Assignment No: 1

S S anath

- Automobile is a vehicle which can propel from one location to another. The basic Requirements of an automobile is an energy source, Energy Conversion Device and a mechanic mechanical Device for transferring the energy from the energy Conversion Device.
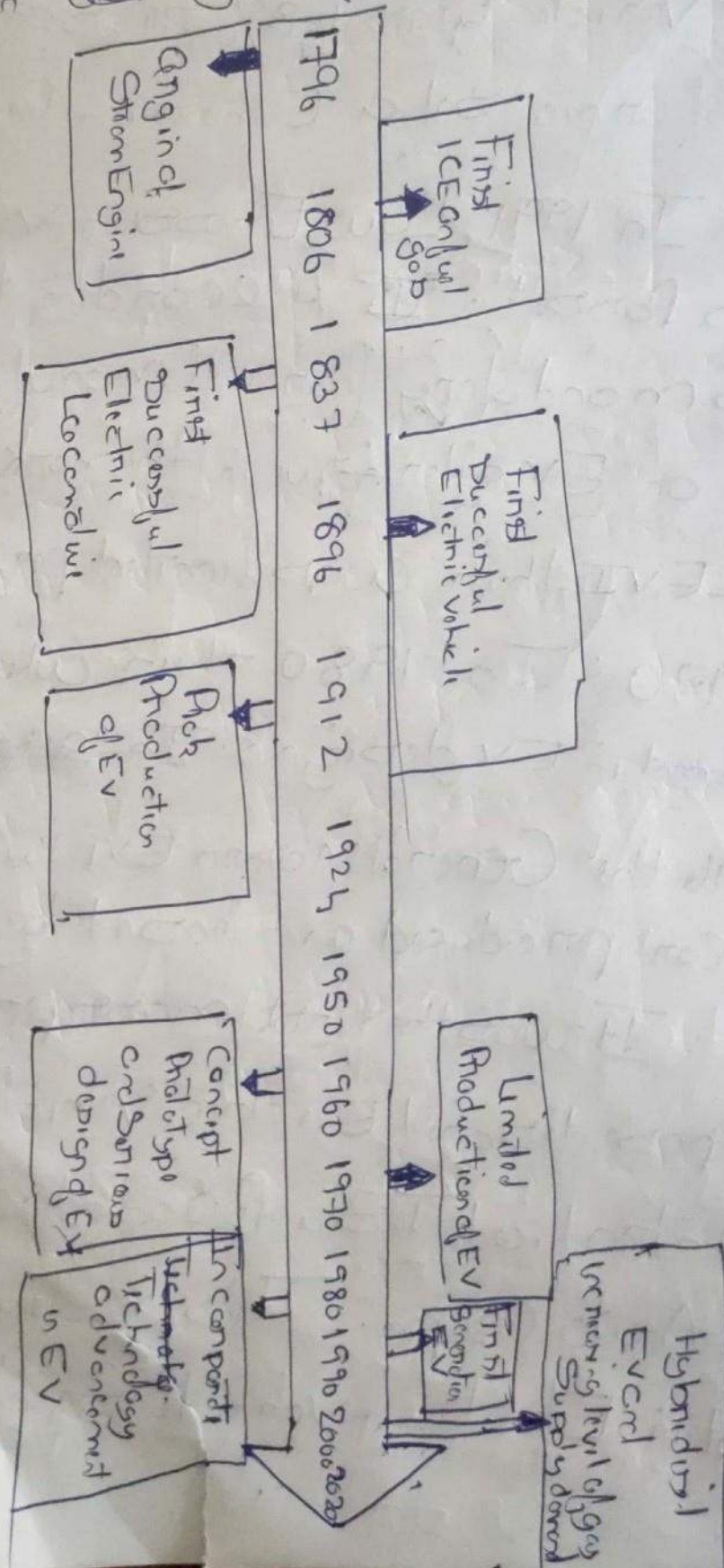
The very First vehicle in the world was built by **Nicolas Cugnot.** was a Steam Engine. Maximum speed of the vehicle by 4 km/hr and Maximum load it can carry was about 4 tons. It was built in 1768. In the Year 1806 Issac de Rovez built the very first IC Engine. It uses Hydrogen gas a fuel. In 1828 Hungarian Inventor Anyos Jedlik invented an world's first electric Motor, and Created a first small model Car powered by this Motor. In 1886 Thomas Panker developed Electric vehicle to undergo a production. In 1884 Carl benz developed IC Engine to undergo production. The First known electric locomotive was built in 1837, in Scotland by chemist Robert Davidson of Aberdeen.

In 1896 William Morrison built a William Carriage that is having a capacity to carry 8 people. It had a speed of 20 kmph, Power of motor used is 4 hp and battery @ Specification of 58v, 112Ah. It had a speed Control. In 1906 Electric vehicle had a Range of 100 miles with a Single charge, having a top speed of 45-50 kmph. In beginning of 1906 Electric Car were lobelled as 'Women' Car'. During 1906 EV gained popularity due to No Emission, Easy start, Low Cost, Efficiency etc. In the Year 1912 Petrol power Cars became easier to drive due to the Invention of charles Kettering and his Electric Stanter. Chorevolot took the patent for Self Start mechanism in 1912. During world war electric vehicle had disadvantage of Range and charging time. This all factors led to the declining on the Interest on EV(1924).

And in the duration of 19___ 1960 there was a domination of Gasoline vehicle over Electric vehicle due to following Reasons. In 1960 the Great Smog occurred and in California and Gasoline vehicle was 48% maason the pollution. And California Set a Emission Regulation in 1970. In 1991 Low Emission Vehicle I (1993-2003) was Passed. According to LEVI it was mandatory for all manufactures to provide an EV alternative in the market. Due to LEVI there was limited production of EV in 1970. In 1980 their were technological advancement in EV design. In 1990's the

In 1996 the General Motors EVI was the electric Car produced and leased by General motors. It was the first mass produced and purpose designed Electric vehicle. In 2006 Tesla Introduced Tesla Roadster in the Santa Monica Auto expo. This made a high Interest in Electric Vehicle Sector.

① On 2010 Nissan leaf was Introduced. It was a 5 door hatch Back EV. Hybrid Vehicle where given more importence due to increase in prices.
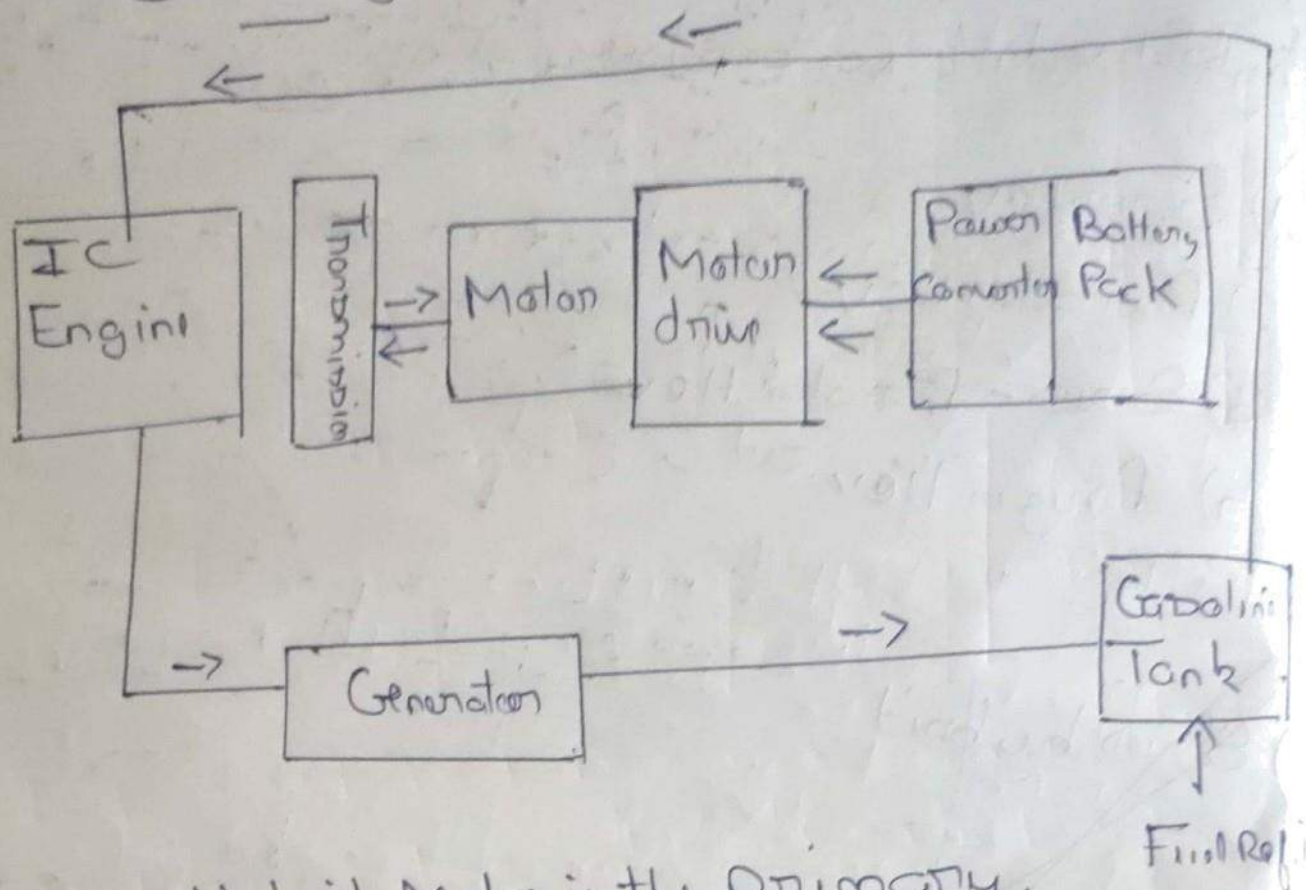

Timeline: 1796 | 1806 | 1837 | 1896 | 1912 | 1924 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2020

- First ICE Angine[ful] Job
- First Successful Electric vehicle
- Original Steam Engine
- First Successful Electric Locomotive
- Ack Production of EV
- Concept Prototype and Serious design EV
- Limited Production of EV
- Final Boomption EV
- Hybrid dual EV and increasing level of gas Supply down
- In competion Vehicular Technology advancement in EV

2. Based on the ~~different~~ ÿ ź. 1) É›1› › ^" ' ' ›

hybrid vehicle can be classify

1) Series Hev

2) Parallel Hev

3) Series - Parallel Hev

4) Plug in Hev.

Series Hybrid

In Series Hybrid Motor is the primary source and IC Engine is the Secondary source. Power is transferred to the transmission only through Motor drive system. IC Engine acts as a Back up. Series hybrid works in 4 Cases.

1) Case 1: Normal driving

Both IC Engine and battery supplies power energy to power converter which then drive motor

2) Case 2: Light load

ICE output is greater than required to drive the wheels, fraction of electric energy is used to change battery

3) Case 3: During braking

Electric motor acts as generator

4) Case 4: Vehicle stop

Battery can also charged by ICE via generation even when vehicle comes to complete stop

Advantages
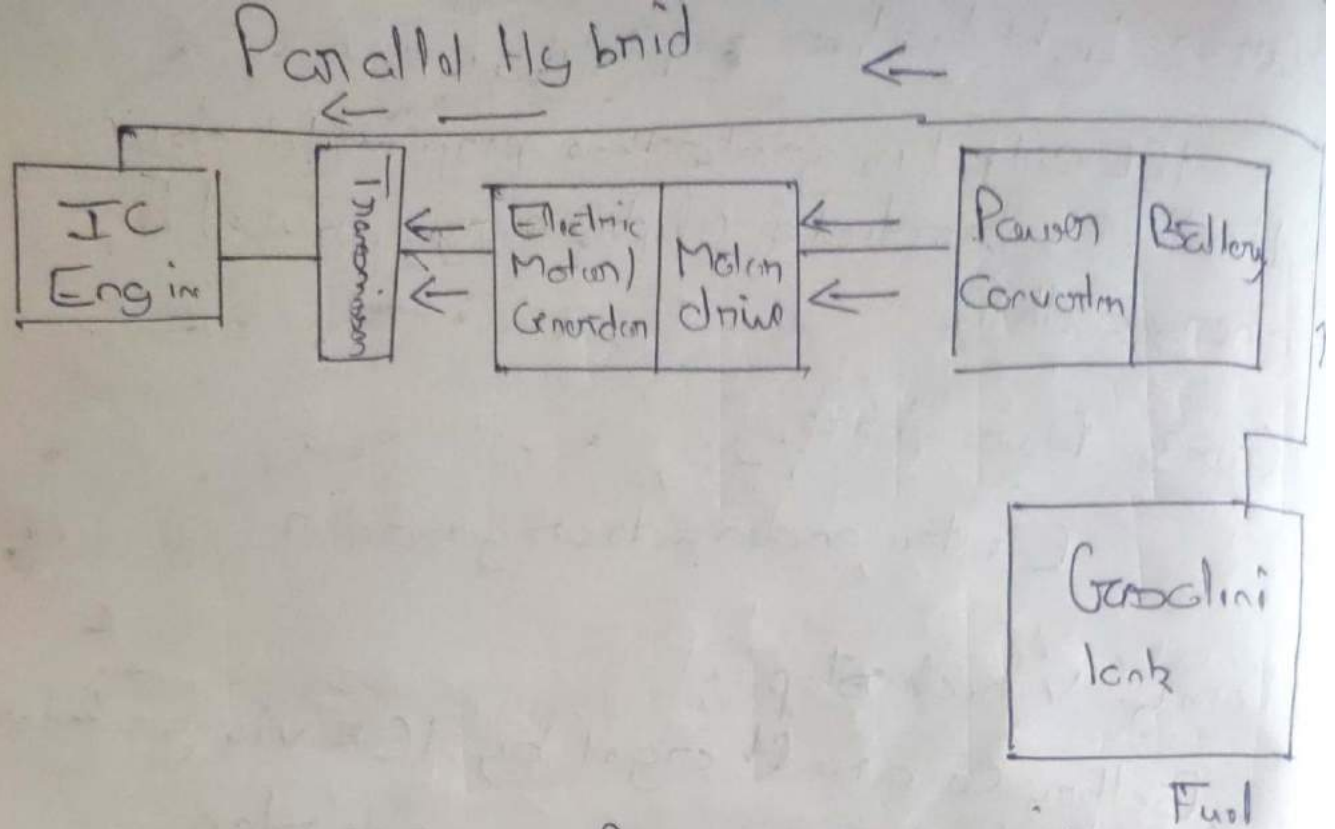
1) Mechanical Decoupling between ICE and driven wheels allows IC Engine operating at very narrow optimal Region

2) Nearly ideal Torque speed characteristics of electric motor make Multi gear transmission Came cassary

Disadvantages

→ The energy is converted twice and this reduces overall efficiency

→ Two Electric machines are needed and a big Traction motor is required because it is the only torque source of the Driven wheels

ES: BMW i3

Parallel Hybrid

In Parallel hybrid Primary source is IC Engine and Secondary source is Electric motor. Here both IC Engine and electric motor supplies power to the transmission

Case 1:
Motar charging. IC Engine Performing drive

Case 2:
Motor performing drive IC Engine Rest Condition

Case 3:
Both Engine and Motor operating

(Case) 4:
    Engine charging and drive mode

Case 5
    : Regenerative braking, Motor acts as
    Generaton.

Advantages
→ Both Engine and Electric motor supply
   torque to driven wheels and no energy form
   conversion occurs

→ Compactness due to no need of the generation
   and smaller traction motor

   Disadvantages

→ Mechanical coupling between engines and the
   driven wheels, thus the Engine operating points
   cannot be fixed in a narrow speed region

→ Mechanical configuration and the control
   Strategy are complex compared to Series
   hybrid drivetrain.

     eg: H and Civic Hybrid

Series Parallel Hybrid

H as both features of series and Parallel Hybrids. Powers plit is a device which splits

⊕ power. Many different modes of driving are possible under Motor dominant drive mode.

Advantages

Advantages

→ ⊕ Enable engine and electric motor to provide power independently or in Conjuction with one another

→ Zero emission operation is possible

Disadvantages
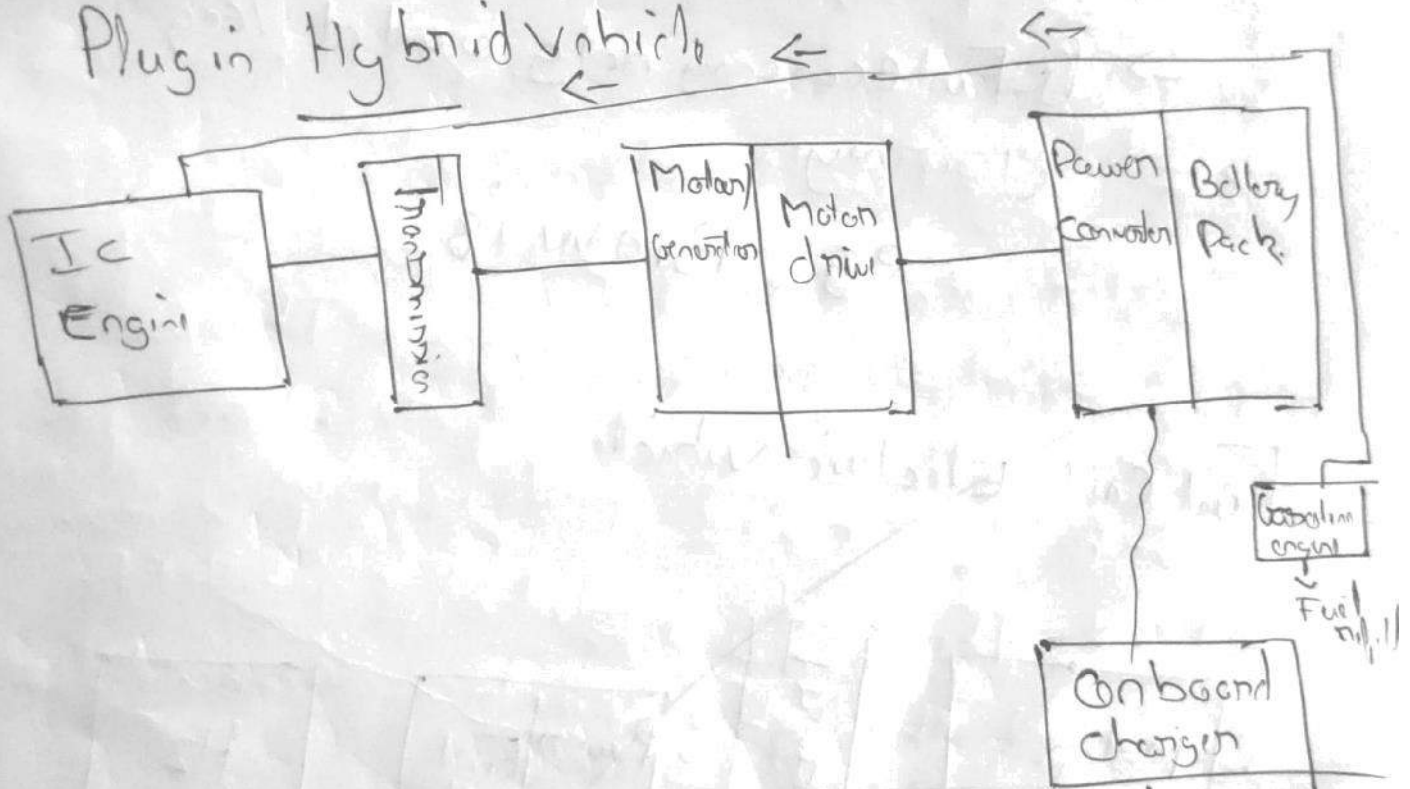
→ Very expensive

→ Complex space packing

eg: Toyota Prius

Plug in Hybrid vehicle ← ←

Plug in hybrid is N[...]we
a charging p~~art to~~ [...]ing. It
can be a series, parallel or series parallel
hybrid. These hybrids may have longer range.
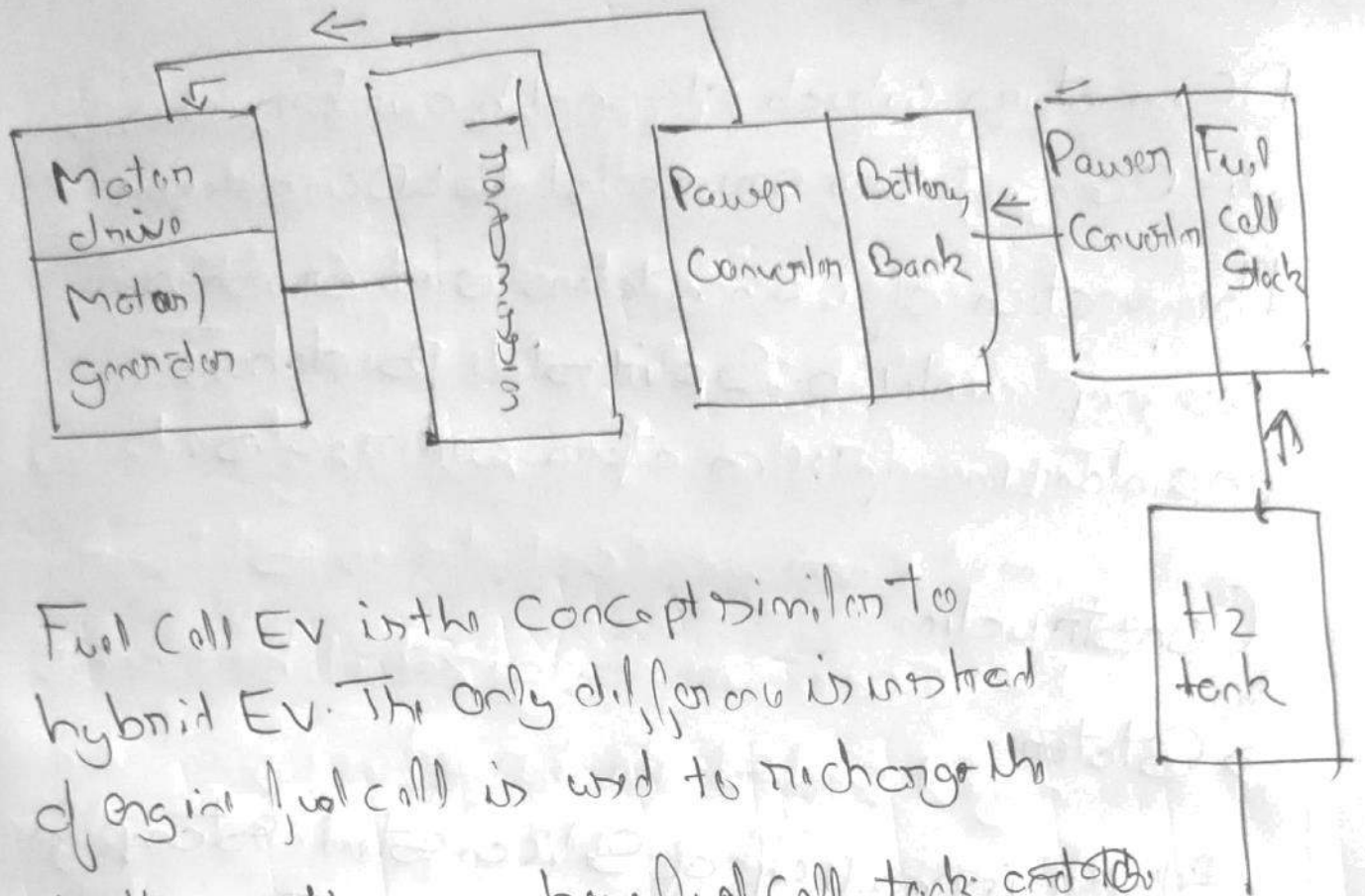
c) ~~Fuel Cell Electric vehicle~~

Advantages

→ Easy to drive

→ Fuel efficient in traffics

Disadvantages.

→ Relatively exepensive

→ Fuel economy not good at long
journey

eg: BMW i8

Fuel Cell EV

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┌──────────┐   ┌──────────┐      ┌──────────┬──────────┐      ┌──────────┬──────────┐
│ Motor    │   │          │      │ Power    │ Battery  │   ←  │ Power    │ Fuel     │
│ drive    │   │ Transmission     │ Conversion│ Bank    │      │ Conversion│ Cell    │
├──────────┤   │          │      │          │          │      │          │ Stack    │
│ Motor)   │   │          │      │          │          │      │          │          │
│ Generator│   │          │      │          │          │      │          │          │
└──────────┘   └──────────┘      └──────────┴──────────┘      └──────────┴──────────┘
                                                                              │
                                                                         ┌────┴────┐
                                                                         │  H2     │
                                                                         │  tank   │
                                                                         └─────────┘
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Fuel Cell EV is the concept similar to hybrid EV. The only difference is instead of engine fuel cell is used to recharge the battery. Here we have fuel cell tank and to energy to electricity, Fuelcell

Advantages

→ Produce no harmful emission
→ Highly efficient compared to others

Disadvantages

1) Difficult to handle H_2 fuel
2) Cost

eg: by Hyundai Nexo.

3. ~~DC motors are~~

DC motors which does not have brushes and commutators are called BLDC motors

The function of commutators are implemented by Solid state switches, maintenance free motors are ___

C

Stator is made up of Silicon steel with slots in its interior surface. These slots accomodate either a closed or opened distributed armature winding usually. it is closed. The winding is suitably connected to DC supply through a electronic commutator.
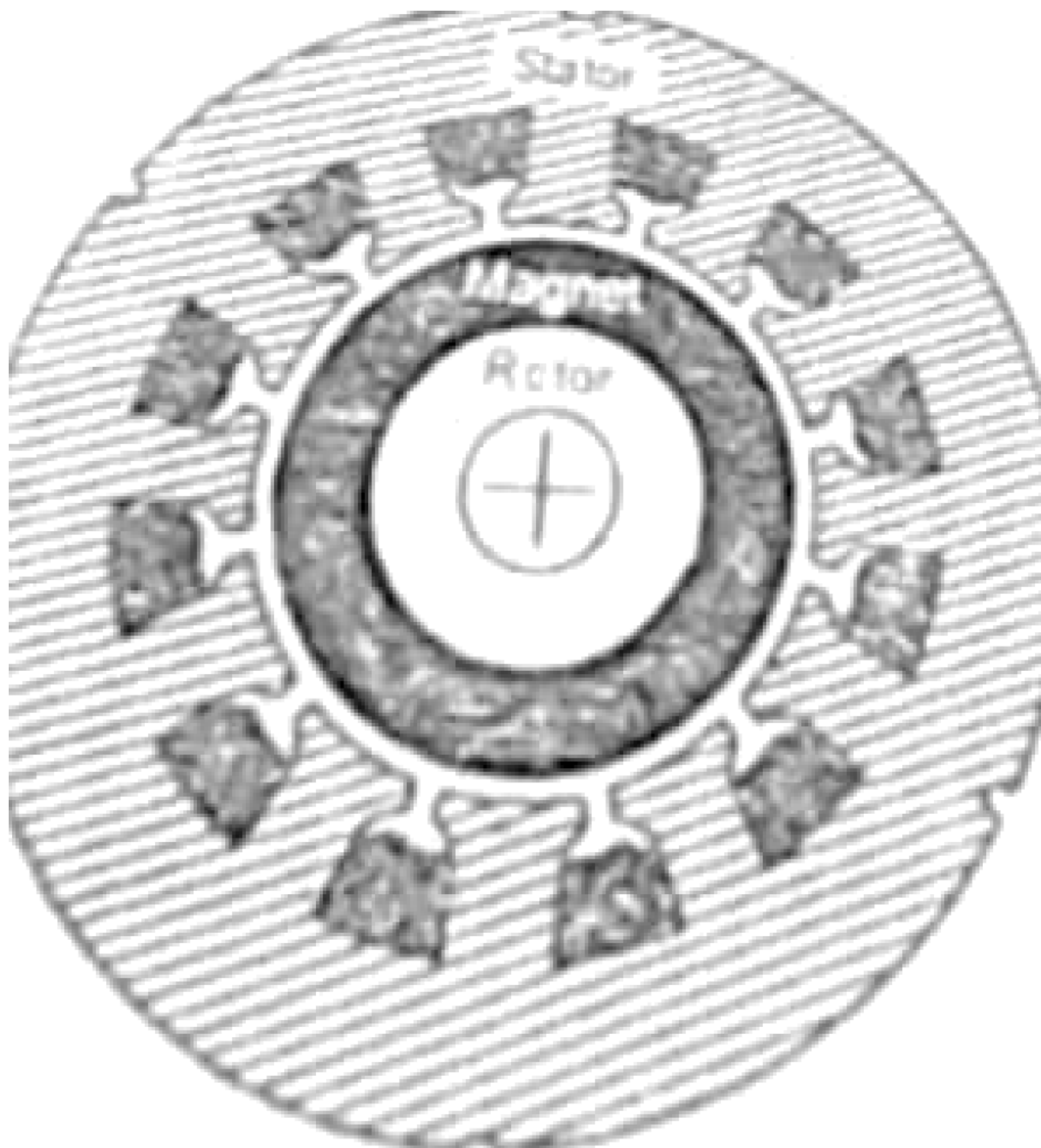
→ Rotor

Rotor is made up of forged steel. Rotor accomodates permanent magnet. Permanent magnet can be fixed in this rotor in two different ways.
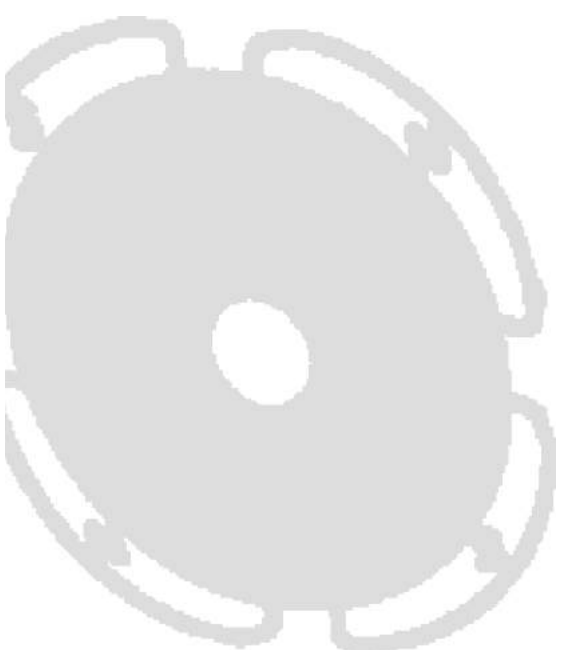
1) Interior PM   2) Surface Mounted PM

① The no: of poles on the Rotor is same as that of Stator. The Rotor position sensor is on the Rotor shaft. Position sensor gives information about position of the shaft to the Controller which sends suitable signals to Electronic Commutator.

②

Constructional details of a BLDC motor

Surface mounted PM rotor

interior PM rotor

...rking Principle of BLDC motor is same as that of Conventional DC motor. Whenever a current carrying Conductor is kept on a magnetic field it experiences a force. In case of BLDC motor, Permanand magnet m a while current carrying Conductor is stationary. When Stator coils are energized it become electro magnet and starts Producing until arm supply is DC, Switching m akes to generate an AC Voltage waveform with trapizoidal shape.

B

O   d

P

Stator with windings

Shaft

Permanent magnet rotor