Design and Fabrication of Hybrid Vehicle

Shoaib Anvar Hussain Multani[1], Jaydeep H. Patel[2]

[1]Student, Mechanical Engineering Department, C. K. Pithawala College of Engineering and Technology
[2]Assistant Professor, Dept. of Mechanical Engineering, C. K. Pithawala College of Engineering and Technology, Gujarat, India.

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Abstract - Since last 2-3 decades the average temperature of earth increased by 3-40^{0c} because of the green house effect. Due to increase in the fuel prices and continuously depletion of natural resources for the fuels causes fuel crises in the modern society. Due to which demand of development of newly energy efficient vehicles increases. The hybrid technology fulfills this requirement by incorporating various combinations of bio-fuels and also by combinations of highly efficient electric drive systems. Along with the same it reduces the emission and cut the fuel cost. This project illustrates an implementation of hybrid technology on a small scale. Project aims at improving the mileage of the car using simple mild parallel hybrid technology with combination of electric motor drive and the petrol engine drive. We have used the straight open kart chassis design. The results show that alone a petrol engine gives best 25Km/lit, alone a electric motor gives 12kms on full battery charge. The combination of above two gives 40Kms run.

***Key Words*: Fuel Consumption, Hybrid Vehicle.**

1. INTRODUCTION

Since the last two decades the judiciary and policymakers all over the world are deeply concerned about the urgent need for protection of the environment, ecology and humanity at large, there has been a steep rise in the accumulation of greenhouse gases particularly co2, which effect global changes in weather. Motor vehicle contribute about 14% of co2from all sources besides, pollution due to both petrol and diesel engine driven vehicles caused by the emission of co, none burnt hydrocarbons, particulate and oxides of tetra ethyl, lead are injury to health and environment. Regulations on exhaust emission from vehicle engines have been made progressively more and more stipend towards the year 2000 and beyond. Vehicle manufactures have been hence obliged to meet these standards by designing cleaner and fuel efficiently engines and through provision for treatment of exhaust gases to satisfy the specified limits. So to satisfy and overcome these two problems namely, Pollution & Efficiency.

The invention of internal combustion engine is one of the greatest inventions of mankind. The conventional vehicles with ICE provide a good performance and long operating range. However they have caused and continue to cause serious problems for poor fuel economy, environment pollution and human life. Reducing fuel consumption and emissions is one of the most important goals of modern design. The hybridization of a convectional combustion engine vehicle with an advanced electric motor drive may greatly enhance the overall efficiency and achieve higher fuel with reduced emissions. Considering the urban status in India, a well organized and fuel efficient scooter has to be designed and developed.

1.1 HYBRID ELECTRIC VEHICLE AT GLANCE

HEVs are the vehicles with more than two energy sources are present. The major challenges for HE design are managing multiple energy source, highly dependent on driving cycles, battery sizing and battery management. HEV‟s take the advantages of electric drive to compensate the inherent weakness office, namely avoiding the idling for increasing the fuel efficiency and reduce emission during starting and speeding operations, to use regenerative braking instead of mechanical braking during deceleration and down slope driving.

HEV can meet customer's need and has added value but cost is the major issue. These vehicles are of high cost and certain program should be supported by the specific government for marketing HEVs.

The HEVs are classified into two basic kinds, IES and parallel. Recently with introduction of me HEVs offering the features of both series and Allele hybrids, the classification has been extended three kinds- series, parallel and series-parallel. It interesting to note that some newly introduced HE not be classified into these three kinds. Here by classification involves series, parallel, series parallel complex hybrid.

1.2 PLUG-IN ELECTRICAL VEHICLE

A plug-in electric vehicle (PEV) is any motor vehicle with rechargeable battery packs that can be charged from the electric grid, and the electricity stored on board drives or contributes to drive the wheels for propulsion. Plug-in electric vehicles are also sometimes referred to as grid-enabled vehicles (GEV) and also as electrically chargeable vehicles

PEV is a subcategory of electric vehicles that includes battery electric vehicles (BEVs), plug-in hybrid vehicles, (PHEVs), and electric vehicle conversions of hybrid electric vehicles and conventional internal combustion engine vehicles. Even though conventional hybrid electric vehicles (HEVs) have a battery that is continually recharged with power from the internal combustion engine and regenerative braking, they cannot be recharged from an off-vehicle electric energy source, and therefore, they do not belong to the category of plug-in electric vehicles.

"Plug-in electric drive vehicle" is the legal term used in U.S. federal legislation to designate the category of motor vehicles eligible for federal tax credits depending on battery size and their all-electric range. In some European countries, particularly in France, "electrically chargeable vehicle" is the formal term used to designate the vehicles eligible for these incentives. While the term "plug-in electric vehicle" most often refers to automobiles or "plug-in cars", there are several other types of plug-in electric vehicle, including scooters, motorcycles, neighbourhood electric vehicles or micro cars, city cars, vans, light trucks or light commercial vehicles, buses, trucks or lorries, and military vehicles.

2. CONSTRUCTION AND WORKING

The design concept is developed for driving a scooter with individual wheels of the vehicle separately propelled with different sources. The rear wheel will be coupled to the vehicle as in before driven by ICE, whereas the front wheel is replaced with an electric motor in-wheel drive driven by five DC batteries. The chosen test vehicle for the analysis purpose is Kinetic Honda Y2K, made, two-stroke, continuously variable transmission, more suitable for testing purpose. For analysis, the mechanical arrangements with respect to suspension in the front wheel are being altered as per the required design for holding the motor wheel.

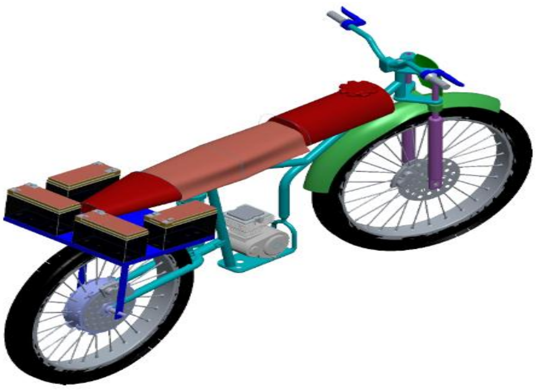

Fig-1: Main Assembly

The controller for the motor is being interfaced with the motor speed regulation. The speed controlling throttle is being interfaced through the motor controller circuit. The motor used here is 48V, 250W, Ampere made hub motor. The controller for the motor is also Ampere made suitable for controlling the specified motor. The throttle is an ampere made throttle for speed regulation of the specified motor. The input to the motor is supplied by five Exide made Electra lead-acid batteries each of 12V, 20Ahthrough controller for testing purpose. Two independent propelling sources are being employed for obtaining total propulsion of the vehicle.

- **WORKING**

In this project main aim is to save fuel and also reduce the pollution means control the pollution. When we start the normal engine at that time we need first use the petrol at initial stage and also we are just use the petrol for the long travel because we need to use more torque and speed but in the city area means in the traffic area we do not required speed and more torque. So at that time with the help of second leaver means controller which is drive the electric motor. And automatically closed the fuel supply valve and we are using the directly the only battery power with the help of controller which is drive the electric motor and our aim is solved automatically.

3. DESIGN CALCULATION OF PARTS

a) SUSPENSION

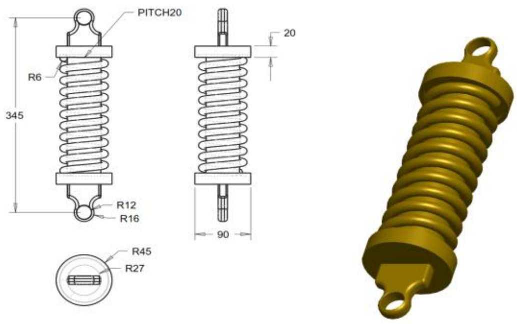

Fig-2: Suspension of Vehicle

b) REAR WHEEL

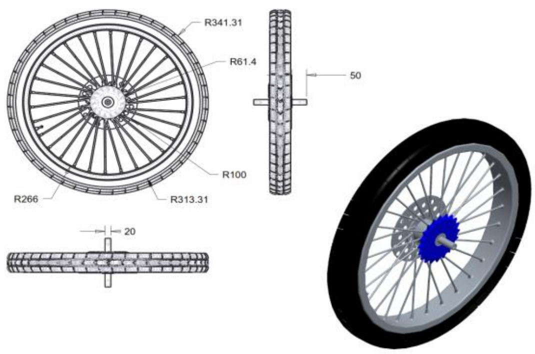

Fig-3: Rear Wheel

c) **FRONT WHEEL**

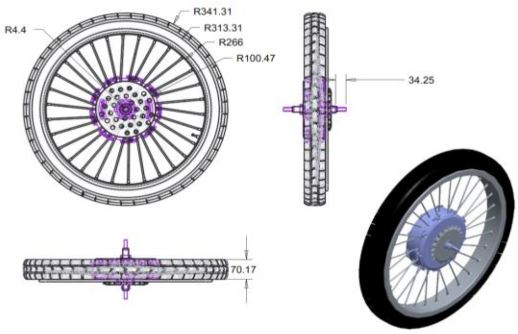

Fig-4: Front Wheel

d) **BOTTOM REAR WHEEL CLAMP**

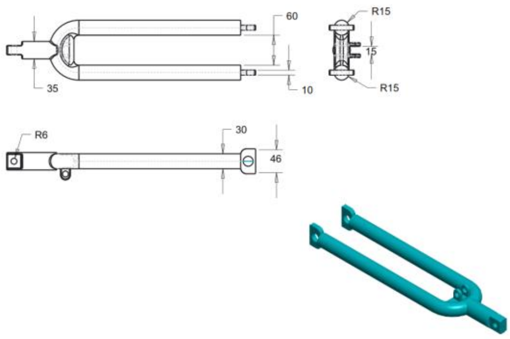

Fig-5: Wheel Clamp at Bottom rear

e) **MAIN FRAME**

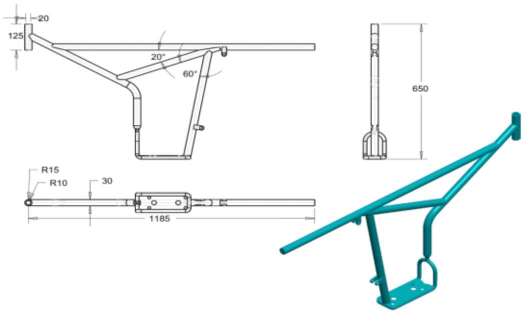

Fig-6: Main Frame of Vehicle

f) **FRONT WHEEL CLAMP**

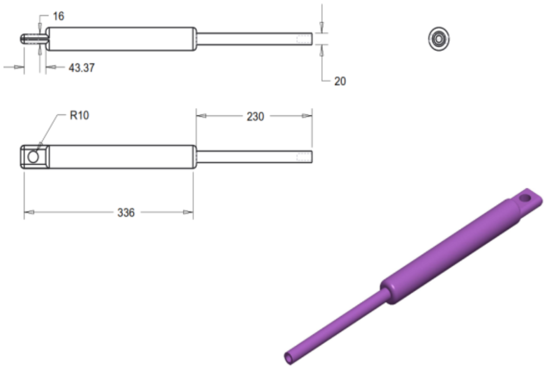

Fig-7: Wheel clamp of Front wheel

g) **FUEL TANK**

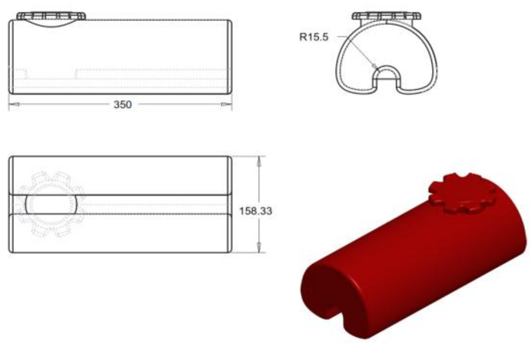

Fig-8: Fuel Tank of Vehicle

h) **HANDLE**

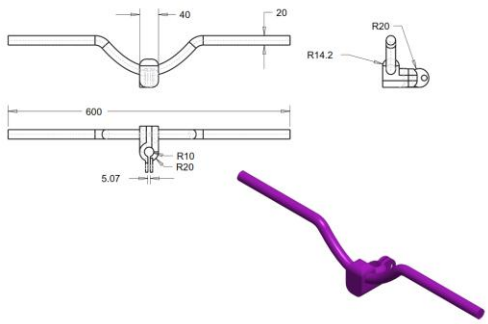

Fig-9: Handle of Vehicle

i) BATTERY

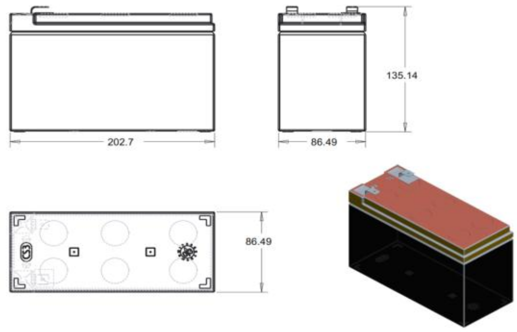

Fig-10: Battery of Vehicle

j) BATTERY STAND

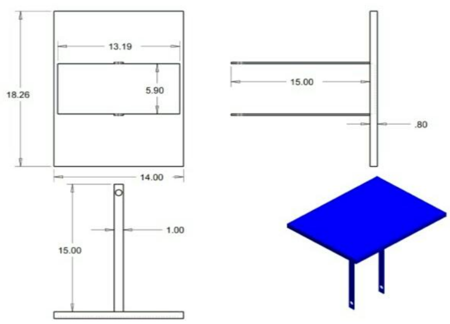

Fig-11: Battery Stand

k) ENGINE PART

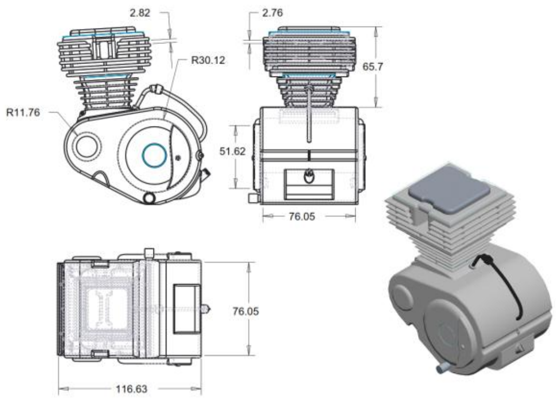

Fig-12: Engine parts

4. Hub Motor Calculation

Motor specification : RPM = 1000

Volt = 48 V

Power = 500 W

I. Power equation

Power = I * V

I = 500/48

= 10.41 A

Where, V = 48 V and P = 500 W

II. To find torque of the motor

T = P*60 / 2*3.14*N

= 500*60 / 2*3.14*1000

= 4.77 N-m

Torque of the wheel hub motor, T= 4.77 N-m

III. Power Required to Propel the Vehicle

Weight = 72+(70*2)

=212 Kgf

Total resistance = Rolling resistance + Air resistance+ Gradient resistance

So That,

R=5.256 Kgf

R=51.56 N

Power= (51.56*8.33)/.9

P=477.417 W

Hence, the power required to propel the vehicle is 477.417 W, which is just below our motor specification 500 W. And the design is safe

IV. BATTERY CALCULATION

To find the current,

Watt = 18 W and Volt = 12 V

Power, P = V * I

18 = 12 * I

I = 18/12 = 1.5 Amps

BATTERY USAGE WITH 1.5 AMPS

= BAH / I

= 8/1.5

= 5.3 hrs

5. CONCLUSIONS

It is observed that, the ICE in this built hybrid electric vehicle is utilized for obtaining the propulsion of the vehicle from the rest, as the speed is increased; the electric Motor propulsion is combined with the ICE propulsion for total movement of the vehicle. The total torque obtained by both ICE and electric motor are synchronized for respective road gradient by varying suitably the respective controllers utilized. By doing torque distribution accordingly, battery life per total charge can be enhanced in driving the electric motor also minimizing the fuel required for ICE propulsion. For the test route chosen, the vehicle in stock condition, eligible for giving a mileage of35km (as observed in stock driving), with this type of arrangement, can enhance the mileage performance efficiently by 25%. The throttle with respect to ICE was moderately involved in obtaining the propulsion during the test run. The throttle involved in driving the electric motor was mutually made involved with respect to ICE throttle. Both motor torque and ICE torque were responsible in propelling the vehicle during the test run. The torque distribution between ICE and electric motor has to be enhanced by designing a suitable torque synchronizer. The short battery life issue related to present electric bikes can be solved implementing this technology. Solar charging scheme which is designed for the proposed vehicle makes it more time efficient. Also low-emission, electric / ICE mode of operations can be further enhanced in this project.

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