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An Improvement in Performance in E- Rickshaw

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ABSTRACT: Auto rickshaws are three-wheeled vehicles commonly used as taxis of people and goods in many Asian countries. In the design of a new solar/battery electric auto rickshaw, the most critical components (i.e. the motor and motor controller) of the drive train must be vigorously studied. The results of such a comprehensive study are needed to balance the design trade-offs in order to achieve an optimally sized and controlled system. This paper focuses specifically on the electric propulsion motor. The size and speed capabilities of the motor are varied in the advanced vehicle simulator, ADVISOR, and the results in terms of efficiency, vehicle gradeability and acceleration abilities of the vehicle are presented andanalysed.

KEYWORDS: Motor (BLDC), Battery, Controller

I.INTRODUCTION

Auto Rickshaw is a three wheel public transport vehicle. It is popular in Asian cities i.e. New Delhi, Mumbai, Dhaka etc. Electric Rickshaw is a modified form of auto rickshaw with BLDC (Brushless DC) motor and a battery for energy supply. It is a partially green public transport medium. The standard specification of electric rickshaw is not available. So, average model of e-rickshaw is considered for the analysis.

The National Electric Mobility Mission Plan 2020

The National Electric Mobility Mission Plan 2020 is one of the most important and ambitious initiatives undertaken by the Government of India that has the potential to bring about a transformational paradigm shift in the automotive and transportation industry in the country. This is a culmination of a comprehensive collaborative planning for promotion of hybrid and electric mobility in India through a combination of policies aimed at gradually ensuring a vehicle population of about 6-7 million electric/hybrid vehicles in India by the year 2020 along with a certain level of indigenization of technology ensuring India's global leadership in some vehicle segments. It is a composite scheme using different policy-levers suchas:

1. Demand side incentives to facilitate acquisition of hybrid/electricvehicles
2. Promoting R&D in technology including battery technology, power electronics, motors, systems integration, battery management system, testing infrastructure, and ensuring industry participation in thesame
3. Promoting charginginfrastructure
4. Encouraging retro-fitment of on-road vehicles with hybridkit
5. Supply side incentives

Environmental Impact

The data collected regarding the e-rickshaw travelling and charging patterns revealed that the sole battery charging option for the vehicle owners remained the household sockets. Thus the e-rickshaws could not be considered as a zero emission vehicle as the charging relates to the CO2 emission at the thermal power stations. Coal-fired thermal

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power stations in India have been reported to emit 1.281 kg ofCO2 per unit of electricity generated. Again CO2 emission considering full combustion of LPG (propane base) has been 1.53 kg/litre. Considering combustion of diesel for the two types of three-wheelers the CO2 emission rate has been considered at 2.71 kg/litre. Thus the specific CO2 emission of the motorized three-wheelers for the passenger transportation has been calculated and shown in the results show that the e-rickshaw has been efficient than that of the other motorized versions of three-wheelers, whereas the specific CO2 emission is higher than that of the mechanized vanrickshaws.

Sr No.	Vehicles	Specific CO2 emission (gm/passenger-km)
1	Auto-rickshaw (LPG)	23.556
2	Auto-rickshaw (Diesel)	21.51
3	Mechanized Van-rickshaw (Diesel)	4.46 – 11.38
4	E-rickshaw	19.129

Table 1.Vechicle Co2 Emission

II. METHODOLOGY

The three-wheeled vehicles, as mentioned earlier, have an important role in public transport sector in West Bengal. In this study the performance of e-rickshaws were studied and compared to other forms of three-wheeled public transport vehicles to check the merits. Data regarding the operating condition of the vehicles have been collected by conducting primary surveys with formatted questionnaires among the operators, union members, drivers, and commuters at major urban and suburban areas where e-rickshaws have started operating. The energy consumption data has been measured with energy meters that were supplied to the vehicle owners. The distance transverse for a day was measured from the vehicle odometers, corresponding to the intervals of battery charging. Each set of data were collected over a week for checking the travel pattern of energy consumption of such vehicles. Again, this study took into account the energy consumption for other types of three-wheeled vehicles, and was compared to that of the e-rickshaw for a comparative analysis. The specific energy consumption was calculated for the collected data. The cost of energy consumption for the e-rickshaws has been calculated based on the electricity tariff of the respective household electric utilities of the region. This is because the sole charging point for the vehicles has been the household sockets. In the survey conducted the electric utilities involved were CESC Ltd. and WBSEDCL (West Bengal State Electricity Distribution Company Ltd.), and for both the utilities the tariff was around INR 6.40/kWh, taking into account the usage of electricity for e- rickshaw battery charging. Due to the use of petroleum based fuels in the other form of vehicles, there remained the issue of environmental impact due to public transportation. In West Bengal, majority of the power supplied to the grid has been based on coal fired thermal powerplants.

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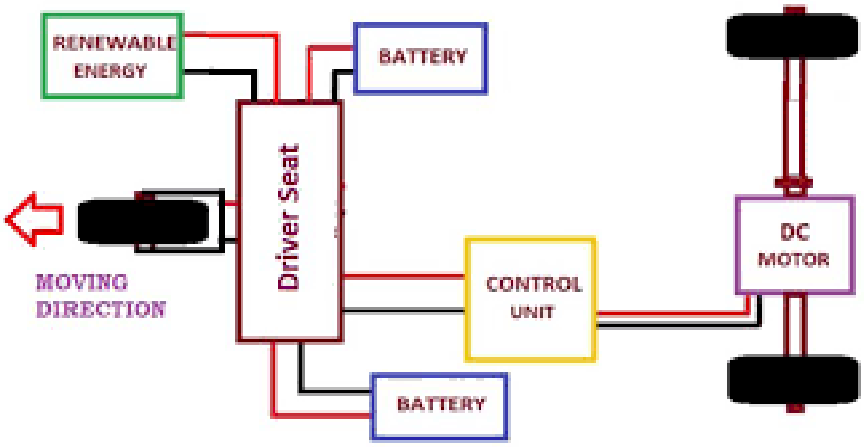

Fig.1 Design Of E Rickshaw

III. WORKING MODEL OFE-RICKSHAW

IV. ENERGY EFFICIENCY ENHANCEMENT

The focus was to minimize the use of energy (watt-hours) per kilometer of travel. A typical electric three-wheeler auto consumed 80 Wh/km on Indian roads in early 2017. Because this was considered excessive, a goal was established to reduce consumption to 45 Wh/km. It then appeared to be an impossible task. Brushless dc electric motors or switched reluctance motors were designed to replace induction motors. Tires were improved to lower rolling resistance, and attempts were made to reduce the weight of the vehicle. Finally, creating better vehicle aerodynamics helped in enhancing energy efficiency. Over the last ten months, most auto manufacturers have reduced their products' energy consumption to below 52 wh/km. the 35% reduction in energy usage means that the battery size required to travel a certain distance decreases by 35%. Because the battery dominates the costs of the EV, this reduction is substantial, cutting the subsidy required. More can be accomplished in the future. Distributed

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motors will be one way to go. The strategy of enhancing energy efficiency is paying dividends in all kinds of EV's.

IV. CHALLENGES

Due to the regularization of the maximum vehicle speed and the maximum motor capacity, the major challenge of the e-rickshaws would be to meet the present day traffic conditions. If these vehicles are allowed to travel with the main stream traffic, the speed of the rest of the traffic will be restricted, as for the conventional vehicles the energy efficient speed has been much higher. But there has been no proper rule to regularize the operation of e-rickshaws. In most of the places in West Bengal no restrictions on the operating zones and even the number of vehicles has been implemented. Till date the RTAs have not taken into account the case of e-rickshaws as no rule has been included in the Motor Vehicles Act in the State unlike that of Tripura Motor Vehicles Act. Thus the local governing bodies are regularizing the rickshaws by charging monthly toll tax depending on the municipalities where these vehicles have been operating. But the problem remains as the number of these e-rickshaws is still not controlled by the unions, resulting in an increasing fleet of e-rickshaws. The major reason of this out-break is unemployment in the state. Due to very less number of industrial activities the opening in the job sector has been very limited. Hence, the e-rickshaw has become the source of income for many.

V. RESULT AND DISCUSSION

In the fig 2 in passenger transportation, the auto-rickshaws have been the mostly utilized form that operates for both medium and short distance commute. Taking into account the driving pattern and technical characteristics, auto-rickshaws have been a good option for vehicle electrification. The average fuel consumption of the auto-rickshaws was found to be around 6.04 litres/day of auto LPG for the scenario of India. Again parallel running of both auto-rickshaws and e-rickshaws by replacing a certain percentage of the former by e-rickshaws showed the economic and environmental benefits. But e-rickshaws have already emerged in the road transport sector. The data collected from the various surveys, revealed that the specific energy consumption of the present e-rickshaws have been the least among the other forms of public road transport vehicles. The average specific energy consumption of the e-rickshaws have been calculated to be around 53.76 kJ/passenger-km the comparison of the specific energy consumption for different types of public road transport vehicles.

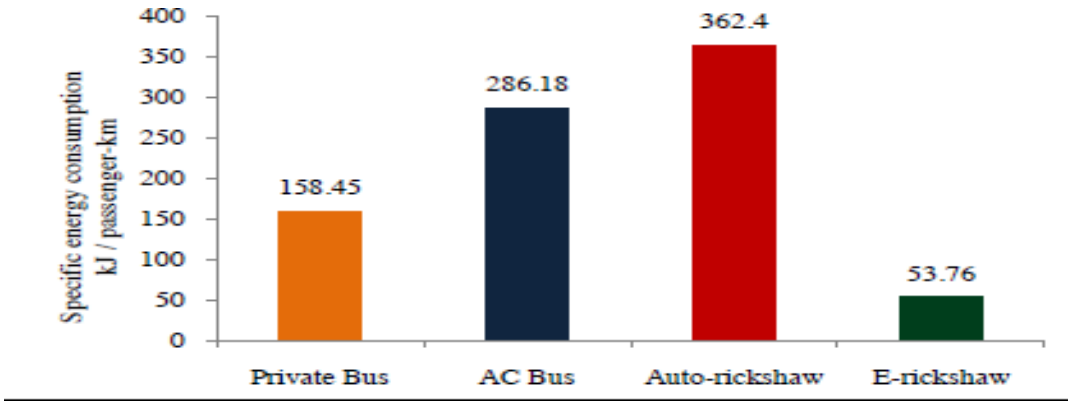

Fig. 2 Performance of public transport

VI. CONCLUSION

The battery operated e-rickshaws have become an important part of the transport system of the state of Delhi, and there is a need to regularize the operation of these rickshaws. The rickshaws have impacted the socio-economic status of a large number of people in the city, and its role in the income generation can be seen as 89% of e-rickshaw drivers saw increase in their salaries from their previous employment, and 39% of the surveyed rickshaw drivers

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were either unemployed or cycle rickshaw drivers before turning to the profession. The absence of a regulatory framework and manufacturing policies for the rickshaws has resulted in a lack of safety structure for the rickshaws, and is a hazard for the commuters. The paper recommends the formation of strong policies which ensure a safe design of the rickshaw and efficient functioning within the city. The analysis of the Tripura Battery Operated Rules, 2014 provided some pertinent recommendations for the formulation of policies in the state of Delhi. Based on the Tripura rules, the paper recommends specified parking spots for these vehicles and zoning of the rickshaws. The findings of the socio- economic study suggest the need for financing and credit/asset lending options for the drivers, and insurance policies for the battery rickshaws

REFERENCES

[1] He, C., Liu, C., Wu, Y., & Wu, T. (2018, December). Estimation for SOC of Electric Vehicles Lithium Battery Based on Artificial Immune Particle Filter. In *2018 3rd International Conference on Smart City and Systems Engineering (ICSCSE)* (pp. 675-678).IEEE.

[2] Xing, N., & Chun, Q. (2014, November). Pad design for a Move-and-Charge System for electric vehicles. In *2014 Makassar International Conference on Electrical Engineering and Informatics (MICEEI)* (pp. 97-102).IEEE.

[3] Agarwal, N., Saraswati, P., Malik, A., &Bhateshvar, Y. K. (2017). DESIGN A BATTERY MONITORING SYSTEM FOR LEAD-ACID BATTERY. *International Journal of Creative Research Thoughts (IJCRT)*, *5*(12), 306-311.

[4] Pravin S. Phutane Balaji C. Takle , Harish B. Dorak , Narendra R. Kumbhar , Akshata R. Wandrekar International Journal of Research in Electrical, Electronics and Communication Engineering,Volume 3,Issue 2,Pages 24-29 MANTECHPUBLICATIONS

[5] S.Lukic,P.Mulhall,andA.Emadi―Energyautonomoussolar/batteryautorickshaw,JournalofAsianElectric Vehicles, Dec.2008

[6] Lairenlakpam, R., Thakre, G. D., Gupta, P., Singh, Y., & Kumar, P. (2017, December). Effect of different drive modes on energy consumption of an electric auto rickshaw. In *2017 IEEE Transportation Electrification Conference (ITEC-India)* (pp. 1-5).IEEE.

[7] Sameeullah, M., &Chandel, S. (2016, April). Design and analysis of solar electric rickshaw: A green transport model. In *2016 International Conference on Energy Efficient Technologies for Sustainability (ICEETS)* (pp. 206- 211).IEEE.

[8] Adware, S. K. M. R. Regenerative Braking in ElectricVehicles.

[9] Kumar, A., & Prasad, L. B. (2018, September). Issues, Challenges and Future Prospects of Electric Vehicles: A Review. In *2018 International Conference on Computing, Power and Communication Technologies (GUCON)* (pp. 1060-1065).IEEE.

[10] Kumar, R. (2016, November). Evolution of solar rickshaw technology vis-à-vis economic feasibility. In *2016 International Conference on Advances in Electrical, Electronic and Systems Engineering (ICAEES)* (pp. 646- 651).IEEE.

[11] Singh, S., Mathur, A., Das, S., Sinha, P., & Singh, V. (2017). Development of Smart Public Transport System by Converting the Existing Conventional Vehicles to EV's in Indian Smart Cities (No. 2017-01-2011). SAE TechnicalPaper.

[12] Patel, L., & Gupta, S. P. Study of solar hybrid rickshaw. international journal of innovative research in science and engineering, vol no, 2, 267-279.

[13] ASHOK, J., MIRAJKAR, P. P., & LAKESAR, A. L. DESIGN AND DEVELOPMENT OF A SOLAR/ELECTRIC POWERED HYBRID VEHICLE WITH TIL TANGLEADJUSTMENT.

[14] Majumdar, D., &Jash, T. (2015). Merits and Challenges of E-Rickshaw as An Alternative form of Public Road Transport System: A Case Study in the State of West Bengal in India. *Energy Procedia*, *79*,307-314.

[15] Mehta, R., Shah, P., Gupta, H., Bhat, P., Gandhi, V., Kale, K &Karnik, A. (2014). *Conversion of a CNG Powered Auto Rickshaw to an Electric Rickshaw Designed for Indian Conditions* (No. 2014-01-1968). SAE TechnicalPaper.

[16] Iqbal, M., Akhter, S., & Ahmad, S. Study on Merits and Demerits of Two Transport Systems: Battery Operated Easy Bike with CNG Operated Auto Rickshaw at Sylhet City inBangladesh.

[17] Mazumder, M., & Roy, M. (2018). Role of Battery-Operated Rickshaw in Income and Employment Generation of Urban Bangladesh: A Study of Chittagong City. *Global Journal of Management And BusinessResearch*.

[18] Sameeullah, M., &Chandel, S. (2016, April). Design and analysis of solar electric rickshaw: A green transport model. In *2016 International Conference on Energy Efficient Technologies for Sustainability (ICEETS)* (pp. 206- 211).IEEE.