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Eco Hybrid Scooter

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Abstract. This paper introduces the novice concept of "Eco-hybrid Two wheeler" which is a combination of two systems i.e. petrol and electric system. This hybrid vehicle will make use of both technologies. Petrol system will be used for rear wheel drive and the electric system for front wheel drive. The batteries will be automatically charged when the vehicle runs on petrol system and that stored power will further be used for running the vehicle on electric system and so running of vehicle on electric system will be free of cost and pollution free also. The most attractive thing is that the batteries can also be recharged from electric supply.

Introduction

These days one of the major problems faced by our country is the increased demand and high prices of fuel with the increase in number of vehicles on the road. Today the need of our world is environment friendly vehicles as the pollution in this globalised world is increasing day by day. Air pollution is of serious concern in many Asian countries, especially in densely-populated countries like India where majority of the people use two wheelers as the means of their transportation.

All India level study, for petrol, reveals that two-wheelers segment accounts for the highest consumption at 61.42%.This is because majority of middle-class population including college students prefer to travel by two-wheelers, as it is more economical than travelling by car[1]. Therefore, a two-wheeler emission represents the main pollution source. So, Hybrid vehicles by reducing CO_2 emissions could considerably reduce the pollution, especially in our areas.

Today numerous types of technologies are emerging with different types of vehicles but until now limited solutions are being provided to the people as the vehicles are either fully IC engine operated or fully electric system operated. Also numerous types of hybrid vehicles are available in the market but the initial and maintenance cost of these vehicles is very high.

Solution Proposed

The paper presents a solution for concerned problems and that is why the vehicle is appropriately termed petrol-electric hybrids. Other power sources may include hydrogen, propane, CNG, and solar energy. This Eco-Hybrid Scooter is a combination of a two systems i.e. petrol system which works on IC engine and electrical system which works on the rechargeable batteries. This hybrid scooter will make the use of both these technologies. Petrol system is used for rear wheel drive and the electric system is used to drive the front wheel. The batteries are automatically charged while the vehicle runs on petrol system and that stored power will further be used for running the vehicle on electric system and this running of vehicle on electric system will be free of cost and pollution free also. The most attractive thing is that the batteries can also be recharged from electric supply.

System Architecture and Design

This paper introduces a new technology which is an integrated system i.e. the combination of petrol and electrical system. The already existing technology of electric system for two wheeler is one in which the only source of energy is rechargeable batteries, which are externally charged with the help of a charger, which is connected to the 220V AC. As the batteries are fully charged, the power goes to the electronic controller through an MCB and a switch. Further this power goes to PMBL (Permanent Magnet Brushless) motor which starts rotating and finally the two-wheeler will run as shown in fig.1.

This project brings in an Eco-hybrid scooter which is more economical and environment friendly as shown in fig.2. This scooter while operating on IC engine will give power to the rear wheel by consuming fuel (petrol) and a permanent magnet brushless motor cum generator is integrated to the front wheel. This motor will freely rotate with the wheel while the scooter is running on IC engine and will act as a generator, the generated power will further go to the controller, then is cutout through a switch and ampere meter and then finally the energy is stored into the batteries.

The motor is connected to the batteries with the help of wiring system along with a controller, an MCB, a switch and a throttle. As the batteries are fully charged, the operator can switch to battery system by switching off the IC engine and then switching ON the MCB so that scooter is now fully operated on the electric system. Now the scooter will run on electric system with the help of accelerator as shown in fig.3. This running of vehicle on electric system will be free of cost and pollution free.

For example, while the scooter will cover a distance of 35km on petrol during that time batteries are charged with the help of brushless motor. Now you can switch to electric system and then further move a distance of 35km. And this cost of running 35km on electric system is free and pollution free.

Other sources of energy can also be used to recharge the batteries externally like electricity (with the help of external charger), solar energy etc.

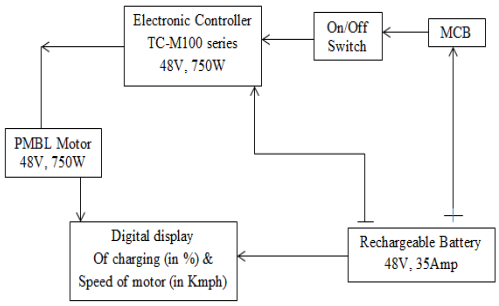

Fig.1 Block diagram of already existing electric system in two-wheelers

Fig.2 Prototype of Eco-Hybrid scooter

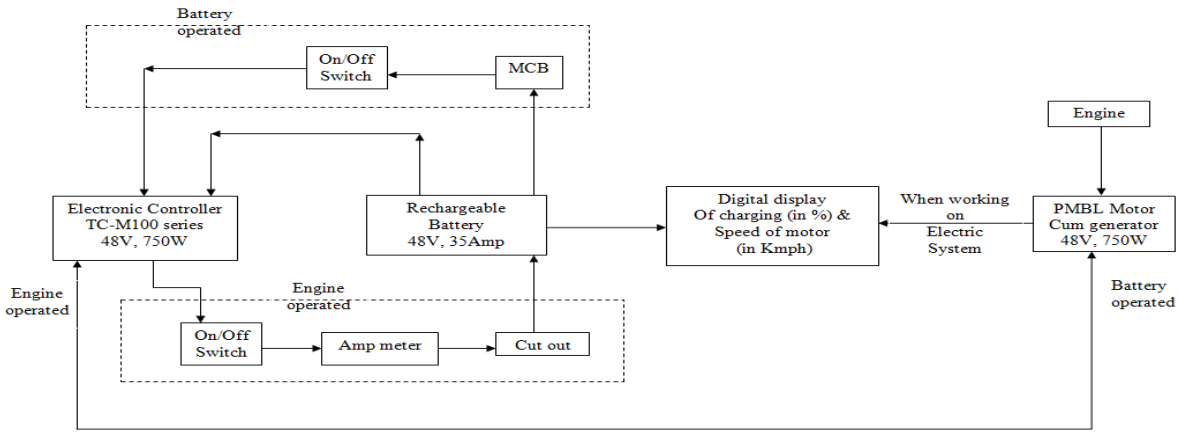

Fig.3 Block diagram of proposed system

Flow Chart of Proposed System. When scooter is operating on IC, engine will give power to the rear wheel by consuming fuel (petrol) and a permanent magnet brushless motor cum generator is integrated to the front wheel. This motor will freely rotate with the wheel while the scooter is running on IC engine and will acts as a generator, the generated power will further goes to the batteries. If the batteries are fully charged then power goes to the PMBL motor cum generator which will now work as a motor and give drive to the front wheel while operated on electric system. If the batteries are not fully charged, then the system will run as it is on IC engine.

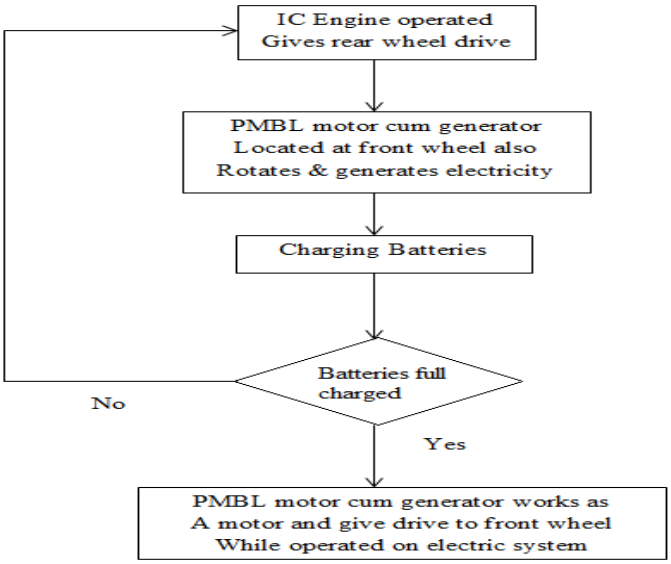

Fig.4 Flow chart of proposed system

Hardware System Design

The proposed system hardware includes the following blocks:

Permanent Magnet Brushless Motor cum Generator. The speed of a vehicle is determined by the output of its engine. This is more accurately characterized in terms of the motor's torque and angular velocity, but often measured in terms of the product: power. The motor has been used as Hub Motor External rotor with magnets envelopes the stator comprising of stamping, winding and sensors [2]. The table below provides the specification.

Fig.5 Permanent Magnet Brushless Motor

Table 1 PMBL Motor cum generator specification

PMBL Motor cum generator specification	
Power	750[W]
Current	33[A]
Voltage	48[V]

Controller. The controller varies the speed and torque of the motor. Any vehicle without control is useless, without the control the vehicle will ruin itself and also dangerous for the human being driving that vehicle. So, in order to avoid that it is very necessary that control system should be installed. The appropriate controller connects the power source- fuel cell or battery - to the actual motor. It controls speed and direction, and optimizes energy conversion. While batteries produce fairly constant voltages which decrease as they are used up, the voltage output by fuel cells varies as a function of power. The table below provides the specification.

Fig.6 Controller

Table 2 Electronic Controller specification

Electronic Controller specification	
Power	750[W]
Voltage	48[V]
Model No.	TC-M 100

It has extended fault detection and protection. Monitoring battery voltage, it will stop driving if battery voltage is too high. It will cut back then stop driving if voltage is going too low. It has built-in current loop and over current protection. The controller has thermal enhanced rugged aluminum housing. For thermal protection Current is cut back on low temperature and high temperature to protect battery and controller from being damaged [3].

Rechargeable Batteries. Battery is like a fuel tank for the electric system and requires refilling by the means of charging. The table below provides the specification.

Fig.7 Batteries

Table 3 Rechargeable batteries specification

Rechargeable batteries specification	
No. of batteries	4
Current	33[A]
Voltage	12[V]

MCB. stands for miniature circuit breaker. A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and by interrupting continuity, to immediately discontinue flow of electricity [4].

Fig.8 MCB

Performance Analysis of Proposed System

The table below provides the performance analysis of proposed system.

Table 4 Performance analysis of proposed system

Performance Analysis of Proposed System			
Parameters	**Electric System**	**Petrol System**	**Proposed System**
Charging Cost (in INR)	64.4 per 10[kWh][5]	0	0
Petrol Cost (in INR)	0	75.56	75.56
Speed on electric system (in km/hr)	40	0	40
Speed on petrol system (in km/hr)	0	70	70
Mileage (in km)	40	45	80

Profit percentage. Cost of Petrol for 45 km – Rs.75.56
Cost of a normal scooter running 80 Km/day for 3years – Rs.1,47,090.133
Running cost of our scooter for 3years – Rs.82,738.2 /80 km/day
Life of 4 batteries – 3 years
Price of 4 batteries – Rs.15,000(approx)
Amount saved in 3yrs – Rs.49,352
Profit %age = 33.55 %(approx)

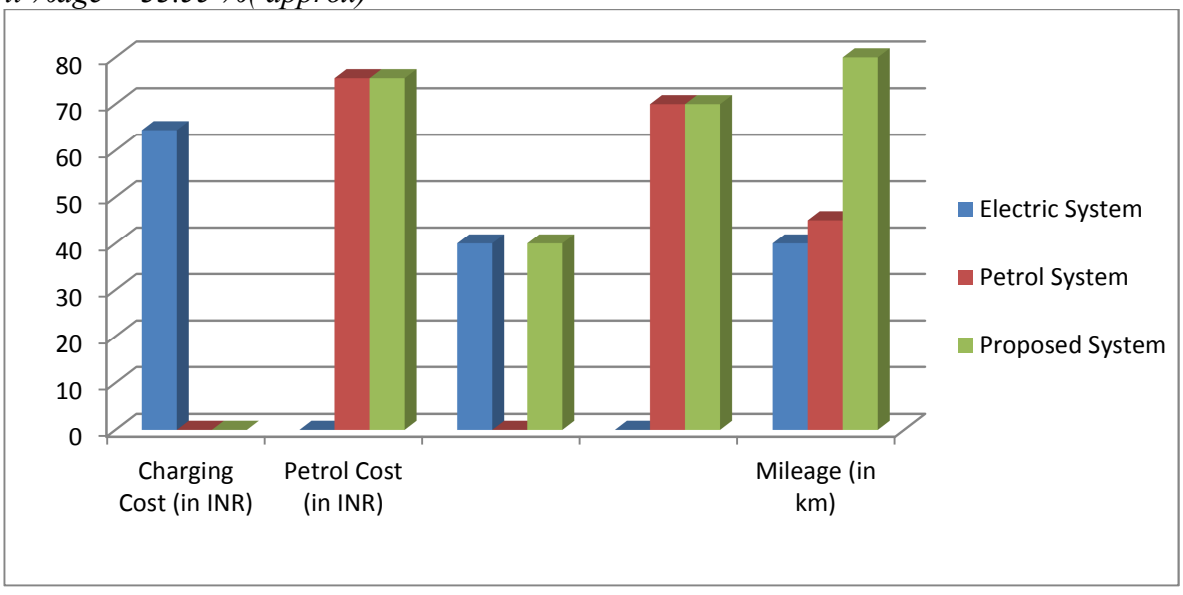

Fig.9 Column chart of performance analysis of proposed system

Conclusion

A petrol-electric hybrid vehicle system is designed successfully which is both economical and environment friendly terms because half of the distance can be travelled with the help of electric system .The amount of fuel consumed by this vehicle is half than other vehicles as it will run by consuming the energy of electric system. This vehicle will be very useful in remote areas as in remote areas the fuel is not easily available and even with little amount of fuel it can run efficiently. We can also use solar energy to charge batteries in these areas. This technology can also be integrated in four wheeler vehicles by using two motors.

References

[1] Information on http://ppac.org.in/writereaddata/PPAC%20Report%20Final%2013%20January%202014.pdf

[2] Information on http://brucelin.ca/scooters/pdf/ch2c.pdf

[3] Information on http://visforvoltage.org/blog/kelly-controls-llc

[4] Information on http://www.langir.com/htm/dc-circuit-breaker.htm

[5] Information on https://www.bijlibachao.com/news/domestic-electricity-lt-tariff-slabs-and-rates-for-all-states-in-india-in-2014.htm

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