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DESIGN OF HYBRID ELECTRIC BIKE (HEB)

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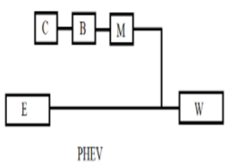
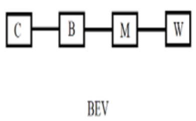
Abstract: - A Petrol-Electric Hybrid Engine Vehicle is a vehicle which works on electrical power as well as fuel like petrol. It has many benefits over its predecessors, which developed power using only fuel. The thought is to design and construct a Hybrid Electric Bike (HEB) powered by battery as well as petrol. The vehicle is made dynamic in nature by making use of electrical power from battery and fuel power. It consumes less fuel and creates comparatively less pollution as compared to conventional vehicles. Hybrid electric Bikes consists of a battery, to drive the electric motor and power system with an IC engine to increase fuel economy reduce harmful emissions from the exhaust.

HYBRID TWO WHEELER

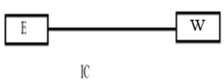
Several economic and environmental factors are contributing to increase interest in alternative vehicle technologies. These factors include rising global demand for oil, concomitant increases in fuel prices and anthropogenic climate change. Rising global demand for oil has both economic and political consequences. Increasing demand has a direct economic impact via increased commodity prices as well as a number of geopolitical implications that create political challenges for countries that rely on imported oil for economic activity. Moreover, evidence of the increasing dangers posed by climate change adds to the urgency to reduce the Green House Gas (GHG) emissions from all sources. GHG emission from the transportation sector is growing more rapidly than from any other economic sector and INDIA is accounted for 11.7 percent of total GHG emissions in 2017. The internal combustion engine is one of the greatest inventions of mankind. The conventional vehicles with ICE provide a good performance and long operating range. However, they have caused and continue to cause serious problems for poor fuel economy, environment pollution and human life. Reducing fuel consumption and emissions is one of the most important goals of modern design. The hybridization of a convectional combustion engine vehicle with an advanced electric motor drive may greatly enhance the overall efficiency and achieve higher fuel with reduced emissions



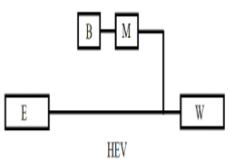
(Figure. 1.1)



(Figure. 1.2)



(Figure. 1.3)



(Figure. 1.4)

Where,
E= Engine
C=Charger
M=Motor
W=Wheel
B=Battery

PROBLEM STATEMENT
Lower running costs
Low maintenance cost
Zero Tailpipe Emissions
Tax and financial benefits

OBJECTIVES

The aim of a hybrid drive is to combine the advantages of both drive systems and balance out their disadvantages: Currently, the main benefit of a car with a gasoline or diesel engine compared to an electric drive system is its range.

SCOPE

Scope of HEVs with better battery technology, they could be more efficient and provide an engaging driving experience. Also, expect HEVs to be more environmentally-friendly with advanced electric powertrains and efficient IC engines. Vehicle life you can use an EV until the battery pack lasts Parameters Electric Vehicles Battery charging You need to plug into a power source to charge the battery pack

MAJOR COMPONENTS

a) Bike.
b) 17" HUB MOTOR 2000 watt.
c) 60V 35-amp Regenerative Controller
d) DCMCB.
e) DC- DC Converter.
f) Throttle.
g) Universal Switch
h) Wiring Harness.
i) Battery Pack.
j) Battery SOC (State OF Charge).
k) Charger.
l) Swing Arms.
m) Chain Sprocket Bracket.

COMPONENTS DETAILS:-

1. Bike

Technical Specifications

- Vehicle Type - Motorcycle.
- Fuel – Petrol.
- Engine Displacement - 111.60 cc
- Engine Details - 4-stroke, air-cooled, Single Cylinder.
- Maximum Power - 7.7 hp @ 7000 rpm.
- Top Speed - 95 kmph.

MOTOR CALCULATION

Kerb weight: - 110kg
Tyre Specs: - 130/70 R-17
Tyre Rim Dia.:17x 25.4 =432mm = 4.432m
Tyre Height =130x0.70=91 mm = 0.091m
Tyre Dia. = 432+91+91= 614mm = 0.614m
Tyre Radius = 614/2 = 307mm = 0.307m
Tyre Circumference= $2\pi r$ =2x3.14x307=2m
60 kmph =60x1000/3600 =16.66 m/s
Required RPM for 60kmph = 16.66x60/2=499.8 =500 RPM

Power=2πNT/60
Bike Frontage Area= 1.2 sq.m
Velocity V = 16.7 m/s
Coefficient of rolling resistance Cr= 0.02
Air Density = 1.2kg/m^3
Air Drag (Cd) = 0.82
Total force Ft = Rolling force (Fr) + Drag force (Fd) + Acceleration force (Fa) + Gradient Force
Fr =m.g. Cr
= 190 x 9.81 x 0.02=37.278
Fd = ½ x Air density x Air Drag (Cd) x Frontage Area x v^2
= 158.722 N
Fa =m x a
a = v/t
Speed required v = 0 - 50kmph
time =6 sec
a = 50 x 1000 / 6 x 3600 = 2.314m/s
Fa = 190 x 2.314
Fa = 439.81N
Fg = m x g x sin3
=190 x 9.81 x 0.05=93.195N.
Ft = Fr + Fd
=37.278 +158.722
Ft = 196 N
Power P = Ft x V
Power P = 196x16.6
Power P=3253.6watt
Power P= 3.3 kW
Motor selection: -
P= 2πNT/60
3253.6=2 x π x 500 x T /60
T= 42.4N-m
BLDC motor Standard RPM = 900
Required RPM at wheel =500
Safety Margin to Archive = 60 kmph
Motor selected for 1000 watt:-
P = 2πNT / 60
1000 = 2 x 3.14 x 500 x T /60
T= 1000x60 / 2 x 3.14 x 500
T= 19.10 Nm.
Motor selected for 2000 watt
P = 2πNT/60
2000 = 2 x 3.144 x 500 x T / 60
T= 2000 x 60/ 2 x 3.14 x 500
T= 38.21 Nm.

BATTERY CALCULATION

First Case: -
Peak Power of Motor 2000 W
Motor voltage 60 V
Amperes = 20:00/60= 33.34 A
Considering 80% we and 20% loss
2000 whr X1.20 = 2400 Whr =
Therefore, Ampere hour required by motor
2400/60 = 40 Ah
Now, (Peak Power) /Speed = 2000 w / 160 kmph
= 33.34 Wh/km
Hence Ampere-hour per Km. 33.34/60=0.55 Ah/km
So, for 50 km
Ampere - hour required = 50×0.55 =27.5Ah
Second Case: -
Range 50 km
Peak Power of Motor 2000 W
Efficiency = 80%
Speed considered=50km
For 50 km
Travel Factor= 50/50 =1
Battery pack Capacity = Power × travel factor/ (Motor + pack efficiency)

2000x1/ 0.80* 0.85
2000 / 0.68
3,076.96 watt
3.1 Kw

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