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Hybrid Bike


A Vamsi Krishna
B.Tech,
Dept of Mechanical Engineering,
Hyderabad Institute of Technology and Management,
Hyderabad, Telangana, India.


G Suraj Kumar
B.Tech,
Dept of Mechanical Engineering,
Hyderabad Institute of Technology and Management,
Hyderabad, Telangana, India.


Ashish Kumar
B.Tech,
Dept of Mechanical Engineering,
Hyderabad Institute of Technology and Management,
Hyderabad, Telangana, India.


M Sampath Kumar
B.Tech,
Dept of Mechanical Engineering,
Hyderabad Institute of Technology and Management,
Hyderabad, Telangana, India.


Singaiah Gali
Assistant Professor,
Dept of Mechanical Engineering,
Hyderabad Institute of Technology and Management,
Hyderabad, Telangana, India.

Abstract:

A 'gasoline-electric hybrid car' or 'hybrid electric vehicle' is a vehicle which relies not only on batteries but also on an internal combustion engine which drives a generator to provide the electricity and may also drive a wheel. It has great advantages over the previously used gasoline engine that drives the power from gasoline only. It also is a major source of air pollution. The objective is to design and fabricate a two wheeler hybrid electric vehicle powered by both battery and gasoline. The combination of both the power makes the vehicle dynamic in nature. It provides its owner with advantages in fuel economy and environmental impact over conventional automobiles. Hybrid electric vehicles combine an electric motor, battery and power system with an internal combustion engine to achieve better fuel economy and reduce toxic emissions. In HEV, the battery alone provides power for low-speed driving conditions where internal combustion engines are least efficient. In accelerating, long highways, or hill climbing the electric motor provides additional power to assist the engine. This allows a smaller, more efficient engine to be used.

I. INTRODUCTION:

Motorcycles have been a feature of our roads for well over a hundred years. During that time they have served as a functional mode of transport, an economical alternative to the car, a workhorse and even a lifestyle icon. Their popularity has risen and fallen in concert with a number of diverse social and economic factors. Sustained interest in motorcycling throws the advantages and disadvantages of motorcycling into sharp relief – the most obvious of the latter being safety. However, it is important to remember that the functions and benefits presented by the motorcycle for over a century are still valid and valuable. A vulnerable mode of transport is not the same as being an undesirable one.

Motorcycles have long provided a legitimate, cost effective and relatively low-polluting form of transport for commuting, work or leisure purposes. However, their riders are susceptible to serious injury even in low-speed collisions. Policy makers, planners, road designers and maintenance engineers have sometimes overlooked their specific safety needs. Raising awareness of those requirements among these professionals is crucial and these Guidelines are a step in that direction. Road designers and traffic engineers need to understand how some design features, benign to other road users, can present a particular hazard to motorcyclists. It is important to keep exploring new ideas and trialling initiatives, despite any perceived controversy.

For example, in 2012 Transport for London granted motorcyclists permanent access to bus lanes on the majority of the city's red routes in what may, at the time, have been perceived as a bold move. Traffic calming measures can be very effective in reducing the number of injury collisions, especially in residential areas. Motorcyclists are no more exempt from the intended effects of traffic calming than any other road user and, arguably, suffer disproportionately from the unintended effects. Such unintended effects can seriously compromise safety Road safety campaigns are a vital component to improving the safety record of motorcyclists.

Attitudes play a major role in determining rider behaviour, irrespective of age or trip purpose. Measures designed to influence behaviour must address these attitudes and take account of the spirit and individuality often expressed in choosing a motorcycle as one's mode of travel. Riders respond better to messages that relate to their own perspective and are likely to ignore general "must do" or "must not do" messages. A good quality surface provides a safer, more pleasant experience for all road users but this is particularly relevant to motorcyclists.

Factors affecting motorcyclists include skid resistance, surface contamination and debris, drainage gullies, service covers, road markings and road studs. All of these factors should be examined from a 'motorcyclist inclusive' viewpoint.

Engine and working Priciples

A heat engine is a machine, which converts heat energy into mechanical energy. The combustion of fuel such as coal, petrol, diesel generates heat. This heat is supplied to a working substance at high temperature. By the expansion of this substance in suitable machines, heat energy is converted into useful work.

Heat engines can be further divided into two types:

External combustion and internal combustion In a steam engine the combustion of fuel takes place outside the engine and the steam thus formed is used to run the engine.

Thus, it is known as external combustion engine. In the case of internal combustion engine, the combustion of fuel takes place inside the engine cylinder itself.

II. SPECIFICATIONS

ENGINE SPECIFICATIONS

- Engine: 147.5cc
- Maximum Power: 12 bhp@ 7000 rpm
- Maximum Torque: 10.5 Nm @ 6500 rpm
- Gears: 5 Speed
- Clutch: NA
- Bore: NA
- Stroke: NA
- Cylinder Configuration: NA
- Engine Block Material: NA
- Chassis Type: NA
- Carburetor: NA

OTHER SPECIFICATIONS

- Weight: 126.00 kg
- Ground Clearance: 155.00 mm
- Fuel Tank: 12.00 ltrs
- Wheelbase: 1270.00 mm

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• Electrical System: NA
• Headlamp: NA
• Horn: NA
• Tubeless: No
• Colors: NA

IC Engine

SI Engine			Justification
	Stroke	4-stroke	4 stroke engines
	No of Cylinders	Single Cylinder	have better
	Displacement	147.8cc	efficiency and this
	Cooling	Air Cooled	engine commercially
	Fuel Supply	Carburettor	cheaper than other
			engines.

Electric Motor

BLDC Hub Motor			Justification
	Operating Voltage	48Volts	High efficiency
	Power	750 watts	and better load
	Max RPM	380 rpm	carrying capability.
	Max Current	15 amps	
Battery			High discharge
	Voltage	48volts	capability
	Capacity	15Ah	

III. INTRODUCTION TO HYBRID BIKE:

A hybrid vehicle combines any two power (energy) sources. Possible combinations include diesel/electric, gasoline/fly wheel, and fuel cell (FC)/battery. Typically, one energy source is storage, and the other is conversion of a fuel to energy. The combination of two power sources may support two separate propulsion systems. Thus to be a True hybrid, the vehicle must have at least two modes of propulsion. For example, a truck that uses a diesel to drive a generator, which in turn drives several electrical motors for all-wheel drive, is not a hybrid. But if the truck has electrical energy storage to provide a second mode, which is electrical assists, then it is a hybrid Vehicle. These two power sources may be paired in series, meaning that the gas engine charges the batteries of an electric motor that powers the car, or in parallel, with both mechanisms driving the car directly.

Hybrid electric vehicle (HEV)

Consistent with the definition of hybrid above, the hybrid electric vehicle combines a gasoline engine with an electric motor. An alternate arrangement is a diesel engine and an electric motor.

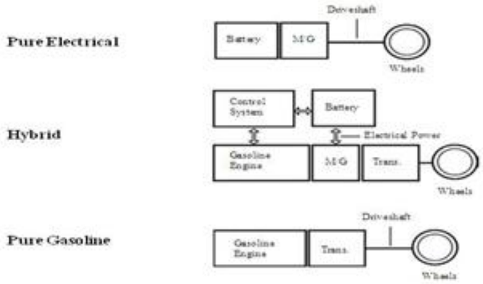

Fig 1: Components of a hybrid Vehicle that combines a gasoline with a pure EV

As shown in Figure, a HEV is formed by merging components from a pure electrical vehicle and a pure gasoline vehicle. The Electric Vehicle (EV) has an M/G which allows regenerative braking for an EV; the M/G installed in the HEV enables regenerative braking. For the HEV, the M/G is tucked directly behind the engine. In Honda hybrids, the M/G is connected directly to the engine. The transmission appears next in line. This arrangement has two torque producers; the M/G in motor mode, M-mode, and the gasoline engine. The battery and M/G are connected electrically. Difference in the source of Energy can be explained as:
•The FC provides high energy but low power.
•The battery supplies both modest power and energy.
•The capacitor supplies very large power but low energy.

The components of an electrochemical cell include anode, cathode, and electrolyte. The current flow both internal and external to the cell is used to describe the current loop. The motion of negative charges is clockwise and forms a closed loop through external wires and load and the electrolyte in the cell.
Power sources of hybrid bike

- Coal, wood or other solid combustibles
- Compressed or liquefied natural gas
- Petrol (gasoline) or Diesel fuel

- Human powered e.g. pedaling or rowing
- Electromagnetic fields, Radio waves
- Electric batteries/capacitors
- Overhead electricity
- Hydraulic accumulator
- Hydrogen
- Flywheel
- Solar
- Wind

How Hybrid-Electrical Vehicles Work?

Hybrids-Electric vehicles (HEVs) combine the advantage of gasoline engines and electric motors.

The key areas for efficiency or performance gains are regenerative braking, dual power sources, and less idling.

Regenerate Braking.

The drivetrain can be used to convert kinetic energy (from the moving car) into stored electrical energy (batteries). The same electric motor that powers the drivetrain is used to resist the motion of the drivetrain. This applied resistance from the electric motor causes the wheel to slow down and simultaneously recharge the batteries.

Dual Power

Power can come from either the engine, motor or both depending on driving circumstances. Additional power to assist the engine in accelerating or climbing might be provided by the electric motor. Or more commonly, a smaller electric motor provides all of the power for low-speed driving conditions and is augmented by the engine at higher speeds.

Automatic Start/Shutoff

It automatically shuts off the engine when the vehicle comes to a stop and restarts it when the accelerator is pressed down. This automation is much simpler with an electric motor. Also see dual power above.

Basic Components of a Hybrid Bike

- Batteries
- Controller
- BLDC motor

Batteries

Kinetic energy, or the energy of motion, is used to keep the electric battery charged on the hybrid. When the driver uses the brakes, this sends a charge to the car's battery. Some hybrids garner energy from the gasoline engine by attaching a spinning electrical generator on the device. Contrary to myth, hybrid vehicles do not need to be plugged in for the battery to be fully charged. No matter where you go, you cannot get away from batteries. They're in your MP3 player, portable radio, telephone, cell phone, laptop computer, portable power tool appliance, game, flashlight, camera, and many more devices. Batteries come in two distinct flavors: rechargeable and non-rechargeable.

Electric Motor

Before hybrids, electric motors were typically used to power smaller devices such as fans, computer equipment and printers. Through what is known as "regenerative braking," braking and accelerating create a steady stream of energy. With the assistance of the car's wheels, the motor functions as a generator, and energy normally wasted from braking and coasting are harnessed. Electric motors can be found in many sizes and places. Universal in application, they can be as big as a house as or smaller than your fingernail, and they can be powered by any source of electricity. Each of us encounters dozens, if not hundreds, of electric motors daily without even thinking about them: alarm clocks, televisions, grinders, shavers, toothbrushes, cell phones, fans, heaters, and air conditioners.

IV. DESIGN CALCULATION'S

- $I = V/R$

  Here I = current (amps)

  V= applied voltage (volts)

  R = resistance (ohms)

- $P_{in} = I * V$

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Here P_{in} = Input power (Watts)
I = Current (amps)
V = applied Voltage (Volts)

- $P_{out} = T * \omega$
  Here P_{out} = output power (Watts, 'W')
  T = Torque (N-V)
  ω =Angular speed (rad/sec)
- $\omega = \frac{2\pi NT}{60}$
  Here N = Speed (RPM)
- Efficiency

$$E = \frac{P_{out}}{P_{in}}$$

- Torque

$$T = \frac{I*V*E*60}{2\pi n}$$

Speed (Kmph)	Output power (W)	Output volt(V)	Output current (A)
5	0.56	6.00	0.126
15	1.89	6.00	0.369
30	4.09	6.00	0.560

Table 1: battery power consumptions for constant voltage Constant-resistance load testing (18 ohms)

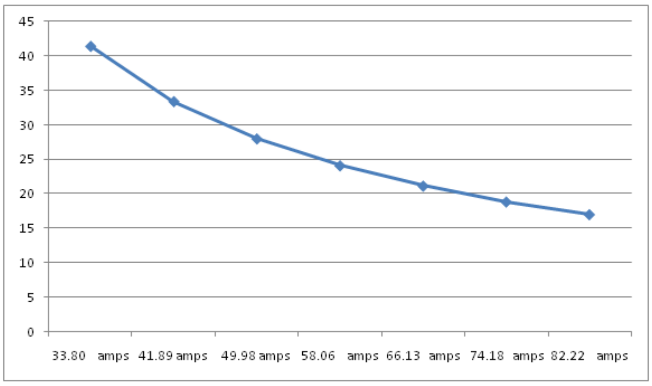
Speed (Kmph)	Output power (W)	Output volt(V)	Output current (A)
5	0.45	2.45	0.115
15	1.89	5.78	0.325
30	3.2	7.23	0.435

Table 2: battery power consumption for varying voltage

Shaft Speed	Terminal Voltage	Continuous Current
Less than 23 rpm	Less than 6 VDC	Less than 0.3 amps
23 to 166 rpm	6 to 15 VDC	0.3 to 0.9 amps
166 to 1130 rpm	15 to 38 VDC	0.9 to 4 amps
1130 to 5200 rpm	38 to 160 VDC	4 to 12 amps
5200 rpm & up	160 VDC & up	12 amps & up

Table 3: speed and V*I

VDC = Varying Direct Current



Scale:

X axis- current in amps
Y-axis-distance in kms

- Dynamo formulae for EMF
  Average emf generated in each conductor is given by $\frac{2\O NpZ}{60C}$
  Where
  Z= Total number of armature conductors
  c= number of parallel paths through winding between positive and negative brushes
  where c= (wave winding) , c= 2p (lap winding)
  = useful flux per pole (weber's), entering or leaving the armature
  P = number of pairs of poles
  N= speed (Revolutions per minute)
- Aerodynamic drag force (F_d):

$$F_d = \frac{C_d * A * V^2}{391}$$

Where c_d= drag coefficient of the vehicle
A= frontal area of the vehicle in square feet
V=the vehicle speed in KMPH

- Rolling resistance (F_r):

$$F_r = C_r * w$$

Where C_r=rolling resistance factor
w=vehicle's weight in kgs

- Force due to acceleration (F_a)

$$F_a = C_i * w * a$$

Where C_i= unit conversion factor
w= weight in kgs
a= acceleration in kmph/sec

- Force due to climbing hills (F_h)

$$F_h = W * \sin(\emptyset)$$

W= vehicle weight in kgs
Sin(Ø) = angle of inclination

- Total force on the vehicle (F_t)

All four forces added together

$$Ft = Fd + Fr + Fa + Fh$$

- The horsepower needed (hp)

$$hp = \frac{Ft * v}{375}$$

Where F_t= total force in kgs
v=speed expressed in kmph

- Torque needed from the motor (T)

$$T = \frac{5252 * hp}{RPM}$$

Where Hp= horse power
RPM= revolutions per minute

- Conversion from hp to watts (W):

$$w = \frac{hp * 1000}{1.34}$$

- Current needed to power in amps(A):

$$A = \frac{w}{v}$$

Where v= volts from the battery
w= power need to run in watts

- Time in hours the vehicle can run (Time):

$$Time = \frac{A_h}{A}$$

Ah= Amp-hours from the battery
A= current

- Total distance in kms vehicle can drive (D):

$$D = \frac{KMPH}{Time}$$

Time = time in hours vehicle can run

- Battery charging time (T_c):

$$T_c = \frac{A_h}{Amp}$$

Where Ah = Amp-hours from the battery
Amp= Amps from the battery charger

kmph	aerodynamics	Rolling resistance	Acceleration resistance	total
30	2.3492	0.715	69.261	72.32
35	3.1975	0.715	69.261	73.1735
40	4.17	0.715	69.261	74.146

Table 4: various resistive forces with a constant acceleration

Speed (kmph)	Power (HP)	Power (w)	torque	Current (Amps)	Distance (km)
40	2.17	1622.59	4.03	33.80	41.42
40	2.69	2010.91	5.00	41.89	33.42
40	3.21	2399.00	5.96	49.98	28.01
40	3.73	2786.74	6.93	58.06	24.11
40	4.25	3174.01	7.89	66.13	21.17
40	4.77	3560.71	8.85	74.18	18.87
40	5.29	3946.72	9.81	82.22	17.03

Table 5: distance and other parameters with varying inclines

Brushless Dc Motor Controller

Features

1) Rated voltage: DC48V

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2) Rated power: 500W (this controller also can work properly for 48V 800W brushless DC Motors)

❖ Rated current: 30A (limit current)
❖ Under-voltage protection: DC41.5V+-0.5V
❖ Current limited: 30A±0.5A
❖ Efficiency: ≥83%
❖ Consumption :< 1.5W
❖ Controller category: Brushless direct current
❖ Applicable model: electric bicycle, electric scooter, electric vehicle, electric tricycle etc..

Functions

1)Super low noise when starting up
2)Speed limit/3 speed
3)Under-voltage protection
4)Under-current protection
5)Cruising control
6)Backward/Reverse function (for tricycle)
7)Water proof

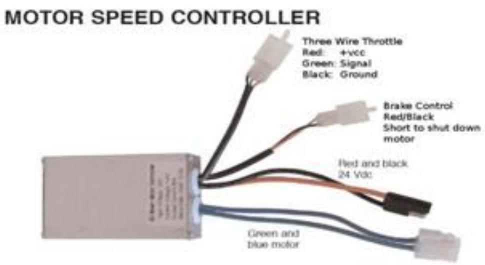

Fig 2: BLDC Motor speed controller

Connections to controller:

- Three wire throttle control for speed control
- Brake control for controlling supply to motor
- Input supply from battery
- Output to motor
- Operating Voltage: 30 through 44 Volts DC (36 Volt Battery Pack)
- Power: 250-350 Watts (Compatible with 250-350 Watt Brushless DC Motors) Current Limit: 18 Amps (18 Amps Maximum Current Output)
- Low Voltage Protection: 30 Volts (Turns Motor Off When Battery Pack Is Under 30 Volts) Works with both Sensored and Sensor less Brushless DC Motors
- Compatible with 120 Degree and 60 Degree Phase Angle Motors

V. ADVANTAGES & COMPARISION

ADVANTAGES OF HEV

HEVs have been vehicles of numerous advantages. Hybrids do indeed get superior gas mileage. They use less gasoline, and therefore emit less greenhouse gas. Thus the problem of environmental pollution can be avoided to certain extent. Apart from that they use less gasoline in comparison to the other vehicles of same power that run only on gasoline.

Thus this reduces the extreme dependence on gasoline which is a non-renewable source of energy. This encourages the method of sustainable development that has been the topic of concern in the modern society. Moreover, HEVs mode of operation are maximum efficient to the conditions, i.e, at low speed and high traffic areas where gasoline engine is least efficient with a lot of energy wasted, HEV moves with power from battery. At up slopes where high power is required and battery is inefficient, gasoline power is used for vehicle motion. Thus the advantages of HEV make it superior than any other vehicle of today.

- Low operating cost
- Dual-source of energy
- Less pollution
- Ease to select any source
- Less energy consumption

COMPARISION:

HYBRID BIKE	PETROL BIKE	ELECTRIC BIKE
1. Dual Source Of Energy 2. High Efficiency 3. Less Pollution 4. Less Energy Consumption 5. High Driving Stability	1. Single Source Of Energy 2. High Pollution 3. High Fuel Cost 4. High Torque	1. Low Efficency 2. Low Power 3. Pollution Free 4. Noise Free 5. Less Torque 6. Less Driving Stability

VI. CONCLUSION:

The hybrid bike can be powered by dual source such as gasoline and electricity. Compared to ordinary bikes this hybrid bike is more efficient and economic. This hybrid bike will be a new innovation in automotive era, it is more eco-friendly because it cause less pollution. The hybrid bike is a better solution for hiking fuel cost day to day.

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