

Assignment - 1

1) Journey of Automotive : Flow chart

- 1768 : First Vehicle - Steam Vehicle - Nicolas Cugnot
↓
- 1806 : First IC engine vehicle - Isaac de Rivaz
↓
- 1828 : First electric motor - Anyos Zedlik
↓
- 1832 : First crude electric carriage - Robert Anderson
↓
- 1835 : Electric locomotive : Thomas Davenport
↓
- 1837 : Small scale electric car - Sibrandus Stratingh
↓
- 1859 : Electric locomotive - Robert Davidson - "Galvani"
↓
- 1859 : Invention of lead-acid battery - Gaston Plante
↓
- 1881 : Electric Bicycle - Gustave Trouve
↓
- 1884 : First EV undergo production - Thomas Parker - England
↓
- 1886 : "Motorwagen" - Carl Benz
↓
- 1888 : Flocken's Electrowagen - Andreas Flocken
↓
- 1890 : Morrison Carriage - William Morrison
↓
- 1897 : Electric Cab - Walter Bersey
↓

- 1898 : "Lohner Porsche" - Ferdinand Porsche - AWD EV
- ↓
- 1899 : Camille Jenatton - Fastest EV - 105.83 km/hr
- ↓
- 1908 : Henry Ford - "Model T" - mass production
- ↓
- 1912 : Charles Kettering - Electric starter
- ↓
- 1950 : The great smog
- ↓
- 1960 : Revival of interest in EV
- ↓
- 1971 : Lunar Roving Vehicle - EV in Moon - Apollo-15
- ↓
- 1980 : Invention of Li-ion Battery - Dr John B Goodenough
- ↓
- 1997 : Honda EV Plus - NiMH battery
- ↓
- 1998 : GM - EV-1 - NiMH battery
- ↓
- 2006 : Tesla Roadster introduced
- ↓
- 2008 : Sale of Roadster
- ↓
- 2010 : Nissan Leaf
- ↓
- 2012 : Tesla model S
- ↓
- 2015 : Tesla model X
- ↓
- 2017 : Tesla model 3 - 1 lakh sales in 1 year

→ a) Invention of Electric Motors

The first electric motor was invented by Anos Zedlik in Austria.

→ b) Golden Era of EV

The beginning of 20th century is considered as a golden era of EV, i.e. 1900 - 1910. In 1906 the 32 % of total vehicle was EV. Electric vehicle with 100 ~~km~~ mile range & 25-50 kmph speed was available in market.

Reasons for EV's popularity

1. No emission
2. Efficiency
3. Low cost
4. No gasoline burning smell
5. Quick start

→ c) Domination of EV by Gasoline cars

Interest in EV reduced after 1910. The invention of electric starters & assembly line production of gasoline cars (model T etc) increased the popularity of gasoline cars. Also people needed

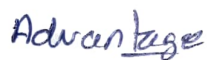
more range and speed than that offered by EV. World war and oil lobby has role in the fall of EV.

d) Coming of New era in EV

After the great smog in 1950 many governments concerned about reducing pollution caused by automobiles. So they started to implement many emission standards in automobile industry, also promoted the electric vehicles and gave many subsidies for buyers also. The increasing gasoline price was also a reason for the comeback of EV.

e) Introduction to Hybrid Electric Vehicles

The first mass produced hybrid vehicle was the Toyota Prius launched in Japan in 1997, & followed by the Honda Insight, launched in 1999 in the US & Japan. HEV's helped to increase the mileage of gasoline vehicle & reduce the ~~automobile~~ pollution caused by automobile.

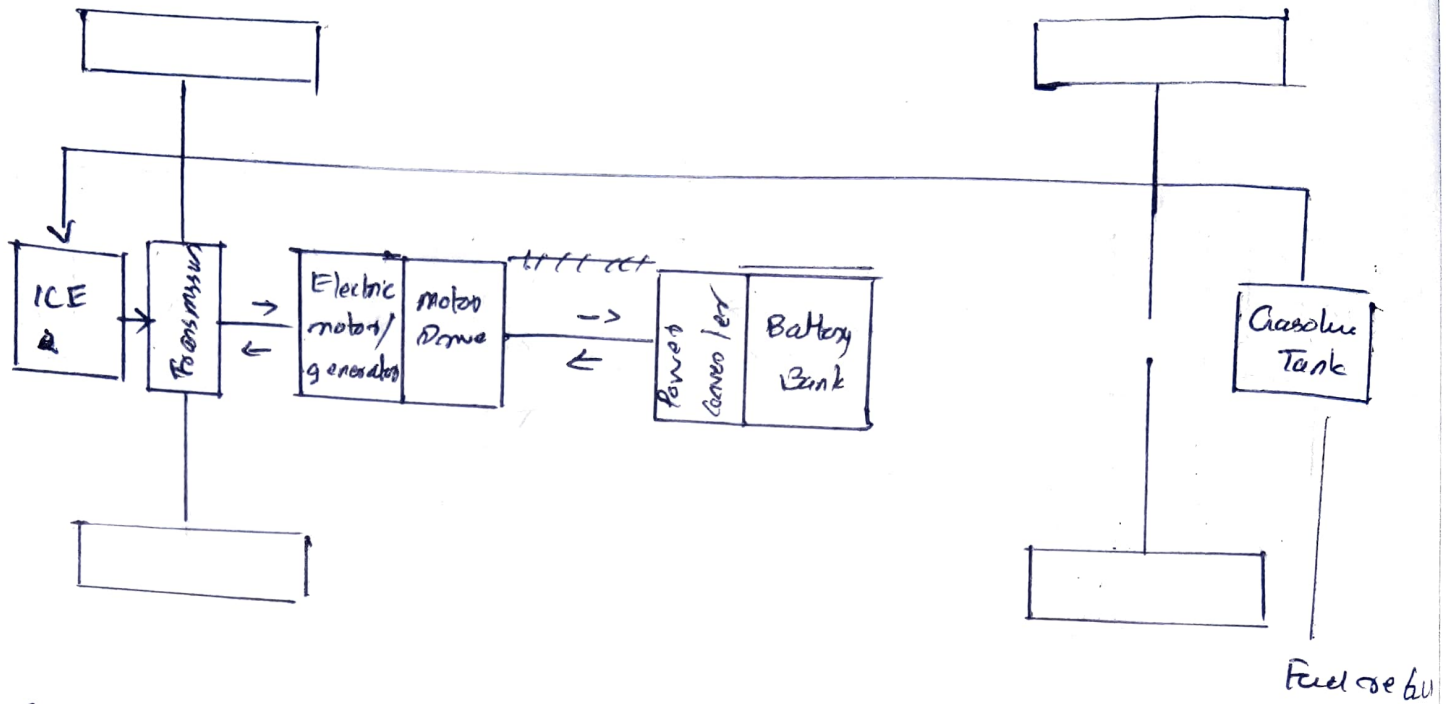


- ### Disadvantages

- ## Application

Bmw i3, heavy duty buses, Youltes

Parallel hybrid



Advantages

- Reduced traction motor size
- Elimination of efficiency losses in multiple power conversion between electric machines & battery

Disadvantages

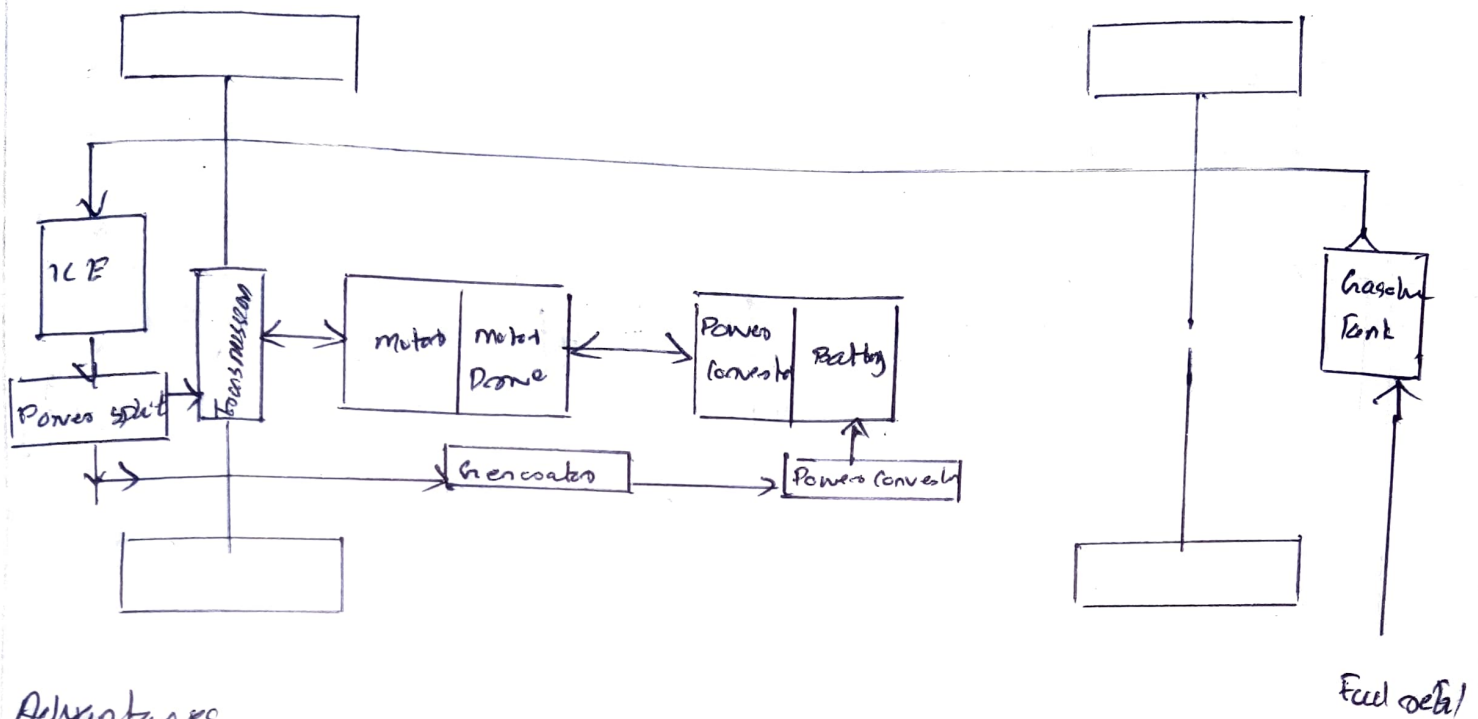
- Additional weight
- More costlier compared to ICE vehicle

Application

Bmw i8

Urban passenger cars

Series-Parallel Hybrid



Advantages

- Enables the engine & motor to provide power independently or in conjunction with one another
- Zero emission operation possible

Disadvantages

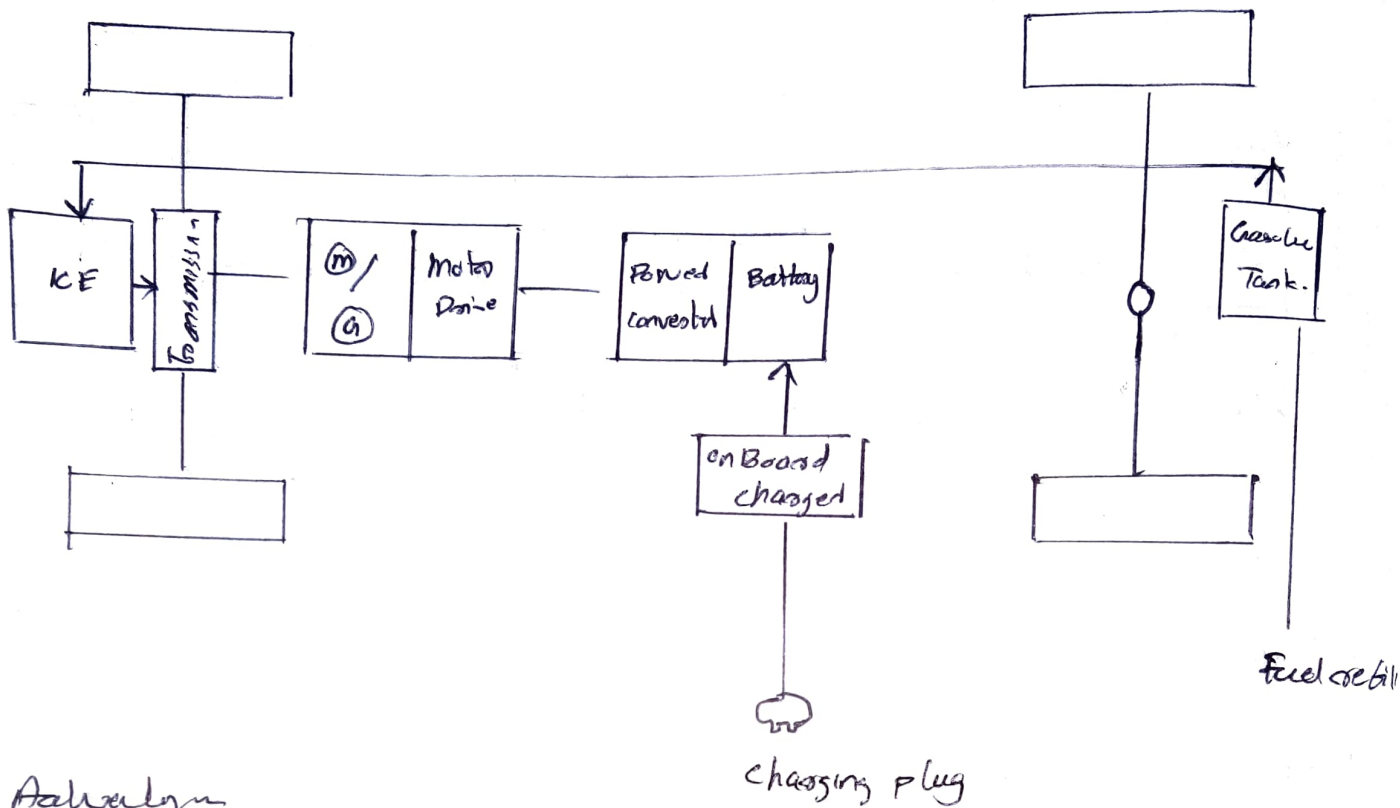
- Very expensive
- Control complexity

Application

Passenger cars

Light duty vehicles.

Plug in Hybrid electric vehicle



Advantages

- low fuel consumption
- charging facility included

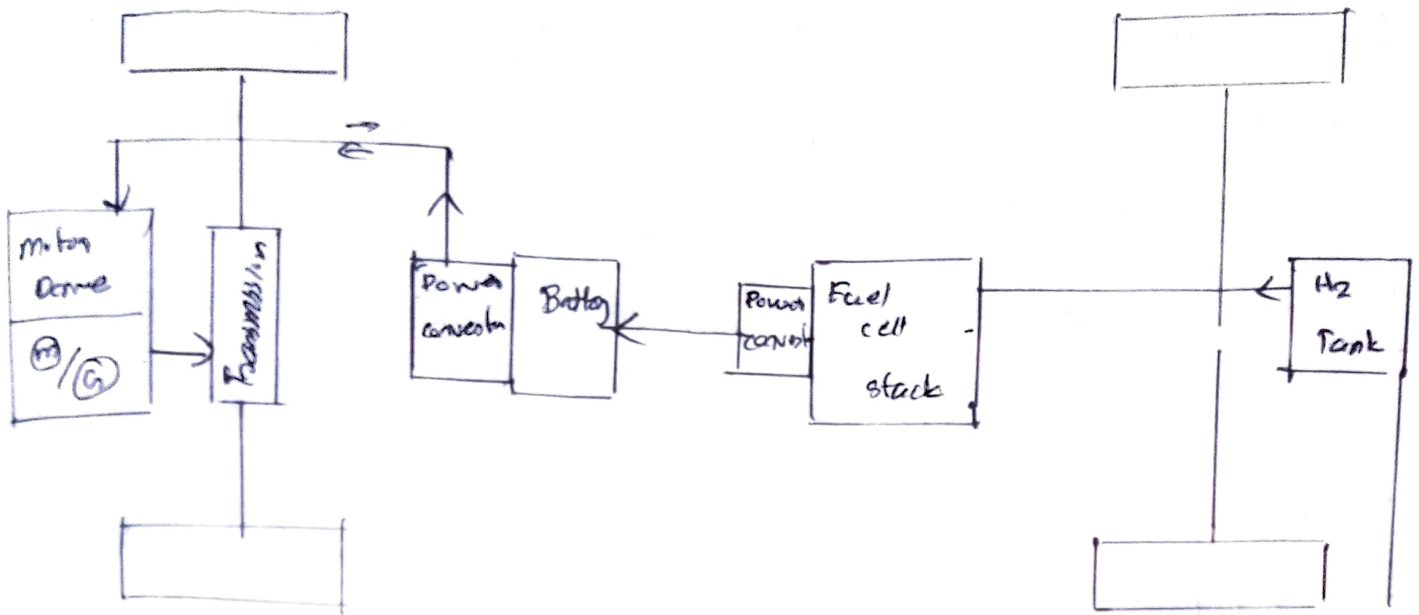
Disadvantages

- more expensive
- Engine's economy not great.

Application

Urban passenger vehicles

FCEV



H₂ refuelling

Advantages

- More efficiency
- High energy density

Disadvantages

- Storage of H₂
- Overall cost

Application

- Passenger vehicle.

3. Construction of BLDC

A commutator brushes arrangement helps in achieving unidirectional torque in a typical dc motor. In BLDC it eliminates it.

Here an integrated inverter / switching ckt is used to achieve unidirectional torque.

→ Permanent magnets are mounted on rotor

→ Stator is wound for a specific no. of poles. Most of times the inverter circuit or controller is integrated into the stator assembly.

Working of BLDC

Stator winding of a BLDC motor are connected to a control ckt. It energizes proper winding at the proper time. In a pattern which rotates around the stator. Permanent magnets on the rotor try to align with the energized electro magnets of the stator and as soon as it aligns the next electromagnets are energized. Thus the rotor keeps running.

