International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 11 | November - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Design And Development Controller and Converter for Electric Vehicle

Nikhil B. Kolhatkar [1], Abhishek D. Dakawale [2], Yash U. Yadav [3], Prof. T.V.Deokar [4]
[1,2,3] BE Student, [4] Professor
[1,2,3,4] Department Of Electrical Engineering
[1,2,3,4] S.B. Patil Collage Of Engineering, Indapur, Maharashtra, India

---

Abstract –

In this paper, we designing and developing controller and converter for the electric vehicles. In the electric vehicle battery is used as the energy source, by using of this battery operating electric motor. If we connect this battery direct to motor without any control device then it causes some unwanted problems in EV's. Because of the output voltage of battery is not suitable to operating Electric vehicles. Which means without any control mechanism the output voltage cannot be controlled and it will give divergence in output voltage in terms of error signal. Its result battery output power will reduce and therefore the performance of electric vehicle is go down in terms of power torque to drive vehicle. So in electric vehicle use of control mechanism is mandatory to control the output voltage of battery and that can achieve proper power and torque by a proper feedback control system. But price of the EV's are to much high higher the electric vehicle because of battery, motor and EV Controller.

Keywords: Battery, motor, microcontroller.

1.INTRODUCTION

Transportation is very important in for the development of a country. it enables the movement of people, goods and services. Which helps to growth of various sectors of economy. Road transportation is primary mode of transportation it consumes 88% sector of total transportation. To that transportation IC engine vehicles are used. Controller is used in EV's to control various actions of motor. A controller is a device that controls the speed, torque, direction, and power of an electric motor that drives an EV. It also enables the regenerative braking, which recovers some of the energy lost during braking. converter is also important part of EV it decrees or increase the voltage level according to required voltage rating. In EV different component are used which operate at low voltage rating and battery output voltage is high it will possible to damage components. therefore converter is used in EV's.

But the cost of EV's is higher than IC engine vehicles because of cost of battery, motor and controller. In this paper we are representing the design and the development of EV controller and controller at cheaper cost and low weight.

ELECTRICAL VAHICLE

Electric vehicles are classified in to four main types:

Electric vehicles are classified based on the type of power source they use and the degree of electrification they have. There are four main types of electric vehicles:
- Battery electric vehicles (BEVs): These are fully powered by electricity and have no internal combustion engine or fuel tank. They rely on a large battery pack that can be charged by plugging into an external source of electricity
- Plug-in hybrid electric vehicles (PHEVs): These use both an internal combustion engine and a battery-powered electric motor. The battery can be charged by plugging into an external source of electricity or by the engine. PHEVs can switch between electric and hybrid modes depending on the driving conditions.
- Hybrid electric vehicles (HEVs): These also use both an internal combustion engine and a battery-powered electric motor, but the battery cannot be charged externally. The engine is used to drive the vehicle and to charge the battery when it is low HEVs are more efficient than conventional vehicles, but less efficient than PHEVs or BEVs.
- Fuel cell electric vehicles (FCEVs): These use a fuel cell to generate electricity from hydrogen and oxygen. The only emission from FCEVs is water vapor. FCEVs have a high driving range and can be refueled quickly, but they are expensive and require a hydrogen infrastructure.

2. LITERATURE REVIEW

Paper 1: "A Study on Recent DC-DC Converters" **Sidharth Sabyasachi, Mousumi Biswal's.**

This paper presents a study on recent developments in dc-dc converters. All the converters are derived based on the two basic converters such as buck converter and boost converter. The aims of developing the converters are high efficiency and high gain with fast response. Research work has been grown dramatically to provide the service to the mankind.

Paper 2 : "Methods of Fast Analysis of DC–DC"- **Górecki, P.; Górecki, K.**

The paper discusses the methods of fast analysis of DC–DC converters dedicated to computer programs. Literature methods of such an analysis are presented, which enable

deter-mination of the characteristics of the considered converters in the steady state and in the transient states.

Paper 3 : "DC-DC Converters for Electric Vehicles"- **Joeri Van Mierlo ,Monzer Al Sakka,Hamid Gualous.**

DC-DC converters can be used to interface the elements in the electric power train by boosting or chopping the voltage levels Thus, in this chapter, a comparative study on three DC/DC converters topologies (Conventional step-up dc-dc converter, interleaved 4-channels step-up dc-dc converter with independent inductors and Full-Bridge step-up dc-dc converter) is carried out. The modeling and the control of each topology are presented.

Paper 4 : "Controller Design for Electric Motor Derived Vehicle"- **Degu Mena ,Nitin Kumar Saxena *.**

In this paper, proportional and integral based controller is designed for controlling the output voltage of battery. A PI based controller is designed and implemented for this electric motor derived vehicle in the present paper. Paper demonstrates how the results improve in presence of controller circuit for this electric motor derived vehicle.

MOTOR CONTROLLER

In most of EV's BLDC motor is used a BLDC motor controller is a device that controls the speed and direction of a BLDC motor. A BLDC motor is a type of electric motor that does not have any brushes or commutators to transfer electricity to the spinning part. Instead, it uses magnets and coils to create motion.

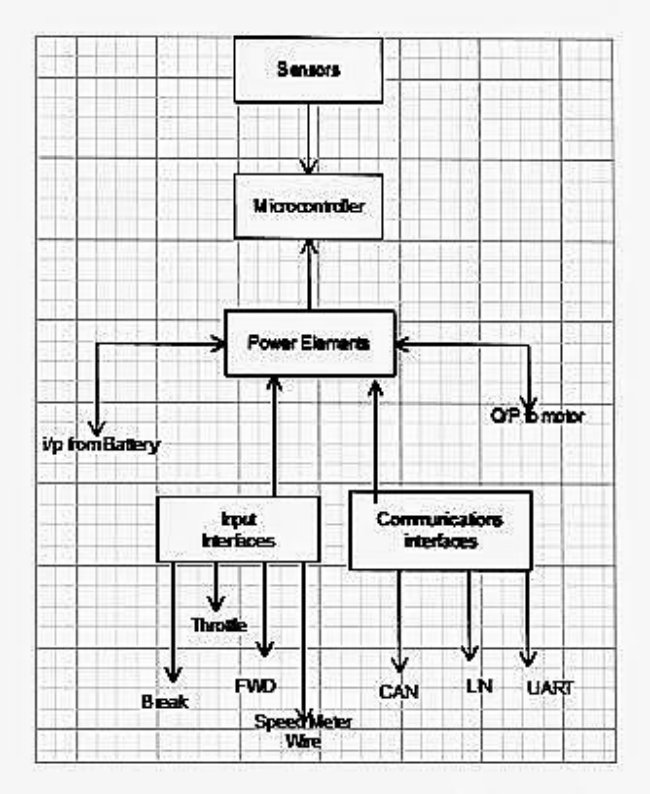
The BLDC motor controller switches the electricity on and off in the windings in a specific sequence. This sequence makes the magnetic field of the stator change its direction and strength. The changing magnetic field attracts and repels the magnets on the rotor, making it spin. The controller can also adjust the amount of electricity in the windings to change the speed and torque of the motor.

The BLDC motor controller has some advantages over a brushed DC motor controller. It is more efficient, reliable, and durable because it does not have any mechanical parts that wear out sparks.It also produce less noise and heat .

3. LIMITAIONS OF EXISTING SYSTEM

It can cause low-speed vibration. It can be complex, as it involves wiring and programming of the controller and the feedback loop. It can have limited speed range. They have power losses and heat generation due to the resistance and switching of the components. They have limitations in terms of the input and output voltage range, current rating, switching frequency, and isolation

BLOCK DIAGRAM OF CONTROLLER :



BLDC MOTOR CONTROLLER FEATURES –

Speed Control: This is the ability to control the speed of the motor by changing the voltage or current applied to the motor. The higher the voltage or current, the faster the motor spins. A common method to control the speed is by using pulse width modulation.

- Direction Control: This is the ability to control the direction of rotation of the motor by changing the sequence of switching the windings. The windings are the coils of wire that create a magnetic field when electricity flows through them. The magnetic field interacts with the permanent magnets on the rotor, which is the spinning part of the motor. By changing the order of switching the windings, the direction of the magnetic field can be reversed, which makes the rotor spin in the opposite direction.

- Torque Control: This is the ability to control the torque of the motor by changing the current in the windings. The torque is the force that causes the motor to rotate. The higher the current, the stronger the magnetic field, and the higher the torque. A torque controller can use a current sensor to measure the actual current and compare it with the desired current.

- PWM Control: This is the ability to control the PWM duty cycle of the motor. The PWM duty cycle is the ratio of the on time to the total period of the PWM signal. The PWM signal is a square wave that switches between high and low voltage levels. The PWM duty cycle determines the average voltage

applied to the motor, which affects the speed and torque of the motor.

- Regenerative Braking: This is the ability to recover the kinetic energy of the motor when it is slowing down or stopping. The kinetic energy is the energy of motion. When the motor is braking, the rotor acts as a generator and produces electricity. This electricity can be stored in a battery or a capacitor for later use. This can reduce the energy consumption and increase the efficiency of the motor.

- Communication Interfaces: These are the ways to communicate with the motor controller and send or receive data. The data can include the input commands, the feedback signals, the status information, the error codes, and the configuration parameters. The communication interfaces can use different protocols and standards, such as serial, parallel, analog, digital, wired, wireless, CAN, UART, SPI, I2C, etc. The communication interfaces can allow the user to monitor, control, and troubleshoot the motor controller.

4.CONCLUSION

In conclusion, The designing and development of EV controller and converter for electric vehicles is a challenging task that require the information about various component. The EV controller is responsible for controlling the speed, torque, direction, and power of the electric motor. It also support various modes of operations.

5. REFERENCES

[1] **Sidharth Sabyasachi, Mousumi Biswal's** described in "A Study on Recent DC-DC Converters" International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2, Issue 6, November-December 2012, pp.657- 663

[2] **Górecki, P.; Górecki, K.** described in "Methods of Fast Analysis of DC–DC" Converters—A Review. Electronics 2021, 10,2920.

[3] **Joeri Van Mierlo ,Monzer Al Sakka,Hamid Gualous** described in "DC-DC Converters for Electric Vehicles" September 2011.

[4]**Degu Mena ,Nitin Kumar Saxena** described in "Controller Design for Electric Motor Derived Vehicle " Indonesian Journal of Electrical Engineering and Informatics (IJEEI) Vol. 6, No. 2, June 2018, pp. 125~131 ISSN: 2089-3272, DOI: 10.11591/ijeei.v6i2.282 08 November 2021.