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DESIGN AND DEVELOPMENT OF ENERGY REGENRATING ELECTRIC TWO WHEELER

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ABSTRACT:

Around 200 Million two wheelers are running on Indian road as on today. The conventional fuel with uncontrolled cost and pollution has created the hazards to the environment. The economies of developing countries like India are also depended upon the cost of fuel as it is consumed in huge amount daily. Most of the transportation is dependent on the conventional fuel like petrol and diesel. The electric bikes in India have been introduced in 1990s but it was not very popular due to the low performance of battery and less mileage per charging. The performance of electric vehicles has improved now with the new charging and battery technologies developed. Authors have proposed the implementation of energy regenerating electric bike in this paper. A prototype is designed, developed and presented in this paper.

KEYWORDS: Electric bike, Electricity Regeneration, DC Motor, Controller, Battery, etc.

INTRODUCTION:

Price of fuel such as petrol and diesel are dependent on the international market. The prices of the fuel are dependent on the several factors such as demand, environmental conditions, relations with the different countries and the cost of processing and transportation. On the other hand the issues due to combustion of the fuel have created the environmental hazards by means of air pollution. The automobile industry has sold around 21 million units in 2018-19. To overcome the problems associated with the conventional fuels, the automobile industry is shifting the focus towards electric automobile. Out of the total electric vehicles sold in India around 16% are electric two wheelers in 2019. This number is encouraging and with the policies of the government to support the use of electric automobile, it further supposed to improve. Following figure shows per year sale of two wheelers in India. It is observed that the number of two wheelers is increasing every year and it is almost doubled in last 10 years.

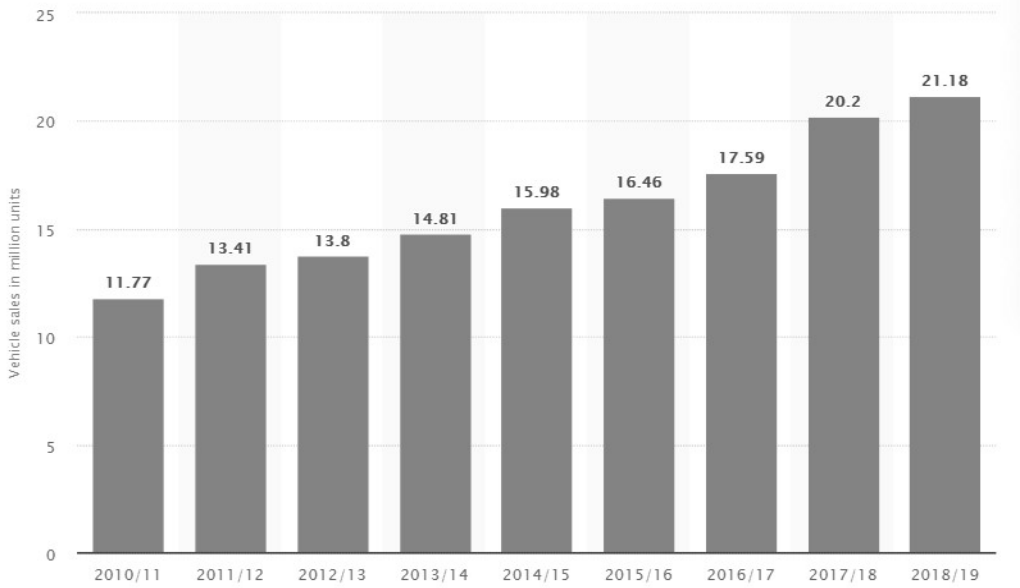

Fig.1: Statistics of number of two wheelers sold in India (Million Units per Year)

Authors have developed the prototype of the motorcycle with self-charging mechanism. The wheel shaft is connected to the motor and the generator so that the motor drives the wheel at the same time the generation of electricity takes place at generator.

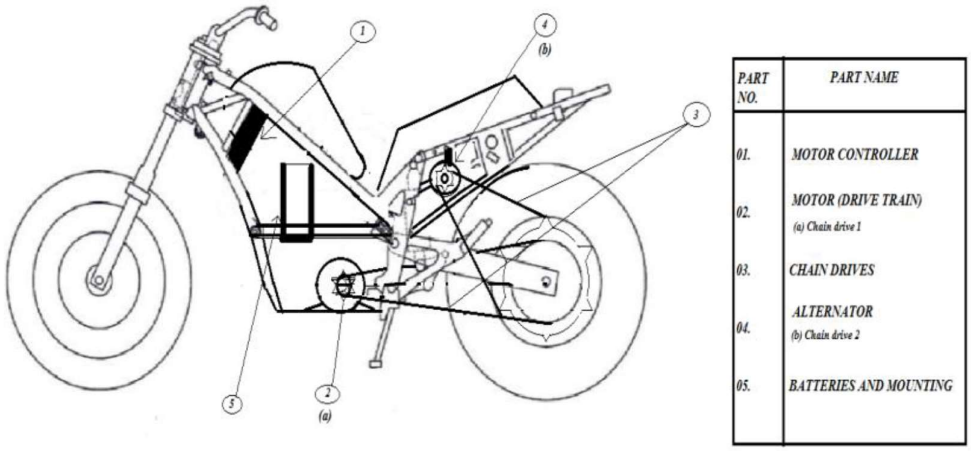

Fig.2: Model for energy regeneration in electric bike

The controller is used to control the motor performance in order to match the required torque and speed. The battery with the charging arrangement with motor load is connected. The chassis for the prototype is used from the motorcycle purchased from scrap. The generation is 14.4V dc in the system which is used to charge the batteries through converter. The frame is modified to fit the components with proper alignment.

MOTIVATION OF WORK:

65% of fuel is used for automobile is consumed by two wheelers in India. This consumption created the huge loss of money and produces the air pollution. The problem associated with electric bikes is the capacity of battery and the weight of battery. The W-h capacity of the battery increases with increase of size of battery. In order to overcome this problem, authors have suggested the system with self-charging mechanism of the battery to improve its performance.

OBJECTIVES OF WORK:

The objectives of the work carried out are:

- To design the regenerative charging system for electric bike.
- To assemble the various parts of the vehicle.
- To develop the electric vehicle with regeneration capacity.

SYSTEM DESIGN:

i. The power is calculated as-

$$P = 2 \times 3.14 \times N \times T / 60$$

$$250 = 2 \times 3.14 \times 2100 \times T / 60 \quad T = 1.13 \text{ N m} = 1136 \text{ N-mm}$$

ii. Chain drive calculations-

$$R_{chain} = 66/11 = 6:1$$

$$\text{Torque at wheel shaft} = T \times R_{chain} = 1136 \times 6 = 6820 \text{ N mm}$$

$$\text{Speed of wheel shaft} = 2100 / 6 = 350 \text{ rpm}$$

iii. Design of Shaft-

$$T = 36000 \text{ N mm}$$

$$T = 3.14 / 16 \times \sigma s \times d3$$

$$Fs \text{ allowable} = 80 \text{ N/mm2}$$

$$6820 = 3.14 \times \sigma s \times d3 / 16$$

$$\sigma s = 34.73 \text{ N/mm2}$$

SYSTEM REQUIREMENT:

Table.1: Specifications of the components used

Sr. No.	Component Details	Photo of Purchased Component
1	**Permanent Magnet Brushless DC Motor:** 48 Volts, 33Amp,3000 rpm, 1.5KW, 8Pole	
2	**Motor Controller:** 48Volts, 50Amp, 2KW	
3	**Battery:** 4 Units, 12Volts, Cycle use : 14.4 V- 15.0 V Charging time : 6-8 Hours	
4	**Alternator:** 2000rpm, 12V, 1KW	

5	**Electronic Display:** 12V LCD		
6	**Motor Chassis:** Honda CD Dawn		

CONCLUSION:

With growing number of two wheelers in India, around 65% of petrol is consumed by the two wheelers only. This fuel consumption not only adds the burden on economy but also produces huge pollution. To avoid such effects it is mandatory to use the electric bikes. The problems associated with the electric bike are the battery performance. To improve this, authors have developed the regeneration of electricity in electric bikes. The prototype is developed for the system and the bike is found working properly. The DC motor, alternator coupled to wheel with chain is used with batteries and controller in this system. The eco-friendly bike will be suitable to use for smaller distances.

REFERENCES:

1) Udayakumar, R., et al. "Design and development of heat recovery steam generation system for automotive engines." *AIP Conference Proceedings*. Vol. 2201. No. 1. AIP Publishing LLC, 2019.
2) Hu, Xu, et al. "Considering Well-to-Wheels Analysis in Control Design: Regenerative Suspension Helps to Reduce Greenhouse Gas Emissions from Battery Electric Vehicles." *Energies* 12.13 (2019): 2594.
3) Long, Guimin, et al. "Regenerative active suspension system with residual energy for in-wheel motor driven electric vehicle." *Applied Energy* 260 (2020): 114180.
4) Saxena, Anchal, Saurabh P. Nikam, and B. G. Fernandes. "Study and Design of An Efficient Dual-Motor Powertrain for Two-Wheeled Electric Vehicles." *IECON 2019-45th Annual Conference of the IEEE Industrial Electronics Society*. Vol. 1. IEEE, 2019.
5) Bhatt, Anurag, et al. "Design and Fabrication of Regenerative Braking in EV." *VIVA-Tech International Journal for Research and Innovation* 1.2 (2019): 1-6.
6) Kavitha, K. N., et al. "Effect of system parameters on load levelling strategy for a plugin parallel hybrid two-wheeler." *2019 Fourteenth International Conference on Ecological Vehicles and Renewable Energies (EVER)*. IEEE, 2019.
7) Kumar, Ravindra, et al. *Design and Development of a Retrofit Solution for Converting a Conventional LCV into Parallel Hybrid Electric Vehicle*. No. 2019-26-0117. SAE Technical Paper, 2019.
8) Rathore, S. S., S. Mishra, and M. K. Paswan. "A Review on Design and Development of Free Piston Linear Generators in Hybrid Vehicles." *IOP Conference Series: Materials Science and Engineering*. Vol. 691. No. 1. IOP Publishing, 2019.
9) Huynh, Quoc-Viet, Ly Vinh Dat, and Khanh-Tan Le. "An Intelligent Regenerative Braking Strategy for Power-split Hybrid Electric Vehicle." *International Journal of Mechanical Engineering and Applications* 8.1 (2020): 27.
10) Kodihal, Kantaprasad, and Ankur Sagar. *Prototype Design of a Small Scale Thermionic Energy Generator for Waste Heat Recovery in Hybrid Electric Vehicle*. No. 2019-28-0027. SAE Technical Paper, 2019.