Study on Parallel Individual Drive Hybrid Technology

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Abstract---Now a day the vehicles use conventional fuels like Gasoline, Diesel, etc., which provide speeds and torque but they have very low efficiency and mileage. Also the engine systems which use fossil fuels releases gases like CO2, NOx, SO2,.....etc., which are harmful to environment and human body too. Also alternate energy source like electric energy for propulsion of vehicle have good mileage but not provide desired speed. An important possibility to make steps towards this goal is the hybrid technology. The topic of this research paper is the study on Parallel Individual Drive Hybrid Technology. The methodologies used to construct a Working Model of Concept Hybrid Car based on Parallel Individual Drive Hybrid Technology. The conclusions of the research are that Parallel Individual Drive Hybrid Technology is much suitable for Indian road and traffic condition on mileage point of view.

Key Words: Hybrid Car, Hybrid Technology, Fuel Efficient Technology, Concept Hybrid Car

I. INTRODUCTION

Today widely known that the fuel consumption of a vehicle clearly affect the surroundings where it is used. It is also widely known that the effects of the emissions are not only local but also affecting the climate globally. As a reason to this increasing and today widely spread problem, this report will propose a working solution to lower the emissions and fuel consumption and thereby increasing the overall efficiency. In particular this research will address Parallel Individual Drive Hybrid Technology. For that we construct Concept Hybrid Car based on Parallel Individual Drive Hybrid Technology which has low fuel consumption and low emissions.

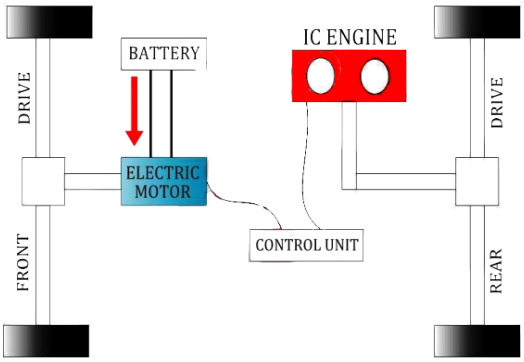
A. Parallel Individual Drive Hybrid Technology

Basically Hybrid Technology is combination of two or more than two kind of power sources. In Parallel Individual Drive Hybrid Technology we combined conventional propulsion system (SI Engine) with rechargeable energy storage system (Electric Motor). Parallel Individual Drive Hybrid Technology consists of centrifugal clutch spark ignition engine, D.C. motor, battery, control unit, switching system and fuel tank.

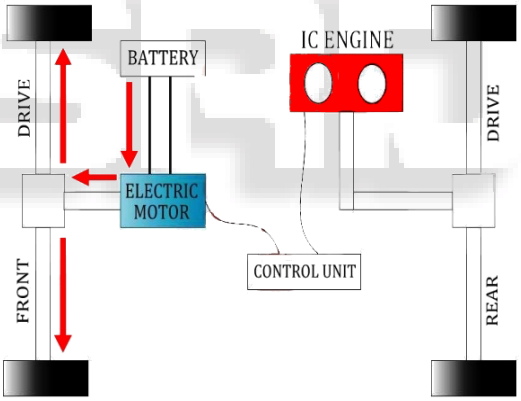
The engine used in this, is fitted at rear of car which drives the rear axle and two equally rated D.C. motors are fitted at the front wheels individually which drives them equally. Battery converts the chemical energy into electrical energy which is supplied to the two front D.C. motor equally. Fuel tank reserves the fuel and supplies it to the engine. Control unit controls the power supply from battery to the D.C. Motors and the switching system used for synchronization of engine and motor.

B. Working Of Parallel Individual Drive Hybrid Technology

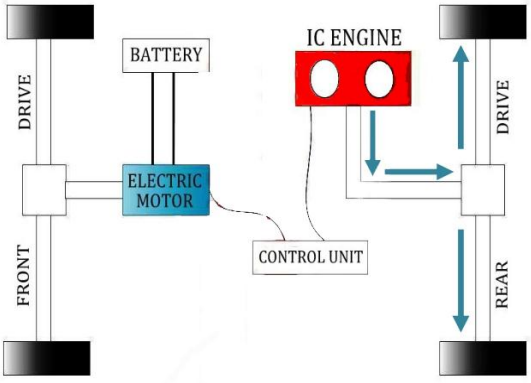
During the starting and idling battery supply the power to Electric Motor



At low speed (High Torque) battery supply the power to front wheel through electric motor for propulsion of car



After certain speed (High Speed and Low Torque) IC Engine supply the power to rear wheel for propulsion of car.



Control System of Parallel Individual Drive Hybrid Technology

Control System of Parallel Individual Drive Hybrid Technology consists of three different modes like Electric

mode, Engine mode, Hybrid Mode.

Electric Mode: In these mode only battery supply power to electric motor to propel the vehicle.

Engine Mode: In theses mode only engine provide the power to propel the vehicle.

Hybrid Mode: In this mode at starting battery supply power to electric motor to propel the vehicle after certain speed (20 – 25 kmph) control unit switch the vehicle into engine mode. Then after engine supply power to propel the vehicle.

II. Vehicle Design And Fabrication

The methodologies used to construct a Working Model of Concept Hybrid Car based on Parallel Individual Drive Hybrid Technology. For this first we made prototype of Concept Hybrid Car with help of thermocole sheet and then we fabricate Concept Hybrid Car.

A. Technical Specification

1) Dimension

- Wheelbase: 2000 mm
- Track: Front: 1250 mm, Rear: 1250 mm
- Length: 2250 mm
- Width: 800 mm
- Height: 850 mm
- Length to Wheelbase ratio: 1.125
- Ground clearance: Front: 150mm Rear: 250 mm
- Weight distribution: Front: 30%, Rear: 60 %,
- Left: 50%, Right: 50 %
- Fuel capacity: 5 liters

2) Engine

- Model: Kinetic DX
- Type: Single cylinder spark ignition 2 stroke engine
- Fuel: Petrol
- Maximum Power Output at Engine Shaft: 7.7bhp @ 5600 rpm
- Maximum Torque at Engine Shaft: 1.0 kgm @ 5000 rpm
- Displacement: 99cc

3) Performance

- Engine:
  Top speed: 40 - 45
  Fuel consumption: 35 - 40 kmpl
- Electric Motor:
  Top Speed: 30-35
  Energy consumption: 34 – 45 km/unit

Electric Motor

- TYPE: Non brush type
- Capacity: 250 Watt and 48 Volt

Load Capacity

- No of seat: 1
- Total load: 120 kg*
- Pay load capacity: 100 kg

Chassis

- Engine location: Rear
- Electric Motor location: Inside the front wheel
- Drive: FWD & RWD

4) Suspension

- Front: Double wishbone type with GRS
- Rear: Non independent coil spring type with GRS

5) Brakes

- Front: NA
- Rear: Disc Brake

6) Steering System

- Bolt & Nut type

7) Transmission

- Chain Transmission System
- Gear Ratio: 0.5

B. Design Consideration

The vehicle is open-wheeled and open- cockpit (a formula style body). There are no openings through the body into the driver compartment.

Round Pipe has high Bending Strength and Compressive Strength, but Round Pipe has not good weldability. So, we use Square pipe.

Due to the limited power capacity of IC Engine and Electric Motor the weight of frame and chassis is limited to 100 kg*.

C. Frame Design and Analysis

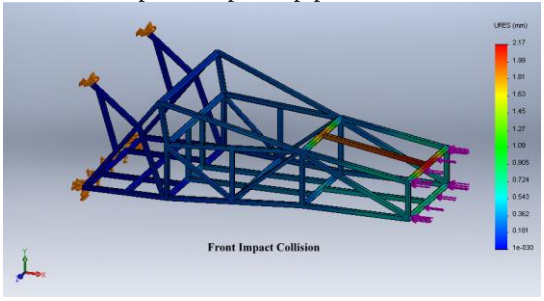
The frame design is very crucial to the safety of the driver, as weight is limited to 200 kg for given power capacity based on these we design frame. We adopted the systems integration approach to designing the frame. In this method the important subsystems of the vehicle and the driver were considered. These sub systems and the driver can perform well when they are given an appropriate placement within the vehicle. We worked on packaging feasibility, agronomics and aesthetic consideration and having obtained the mounting points of sub-systems, the frame was designed. For these first we made prototype of frame with important sub system of the vehicle and driver compartment. Then analysis concerning various impact scenarios was carried out on the Frame to check for failure and deformation. The initial analysis gave us several points to optimize upon, which then gave us the final frame design as shown in the 3D views. The final analysis was carried out in SolidWorks. The test results came out positive.

The following are the results:

All loads were applied on the various member of frame keeping various members in constraints, depending on the test under consideration.

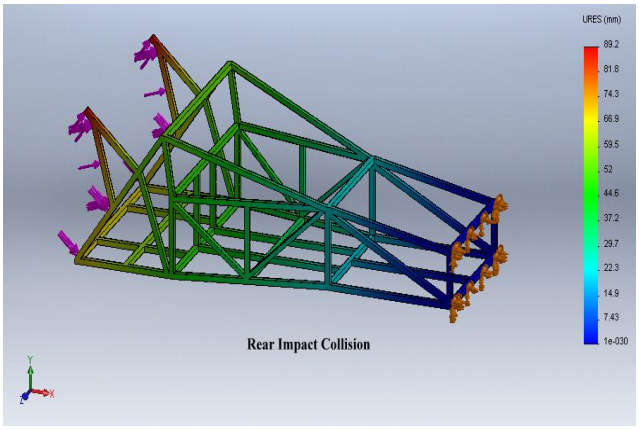
1) Front Impact Collision

- Load on front frame: 20,000 N
- Rear Suspension pick up point constrained



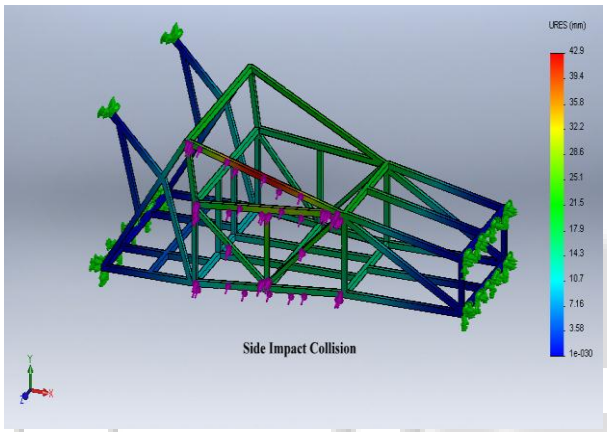
2) Rear Impact Collision

- Load on Rear Suspension pick up point:20,000 N
- Front Frame constrained



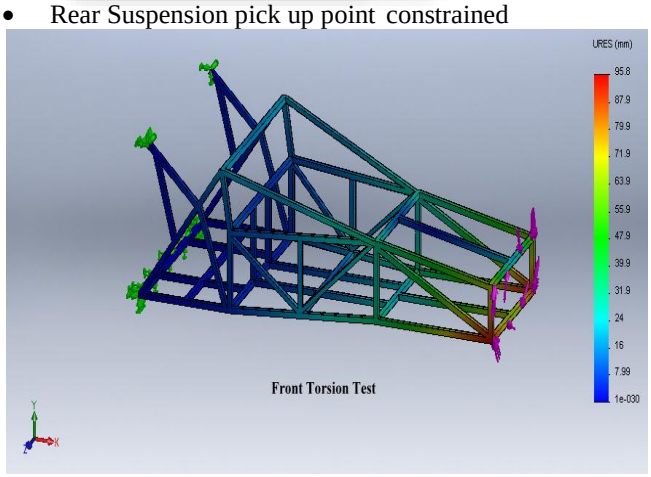
3) Side Impact Collision

- Load on side impact structure: 20,000 N
- Load on Front and Rear Suspension pick up point constrained



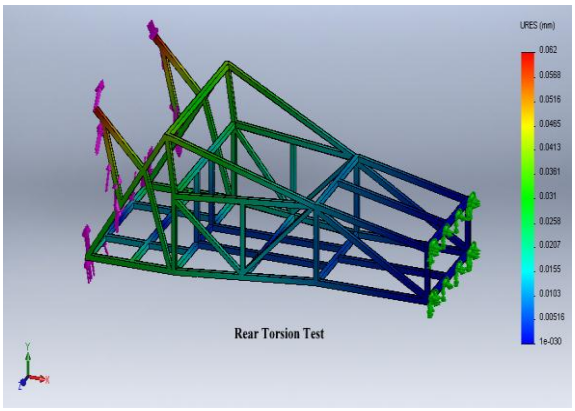
4) Front Torsion Test

- Load on front frame (Moment Created): 20,000N
- Rear Suspension pick up point constrained



5) Rear Torsion Test

- Load on rear suspension pick up point (Moment Created): 20,000N
- Front frame constrained



D. Result

The analysis was carried out in SolidWorks 2011. We have used square pipe of 1' × 1' and 1.3 mm thickness for the test and have found the average stress induced in the vehicle frame and the corresponding deflection for various collision types.

The initial c/s of square pipe prior to the analysis is:

- Size of square pipe all around the frame: 1' × 1' and 1.3 mm thickness

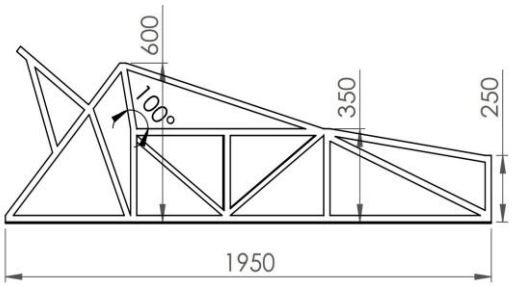
After analysis done in SolidWorks simulation of the frame the final dimension used is:

- Size of square pipe Front side: 1' × 1'& 1.3 mm thickness
- Rear side: 1' × 1' & 1.6 mm thickness
- Base Side: 1' × 1' & 1.6 mm thickness

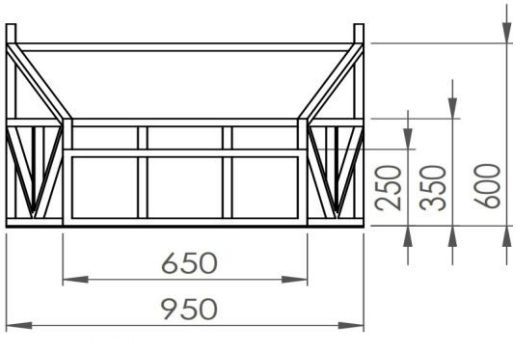
The result of the analysis we can now assume that our frame is safe for the driver to be seated within, in case of worst collision.

We have added certain square pipe after performing analysis in SolidWorks according to mounting point of view and space optimization.

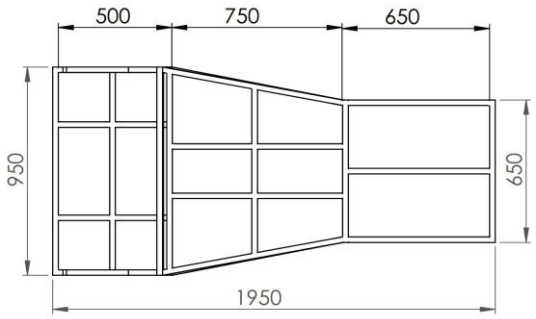
E. 3D View of Frame (All Dimensions are in mm)



Side View



Front View



Top View

Working Model of Concept Hybrid Car based on Parallel Individual Drive Hybrid Technology

III. Vehicle Performance

Following are the results which are observed during the testing.

	Electric Mode	Engine Mode	Hybrid Mode
Average	35-40 kmpl	34-45 km/unit	60-70 kmpl
Top Speed	40-45 kmph	30-35 kmph	40-50 kmph

IV. Conclusion

Concept Hybrid Car based on Parallel Individual Drive Hybrid Technology are definitely more environmentally friendly and efficient than individual internal combustion engine or individual electric vehicle.

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