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Bidirectional Dc - DC Convertor

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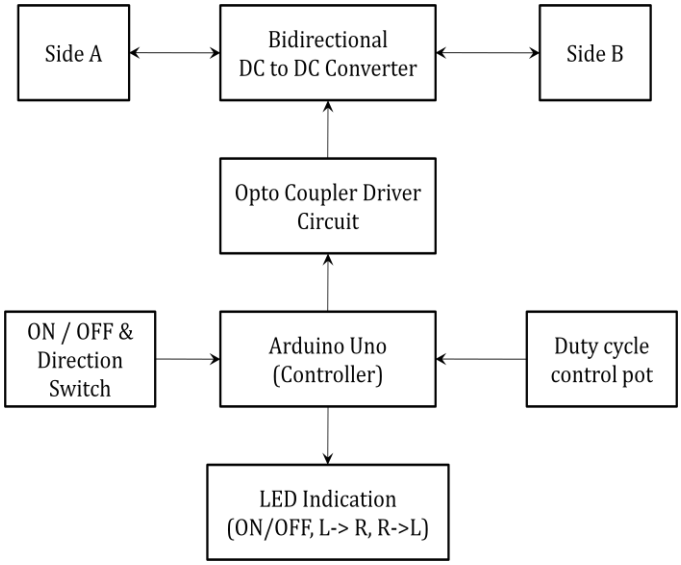
ABSTRACT :-

This paper presents a study on recent developments in dc to 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. Today's world demands the low power application devices which is the focus of the researchers. There are so many parameters are involved while developing those converters. A lot of computer software has been developed to design such type of converters. With the help of simulations, the behavior of the system can be easily analyzed without any hardware which can prevent the damage. Research work has been grown dramatically to provide the service to the mankind. This paper presents some new converters with suggested control method which can help the researchers to work in that field. MATLAB and PSIM software has been used for simulation.

Introduction:-

The world is now habituated with the electronics devices without which it is very difficult for the mankind to keep going. So it is very important to develop the devices error free and fast response with high efficiency. Of the research field is dc-dc converters. The dc-dc converters mean the input is dc and the output is also dc. The two basic dc-dc converters are buck converter and boost converter. Based on these two converters, all other converters are derived. The semiconductor devices are used as switching devices due to which the converters can operate at high frequencies. The different arrangement of inductors and capacitors in the converters operates as a filter circuit. The resistance act as a load in the circuit which can be varied to study the behavior during light load and heavy load. The different types of input dc sources are used like battery, renewable energy sources etc. The converter is operated at different frequency levels to improve the response of the converters. The various frequency ranges are shown in the daigram.This paper helps to known the various types of converters, design of converters, and analysis with the help of different software, various control methods to obtain the desired output and so on. This paper gives a brief idea about the starting from the design level to application level. Different types of converters, different operating regions, different application has been mentioned. The various approaches has been mentioned which can help for the researchers to work in that area. Some simulations have been presented with the help of PSIM and MATLAB which adds value to this work. The controller is the brain of the converter system which controls and stable during disturbances. The objective of this paper is to familiar the various process involved during design various kinds of convertors

Block Diagram.



Working:-

The bidirectional DC to DC Converter. In the system the current flow in directions between side A and B is controlled by the bidirectional DC to DC Converter. The MOSFET in this converter are driven by opto coupler. The PWM signal for driving the opto coupler circuit is obtained from Arduino Uno board. The direction of controller is decided by direction selection switch connected to the Arduino. For duty cycle control a pot is interfaced. The indication of converter working is presented through LED indicators. The system is designedas per specifications mentioned in table .

Bidirectional converter:-

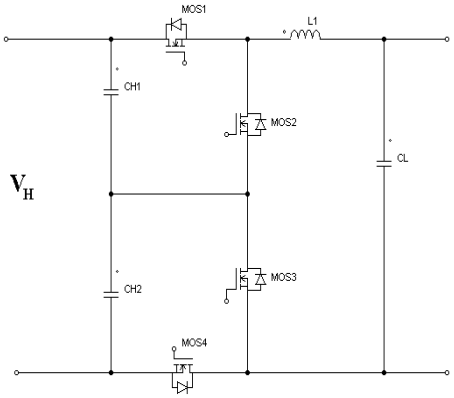
One such type of converter is bidirectional buck-boost converters. In this type of converters, one direction is used to step-up the voltage and another direction is used to step-down the voltage. It is like the charging and discharging of the converter.

Buck converter:-

A buck converter step down converter is a DC -DC power converter which step down voltage while drawing less average current from its input supply.

Boost convertor:-

The key principal that drives is the boost converter is the tendency of an inductor to resistor change in current by either increasing or decreasing the energy stored in the inductor magnetic field. In a boost converter, the output voltage is always high than input voltage.



Components:-

1. Converter:-

The controller selection is done on basis of following requirements

- Analog to digital converter input voltage sensing

- Serial communication interface for debugging.
- Digital input/ output ports for switch and LED interface
- PWM Pins for duty cycle control
- Considering the above requirements, Arduino Uno controller is selected for execution of project work. Following key features of Arduino Uno are used
- Micro-controller: At-mega 328
- Operating Voltage; 5V, as all the sensors used are operating at 5V level, they can be directly interfaced with Arduino
- Supply voltage: 7 _ 20V
- 14 digital I/O pins
- 6 Analog input pins
- 6 configurable PWM outputs; used for speed control of motor
- Serial, I2C communication support
- Software serial supported libraries
- Libraries for easy hardware interface
- 32KB programmable flash memory
- Clock speed: 16 MHz

2. MOSFET:-

For selection of MOSFET, the load (motor) power, voltage and current ratings are considered. The load voltage is 24V, power is 50W and maximum current is 2A. The MOSFET selected should have voltage rating at least three times the load voltage rating hence MOSFET voltage rating should be greater than 72V. The current rating of selected MOSFET should be greater than two times the rated load current. Hence MOSFET current should be greater than 4A, considering above stimulation MOSFET IRF250 is selected having following specifications.

3. Opto coupler:-

MOSFET is power electronic switching device operating at high voltage. The micro-controller gives control signal in form of PWM. The desired isolation and coupling between low voltage micro-controller and high voltage MOSFET is provided through PC817 based opto coupler driver circuit as mentioned in figure.

4. Switches, LED's and Pot

A Toggle Switch is an electromechanical switch which uses a lever or baton as an actuator. Toggle switches are available in many sizes and configurations and offer a wide range of uses. They are popular for their ease of operation and generally offer positions to open or close a circuit.A potentiometer is a simple mechanical device that provides a varying amount of resistance when its shaft is turned. The variable terminal of the pot gives out the variable analog output voltage. LED's can be considered as a simple digital output device. The LED is used as indicator to display the status of operation in digital form

5. Relay

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.A relay is used to provide interface between Arduino and solenoid lock. A 5V relay is selected for the interface

Conclusion:

Based on the data ontained from all the tests that have been done can be concluded the test results convertor in buckmode has been able to reduse the voltage from 14-20V dc to 13-14.1 V dc with duty cucle ranges from 18.1%- 24% in positive current flow , in boost mode convertor has been able to raise the vtg from 12Vdc to 14.3Vdc with duty cycle range 22.3% to 22.5%.

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