HYBRID ELECTRIC VEHICLE

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Abstract

The renewable energy is vital for today's world as in near future the non renewable sources that we are using are going to get exhausted. The multi powered Hybrid Electric Vehicle (solar and wind) is a step in saving these non renewable sources of energy. The basic principle of HEV is to use energy that is stored in a battery during and after charging it from a solar panel and wind turbine. The charged batteries are used to drive the motor which serves here as an engine and moves the vehicle in reverse or forward direction. The electrical tapping rheostat is provided so as to control the motor speed. This avoids excess flow of current when the vehicle is supposed to be stopped suddenly as it is in normal cars with regards to fuel. This idea, in future, may help protect our fuels from getting extinguished.

Introduction:-

Fossil fuel combustion, particularly as it occurs in motor vehicles, has been identified as the largest contributor to air pollution in the world. The biggest disadvantage of burning fossil fuel is the by-product, carbon dioxide, which leads to a greenhouse effect that harms the planet. If Environmental concerns keep growing, and restrictive guidelines constrain the use of the pollutant sources, wind and solar Photovoltaic (PV) power can be considered as viable option for future transportation. Therefore, the electric vehicle with zero emission will undoubtedly become the mainstream means of private transportation in the future.

The governments of each country and their societies have outlined large scale plans to promote battery-powered electric vehicles and for considerable opportunities to change the nature of private vehicles. As

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a result, people are becoming more aware of the energy related actions and have started looking for an alternative sustainable source. The conventional electric car finds the difficulty of charging it after few kilometers but the wind and solar powered car helps to eliminate this drawback as this car has the facility to be charged on board due to wind and solar energy. Here, power is generated from wind turbines and the solar plates and is directed to the battery for the charging. The battery is recharged on board and the vehicle doesn't need to be standby for charging.

Components:-

The following components are required for the hybrid electric vehicle

1) Solar panel
2) Wind energy
3) Charging circuit
4) Batteries
5) SMPS plug in charger
6) Motor controller
7) BLDC Motor
8) Chessis
9) Wheels, Suspension , Steering
10) Disk breaking

Working:-

Hybrid electric vehicle are vehicles propelled by more than one power source

Block Diagram:-

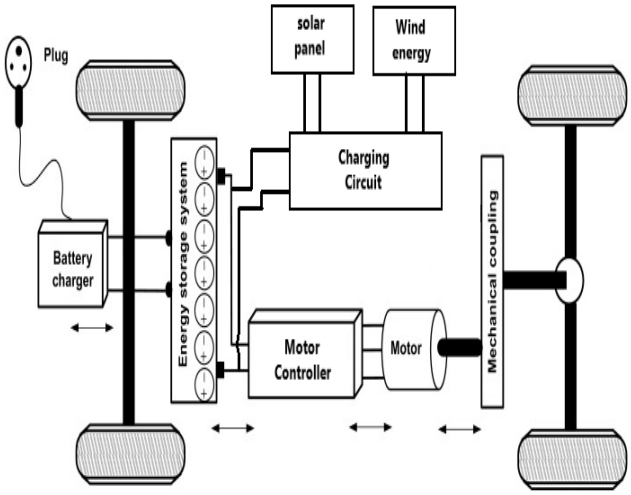

Figure 1: - Block diagram of Hybrid Electric Vehicle using solar and wind

such as solar , wind and electric battery. Moreover, electric cars do not require oil changes because no oil is used since they have electric motors instead of internal combustion engines. This is also the reason why these cars are so quiet. Since electric cars do not require oil changes and have many fewer moving parts, they have considerably less maintenance.

CONVERSION OF SOLAR ENERGY INTO ELECTRICAL ENERGY

Solar panel is situated on the top of battery in the prototype. Where in actual vehicle it will be mounted on the upper body of chassis of four wheeler. While the vehicle

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in running position or stand still and have a sufficient solar energy the solar panel will trap that energy and due to the photovoltaic effect of solar panel, it will convert this solar energy into electric energy which will get stored into the battery.

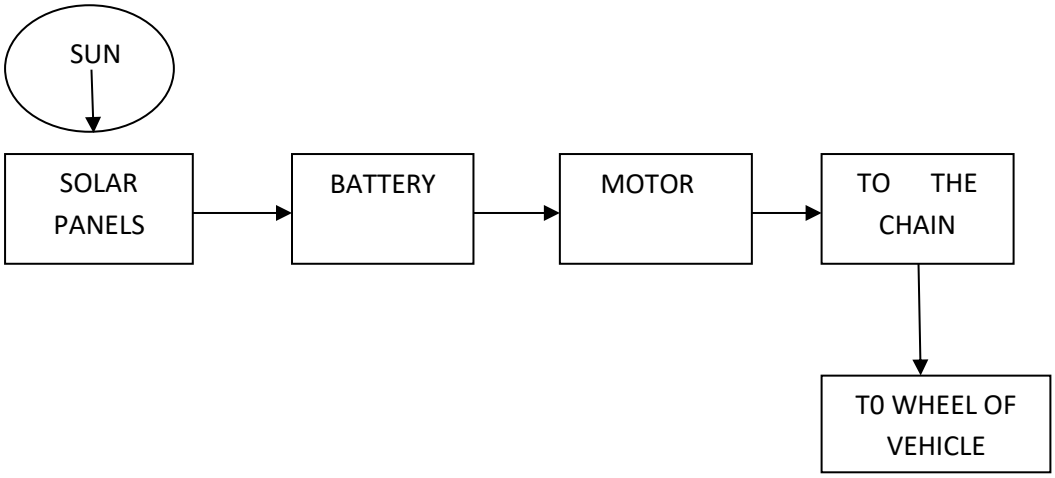

Figure 2: Conversion of solar energy into electrical energy

CONVERSION OF WIND ENERGY INTO ELECTRIC ENERGY:

In this prototype the wind capturing device is a vertical wind blade turbine, turbine is mounted on the top of the vehicle of the chassis, blade will get rotated by the wind blown by the blower which will get directed toward the blade in actual it will be the wind vehicle is in running condition. Rotating blades will convert the captured kinetic energy of wind into mechanical energy .The centre motor which is connected to battery will convert this mechanical energy into electric energy which is going to stored in the battery. Fig shows below the energy stored by prototype from wind energy.

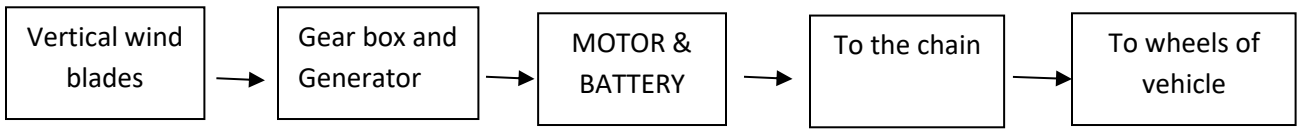

Figure 3: Conversion of wind energy into electric energy

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The output of a motor controller is PWM based, which stands for pulse width modulation. The concept of a PWM signal is to switch the output power on and off really fast in order to reduce the average voltage supplied to the motor in order to precisely control the speed of a motor.

Advantages:-

- This concept of multi powered electric car is useful as it has two power sources for vehicle. While running the vehicle the amount of energy get losses so that energy can be recovered by use of wind energy when vehicle is moving.
- It will help in reducing the pollution in environment, reduce global warming.
- No fuel, no emission. zero emission electric car
- Low maintenance cost.
- Good performance.
- Free sources of energy which is get by environment.

Disadvantages:-

- Initial cost is high.
- Weather dependent.
- In solar cloudy do not produce much energy
- Energy storage is quite expensive.
- Limited vehicle speed
- Takes more time to charge the battery

Results:-

FORCE OF ACCELERATION

The force of acceleration should be only accounted for when the car is accelerating and is given by Newton's 2nd law of motion

$F_{ACCELERATION}$ = [m*a]

Where **m** is the mass of the car and **a** is the acceleration.

FORCE ACCELERATION CALCULATION :-

With following parameters

Mass m =80kg

Acceleration a = $0.05ms^{-2}$

$F_{ACCELERATION}$ =80*0.05

$F_{ACCELERATION}$ = 4N

The total driving force thus required to overcome the sum of these opposing forces to move the car is, F_T = FROLLING + FDRAG + FAC

= $[\mu_R*W] + [(1/2)* c_D*A_{cross} * \rho * (V)^2] + [m*a]$

= 9.417 + 28.56 + 4

= 41.98NF_T = 41.98N

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Figure 4: Electrical Vehicle

At the design stage the following necessary assumptions of what the most probable values of the above parameters might be was made as given below in Table

The power needed to be supplied by the motor in order to provide the current speed and acceleration will therefore be, $P_T=F_T* V$

TOTAL POWER CALCULATION:

$F_T = 41.98N$

$V = 40 km/h = 11.12 ms^{-1}$

$P_T = F_T* V$

$= 41.98 * 11.12$

$P_T = 466.82Watt$

$P_T = 4.67KW$

BATTERY CAPACITY:

Capacity is the measurement of how much energy the battery can contain (in Ampere-hours), analogous to the amount of water in a jug. The capacity required will be dependent on the cars acceleration and speed as well as the total distance the car will overcome before the battery charge is depleted**.**

Thus the maximum power needed to be supplied to achieve different values of acceleration while the car is at its maximum assumed speed of 40 km/h, can be obtained by plotting a graph of motor Power vs. car acceleration with the speed constant at 40kmph.

Parameters of Electrical Vehicle

Sl. No	**Parameters**	**Value**
1	Weight, W= mg	80 kg * 9.81 ms^{-2}
2	Top speed, V_{MAX}	40 km/h = 11.12 ms^{-1}
3	Coefficient of rolling resistance, μ_R	0.012
4	Coefficient of drag, c_D	0.35
5	Frontal area, A_{CROSS}	1 m *1.1 m
6	Mass density of air, ρ	1.2 kgm-3

Table 1: Parameters of Electrical Vehicle

Total power**, P_T**	4.6 KW
Max dist, **d_{MAX}**	25 Km
Top speed**,V**	40 kmph

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OUTPUTS:-

Sl. No	Max speed	Power, P_T	%of the journey	Motor energy needed $E_{MO} = P * (d)* \%$ journey/ V
1	V=40 km/h	P = 2.8 kW	60%	1.05kWh
2	V=20 km/h	P= 1.12kW	40%	0.56kWh

Total Motor Output Energy, 1.61kWh

Table 2: Parameters for Battery Capacity Calculations

Summary:-

In order to increasing demands for fuel and the terrible environment pollution due to driving carbon-based vehicles, it is quite necessary to switch to a new source of energy, i.e. the multi power(solar and wind) which would be a cheap, efficient, limitless and of course an eco-friendly alternative.

Multi powered electric car are safe with no volatile fuel or hot exhaust systems. They are zero emission vehicles, odorless, smokeless and noiseless. They require minimal maintenance, are more reliable with little or no moving parts and can be efficiently charged nearly anywhere. Needless to say it is very much cost efficient. Since Multi powered electric car can easily incorporate future technology, we hope that it would not be long before the majority of the worlds' people would switch to driving this modern vehicle and thereby bring about a positive change in their lives and the environment. This is just the beginning of a new technology and it is guaranteed that future developments will make Multi powered electric car the predominant mode of transportation over vehicles with internal combustion engines.

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