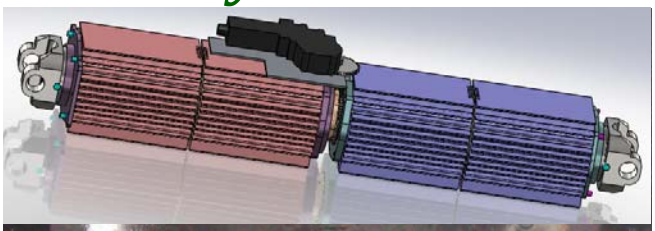
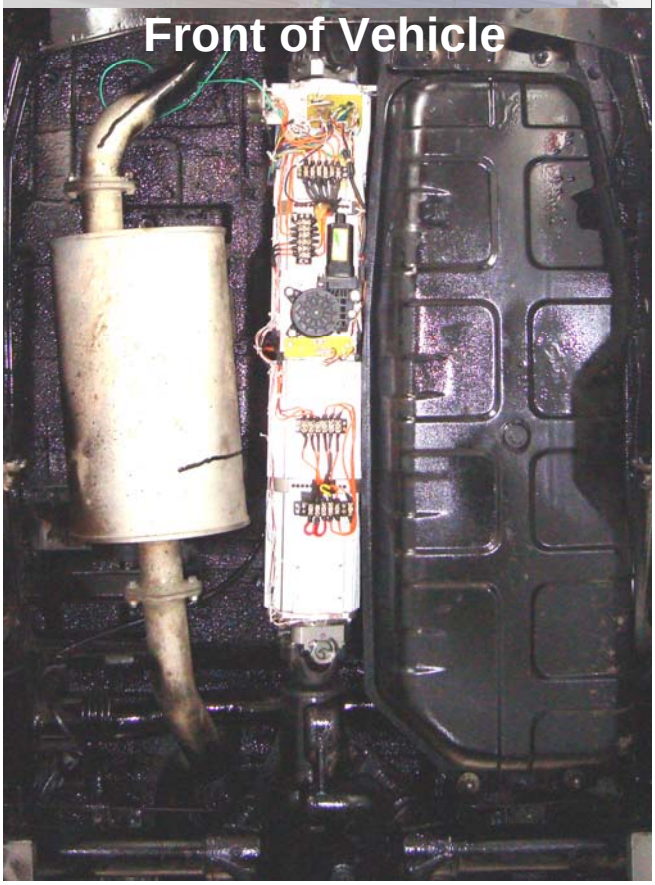
Transformation of a Vehicle to Hybrid Electric

About Hybrid car

There are three possible configurations to mount motor in the hybrid car

1. Motor is mounted between engine and gear box
2. Motor is mounted on wheels like hub motor
3. Motor is fabricated and mounted on the transmission shaft





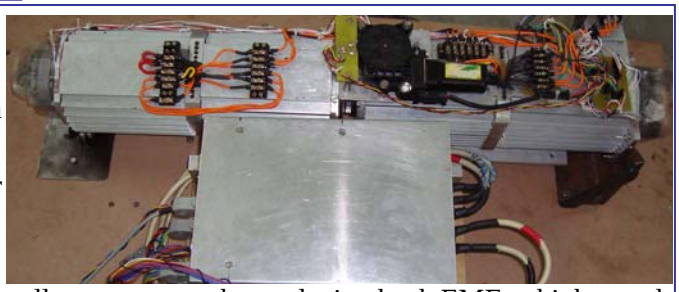
Benefits in this design:

- Motor on the transmission shaft is the best solution for retrofit
- It requires negligible modifications in the existing car
- Just replace the transmission shaft with this motor which is built on the transmission shaft

Critical issues / challenges in Transmission Shaft based Motor for Hybrid Vehicle

1. Motor on transmission shaft/wheel run in wide speed range
2. Motor on transmission shaft has critical dimensions (small width and height)
3. Running a motor at 8000 rpm above base speed of 1500 rpm has many issues
   - ➢ AC vector control with field weakening is required to run at over speed
   - ➢ Running as generator is difficult at high speed
   - ➢ Zero Vector Breaking technique has many risks of too much retardation which increases chances of accident
   - ➢ Other techniques like tap field requires many high power relays & put the stator winding at risk of insulation failure due to high voltage

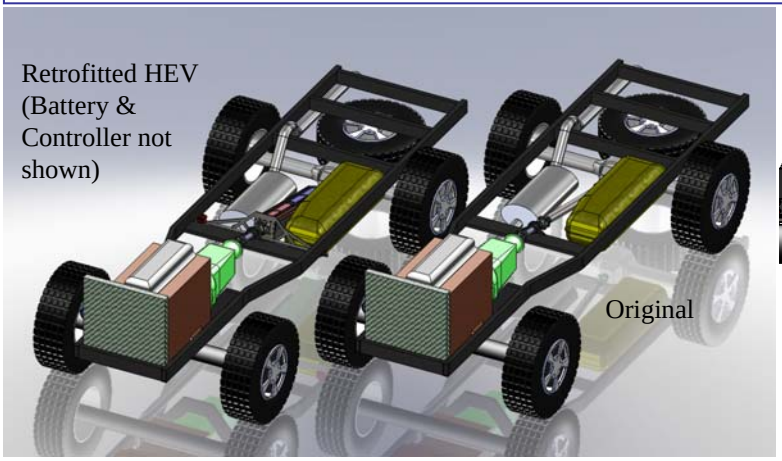
About motor design *[Covered by patent application]*

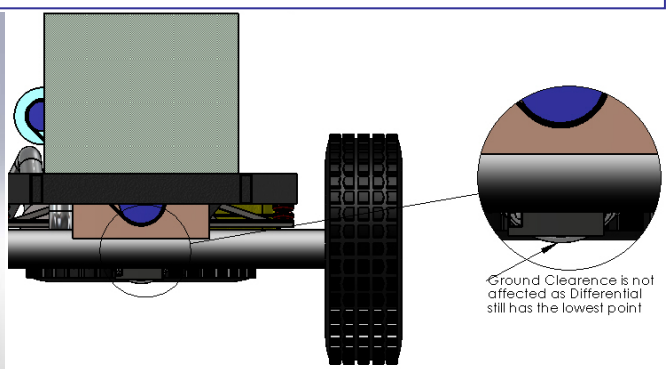


- ❖ Motor contains 4 sets of stators – rotors in 2 bodies
- ❖ Both motor bodies are mounted on common transmission shaft
- ❖ All stators are interconnected in series in a particular sequence

Invented technique

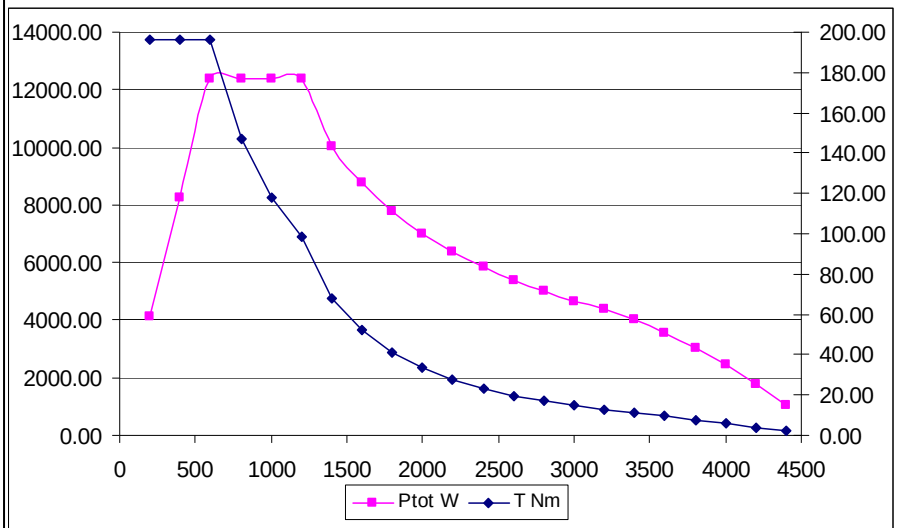
- ❖ One Motor Body can rotate with respect to other body by a small servo motor, thus reducing back EMF at high speed
- ❖ This allows motor operation in wide speed range





Drawing depicting no change in Ground Clearance due to Motor

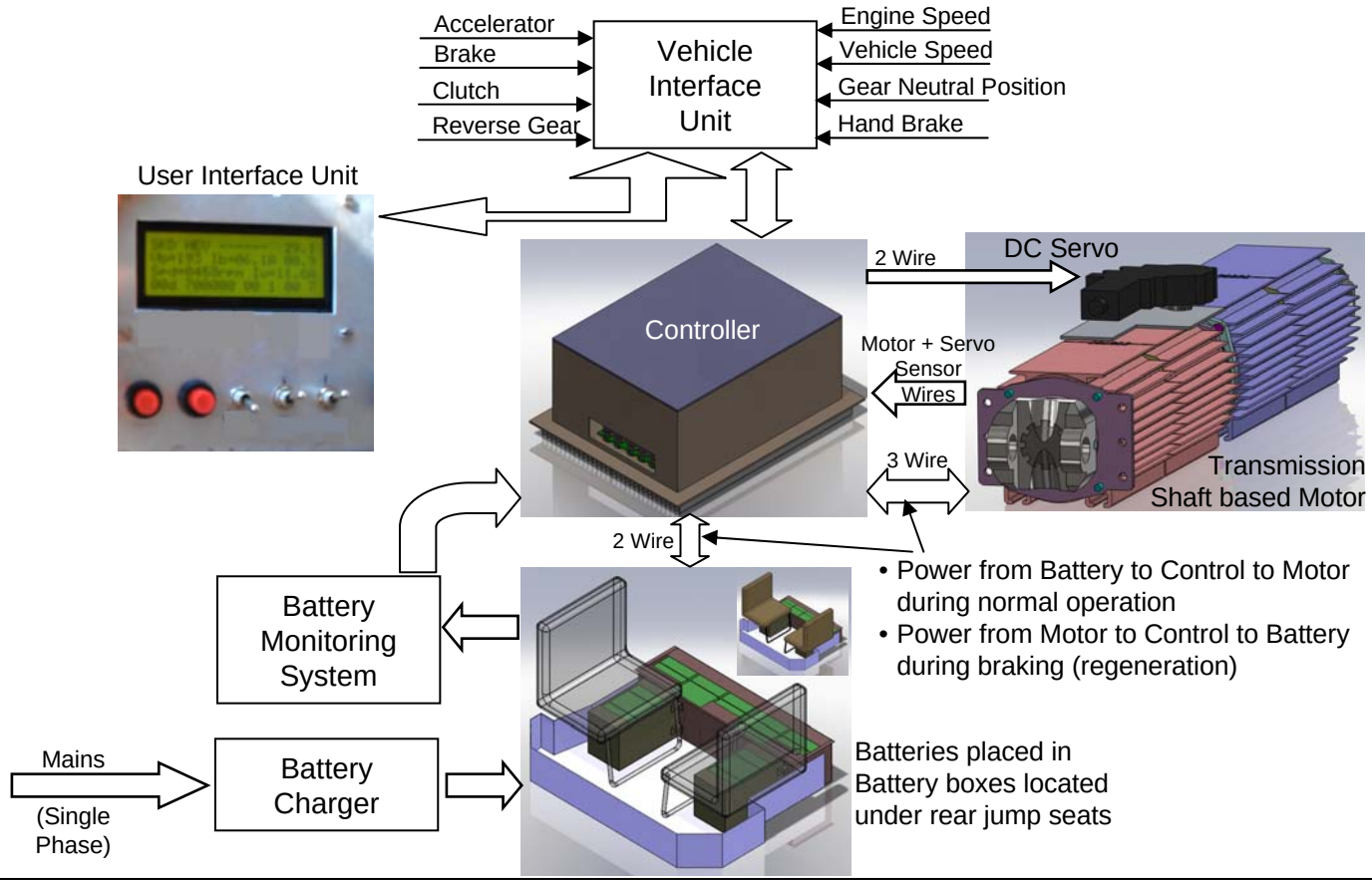
Estimated Performance considering motor parameters



General specifications:

Peak Power:	12 KW at 600 rpm for 10 seconds
Peak Torque:	190 Nm for 10 seconds
Continuous torque:	95 Nm at 600 rpm
Base Speed:	600 rpm for rated torque
Max speed:	4500 rpm
Power source:	200 V DC batteries
Operation mode:	4 quadrant (Motor, generator)
Dimensions:	130 mm x 130 mm x 850 mm
Mounting:	Mounted in place of transmission shaft
Efficiency:	> 85 % at rated speed

Block Diagram of HEV System



Advantages of this Hybrid Electric System

- Reduced pollution
- Reduced fuel consumption
- Comfort in driving
- Can operate on pure electric for short distance
- Less expensive compared to any competition
- Battery charging from Mains Power / Regeneration

Major subassemblies:

1. Motor Control drive with servo control
2. Motor (build on Transmission shaft)
3. Interface unit to interface car sensors
4. Battery monitoring unit
5. Battery charger (700W)
6. Batteries 12V 30AH x 16, 210V DC
7. Battery Box

SKD

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