# A New Multioutput DC-DC Converter for Electric Vehicle Applications

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**Abstract - Electric cars (EVs) are gaining popularity due to their eco-friendly advantages and in enhancement in battery technology. To power the various electric system in an EV efficiently, multi output DC-DC converter plays an vital role. This article introduces the invention of a fresh multi output DC-DC converter exclusively tailored for EV usage. The suggested converter includes various output channels, each fine tuned for different voltage specifications needed by different parts like the propulsion motor, support systems and on board charging mechanism. By effectively controlling power distribution, the converter enhances the overall system efficiency and curtails energy wastage, thus expanding the driving range of the EV. Key design elements encompass high efficiency, small size and consistent performance under varying lor7r7uu77uuuad circumstances. The converter deploys sophisticated control algorithms to precisely output voltages and rapidly respond shifts in load requirements. Additionally, it incorporates features like soft-switching methods and optimization of passive components to minimize switching errors and enhances overall efficiency.**

**Keywords -- Internet of Things, Electric Vehicle, Eco-friendly, DC-DC converter, PIC controller.**

## I. INTRODUCTION

Power plays a crucial role in our daily lives, fuelling nearly every aspects of our contemporary world. The need of electricity is continuously on the rise due to technological progress and the growing population. Nevertheless, the generation of electricity using traditional methods like fossil fuels and nuclear power has notable environmental, economic and social conveniences. Global warming, air pollution and resources exhaustion are among the outcomes of depending on non-renewable energy sources. In recent times, there has been a shift towards exploring alternatives and sustainable approaches for producing electricity. Different renewable energy sources, including solar, wind and hydropower have been investigated and put into practice. However, there is still a necessity of further cutting-edge and effective solutions. This article introduces a newly designed multi output DC-DC converter tailored for EV applications, featuring advanced controlled algorithms, compact packages and high-efficiency power conversion techniques to meet the strict requirements of modern electric vehicles. Key design element encompass voltage regulations, thermal management and compatibility with various EV structures. The advancement of this DC-DC multi output converter marks a significant progress in EV power electronics technology, paving the way for more efficient and sustainable electric transportation solutions.

## II. LITERATURE SURVEY

This paper presents an comprehensive review of non-isolated Bi-directional DC+DC converters designed for PHEV charge station application at municipal parking desk. The review covers the various converter topologies, control strategies and performance metrics, highlighting their advantage and limitations in terms of their efficiency, power density, cost and grid integration capabilities(1). The integration of renewable energy source such as solar, wind power into modern system necessities efficiency energy conversion and management solutions. This paper proposes the utilization of three-level DC-DC converter as an efficient interface in two-stage integrated energy exchange (IEE) power system(2) The review covers the range of wide topologies including buck, boost, buck-boost and multi-level converter, discussing their advantages limitations and suitability for different high-power applications(3). The paper discusses the operating principles of ECCI and their advantage in terms of magnetic coupling, leakage inductance reduction and enhanced power density. Furthermore, the paper outlines the design consideration, control strategies and performance of high power DC-DC converter utilising ECCI, focusing on its suitability for its applications(4).

This paper presents a comprehensive characterization and Comparison of high blocking voltage insulated gate bipolar transistor (IGBT) and Inverted-Embedded Gate Transistor(IEGT) under both hard and soft switching conditions(5). This paper proposes a novel neutral-point-clamped(NPC) and pulse width modulation (PWM) inverter designed for high performance power conservation application . The proposed NPC PWM inverter offers several advantages over traditional NPC inverter, including reduced switching losses, improved harmonic performance and enhanced reliability (6). The results confirms the superior performance and efficiency of three level ZVS PWM converter compared to conventional converters positioning it as promising solutions for next generation power conversion system in renewable energy, electric vehicles and industrial applications (7). This paper introduces a novel neutral-point-clamped (NPC) a multi level a four quadrant dc-dc

converter controlled by integrated voltage control method. The proposed Converter architecture aims to address the challenge of high power DC-DC conversion providing the improved efficiency, reduced switches losses and enhanced control flexibility (8).

## III.PROPOSED SYSTEM

The proposed concept of a new multi output DC-DC converter for e-vehicles applications aims to address the increasing demand for effective power distribution for EVs. Unlike traditional output single-output converter, this innovative features like multi output channels optimized for various voltage level required by different components of vehicles. The key concept revolves around the idea of enhancing overall system efficiency and managing power distribution to different sub-systems of EVs.

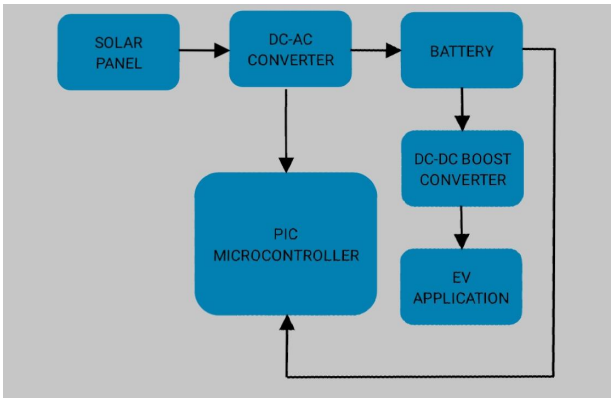


Figure 1. Block diagram of proposed work

By incorporating the multi output channels of converter can simultaneously supply power to traction motor, auxiliary systems and on-board charging systems, each operates on different voltage levels. The design focus on achieving the high efficiency, compact size and reliability under various load conditions. Advanced control algorithms are employed to regulate output voltage accurately and respond shiftily to change in load demand, ensuring optical performance across a range of operating conditions. Moreover the converter utilizes the soft switching techniques and passive components optimization to minimize the switching losses and maximize the efficiency.

## IV.HARDWARE SPECIFICATION

1. PIC Microcontroller:

PIC stands for "Peripheral Interface Controller." This system uses the "PIC16F877A" microcontroller, an integrated chip consisting of RAM, ROM, CPU, timers, counter, ADC, and DAC. It is an 8-bit microcontroller that was developed by "Microchip Technology." PIC is designed based on "Harvard Architecture" and "Reduced Instruction Set Computer (RISC)"

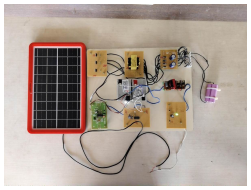

Figure 2. A new multi-output DC-DC converter for e-vehicle application Hardware kit.

architecture. It consists of 40 pins with 256 bytes of EEPROM memory. A PIC is a self-programming controller, and it requires a minimum operating voltage of 2V and a maximum operating voltage of 5.5V. It contains comparators and ADC channels. The memory capacity of RAM is 368 bytes. Compared to other microcontrollers like the 8051, this controller consumes less power, has a larger programming memory, and is easier to program. It easily allows users to interface with other external devices. PIC 16F877A supports "Inter-Integrated Circuit (I2C) Communication." This controller also supports Controller Area Network (CAN), Serial Peripheral Interface (SPI), and Universal Asynchronous Receiver Transmitter (UART) protocols.

2. Solar Panel:

The sun based boards are known as photo voltaic(PV) modules that change over daylight into power by utilising photovoltaic cells. These cells are ordinary made of semiconductor materials such as silicon, which retains protons from daylight and create an electric current through the photovoltaic effect.

3. Battery:

The lead-acid batteries are common type of rechargeable battery that can come under various configurations. They are frequently used in various operation like UPS, electric vehicles and solar power systems. Some rechargeable batteries use lithium-ion technology which is known for its high energy viscosity.

4.DC-DC boost converter:

A DC-DC boost converter, also known as step up converter, is a type of power electronic used to increase the output voltage level from a DC input voltage. The dc boost converter operating storage energy in an inductor during the on period of the switching cycle and then releasing this energy to the output during the OFF period. This process effectively boost the input voltage to a higher level at output.

## V. FUTURE SCOPE AND COMPARISON

The future scope of new multi output DC-DC converter for e vehicle application lies in its potential to revolutionize the efficiency, reliability and performance of (EV's). By providing the multiple output tailored to specific needs of various vehicle sub systems such as traction motor, on board electronics and auxiliary systems. The converter offers flexibility and optimization opportunities for EV power management. Additionally, the converter's compact size, light weight design and make it well suited for integration with next generation EV platforms and enabled increased efficiency, extended driving range and enhances overall driving performances. In comparison to traditional single output converters, the multi-output converters offers superiority and scalability, allowing for the efficient utilization of electrical energy and improved energy system-level performance in EV.

Figure 3. Voltage of multi-output DC-DC Converter.


## III. CONCLUSION AND FUTURE SCOPE

In conclusion, the development of new multi-output DC-DC converter for (EV) application represents a significant advancement in EV power electronics technology. This innovative converter design offers multiple output channel optimized for various voltage level required by different components within EV, including the traction motor, auxiliary motors and on-board charging systems.

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