

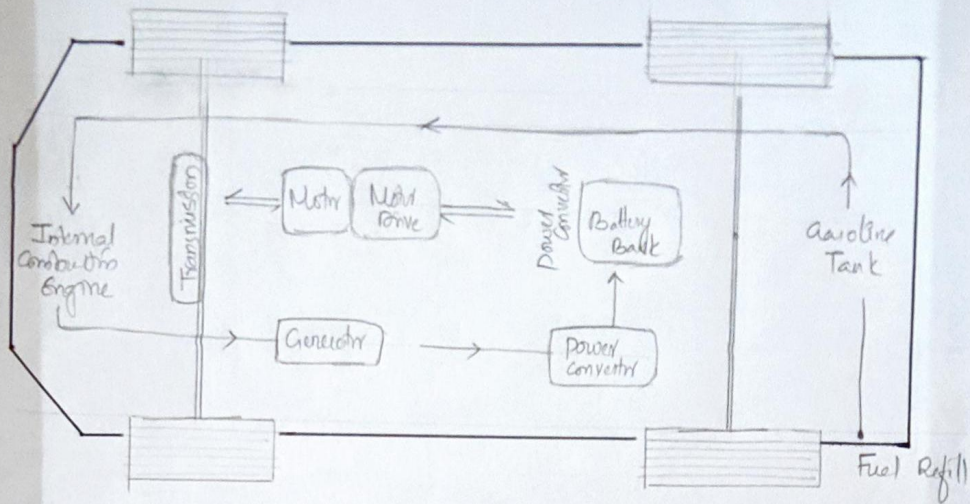
Coming of New Era in EV

In 2006, Santa Monica Auto Expo, Tesla Roadster was displayed. In 2010, Nissan Leaf was launched with range of 100 miles speed of 130 kmph. It was a truly affordable vehicle. and they proved EV can be really sold for an affordable prices.

Introduction to Hybrid Electric Vehicles:

Hybrid Electric Vehicles are powered by an Internal Combustion engine and one or more electric motors, which uses energy stored in batteries. A hybrid electric vehicle cannot be plugged into charge the battery. The battery is charged through regenerative braking and by the internal combustion engine. The extra power is provided by the electric motor can potentially allow for a small engine. The battery can also power auxiliary loads and reduce engine idling when stopped.

Q2. a) Series Hybrid Electric Vehicles.



In a Series hybrid, the electric motor is only means of providing power to the wheels. The motor receives electric power from either battery pack or from a generator run by gasoline engine. Both engine/generator and the use of regenerative braking recharge the battery pack.

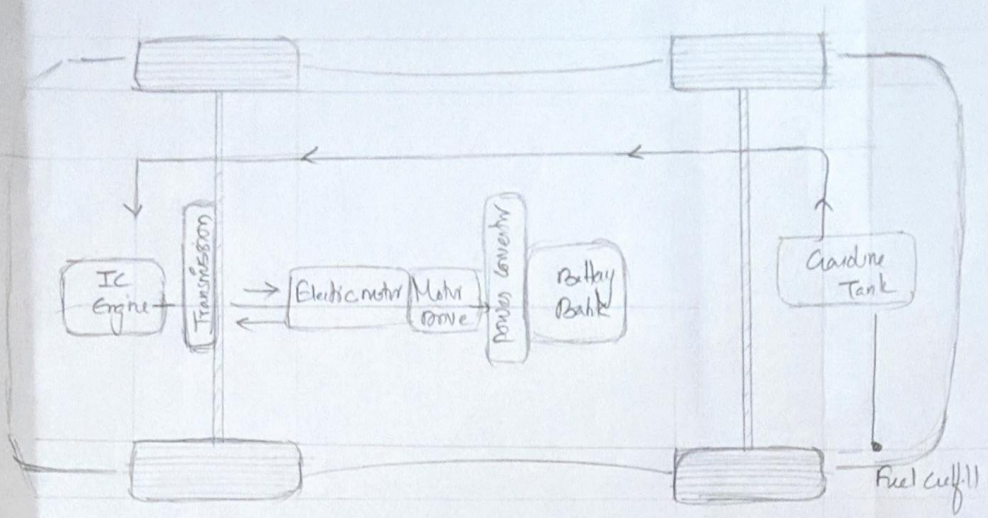
Advantages :-

- * Engine is smaller
- * Battery pack is more powerful.

Disadvantages

- * Since it make use of larger battery and motor the cost is very high
- * More expensive than parallel hybrids

b) Parallel Hybrid Electric Vehicle.

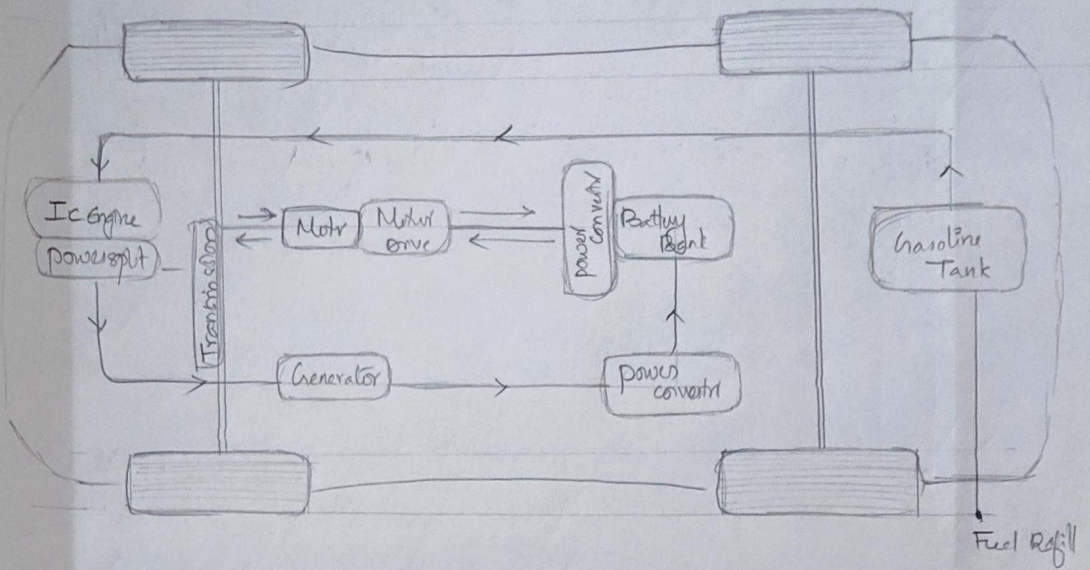


In parallel hybrid drivetrains, engine and electric motor work in tandem to generate power that drives the wheel. They use smaller battery pack, relays on regenerative braking to keep it recharged. When power demands are low parallel hybrids also utilizes the motor as a generator for supplemental recharging, much like an alternator.

Advantages:

- * Since the engine is connected to wheels directly the efficiency of converting mechanical power to electricity and back is eliminated.
- * High efficiency compared to Series-hybrid.

c) Series/Parallel Hybrid EV



It merges advantages and disadvantages of parallel and series drive trains. By combining the two designs, the engine can drive both wheels directly (as in parallel drive train) and be effectively disconnected with only electric motor providing power (as in series drive train).

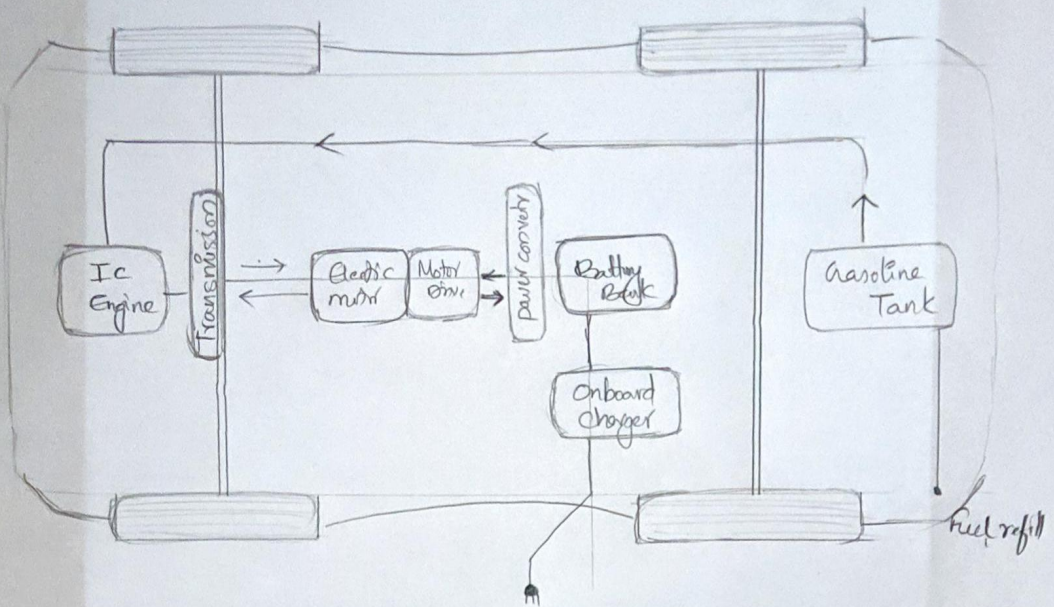
Advantages :-

- * Engine Operates at near optimum efficiency.
- * Minimal ~~energy~~^{energy} loss

Disadvantage

- * Cart of fish
- * Large battery pack of required.

d) Plug-in Hybrid EV



PHEV have both Engine and a motor. It can be used with conventional fuel or alternative fuel. The battery can be charged externally. They can run at least 2 modes.

All electric mode, and hybrid mode

ex: Porsche Cayenne S E-hybrid,
BMW 330e, BMW i8 etc

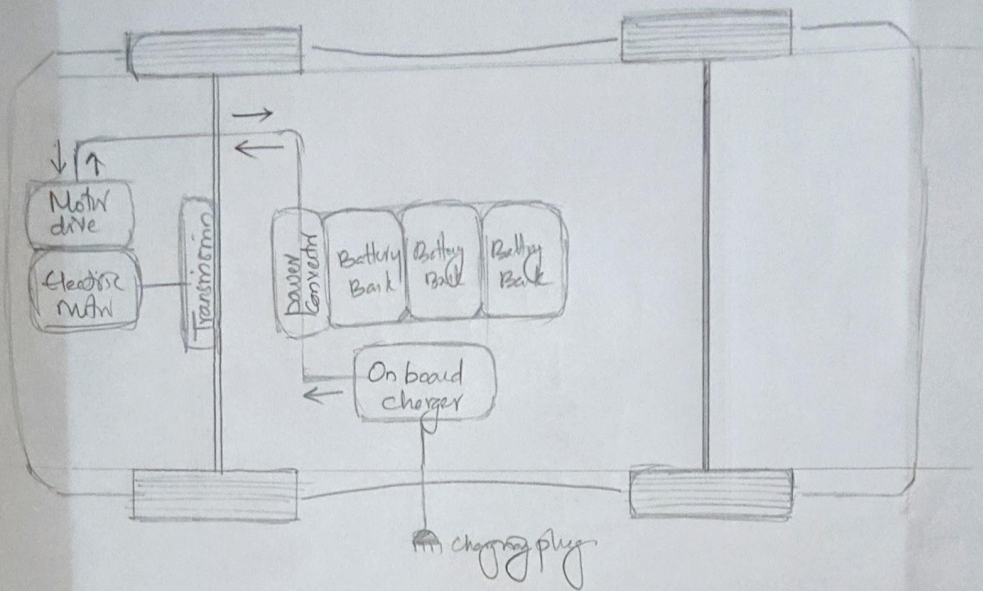
Advantages

- o ~~Zero~~
- o

Disadvantages

- Most Expensive
- Charging time is very high.

e) Fuel cell EV



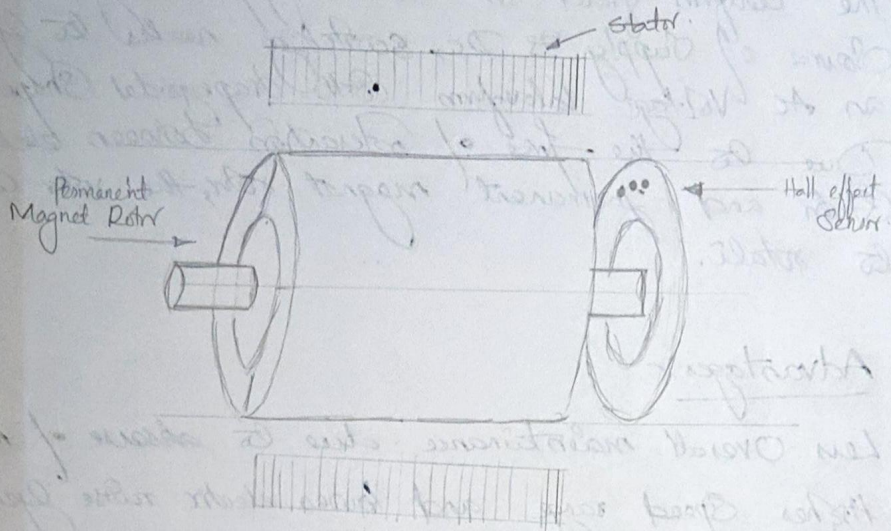
FCEVs are also known as Zero Emission Vehicles. They employ fuel cell technology to generate the electricity to run the vehicle. The chemical energy of fuel is converted directly to electric energy.

ex: Toyota Mirai, Hyundai Tucson FCEV, Hyundai Nexo etc.

Advantages

Disadvantages

Q3. Construction and Working Principle of Brushless Motor BLDC?



A brushless DC motor is a permanent magnet synchronous electric motor, which is driven by direct current (DC), and it accomplishes electronically controlled commutation system instead of a mechanically commutational system. Unlike conventional brushed type DC Motor, the brushes makes the mechanical contact with commutator on the rotor so as to form an electric path between a DC electric source and rotor armature windings, BLDC motor employs electrical commutation with permanent magnet rotor and a stator with sequence of coils. In this motor, permanent magnet rotates and current carrying conductors are fixed (stator).

Working principle:- BLDC motor works on the principle similar to that of brushed DC Motor, i.e. Lorentz force law, which states that whenever a current carrying conductor placed in a magnetic field it experiences a force. As a consequence of reaction force, the magnet coil experience an equal and opposite force.

When the Stator coils get a supply from source, it becomes electrified and starts producing the uniform field in the air gap. Through the source of supply as DC, switching makes to generate an AC Voltage waveform with trapezoidal shape. Due to the force of interaction between electromagnetic field and permanent magnet rotor, the rotor continues to rotate.

Advantages:-

- * Less Overall maintenance due to absence of brushes
- * Higher Speed range and lower electric noise generation.
- * Low electromagnetic interference.
- * Low noise due to absence of brushes.
- * Higher dynamic response due to low inertia and carrying windings in Stator.

Limitations:-

- Expensive
- Requires complex drive circuitry.
- Need of additional sensors.
- Electronic Controller required for the motor is expensive.