arrangement reduces space for power [01]

Figure 3 Front wheel hub motor

2.2.3 Chassis
When all above parts are ready the next step was to assembling the chassis. As shown in the Fig (4) front and rear wheels are mounted, batteries are placed inside the battery cage at centre. The battery supply is connected to front hub wheel motor makes it front wheel drive. [01]

Figure 4 vehicle chassis

Table 1 Cost Estimation

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>SPECIFICATION</th>
<th>COST IN INR</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUB-MOTOR</td>
<td>1KW</td>
<td>7000</td>
</tr>
<tr>
<td>BATTERY</td>
<td>LITHIUM-ION 12V 24Ah</td>
<td>12000</td>
</tr>
</tbody>
</table>
2. Development of an Electric Tri-Wheel Scooter, Ronaldo B. Asuncion, Warlito M. Galita

Today, human conveyance plays an important role for obtaining a comfortable life. However, as the global human population grows more and more each day, more and more vehicles are added to the already burgeoning number of cars plying roads and main thoroughfares, thereby increasing the risks of air pollution. Passenger vehicles are a major pollution contributor, producing significant amounts of nitrogen oxides, carbon monoxide, and other pollution. In 2013, transportation contributed more than half of the carbon monoxide and nitrogen oxides, and almost a quarter of the hydrocarbons emitted into our air [02].

The Research Problem

The major objective of this undertaking is to design and develop an Electric Tri-Wheel Scooter. Specifically, the study aims to answer the following:

1) Develop a three-wheel scooter that has a forward and reverse operation.
2) Design an appropriate sensor circuit for proper positioning and safety of the rider.
3) Design a scooter that is easy to use and can be compared with other expensive brands available in the market today.
4) Determine the acceptability of the device based on the following criteria, namely: a) Functionality; b) Safety Features; c) Durability; and d) Aesthetics.

3. Campus Mobility for the Future: The Electric scooter, Ian Vince McLoughlin, I. Komang Narendra, Leong Hai Koh, Quang Huy Nguyen, Bharath Seshadri, Wei Zeng, Chang Yao

In terms of personal electro-mobility alternatives, there are a plethora of amazing inventions ranging from the Segway, the Yike Bike, Ryno, various electric scooters, skateboards, power skates, electric quad bikes and so on. Ignoring the fossil-fuelled variants, recent alternatives have been released which are powered by compressed air [03], flywheel [03], fuel cell [03] and probably other unusual power sources. However, the vast majority of experimental machines use a combination of electrical motor and battery. Battery solutions tend to be limited to the robust but weighty lead-acid cells in cheaper or older systems, through surprisingly few NiMH variants, to Lithium Ion (predominantly LiFePO4 or LiMn2O4 based cells) in more modern and expensive variants [03].


As for the conclusion, we have some points to present about the project that makes this concept work as a future substitute for petrol that makes this concept work as a future substitute for petrol scooters. This scooter is different than that of present electric scooters as these provide more power, speed and range. This concept surely promises future technology and also equally importance in the coming future. [04]

5. Design of Efficient In-Wheel Motor for Electric Vehicles, Winai Chanpeng, Prasert Hachanont

The experiment indicates that the proposed in-wheel motor is able to drive a 70-kg-load vehicle travelling at speed of 20 km/h. The in-wheel motor is tested in the laboratory by varying power load. The maximum efficiency of 82.56% with the speed of 468 rpm is achieved at 2.5 N.m torque, with a 5.81A input current. The maximum torque achieved is 6.25 N.m with the input power of 348.76 watts and 13.72A, but the speed of the motor is reduced to 395rpm. [05]
III. CONCLUSION

After doing all above analysis and design calculation this paper clearly concludes that design is safe against corresponding various load conditions. We also noted down various parameter after testing to evaluate vehicle’s performance. As already discussed the model satisfies the primary requirement of campus mobility. According tour team, to make the model viable the only possible option is to lower the weight and cost of vehicle. This may be achieved by studying various materials which are light in weight and removing material at unwanted or less critical regions. Another possible way is to use composite material at some of the areas as we can get the benefit of higher strength with less weight.

REFERENCE