© 2016 IJSRSET | Volume 2 | Issue 2 | Print ISSN : 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

Design of Directional Converter for Electric Vehicles using Microcontroller

Balamurugan. M, Parthiban. T, Chandrakumar. S, Ganeshakumar. A

Excel College of Engineering and Technology, Namakkal, Tamilnadu, India

ABSTRACT

This project presents the Bidirectional converter and the Atmega8 microcontroller connection for electric vehicles (EVs) applications. Mainly this project is used to convert the regenerative energy under removing accelerator condition to electrical energy. An original method for the embedded energy management is proposed. This method is used to share the energetic request of the EV between the accelerator and the battery. The microcontroller is connected with bidirectional converter which provides automatic control for regenerative energy conversion from accelerator to the Battery. The PWM control technique is used to adjust duty cycle of converters. Bidirectional dc-dc converters (BDC) has recently received a lot of attention due to the increasing need to systems with the capability of bidirectional energy transfer between batteries and the motor in the electric vehicle.

Apart from traditional application, the new applications of converter include energy storage in renewable energy systems, fuel cell energy systems, hybrid electric vehicles (HEV) and uninterruptible power supplies (UPS).By using this project, we can convert regenerative energy into an electric energy and that is stored in the battery. Here, we use double carrier PWM technique for changing the duty cycle. Also it provides constant voltage transfer between motor and battery. It consists of solar panel which is connected to the DC power supply (Battery). Due to the voltage from solar panel it changes the duty cycle of bidirectional converter and the regenerative Energy conversion also gets change. Hence regenerative energy is converted as electric energy and it again stored in the battery.

Keywords: Electric Vehicle, BDC, HEV, ICE, PWM

I. INTRODUCTION

Electric vehicle (EV) referred to as an electric drive vehicle, uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery or generator to convert fuel to electricity. EVs include road and rail vehicles, surface and underwater vessels, electric aircraft and electrically powered space vehicles.

EVs first came into existence in the mid-19th century, when electricity was among the preferred methods for motor vehicle propulsion, providing a level of comfort and ease of operation that could not be achieved by the gasoline cars of the time. The internal combustion engine (ICE) has been the dominant propulsion method for motor vehicles for almost 100 years, but electric power has remained commonplace in other vehicle types, such as trains and smaller vehicles of all types.

A. Properties of Electric Vehicle

Components

The type of battery, the type of traction motor and the motor controller design vary according to the size, power and proposed application, which can be as small as a motorized shopping cart or wheelchair, through peddles, electric motorcycles and scooters, neighborhood electric vehicles, industrial fork-lift trucks and including many hybrid vehicles.

Energy Sources

Although EVs have few direct emissions, all rely on energy created through electricity generation, and will usually emit pollution and generate waste, unless it is generated by renewable source power plants. Since EVs use whatever electricity is delivered by their electrical utility/grid operator, EVs can be made more or less efficient, polluting and expensive to run, by modifying the electrical generating stations. This would be done by an electrical utility under a government energy policy, in a timescale negotiated between utilities and government.

II. METHODS AND MATERIAL

A. Merits

- Cost of fuel is at an all-time record high and still increasing. An electric car is far cheaper to run costing only a few pence per mile.
- No London Congestion charge.
- No road Tax, although you still require a tax disc.
- Government incentives are available both in the UK and US.
- No pollution from the car, and although some CO2 will be produced from the electric required this is still much lower than the amount of CO2 produced by using a car. It is possible to use renewable power or a green energy supplier for your electric.
- For each litre of fuel used in a car engine, produces more than 2.5kg of CO2. Cheap car insurance, some cars are group 1.
- Help to reduce noise pollution as they are much quieter.

B. Block Diagram

- **Dc to Dc Converter**

A DC-to-DC converter is an electronic circuit which converts a source of direct current (DC) from one voltage level to another. It is a class of power converter. Buck-Boost converter is used in this project for increasing and decreasing the voltage level according to the need.

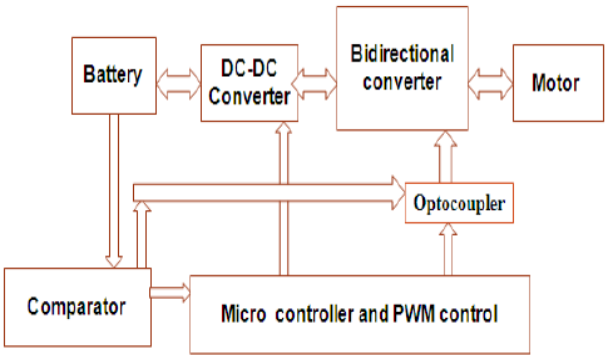

Figure 1 : Block diagram

- **Usage**

DC to DC converters are important in portable electronic devices such as cellular phones and laptop computers, which are supplied with power from batteries primarily. Switched DC to DC converters offer a method to increase voltage from a partially lowered battery voltage thereby saving space instead of using multiple batteries to accomplish the same thing. The converter will act as buck converter when then voltage across it is more than the limit and will act as boost converter when the voltage level across it is lower than the limit. So it can be used to charge the battery without damaging it.

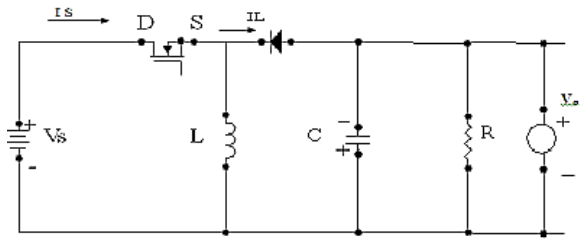

Figure 2 : Buck Boost Converter

C. Conversion Methods

i. Electronic (Linear)

Linear regulators can only give output at lower voltages from the input. They are very inefficient when the voltage drop is large and the current is high as they dissipate heat equal to the product of the output current and the voltage drop; consequently they are not normally used for large-drop high-current applications. They are practical if the current is low, the power dissipated being small, although it may still be a large fraction of the total power consumed. They are often used as part of a simple regulated power supply for higher currents: a

transformer generates a voltage which, when rectified, is a little higher than that needed to bias the linear regulator. The linear regulator drops the excess voltage, reducing hum-generating ripple current and providing a constant output voltage independent of normal fluctuations of the unregulated input voltage from the transformer / bridge rectifier circuit and of the load current.

ii. Switched-Mode Conversion

Electronic switch-mode DC to DC converters convert one DC voltage level to another, by storing the input energy temporarily and then releasing that energy to the output at a different voltage. The storage may be in either magnetic field storage components (inductors, transformers) or electric field storage components (capacitors). This conversion method is more power efficient (often 75% to 98%) than linear voltage regulation (which dissipates unwanted power as heat). This efficiency is beneficial to increasing the running time of battery operated devices.

iii. Inverter

An inverter is an electrical device that converts direct current (DC) to alternating current (AC); the converted AC can be at any required voltage and frequency with the use of appropriate transformers, switching, and control circuits. Solid-state inverters have no moving parts and are used in a wide range of applications, from small switching power supplies in computers, to large electric utility high-voltage direct current applications that transport bulk power. Inverters are commonly used to supply AC power from DC sources such as solar panels or batteries. The inverter performs the opposite function of a rectifier.

iv. Waveform

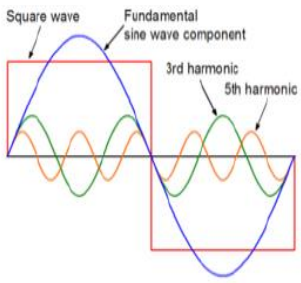

Figure 3: wave form

III. RESULTS AND DISCUSSION

Hardware Description:

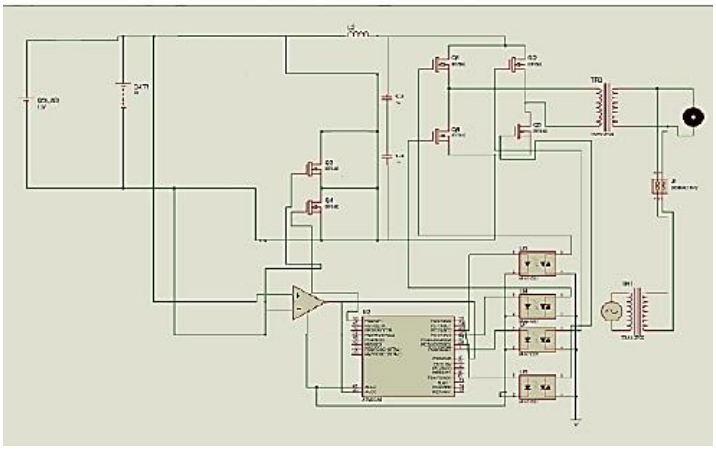

Figure 4. Circuit diagram

When apply the accelerator normal working the current flow from battery to motor of the electric vehicle. Initially the dc voltage from the battery is fed to the DC to DC converter (chopper). Here the constant DC voltage is converted into a variable DC voltage. Then the DC voltage is passed to LC filter (inductive and capacitive filter). Few amount of DC voltage taken to work Atmega8 Microcontroller. From the LC filter the pure DC voltage is obtained by means of removing harmonics and interference. Since it is passed to the inverter circuit which converts DC voltage into the AC voltage. Subsequently this AC voltage is fed to motor and make it as rotate. Hence the voltage delivered from battery to vehicle motor.

By means of comparator circuit the voltage transaction in battery is obtained. The comparator circuit coupled with microcontroller. The microcontroller circuit is used to provide the automatic control as well as take account to PWM control. Through this PWM control the duty cycle of the bidirectional converter and inverter are changed. Meanwhile this microcontroller connected to optocoupler. Correspondingly optocoupler connected to bidirectional converter circuit. Optocoupler prevent high voltages from affecting the system receiving the signal.

IV. CONCLUSION

Novel bidirectional converter with Atmega8 microcontroller is applicable for mainly hybrid electric vehicle. In order to translate energy from battery source to motor belong the apply accelerator mode as well as translate energy from motor to battery at the accelerator releasing mode this project was designed. In a previous existing system never control voltage level. But this innovative bidirectional converter control voltage level using microcontroller. Besides solar panel also build with it on account of increase battery charge. As a result this bidirectional converter is supreme convenient scheme for electric vehicles.

In acceleration operation battery provide 12V electrical energy that is connected into a converter and that is fed to filter circuit from where it is boost upto 80-90V dc supply. And it is converted into ac voltage by the help of bidirectional converter. Finally a voltage of 200-220V is supplied to the ac motor.

V. REFERENCES

[1] A. Nagasaka, M. Nada, H. Hamada, S. Hiramatsu, Y. Kikuchi, Development Of The Hybrid/Battery Ecu For The Toyota Hybrid System,Jsae 98122, 1998.

[2] F. Z. Peng, A Generalized Multilevel Inverter Topology With Self Voltage Balancing,Ieee/Ias Annual Meeting, Oct. 8-12, Rome, Italy, 2000.

[3] G. A. Hubbard, Modeling And Control Of A Hybrid-Electric Vehicle,M. S. Thesis, Massachusetts Institute Of Technology, Cambridge, Ma, 1996.

[4] G. Sinha, And T. A. Lipo, A Four-Level Rectifier Inverter System For Drive Applications,Ieee Industry Applications Magazine, Jan.Feb. 1998, Pp. 66-74.

[5] H. Bode, Lead-Acid Batteries, R. J. Brodd And K. V. Kordesch, Translators, John Wiley & Sons, New York, 1977.

[6] J. S. Lai, F. Z. Peng, Multilevel Converters – A New Breed Of Power Converters,Ieee Transactions On Industry Applications, Vol. 32, No. 3, May 1996, Pp. 509-517.