IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

CONVERSION OF IC ENGINE TO ELECTRIC VEHICLE WITH BATTERY SAFETY SYSTEM

BAIAJI.G[1], SAILESHWARAN.S[2], SATHISHKUMAR.R[3], SATHISHKUMAR.S[4], TAMILARASAN.P[5]
1 PROFESSOR 2,3,4,5 UG SCHOLAR
ELECTRICAL AND ELECTRONICS ENGINEERING
PAAVAI ENGINEERING COLLEGE, TAMILNADU, INDIA

ABSTRACT

The electric car plays a vital role in current technology due to its various features. There is a need for an effective transportation system, particularly four wheelers, due to overpopulation. The amount of fossil fuel being consumed to make petroleum products is rising. As a result, the price of petroleum items is steadily rising every day. Individuals frequently suffer as a result of the rising price of petroleum products. There are also new models of electric cars on the market that can run entirely on electricity stored in a battery, eliminating the need for fuel energy. As a result, lots of individuals are enthusiastically purchasing and using it. But, compared to a typical petrol car, an electric car is unable to travel farther, climb hills more easily, or run at its top speed. We presented a new electric car that addresses the flaw of existing cars in order to get over these issues with gasoline and electric cars. Both an internal combustion engine and an electric motor are used to power our car. The drives of internal combustion engines and electric motors operate independently of one another. The user has the option of selecting between the electric mode as the driving mode. The client can experience a dual mileage system with our car by using battery power. Our car has a regenerative braking mechanism installed, which results in a little amount of battery charging. Fast battery charging is not possible with electric cars, making it uncomfortable for the rider in an emergency. Yet, under our system, a user can work in fuel mode during an emergency, charge the battery during downtime, and then use. We provide a detachable electric fitting; client can use the same component for another model of petrol car. Also, we offer a battery overheating warning system and a theft alarm, which will undoubtedly help the user avoid fire. This car offers the rider excellent durability and high flexibility while requiring less maintenance. Our method will undoubtedly benefit the user with greater efficiency in the world we live in today, where there is a huge demand for gasoline.

Keywords: Battery, Petrol car, Electric Propulsion and Hybrid electric vehicle.

1. INTRODUCTION

The idea of employing electric power instead of fossil fuels as motive energy of vehicles is not new. Scientists and manufacturers have attempted to design an Electric Vehicle (EV) since long time ago. Robert Anderson had built the first electric carriage in 1839 and David Salomon developed an electric car using a light electric motor in 1870. Conventional electric vehicles have a central electric motor that actuates two or all four wheels of the vehicle. However, the in-wheel motor idea first introduced in 1884 by Wellington Adams who have built and attached an electric motor directly in the vehicle's wheel through complicated gearings. Since in an in-wheel motor EV individual control of each wheel is possible; better vehicle speed, torque and acceleration control can be achieved. Using in-wheel motor technology improves drive train efficiency, dynamic stability control and safety of electric vehicles. An electric car, battery electric car, or all-electric car is an automobile that is propelled by one or more electric motors, using only energy stored in batteries. Compared to internal combustion engine (ICE) vehicles, electric cars are quieter, have no exhaust emissions, and lower emissions overall.[1] In the United States and the European

Union, as of 2020, the total cost of ownership of recent electric vehicles is cheaper than that of equivalent ICE cars, due to lower fueling and maintenance costs. Charging an electric car can be done at a variety of charging stations; these charging stations can be installed in both houses and public areas. Conventional vehicles use fossil fuel and pollution due to combustion is a serious concern on the environment. The scope of Electric vehicles (EV) has been essential due to the adverse impact of fossil fuels on the environment. An electric vehicle does not use any fossil fuel for power generation and has zero emission Many initiatives have been taken to reduce air pollution using non-conventional energy sources. Electric vehicles use the electric battery and help to reduce pollution.

2. LITERATURE SURVEY

A. Nagasaka et.al -(1995) An effective comparison of the performances of the four main electric propulsion systems, namely the DC motor, the induction motor (IM), the permanent magnet synchronous motor, and the switched reluctance motor. The main conclusion drawn by the proposed comparative study is that it is the cage IM that better fulfils the major requirements of the HEV electric propulsion.

Nada et.al -OECD/IEA – (1993) The selection of the most appropriate electric- propulsion system for a parallel hybrid electric vehicle (HEV). This is based on an exhaustive review of the state of the art and on an effective comparison of the performances of the four main electric propulsion systems, namely the DC motor, the induction motor (IM), the permanent magnet synchronous motor, and the switched reluctance motor. The main conclusion drawn by the proposed comparative study is that it is the cage IM that better fulfils the major requirements of the HEV electric propulsion**.**

Mounir Zeraoulia et.al -(2006) The operation of PMBLDC motors requires rotor- position sensing for controlling the winding currents. the most appropriate electric- propulsion system for a parallel hybrid electric vehicle (HEV). Based on an exhaustive review of the state of the art and on an effective comparison of the performances of the four main electric propulsion systems, namely the DC motor, the induction motor (IM), the permanent magnet synchronous motor, and the switched reluctance motor.

Chau, K.T., et.al -(2008). Sensor less control would need estimation of rotor position from the voltage and current signals, which are easily sensed. With ever- increasing concerns on our environment, there is a fast-growing interest in electric vehicles (EVs) and hybrid EVs (HEVs) from automakers, governments, and customers. As electric drives are the core of both EVs and HEVs, it is a pressing need for researchers to develop advanced electric drive systems. An overview of permanent-magnet (PM) brushless (BL) drives for EVs and HEVs is presented, with emphasis on machine topologies, drive operations, and control strategies.

Singh, B., and Singh, et.al – (2009). Permanent magnet brushless DC (PMBLDC) motors are the latest choice of researchers due to their high efficiency, silent operation, compact size, high reliability, and low maintenance requirements. These motors are preferred for numerous applications; however, most of them require sensor less control of these motors. The operation of PMBLDC motors requires rotor-position sensing for controlling the winding currents. The sensor less control would need estimation of rotor position from the voltage and current signals, which are easily sensed. This presents state of the art PMBLDC motor drives with an emphasis on sensor less control of these motors.

K.T. and Jiang, J.Z- (2010) Due to growing concerns about environmental protection and energy conservation, the development of energy-efficient technologies for hybrid electric vehicles (HEVS) has taken on an accelerated pace. Electric machines and drives are one of the key energy efficient technologies for HEVS. In a conventional automotive electrical system, because most of the electric machines cannot offer high starting torque and wide speed range simultaneously, the starter motor and the generator have to be separately employed for engine cranking and battery charging, respectively.

Berthelot. E et.al-(2017) Author proposed the energy management of a fuel cell system coupled to a super capacitor energy storage system both in simulation and on a same-scale test bench. This system can be used to power an urban electric scooter. To obtain a low real-time hydrogen consumption, an online energy management strategy needs to be embedded. This paper assesses the best energy performance of two promising real-time energy management strategies for fuel cell electric vehicle applications: adaptive equivalent consumption minimization strategy and stochastic dynamic programming.

Kebriaei, M et.al-(2015) In this paper author proposed hybrid electrical vehicle (HEV) which attracted considerable attention because of the necessity of developing alternative methods to generate energy for vehicles due to limited fuel-based energy, global warming and exhaust emission limits in the last century. HEV incorporates internal composition engine, electric machines and power electronic equipment. In this paper, an overview of HEVs is presented. In fact, we aim to introduce the HEVs and present their history, advantages, disadvantages, classification, vehicle types, energy management strategies and some other related information. The methodology used in this paper is descriptive, library and analytical. The descriptive aspect of this paper is based on identification and definitions and its required materials and information have been complied using related scientific approach.

3. EXISTING SYSTEM OF HYBRID CAR

3.1 INTERNAL COMBUSTION ENGINE (ICE)

In an internal combustion engine, the expansion of the high-temperature and high-pressure gases produced by combustion applies direct force to some component of the engine. The force is applied typically to pistons, turbine blades, rotor, or a nozzle. This force moves the component over a distance, transforming chemical energy into useful work. The first commercially successful internal combustion engine was created by Étienne Lenoir around 1859.The first modem internal combustion engine was created in 1876 by Nicolaus Otto. The term internal combustion engine usually refers to an engine in which combustion is intermittent, such as the more familiar four-stroke and two stroke piston engines, along with variants, such as the six-stroke piston engine and the Wankel rotary engine. A second class of internal combustion engines use continuous combustion: gas turbines, jet engines and most rocket engines, each of which are internal combustion engines on the same principle as previously described. Firearms are also a form of internal combustion engine. In contrast, in external combustion engines, such as steam or Stirling engines, energy is delivered to a working fluid not consisting of, mixed with, or contaminated by combustion products. Working fluids can be air, hot water, pressurized water or even liquid sodium, heated in a boiler. ICEs are usually powered by energy-dense fuels such as gasoline or diesel fuel, liquids derived from fossil fuels.

3.2 BRUSHLESS DC MOTORS (BLDC)

This have been a much-focused area for numerous motor manufacturers as these motors are increasingly the preferred choice in many applications, especially in the field of motor control technology. BLDC motors are superior to brushed DC motors in many ways, such as ability to operate at high speeds, high efficiency, and better heat dissipation. They are an indispensable part of modern drive technology. With the development of sensor less technology besides digital control, these motors become so effective in terms of total system cost, size, and reliability. The force is applied typically to pistons, turbine blades, rotor, or a nozzle. This force moves the component over a distance, transforming chemical energy into useful work. The first commercially successful internal combustion engine was created by Étienne Lenoir around 1859.The first modem internal combustion engine was created in 1876 by Nikolaus Otto.

4. PROPOSED SYSTEM OF IC ENGINE TO ELECTRIC CAR

4.1 PERMANENT MAGNET BRUSHLESS DC MOTOR

The rotor of this motor is made of PM (most commonly NdFeB) the stator is provided an alternating current (AC) supply from a DC source through an inverter. As there are no windings in the rotor, there is no rotor copper loss, which makes it more efficient than induction motors. represents photograph of car IC engine. This motor is also lighter, smaller, better at dissipating heat (as it is generated in the stator), more reliable, has more torque density and specific power. But because of its restrained field weakening ability, the constant power range is quite short. The torque also decreases with increased speed because of back EMF generated in the stator windings. The use of PM increases the cost as well. However, enhancement of speed range and better overall efficiency is possible with additional field windings. Such arrangements are often dubbed PM hybrid motors because of the presence of both PM and field windings. But such arrangements too are restrained by complexity of structure; the speed ratio is not enough to meet the needs of EV use, specifically in off-roaders. Controlling the conduction angle of the power converter can improve the efficiency of PMBLDCs as well as speed range, reaching as high as four times the base speed, though the efficiency may decrease at very high-speed resulting from demagnetization of PM. Other than the PM hybrid configurations, PMBLDCs can be buried magnet mounted-which can provide more air gap flux density, or surface magnet mounted-which require less amount of magnet. The figure 3.2 shows the schematic view of PMBLDC motor.

5. PERFORMANCE ANALYSIS AND HARDWARE DETAILES

State variable model is mathematical model which created from analysis of PMBLDC motor characteristic. From the state variable, the mathematical model is converted by using into discrete time form where trapezoidal algorithm is used. The trapezoidal is the preferred algorithm because of its highest accuracy level and lowest simulation time. A combination of the forward and backward- Euler algorithms generates the trapezoidal algorithm. Trapezoidal algorithm is a technique usually used to evaluate differential of bounded functions. State variable model is also known as state-space model. Advantages of the state-space method over the existing methods are that no convergence, initialization, instability problems, and no restrictions such as the number and configuration of nonlinear elements. This model needs to be transformed to discrete time because differential equation in state-space can be solved easily. Developing the model of PMBLDC motor is to investigate torque Behaviour. When the input currents and motor flux linkages are perfect, no torque pulsations are produced in the motor. However, imperfections in the currents arise due to finite commutation time while imperfections in the flux linkage can arise due to the phase spread, finite slot numbers and manufacturing tolerances. Since both the magnet and the stainless-steel retaining sleeves of the PMBLDC motor have high resistivity, rotor induced currents can be neglected and no damper windings are modelled. Equivalent circuit diagram of PMBLDC motor. Because of the fact that the induced elves are non-sinusoidal in this motor, phase variables are chosen for the model development.

6. OPERATION OF THE SYSTEM

6.1 WORKING AND OPERATION OF THE ELECTRIC VEHICLE

Electric cars operate by using an electric motor powered by a rechargeable battery pack instead of an internal combustion engine that burns gasoline or diesel fuel. Here is an overview of the operation and working of an electric car: Power source: Electric cars are powered by a large battery pack made up of several smaller batteries. These batteries can be charged by plugging the car into a charging station or a standard electrical outlet. Electric motor: The electric motor is the main component that powers the car. It converts electrical energy from the battery pack into mechanical energy that drives the wheels. Controller: The controller manages the flow of electricity from the battery pack to the electric motor. It regulates the speed of the motor and monitors the temperature of the batteries to ensure they don't overheat. Regenerative braking: When the driver applies the brakes, the electric motor acts as a generator and converts the car's kinetic energy into electrical energy, which is stored in the battery pack. This process is called regenerative braking, and it helps to extend the car's range. Charging: Electric cars can be charged at home or at public charging stations. The time it takes to fully charge the battery pack depends on the charging rate and the size of the battery. Range: The range of an electric car depends on the size of the battery pack, the driving conditions, and the driving style. Most electric cars have a range of 100 to 300 miles on a single charge.

Overall, electric cars are more efficient and produce fewer emissions than gasoline-powered cars. They are also quieter and require less maintenance. However, the initial cost of an electric car can be higher than a gasoline-powered car, and finding charging stations can sometimes be a challenge.

6.2 REGENERATIVE BRAKING

Regenerative braking is a technology used in electric and hybrid cars to capture the energy that is normally lost during braking and use it to recharge the car's battery. When the driver applies the brakes, the electric motor acts as a generator and converts the car's kinetic energy into electrical energy, which is stored in the battery pack. Here's how regenerative braking works in an electric car:

When the driver presses the brake pedal, the brake system applies pressure to the wheels, causing them to slow down.

As the wheels slow down, the electric motor in the car is also slowed down.

The electric motor acts as a generator and converts the kinetic energy of the car into electrical energy.

The electrical energy is then fed back into the car's battery, which can then be used to power the car's electric motor.

The regenerative braking system can capture up to 70% of the energy that is normally lost during braking, which can significantly extend the car 's range and reduce the need for frequent recharging.

In addition to increasing the car's range, regenerative braking also helps to reduce wear and tear on the car's brake pads and rotors, which can save the owner money on maintenance costs over time.

Overall, regenerative braking is an important feature of electric cars that helps to increase their efficiency and reduce their environmental impact.

7. CONCLUSION

In this existing electric vehicle, there are many disadvantage. The hub motored electric vehicle does not provide more initial torque and then the vehicle will not provide more speed as given by the BLDC motor. By implementation of this project it reduces the cost of an electric vehicle and with these component the speed and range for the vehicle can be achieved. By this project idea we can save the energy used for recycling old vehicle frames and also we can protect the environment by reducing the usage of petrol.

8. REFERENCES

[1] A. Nagasaka, M. Nada, H. Hamada, S. Hiramatsu, Y. Kikuchi, and H. Kato, "Development of the Hybrid/Battery ECU for the Toyota Hybrid System", Technology for Electric and Hybrid Vehicles, SP-1331, Society of Automotive Engineers, Inc., U. S. A., 1998, pp. 19-27.

[2] Electric Vehicle: Technology, Performance and Potential, International Energy Agency, OECD/IEA, 1993, Paris.

[3] Mounir Zeraoulia, Mohamed El Hachemi Benbouzid, and Demba Diallo, "Electric Motor Drive Selection Issues for HEV Propulsion Systems: A Comparative Study", IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 55, NO. 6, NOVEMBER 2006, pp. 1756-1764.

[4] Chau, K.T., Chan, C.C. and Liu, C., 2008. Overview of permanent magnet brushless drives for electric and hybrid electric vehicles. IEEE Transactions on industrial electronics,55(6), pp.2246-2257.

[5] Singh, B. and Singh, S., 2009. State of the art on permanent magnet brushless DC motor drives. journal of power electronics, 9(1), pp.1-17.

[6] Liu, C., Chau, K.T. and Jiang, J.Z., 2010. A permanent-magnet hybrid brushless integrated starter-generator for hybrid electric vehicles. IEEE Transactions on Industrial Electronics, 57(12), pp.4055-4064

[7] Jiang, Q., Bethoux, O., Ossart, F., Berthelot, E. and Marchand, C., 2017 December. A-ECMS and SDP energy management algorithms applied to a fuel cell electric scooter. In 2017 IEEE Vehicle Power and Propulsion Conference (VPPC) (pp. 1-5). IEEE.

[8] Kebriaei, M., Niasar, A.H. and Asaei, B., 2015, October. Hybrid electric vehicles: An overview. In 2015 International Conference on Connected Vehicles and Expo (ICCVE) (pp. 299-305). IEEE.

[9] Hicham, C., Nasri, A. and Kayisli, K., 2021. A Novel Method of Electric Scooter Torque Estimation Using the Space Vector Modulation Control. International Journal of Renewable Energy Development, 10(2).

[10] Di Giorgio, P., Di Ilio, G., Jannelli, E. and Conte, F.V., 2023. Numerical analysis of an energy storage system based on a metal hydride hydrogen tank and a lithium-ion battery pack for a plug-in fuel cell electric Vehicle. International Journal of Hydrogen Energy, 48(9), pp.3552-3565.