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Design and Fabrication of Electric and Petrol Hybrid Vehicle

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ABSTRACT

The progress of automobiles for transportation has been intimately associated with the progress of civilization. The automobile of today is the result of the accumulation of many years of pioneering research development. In the modern trend automobiles have certain disadvantages soon as fuel cost relative to mileage, pollution and less efficiency.

- To improve efficiency

- To decrease the fuel cost relative to mileage

- To control the pollution is to be effect

Then our "HYBRID TWO WHEELER" is an aspect. The goal of this project was to implement the most efficient and less polluting vehicle. In our project the hybrid electric vehicle model combines the internal combustion engine of a conventional vehicle with the battery and electric motor of an electric vehicle, resulting in twice the fuel economy of conventional vehicle. We implement this hybrid electric vehicle concept for two wheelers

Keywords: Hybrid vehicle, Fabrication, Automobile efficiency

1. INTRODUCTION

Since the last two decades the judiciary and policy makers 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 co2 from all sources besides, pollution due to both petrol and diesel engine driven vehicles caused by the emission of co, no un 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

Then we go for a hybrid vehicle in the name of HYBRID TWO WHEELER.

2. SELECTION OF COMPONENTS

Based on the literature survey and availability, we have listed the required components of the hybrid vehicle.

1. Battery (Power supply unit)
2. Speed controller
3. Brushless DC Hub Motor
4. Battery Charging Kit
5. Bajaj spirit

Engine & Transmission	Technical Specifications	Spirit – Advantage
Engine Type	2-Stroke. Forced air cooled	All aluminiumengines. Reliable and superior in performance
Engine Displacement	59.9cc	
Maxl Net Power	3.6Hp at 6500 rpm	Can carry two with ease.
Transmission Type	Oil-immersed 2-speed	Consistent performance and fuel efficiency. Lower maintenance.
Grade ability	15%	Takes on steep terrain with ease.
	Chassis	
Frame Type	Tubular	Strong durable frame.
Suspension-Front	Leading link with co-axial hydraulic dampers, coil springs and anti-dive link	Coasts along comfortably even on rough roads.
Suspension-Rear	Hydraulic damper with co-axial springs	
Tyres-Front and Back	2.75 X 10	Better road grip.
	Electricals	
System	12V, AC + DC	Powerful electrical for safe riding.
Head Lamp	35/35W	Night piercing headlamp for safe riding.
Electric Start	Options available	Life gets easier.
	Dimensions	
Length x Width x Height	1685mm x 635mm x 1020mm	Lower height for absolute ease of riding.
Wheelbase	1165mm	Better manoeuvrability
Ground Clearance	120mm	Rides through rough roads with ease.
Kerb Weight	72Kg	Light and easy to handle.
Min Turning Radius	1.75m	Easy manoeuvrability helps you weave in and out of city traffic.

Figure: 1 Specifications

3. CALCULATIONS

3.1 Hub Motor Calculation

Motor specification

Rpm = 1000

Volt = 48 V

Power = 500 W

Power equation

Power = $I * V$

Where

V = 48 V

P = 500 W

I = 500/48

= 10.41 A

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

3.2 Power Required to Propell the Vehicle

Weight = 72+(70*2)

=212 Kgf

Total resistance = Rolling resistance + Air resistance + Gradient resistance

$R= K_rW+K_aAV^2+Wsin\theta$ R=(0.018*212)+(.0028*30^2*.635*.9)

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

3.3 Battery Calculation

To find the current

Watt / Volt	=	18 W
P	=	12 V
	=	V * I
18	=	12 * I
I	=	18/12
	=	1.5 Amps

BATTERY USAGE WITH 1.5 AMPS

B_{AH} / I

8/1.5 = 5.3 hrs

4. WORKING PRINCIPLE

The working principle of HYBRID BIKE basically involves three processes, the first process involves when the vehicle is running by means of internal combustion engine, second process involves when the vehicle is running by means of an electric motor and the third process involves when the vehicle is running in both the modes according to the requirements. When the vehicle is driven at the outside of the city and need more power to drive, the vehicle is powered by means of internal combustion engine. The power from the engine is taken from pulley and then it rotates the wheel.

4.1 Petrol Mode

In petrol mode, engine will supply power to the rear wheel. When the switch is moved to this position (S1), the microcontroller will sense the position of the switch and transmits signal to the relay, which will energise the ignition coil and operate the starter motor. The rider can control the speed by means of ordinary accelerator handle. In this mode the BLDC motor will be in ideal position at the front wheel, where its battery connections are cut off by another relay which again controlled by thee micro controller. This mode can be activated when we require high

power outside the city limits. During this high power operation engine will run on its own rated rpm, so the fuel consumption are considerably low, also the pollutants coming out of the exhaust is reduced.

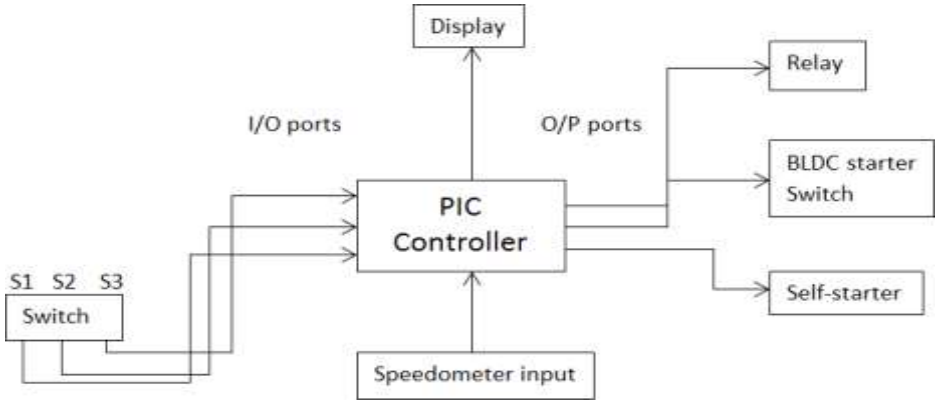

Figure: 2 Layout of control circuit

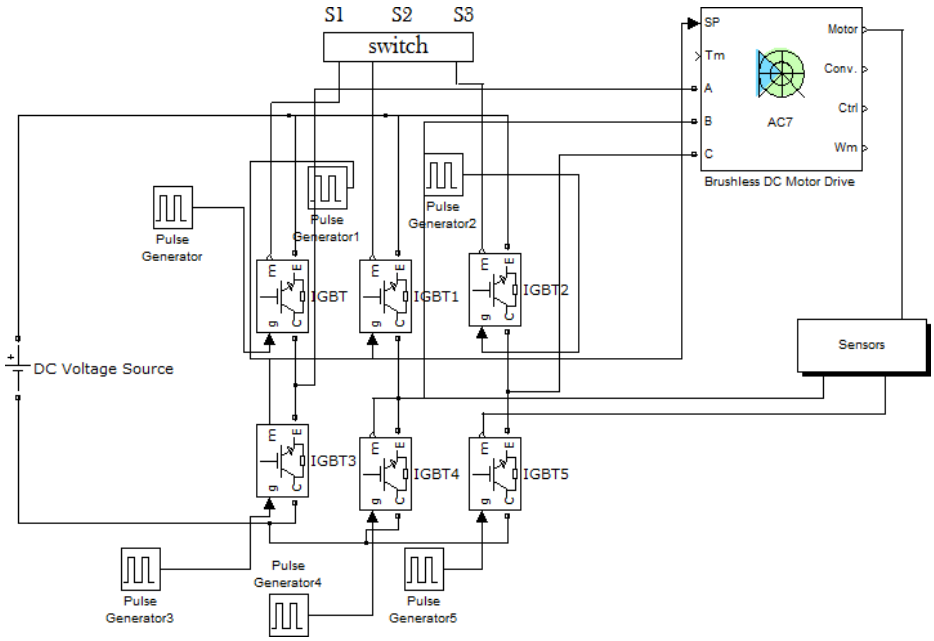

Figure: 3 BLDC circuit diagram

4.2 Electric Mode

Here we are using the BLDC hub motor which is running with help of battery power. Battery is placed in the goods space under the seat. The motor are fixed on the front wheel of the vehicle and it is controlled through the controlled unit. The hub motor is steadily emerging as a standard drive method just like e-bikes, scooters, solar cars, and many other light electric vehicles. With a hub motor conversion, there is no need for external mounting brackets and drive chains to support a motor and transmission. The direct drive hub motor is about as simple as things get. The motor are exactly fixed as in centre axis of the wheel hub. Now the vehicle rim starts to spin over the axis body for rotation of wheel. The electric power supply is charged to the battery through the separate charger. Here some losses may be occurred due to mechanical friction. Here we are also having the fuel drive which is coupled with the back wheel of the vehicle.

When the vehicle is driven inside the city, running in the plain and need of low power the vehicle is powered by means of a motor. The power to run the motor is supplied from the battery.

During this process the speed of the vehicle will be minimum and there is no smog forming pollutants produced during the vehicle runs. The mileage of the vehicle while running on the electric motor is mainly depends upon the time of charging and also depends upon the capacity of the battery. During this process the mileage of the vehicle is increased considerably.

4.3 Hybrid Mode

This is a special type of mode where rider does not care about the current mode of operation. This is entirely controlled by microcontroller. In this mode switch will be in S3 position. Microcontroller is programmed as when the vehicle is running in 30kmph or less than that, electric mode will be activated.

If it is above 30kmph, then petrol mode is to be operated. To sense the speed of the vehicle, we are going to take speedometer readings as input. At city limits the vehicle operates in electric mode and in outer it will operate in petrol mode. Therefore we can reduce the energy consumption, pollution, rupees per kilometre.

5. ANALYSIS OF VEHICLE

IC Engine Vehicle

1. Vehicle cost (ES spirit) - 35000 /=
2. Fuel cost (1 Lit) - 72 /=
3. Mileage (1 Lit) -45 Km/Lit
4. Running cost of the vehicle per kilometer - 1.6 /=
5. Speed of the vehicle-Max speed 60 Km/hr

Battery Vehicle

1. Vehicle cost - 33 /=
2. Fuel cost (1 Full charge Battery) - 8 /=
3. Mileage (1 Full charge Battery) - 50 Km
4. Running cost of the vehicle per kilometer - 0.16 /=
5. Speed of the vehicle-Max speed 35 Km/hr

Hybrid Vehicle

1. Vehicle cost - 40 /=
2. Fuel cost (1 Lit and 1 Full charge Battery) - 80 /=
3. Mileage (1 Lit and 1 Full charge Battery) - 95 Km
4. Running cost of the vehicle per kilometre -0.84 /=
5. Speed of the vehicle-Max speed 45 Km/hr

6. COMPARISON

Type Category	IC Engine	Electric	Hybrid
Vehicle cost (Rupees)	35000	33000	40000
Fuel cost 1 Lit (Rupees)	72	8	80
Mileage (1 Lit)	45	50	95
Running cost of the vehicle per kilometre	1.6	0.16	0.84
Speed of the Vehicle	55	35	45

Table: 1 Comparison and Result

7. CONCLUSION

In heavy traffic and inside the city there is no chance for moving fast. At that time, if vehicle is run by IC engine, more fuel is wasted due to variation of acceleration. If the vehicle is run electric hub motor through battery, the consumption of power is reduced. During less load operation, vehicle can be easily run by mean of battery instead of by engine, when high torque is required it can be changed to IC engine mode. Further we are going to implement this idea in the Bajaj spirit and planned to conduct performance test.

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