IJESMR

International Journal OF Engineering Sciences & Management Research

A REVIEW ON: THE IMPLEMENTATION OF HYBRID TECHNOLOGY ON THE BIKE AS A TWO WAY POWER MOTOR CYCLE

Babu Lingappa Teli *, Md Maroof Md Nayeem
* Mechanical Engineering Department, A.R. Kalsekar Polytechnic Panvel,India
Mechanical Engineering Department, A.R. Kalsekar Polytechnic Panvel,India

ABSTRACT

In the last few years, environmental impact and price rise of the Petroleum based fuels have increased. For this perfect alternative, Electric vehicles are much preferred commonly around the world. Now Transient period of conventional vehicles to electric vehicles have started. Dual-mode vehicles are electrically powered and conventional internal combustion engine run in dual-mode for power too. Using batteries for electric drive and reciprocating engine for conventional drive either one can be operated at a time and this can be switch manually according to the application requirement. The Motorcycle with combination of IC engine and electric motor will provide a good start for electric vehicle usage by the consumers. This method of dual operation in two wheelers reduces running cost and environmental impacts. In this present paper shows dual operation of a two wheeler with mode-1 by conventional IC engine drive and the mode-2 is an electric drive consisting of a BL-DC motor fixed on the front of the vehicle powered by a 12V battery placed above the motor. The power from thatBL- DC motor is transmitted to the rear axle shaft with modified transmission to drive the vehicle. This power can be restored to the battery with an alternator.The battery can also be charged using solar cells. The motor speed is controlled through a Rheostat Control Method.

KEYWORDS: Electric vehicles, Dual-mode Technology, Rheostat Control Method, solar cells, electrically powered and conventional internal combustion engine.

INTRODUCTION

India is a developing country, with a lot of motor vehicles on road and a lot are added daily to the count. India is the second largest motorcycle manufacturer in the world. Out of total 18.10 million motor vehicles units sold in 2013 14.36 million were two wheelers. This results in an ever increasing demand for the fossil fuels like petrol and diesel to run those vehicles. It is a well-established fact that fossils fuels are limited in amount and also their use cause pollution. To save these fossil fuels for the future it is necessary to make the current vehicles more efficient and to come up with some alternate ways to power these vehicles. Internal combustion engine powered vehicles at the most 20% of chemical energy available in the fossil fuel to power not to mention the additional pollution caused due to burning of fossil fuels. But an electric vehicle on the other hand can convert 75% or more of energy from the battery to power. Also electric vehicles are clean and eco-friendly. Even if the electricity for charging the battery comes from a power station, it still is cleaner than internal combustion engine vehicles. Because, power stations are stationary power generation units and they can be made more efficient over time. Electric bikes runs on batteries, the batteries are very heavy to carry and they need to recharge from time to time. That‘s why the distance up to which an electric bike can go is limited by the capacity and weight of the battery. We cannot take an electric bike on a long ride unless there are electric charging stations around everywhere to charge the batteries on the go. For reasons mentioned above, Hybrid bikes are developed. A hybrid bike uses both the electric motor and an internal combustion engine to power itself. This way it can make use of the better side of both technologies, i.e. efficiency and ecofriendliness of electric motor and the range of Internal Combustion Engines. A lot of research is being carried out to make the batteries more compact more powerful and less heavy to increase the range of electric vehicles, until then hybrid bikes are the best option.

Background

These studies included both in-depth computer simulations of hypothetical vehicles and the design, construction, and testing of prototype vehicles (Burke 1992). The JPL/GE Near-Term Hybrid Vehicle program, which ran from 1978-82, developed a working vehicle, called the HTV-1, with a parallel hybrid drivetrain (Burke 1992). The target performance of the vehicles contemplated and built in these early programs was between that of conventional gasoline vehicles and electric vehicles of the time and comparable to the relatively low-powered diesel vehicles then available. The Department of Energy has since embarked on programs that aim to produce vehicles with performance more likely to compete with conventional gasoline-powered vehicles.

IJESMR
International Journal OF Engineering Sciences & Management Research
The Department has pursued both its own research program, the Electric and Hybrid Vehicles Program, and a joint government/industry program, the Partnership for a New Generation of Vehicles (PNGV), initiated in 1993. At the time this vehicle was built, the available motors, controllers, and inverters were much heavier than those available today. The 80-90 kW that would have been demanded with a series configuration which demands considerably more power in the electric drivetrain than does a parallel configuration would have been difficult to package.

The PNGV‘s primary goal is to develop a fully competitive family car with fuel economy up to 3 times the current levels; the PNGV research team has settled on a hybrid drivetrain as an integral part of this vehicle. The DOE and PNGV have been driven largely by concerns about oil savings. Interest in hybrid vehicles stems also from the State of California‘s Zero Emission Vehicle (ZEV) requirements, which demand that automakers doing business in California begin producing substantial quantities of ZEVs within the next decade. The ZEV requirements are driven by air quality concerns, and the California Air Resources Board (CARB) proposes allowing hybrids to attain partial ZEV credits (that is, each hybrid vehicle will be counted as a fraction of one electric vehicle).

Hypothesis

The price of petrol and diesel is increasing day by day; due this reason the cost of one kilometre drive of a motorcycle is also increasing. If a motorcycle gives a fuel economy of 50kmpl, assuming the cost of petrol as Rs. 75 per litre. Thus the cost of driving on the motorcycle for one kilometre will be Rs. 1.5 per kilometre. On the other hand if an electric vehicle with a battery of 2kWh capacity can go up to 40km on a single charge and the cost of a single unit of electricity is roughly around Rs10. Then the costs of driving one kilometre on an electric bike will only Rs. 0.5 per kilometre. Thus electric bikes are more economical and environment friendly.The proposed project will improve the efficiency of the system thereby improving the fuel economy of the system. Emissions of the bike will reduce if the bike is run using the electric drive. The proposed bike will run on the electric motor for one hour of continuous operation.

Scope of Hybrid bikes

India National Electric Mobility Mission Plan 2020 envisages 5-7 million electric vehicles (EVs) will be on the roads by 2020. An opportunity for EVs in India exists in the nascent 4W market and it is driven by low hybrid/electric penetration, high oil price forecasts, and an unsaturated, growing demand for personal passenger cars. These _EVs‘ refer to hybrids (HEVs), plug-in hybrids (PHEVs) and electric vehicles (EVs) ranging from 2 wheelers (2W) to passenger cars and fleet vehicles (4W). However, the demand for EV passenger cars remains weak as any potential fuel savings do not sufficiently compensate a consumer for a high purchase price. Meanwhile, the emissions-reduction case for EVs will not exist in India unless renewable energy is used to power EVs. Mobility Mission Plan (NEMMP) expects that 92% of all consumed crude oil will be imported by 2020. Electric transport is seen as a lever to reduce crude demand. EV uptake can help reduce overall oil deficit and/or re-direct crude to stimulate energy-intensive export sectors like mining, manufacturing, and agriculture.

METHODOLOGY

Acquisition of a bike to work on. Test the initial performance of bike for the purpose of comparison after the completion of the project. Select the type of motor to be used a Hub motor or BLDC motor. Acquisition of motor and batteries according to motor type. Find various options for mounting of motor and the batteries according to the space available in the bike. Then clear the space and removing the unnecessary accessories fitted to the bike for mounting of motor and batteries. Designe the frame for firm mounting of motor and batteries. Check the feasibility of mountings which shoud not effect the balancing of bike. Check for any troubles and rectifying the problems by making fine adjustment mountings. Design power transmission system from motor to rear wheel by modifying existing transmission system. The modified transmission system has to be integrated existing transmission system of bike. Design of transmission components are such a way that when bike is made to run by DC motor, all engine parts should remain idle, this will help to avoid loss of Friction Power in engine.

DESIGN OF POWER TRANSMISSION COMPONENTS

1. Reduction Gear Box for Motor

The max speed of BL-DC motor is 2880 rpm and we required 1440 rpm at output of reduction gear box. This is achieved by reduction gearbox of reduction ratio 2:1. Due to this gearbox the torque at output will increase. Power is to be transmitted between two shaft which are at 90^0 apart, which is done by spiral gears.

IJESMR
International Journal OF Engineering Sciences & Management Research

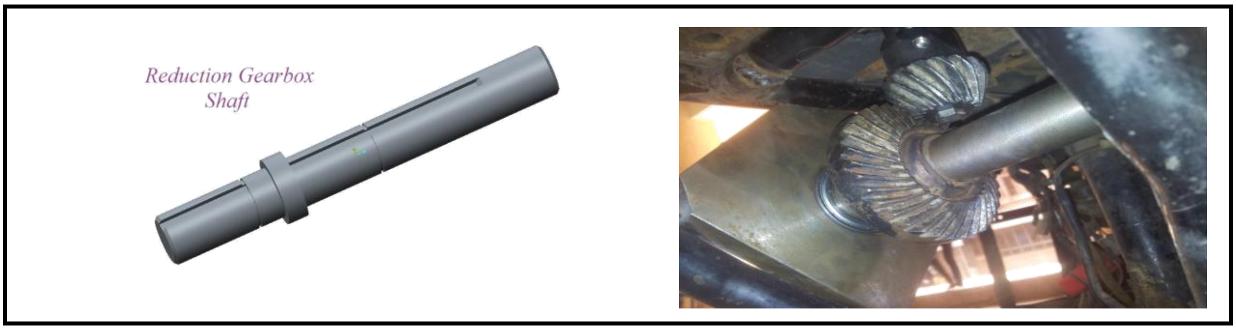

Figure 1. Actual Image of Reduction Gear Box

Table 1. Properties of materials used for design of spiral gears.

Component	Material	σ_b (N/mm^2)	σ_c (N/mm^2)	HB
Pinion	40NiCr1Mo28	380	1100	600
Gear	15NiCr1Mo15	300	950	500

Table2. Calculated important dimensions of Spiral Bevel gears

Sr. No.	Elements	Pinion	Gear
1	No. Of Teeth	Z1 = 18	Z2 = 37
2	Pressure angle	$\alpha = 20^0$	$\alpha = 20^0$
3	Module	Mt = 2 mm	Mt = 2 mm
4	Face width	B = 20 mm	b = 20 mm
5	Cone distance	R = 60 mm	R = 60 mm
6	Pitch angle	$\partial_1 = 26^0$	$\partial_2 = 64^0$
7	PCD	$D_1 = Mt_1 * Z_1 = 36$ mm	$D_2 = Mt_1 * Z_2 = 74$ mm
8	Tip Dia.(d_o)	$Da_1 = Mt\,(Z1+2\cos\partial 1)$ = 39.6 mm	$Da_2 = Mt\,(Z2+2\cos\partial 2)$ = 75.75 mm
9	Root Dia.(df) (hf = 1.3 Mt)	$Df_1 = [d1 - 2hf.\cos\partial 1]$ = 31.32mm	$Df_2 = [d2 - 2hf.\cos\partial 2]$ = 71.72mm

2. Compound Ratchet Sprocket

The function of the compound ratchet is to allow the transmission of power either from the engine gear box or from the motor reduction gear box. While transmitting the power from motor reduction gear box to the vehicles it isolates the engine components from the drive. Due to the isolation the engine & gear box components will remain in idle condition. Thus the frictional power loss of the moving engine components is eliminated. On the other hand, when vehicle runs on the engine power it transmits the power to the rear wheel through chain drive & shares some part of its energy to recharge the battery through reduction gearbox and motor

Figure 2. CAD Model and Actual Image of Compound Ratchet Sprocket

FUTURE WORK HIGHLIGHT

Generally IC Engine gives maximum efficiency at its optimum speed. At this speed Engine runs at higher economy point. But in actual practice Engine speed could not remain constant on road condition. Therefore speed of engine divert from maximum efficiency point and overall fuel economy decreases.

IJESMR
International Journal OF Engineering Sciences & Management Research

By integrating IC Engine and BL-DC motor mechanically and controlling entire unit by electronic control system, it is possible to run IC Engine at higher efficiency point at all road conditions. When the load on the Engine is increases, then excessive power will be supplied from BL-DC motor. When load on the Engine is reduces, then excessive power developed by engine will be ternasfered to the BL-DC motor and motor will act as Alternator. Electricity generated by Alternator will be stored in batteries through charging circuits.Aproximataly 50% of waste exhaust energy can be utilized by use of solide oxide fuel cells (SOFC).This cells will convert thermal energy into electrical energy which will be stored in the batteries. Similarly solar power battery charging system can be used in hybrid vehical.

Figure3. Solid oxide fuel cell (SOFC)

EXPERIMENTAL ANALYSIS

Test performance before modification

- Cost of petrol: Rs.74.67
- Normal driving speed of bike: Within economy i.e 30-40kmph
- Quantity of petrol in the bike: One litre
- Load on the bike: Weight of a single
- Terrain of drive: person Highway
- Distance covered: 54.7 km (approx)
- Fuel Economy: 54.7 km/litre
- Ride economy : 1.36 Rs/km

Test performance after modification

- Cost of petrol: Rs.68.73
- Cost of single unit of electricity: Rs. 5 (Rs.4.13 rounded off)
- Power required for fully charging the battery: 2.4 KW
- Normal driving speed of bike:
    - When on ICE: Within economy i.e 30-40 kmph
    - When on electric motor: 24 kmph
- Quantity of petrol in the bike: One litre
- Load on the bike: Weight of a single person
- Terrain of drive: Highway
- Distance covered:
    - On Battery: 16.2 km (approx.)
    - On petrol: 43.4 km (approx.)
    - On battery again after it was charged from engine: 6.7 km
- Fuel Economy: 43.4 km/litre
- Ride economy: 0.8212 Rs/km

CONCLUSION

It can be seen from above results that the ride economy of the bike improved. There is a reduction in fuel economy of the bike this is due to increase in weight of the electric motor, batteries and the mountings.The reduction in the economy is compensated as electrical energy which is stored in the batteries. This energy from battery is used to drive DC motor, hence ride economy of Bike is improved. Thus the proposed project is one of various ways to reduce the consumption of crude oil and to reduce the running cost of the vehicle

ISSN 2349-6193
Impact Factor (PIF): 2.243

IJESMR

International Journal OF Engineering Sciences & Management Research

REFERENCES

[1] Karan C. Prajapati, Ravi Patel, Rachit Sagar "Hybrid Vehicle A Study on Technology"" International Journal of Engineering Research & Technology (IJERT), VOL. 3, NO. 12, DECEMBER 2014
[2] E. D. Tate, Michael O. Harpster and Peter J. Savagian, "The Electrification of the Automobile: From Conventional Hybrid, to Plug-in Hybrids to Extended-Range Electric Vehicles" SAE TECHNICAL PAPER SERIES, 2008-01-0458.
[3] SAE J1715 Information Report, Hybrid Vehicle (HEV) and Electric Vehicle Terminology, July 2007.
[4] M. I.Marei,S.J.Samborsky, S.B. Lambert, M. M. A Salama. "On the Characterization of Ultracapacitor Banks Used for HEVs", Proceedings of the IEEE Vehicle Power and Propulsion Conference, VPPC "06, Windsor, UK,2006, pp. 1-6.
[5] M. Ehsani, Y. Gao, S. Gay, A.Emadi. "Modern Electric, Hybrid Electric and Fuel Cell Vehilces", CRC Press: USA, 2005.
[6] M. Barcaro, N. Bianchi, F. Magnussen "PM Motors for Hybrid Electric Vehicles" The Open Fuels & Energy Science Journal, Vol. 2, pp. 135-141, June 2009.
[7] T.Yaegashi "In Challenge of Achieving Sustainable Mobility through Hybridization", Research and Development of Hybrid Vehicles in Japan and Sweden Seminarim, Göteborg, Sweden, 2006.
[8] L. Graham, M. Christenson, and D. Karman, "Light duty hybridvehicles - influence of driving cycle and operating temperature on fuel economy and ghg emissions," in Proceedings of the IEEE EIC Climate Change Technology, M. Christenson, Ed., 2006, pp. 1–6.
[9] E. Tate, J. Grizzle, and H. Peng, "Shortest path stochastic control for hybrid electric vehicles," International Journal of Robust and Nonlinear Control, vol. 18, pp. 1409–1429, 2008.
[10] "Hybrid Electric Vehicles: An Overview of current technology and its application in developing and transitional countries. Printed" United Nations Environment Programme, Nairobi, Kenya, September 2009.
[11] F Nemry, G Leduc, A Muñoz "Plug-in Hybrid and Battery-Electric Vehicles", State of the research and development and comparative analysis of energy and cost efficiency, 2009.