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An Experimental study on Economic aspects of a 2-Wheeler Hybrid Engine

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Abstract— *Hybrid technology has become popular in the automotive industry since the technology has proven to improve the vehicle's efficiency, saving fuel and is environment friendly. A 2-wheeler hybrid engine combines a conventional internal combustion engine (ICE) propulsion system with an electric propulsion system. The concept is to induce a vehicle, which can run on the road at the minimal cost, minimum consumption of the fuel and with minimum emission of the pollution in the air. In this study, an experimental investigation was carried out on the performance of a 2- wheeler hybrid engine in steady state. If the use of battery vehicle or the hybrid engine is promoted on large scale, it can pay a noticeable contribution in solving the problem of global warming.*

Keywords— *hybrid engine, automotive, global warming, electric propulsion system, emission.*

I. INTRODUCTION

In hybrid engine (petrol + electric), the presence of the electric power is intended to achieve either better fuel economy than a conventional vehicle, or better performance. Modern hybrid engines make use of efficiency-improving technologies such as regenerative braking, which converts the vehicle's kinetic energy into battery-replenishing electric energy, rather than wasting it as heat energy as conventional brakes do. Some varieties of 2WHE use their internal combustion engine either to generate electricity by spinning an magnet, to recharge the batteries or to directly power the electric drive motors also reduce idle emissions by shutting down the ICE at idle and restarting it when needed; known as a start-stop system. In a normal road vehicle, the whole series-hybrid power-transmission setup may be smaller and lighter than the equivalent conventional mechanical power-transmission setup, liberating space and less weight. This offers great simplicity. As the combustion generator set only requires cables to the driving electric motors, this provides the superior weight distribution. Thus the braking mechanisms can be lighter & aluminum wheels may be used to reduce the mass of the wheel assembly. The power sources for hybrid vehicle include: On-board or out-board rechargeable energy storage system (RESS), Petrol or Diesel fuel, & Waste heat from internal combustion engine.

1.2 Operation and working of a 2-Wheeler Hybrid engine.

Main stages of working for the vehicle are as follows:

1. First, the Vehicle Starts on Battery Power.
2. When the throttle is given, the dynamometer wheel rotates with which the rear wheel of the vehicle starts revolving.
3. When the vehicle gains the speed of 170 RPM continuously for 30 sec (by observations), the dynamometer senses the speed and sends the signal to the controller.
4. The circuit automatically converts the vehicle from battery power to petrol engine by the starter timed for 3 seconds. Now the vehicle is fully operating on the petrol mode and above the speed of 30 kmph, but when the brakes are applied and as soon as the speed reduces below 170 RPM for 30 seconds the petrol engine will stop and the vehicle will again get converted onto the battery power mode. *Figure 1* and *Figure 2* shows the block diagram and its working model respectively.

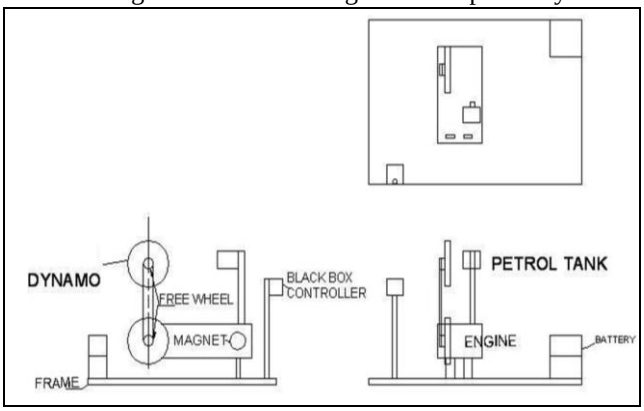

Figure. 1 Block Diagram

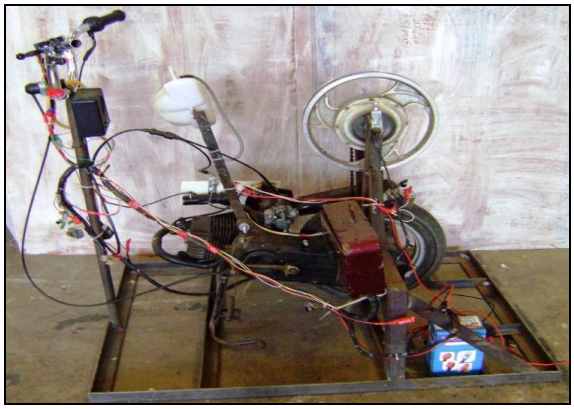

Figure. 2 Working Model

1.3 Specifications of Hybrid engine:

Petrol Mode Specifications

Wheel Base	1220 mm
Fuel Tank Capacity	3.5 liter
Engine Type	2 Stroke Air Cooled
Displacement	59.9cc
Ignition	CDI
Gear box	Variomatic
Front Brakes	110 Drum
Rear Brakes	130 Drum
Front wheel	2.75 X 10
Rear wheel	2.75 X 10

Electric Mode Specifications

Overall Length	1750 mm
Overall Width	615 mm
Overall Height	1050 mm
Max Payload	75 Kg
Motor Type	Brushless DC Motor
Front Wheel	16' X 2.5'
Rear Wheel	16' X 2.5'

1.4 Electronic circuits

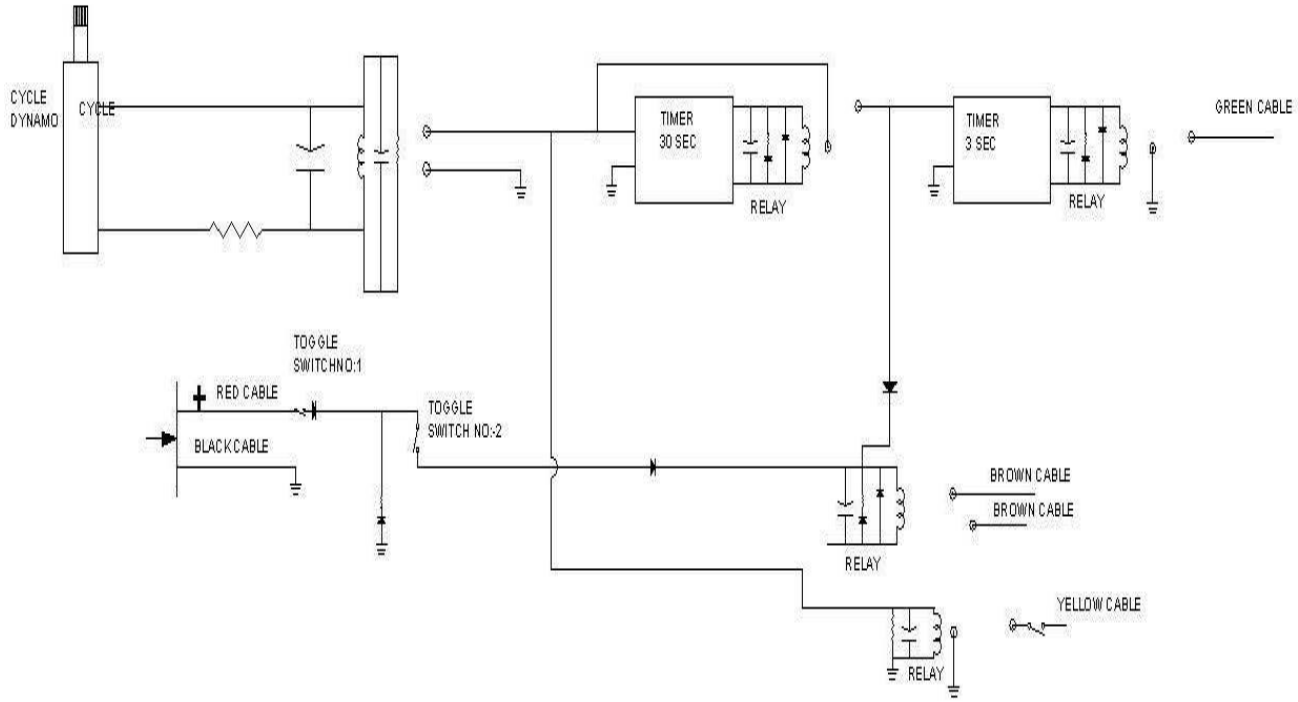

Figure 3 Circuit diagram for Hybrid vehicle.

II. OBSERVATIONS AND RESULTS

Battery specifications		
1	No of batteries	= 4 batteries of 12 volts
2	Battery	= 15 amps
3	Rating of battery	= 2.25 amp /hrs.
4	Power of battery	= 48v × 15 amp = 720 watt

If we assume that the vehicle is moving on the road at the speed of 30 km/hr. when the battery is full charged.

1. Total distance $= 30 \text{ km/hr} \times \dfrac{\text{battery power}}{\text{dynamo power / hr}} = 30 \text{ km / hr} \times 720 / 350 = 61.71 \text{ km}$

2. Charging power/hr = rating of battery × total voltage = 2.25 amp / hr × 48v =108 watt / hr

3. Total time required to charge the battery $= \dfrac{\text{total battery power}}{\text{charging power/hr}} = 720 / 108 = 6.66 \text{ hrs.}$

4. Total power required for charging battery is 720 watt,

If 1 kwh $(1 \text{ unit}) =$ Rs. 15 (say),

Cost of charging power $= 108 * 10^{-3}$kwh $= 1.62$ Rs/hr

The total cost = total time$\times$cost of charging power/hr $= 6.6$ hrs.$\times Rs.1.62 = Rs.10.692\,(approx)$.

The study demonstrates the comparison between the cost effectiveness of a fully charged battery to the cost of fuel for the vehicle to travel the same distance.

III. COMPARISION

2-wheeler hybrid engine	Conventional vehicle	Electric vehicle
1. Dual source of energy	1 Single source of energy	1. Low efficiency
2. Better efficiency	2. High pollution	2. Low power
3. Less pollution	3. High fuel cost	3. Pollution free
4. Less energy consumption	4. High torque	4. Noise free

III. CONCLUSIONS

In this work we conclude that when the vehicle is running below the speed of 30kmph the power required to run the vehicle is comparatively less and the cost of electricity for charging the electric vehicle is considerably low. So if the vehicle is made to run on a battery up to 30 km/h, 60% (approximately) of the fuel consumption can be reduced while riding in the cities. The world today is facing the scarcity of fuels and energy, therefore to overcome this problem in the field of automobile the Hybrid Engine / Dual Mode Engine can be more beneficial than only a conventional vehicle. If the use of this vehicle is promoted on large scale, it can pay a noticeable contribution in solving the problems of air pollution. Further in future scope the solar power can be used as a source of charging instead of electric power.

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