

Design and Fabrication of Dual Mode Power Drive System in Motorcycle

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Abstract

In the last few years, environmental impact and price rise of the petroleum based fuels have increased. For these perfect alternative, electric vehicles are much preferred commonly around the world. Now transient period of conventional vehicles to electric vehicles have started. Dual-mode vehicles are electrically powered and conventional internal combustion engine run in dual-mode for power too. Using batteries for electric drive and reciprocating engine for conventional drive either one can be operated at a time and this can be switch manually according to the application requirement. The Motorcycle with combination of IC engine and electric motor will provide a good start for electric vehicle usage by the consumers. This method of dual operation in two wheelers reduces running cost and environmental impacts. In this present paper shows dual operation of a two wheeler with mode-1 by conventional IC engine drive and the mode-2 is an electric drive consisting of a DC motor fixed on the front of the vehicle powered by a 12V battery placed above the motor. The power from that DC motor is transmitted to the rear axle shaft with a special pulley with belt drive transmission to drive the vehicle. This power can be restored to the battery with an alternator. The motor speed is controlled through a Rheostat Control Method.

Keywords: DC Motor; Battery; IC Engine; Controller; Driving mode.

1. Introduction

The Two wheeler with combination of IC engine and electric motor will provide a good start for electric vehicle usage by the consumers. The method of dual operation in

two wheelers reduces running cost and environmental impacts. In this present paper shows dual operation of a two wheeler with mode-1 by conventional IC engine drive and the mode-2 is an electric drive consisting of a DC motor fixed on the front of the vehicle powered by a 12V battery placed above the motor. The power from that DC motor is transmitted to the rear axle shaft with a special pulley with belt drive transmission to drive the vehicle. This power can be restored to the battery with an alternator. The motor speed is controlled through a Rheostat Control Method.

The D C motor fixed on the front of the vehicle. The power is transmitted to the D C motor to rear axle wheel shaft with a special pulley with belt drive transmission to drive the vehicle this power is stored to the battery, which is placed above the motor and this charge is supplied back to run the motor. The motor speed is controlled through a Rheostat Controller. The drive from the motor is transmitted through belt drive transmission to the rear wheel. The man segments are as follows, Battery, Speed controller, Motor, Transmission unit and Charger.

Ability of electric drive to function unattached for long periods as evidence in space programmed. Modular nature in which desired current, voltages and power levels can be achieved by mere integration. Maintenance cost is low as they are easy to operate. They do not create pollution. They have a long effective life. And they are highly reliable.

The basic principle of motor action lies in a simple fact a current carrying conductor lying in a magnetic field experience a force. The direction of such force developed is given by Fleming's left hand rule, which states as follows. Hold thumb, fore finger and middle finger of the left hand at right angle to one another. If fore finger indicates the direction of flux and middle finger indicates the direction of current, then the thumb gives the direction of force developed on the conductor. This will be clearly seen in the illustration.

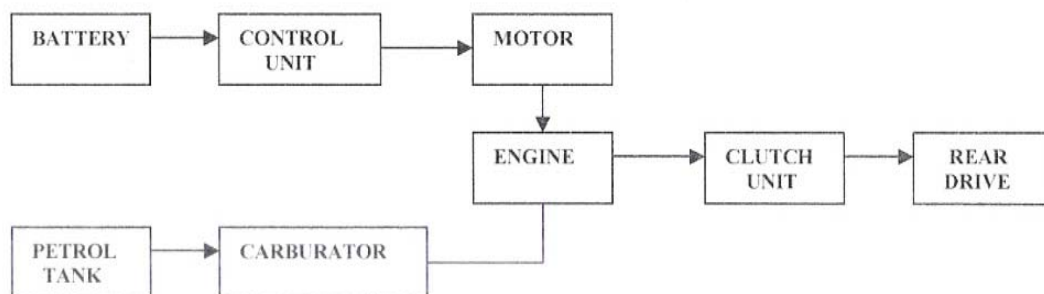


Fig. 1: Schematic representation of dual operation.

2. Experimental Design Factors and Consideration

For the motion of a vehicle on a road can have resistance by aerodynamic forces like air resistance and rolling resistance. In addition there are two other resistances to be overcome by vehicle is grade resistance when vehicle motion at gradient. Therefore the total power to propel the vehicle is the sum of all the resistance called total resistance, The power that overcomes the total resistance propels the vehicle, more power increase the velocity of the vehicle.

2.1 Air resistance

The resistance occurred by air velocity against the motion of the vehicle. The air resistance depends on size and shape of the vehicle body. This resistance is very small when vehicle moves at slow speed and thereby can be neglected, But at high speeds it is very important to be considered.

2.2 Rolling Resistance

The resistance due to the deformation of road and tyre and dissipation of energy Through impact. The factor of rolling resistance in vehicle occurs with constant speed.

2.3 Grade Resistance

The weight of the vehicle motion in parallel to the gradient, Then the force due to the weight of the vehicle is neutralized by the additional force of the vehicle called grade resistance.

2.4 Tractive Effort

The force produced at the point of contact of the wheel on the road. The torque available at the wheels from the engine produces a driving force parallel to the road. This force is known as the Tractive effort.

3. Constructional Set Up

3.1 IC engine

A 80 cc two stroke engine reciprocates inside the cylinder. It is connected to the crank shaft by means of a connecting rod and crank. There are no valves in two stroke engines. Instead of valves, ports are cut in the cylinder walls. There are three ports namely inlet, exhaust and transfer ports. The closing and opening of the port is obtained by the movement of the piston. The crown of the piston is made of a particular shape. This is to deflect the fresh charge upwards in the cylinder. A spark plug is also provided in the cylinder to start up ignition.

3.2 DC motors

It is a permanent magnet DC motor that serves as both motor as well as generator that will runs at 1500 rpm of 12V and 28A. The motor drives the wheel through the transmission unit. The permanent magnet of the PMDC motor are supported by a cylindrical steel Stator, which also serves as a return path for the magnet flux. The rotor has winding slots. Commutator segments and brushes are as in conventional dc machines.

3.3 Battery

The power package for the vehicle is battery of five 12V, 13 plate battery connected in series, the battery gives up and take away current when flow direction. A lead acid battery consist of three cells or 12 cells in series giving 6V, 12V and 24V, respectively. Positive and negative plants immersed in dilute sulphuric acid and Kept apart by separators in each of its cells. The battery used is a combination of individual cells. A cell is a electrical combination of materials and electrolyte constituting the basic

electrochemical energy store. A battery can also be thought of as a black box into which electrical energy is put, stored electrochemically, and later regained as electrical energy. Battery storage system may be included under chemical energy storage also.

4. Working and Controls

The Dual operated two wheeler has two mode of operation. The mode-1 is the conventional 2 stroke IC engine which is controlled by carbureted throttles. The mode-2 is the PMDC of 12v with 1 kw power is used, and controlled by a rheostat controller

4.1 Mode-1, The 2 stroke IC engine strokes of operation

First stroke (upward stroke of the piston) starts with Compression of piston movement from BDC to TDC. Both transfer and exhaust ports are covered by the piston. Air fuel mixture which is transferred already into the engine cylinder is Compressed by the moving piston. The pressure and temperature increases at the end of compression. Piton almost reaches the top dead center. The air fuel mixture inside the cylinder is lighted by means of an electric spark produced by a spark plug. At the same time, the inlet port is uncovered by the piston. Fresh air fuel mixture enters the crank case through the inlet port.

Second stroke (down ward stroke of the piston) starts with Expansion of piston and Crankcase compression as the burning gases expand in the cylinder. The burning gases force the piston to move down. Thus useful work is obtained. When the piston moves down, the air fuel mixture in the crankcase is partially compressed. Thus compression is known in crankcase compression. Now, at the end of expansion, exhaust port is uncovered. Burnt gases escape to the atmosphere. Transfer port is also opened. The partially compresses air fuel mixture enters the cylinder through transfer port.

4.2 Mode-2, The electric drive

The motors usually run on 12V DC supply obtained either from batteries or rectified alternating current. In such motors, torque is produced by interaction between the axial current carrying rotor conductors and magnetic flux produced by the permanent magnets.

The basic principle of motor action lies in a simple fact that a current carrying conductor lying in a magnetic field experience a force. The direction of such force developed is given by Fleming's left hand rule, Hold thumb, for finger and middle finger of the left hand at right angle to one another. If fore finger indicates the direction of flux and middle finger indicates the direction of current, then the thumb gives the direction of force developed on the conductor. This will be clearly seen in the illustration.

Rheostat Control Method is used, when speed is below no-load speed are required as the supply voltage is normally constant, the voltage across the armature is varied by inserting variable rheostat or resistant in series with the armature circuit. As control resistant is increased, Voltage across the armature decrease, thereby decreasing the armature speed.

A effective belt drive transmission is adapted, the motor output Pulley is connected with belt to the pulley in rear wheel. The electric drive is transmitted with a magnetic

coupler at rear of vehicle. when the electric mode is chosen the magnetic coupler engages the rear wheel pulley to rear wheel.

5. Results and Discussions

From the tables, comparing both driving modes, the electric drive mode is much cost effective than conventional drive mode. In comparison from above tables for 40 km mode-1 consumes 1l gasoline and mode-2 requires 1hr charge. From cost wise consideration mode-2 electric drive is cost effective than conventional engine drive. By dual operation of both drives with 1l of gasoline and 1hr battery charge vehicle can run 80 km. Recharging of battery while vehicle running for 80 km that can be recharged by dynamo, that provides charge as added advantage for some more distances.

Table 1: Tabular Column for Running in Petrol.

PER ML	KMS
100	4
200	8
300	12
400	16
500	20
600	24
700	28
800	32
900	36
1000	40

Table 2: Tabular Column for Running in Battery.

Charge Per HRS	KMS
1	40
2	80

6. Conclusion

The electric drive mode gives out zero pollution, so dual operation usage of 80 km provides much lesser pollution compared to 80km running in conventional engine drive.

- An electric drive mode cost is lower, so overall view of dual power operation system makes more economy for users.
- Depends upon the driver usability, it can be automatically switch over the drive from convention to electric or electric to conventional easily and quickly. The electrical mode drive operation provides smoother transmission and also transmission efficiency has increased to 10 percent than the conventional drive transmission. Once transmission losses reduced it makes the electric drive more effective.
- This system can be easily accomplished with all existing vehicle and need not required more modification on existing system.
- In this research , found that the electric drive has certain advantages over conventional drive – followings are:

- Produce a high initial torque and provides quicker throttle response
- Less running cost due to low maintenance and long effective lifecycle operation.
- Highly reliable
- Finally in this research work, putting forward the combination of conventional and electric drive together in a vehicle as a driver choice and found difficulties like overall vehicle weight drive connection lines to drive wheels and complex linkages. This can be eliminated when the choice of material varies but it leads to more initial cost and made again as a drawback.

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