

Abstract:

The High Gain DC-DC Converters are most trending power converters for the Photovoltaic (PV) Applications. The output voltage of Photovoltaic Panel is very low. The conventional Boost Converter is limited to gain 4. The High Gain DC-DC Converter will provide a large range of gain, so in order to step the voltage to higher voltage. The newly proposed quadratic interleaved Quadratic Converter will provide a gain of nearly 30 gain. This high gain converter is suitable for High voltage and less current applications. The efficiency of this converter is 90%.

Introduction:

Interleaved: "Interleaved" typically suggests a technique or method where multiple components or circuits work together in a coordinated manner to improve system performance. In this context, it might refer to multiple DC-DC converters are used together.

Quadratic: "Quadratic" often relates to mathematical or functional relationships involving squares or second-order terms.

High Gain: "High Gain" usually means achieving a significant increase in a desired parameter, such as voltage or current, which could be relevant in the context of DC-DC converters.

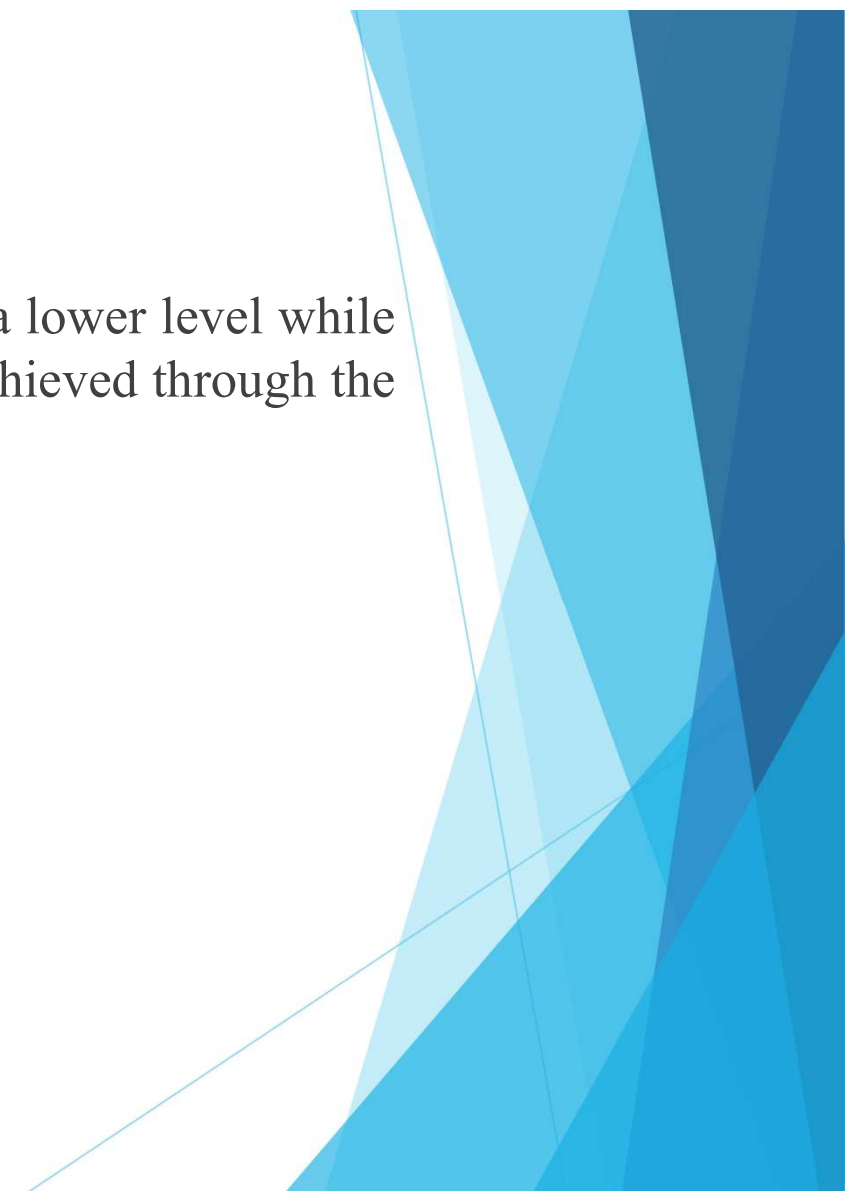
DC-DC Converter: A DC-DC converter is an electronic device that converts one voltage level of direct current (DC) to another. These converters are commonly used in various applications, including solar power systems, to match the voltage levels between different components.

Objectives:

- ▶ Improving power conversion efficiency.
- ▶ Minimizing voltage ripple, reducing electromagnetic interference (EMI).
- ▶ Simple circuit with less components.

Problem Focused:

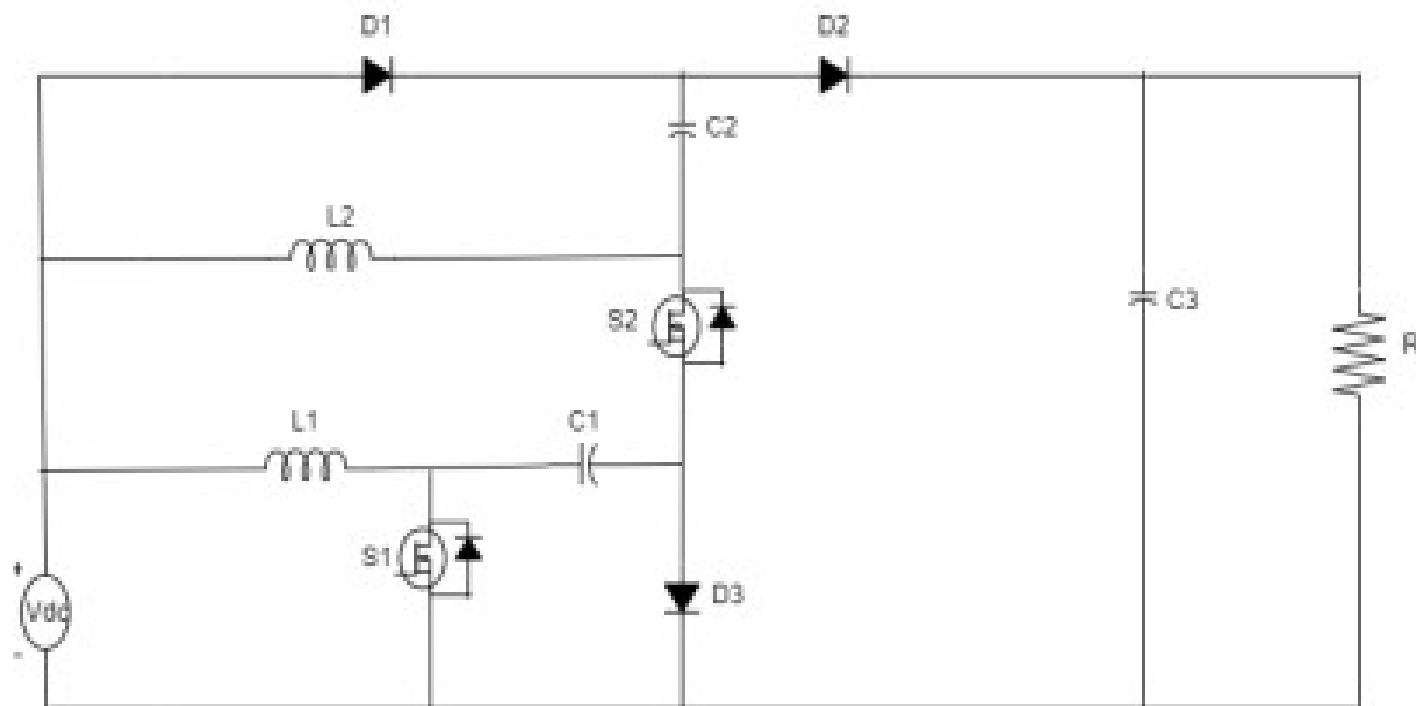
The primary objective is to elevate the voltage from a lower level while simultaneously enhancing the overall system gain, achieved through the utilization of a High Gain DC-DC Converter.



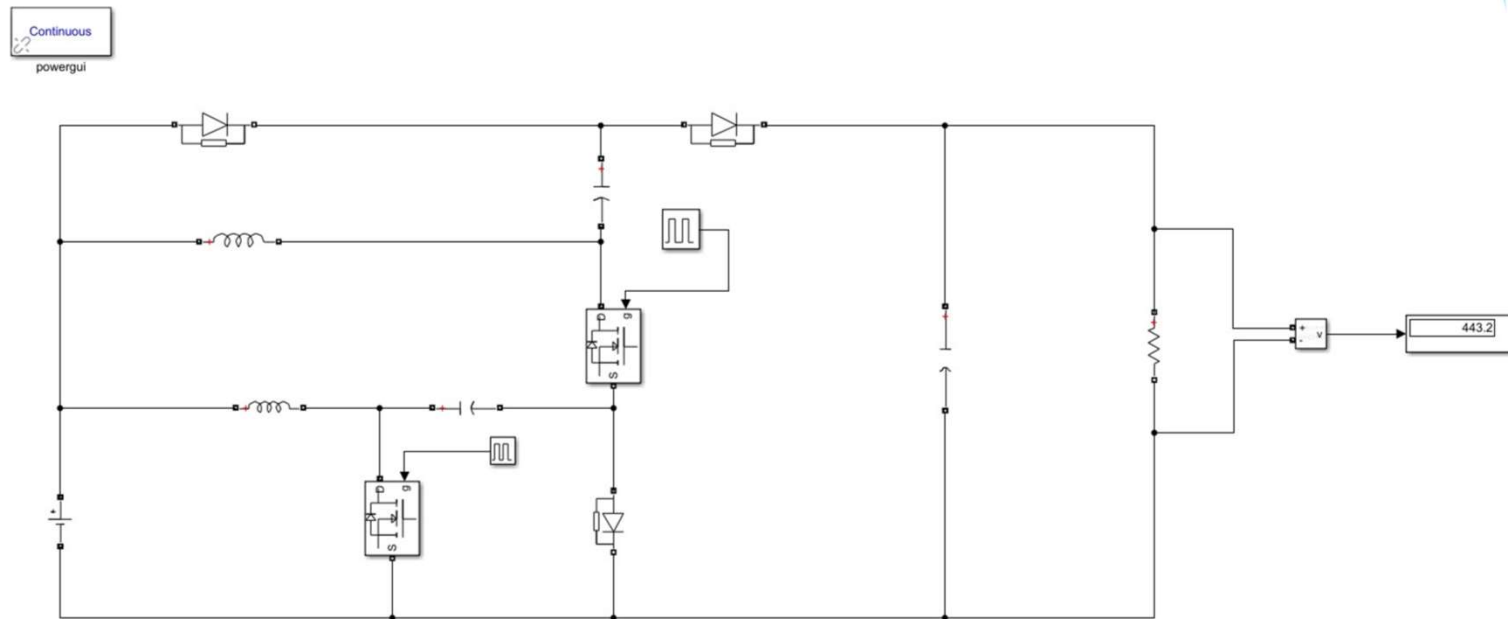
Problem Solution:

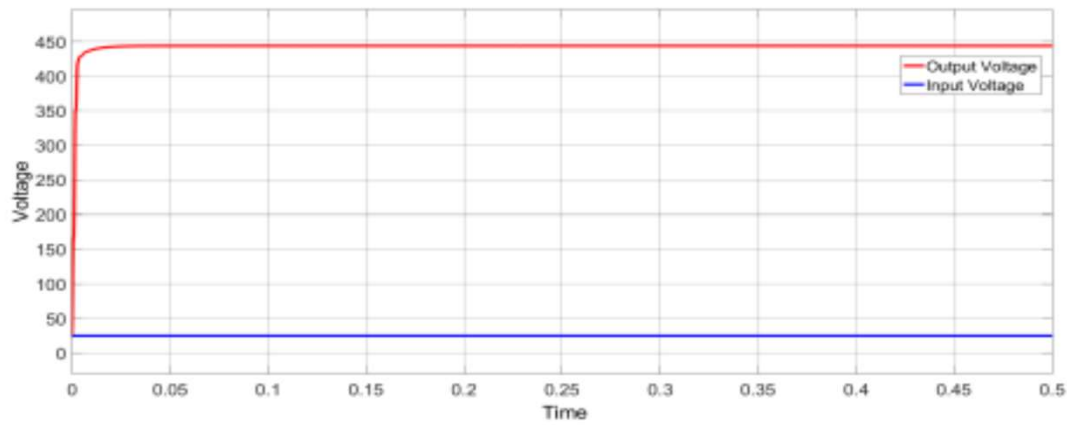
A voltage converter with an input of 4 volts and an output of 110 volts was designed. The converter's gain was increased to 30. This high voltage is contributed to grid.

Block diagram:

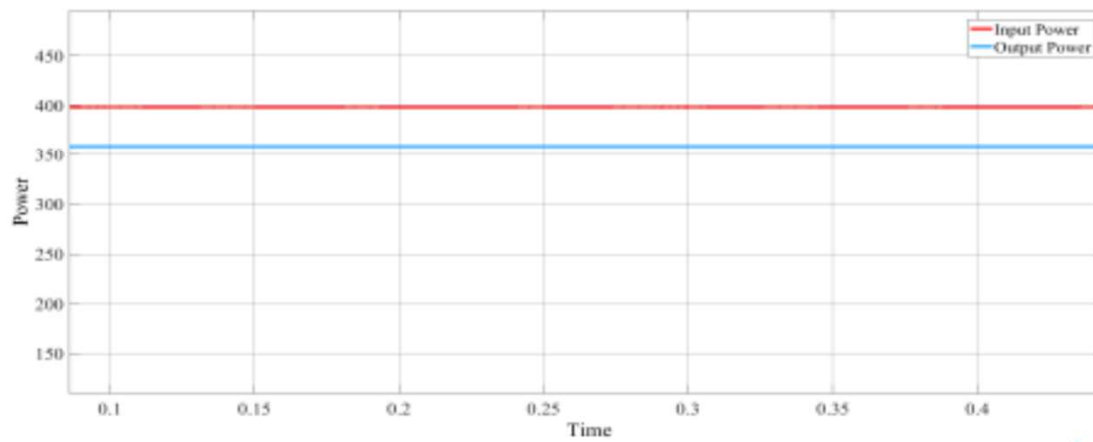


Simulation Diagram:





Input Voltage and Output Voltage



Input and Output power Gain

Hardware

Components:

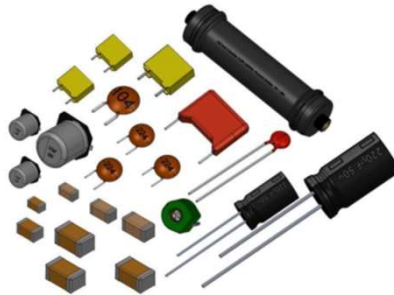
- ▶ **Battery:** Battery stores chemical energy, converts to electrical energy through chemical reactions, powering portable devices.



- ▶ **Inductor:** Inductor is a passive electronic component that stores energy in a magnetic field when an electric current flows through it. It typically consists of an insulated wire wound into a coil.



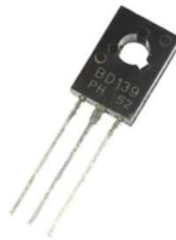
- ▶ **Capacitor:** Capacitor stores electrical energy in an electric field, opposes any change in voltage, used in filters, oscillators, and power supplies.



- ▶ **Diode :** Diode allows current to flow in one direction only, used in rectifiers, voltage regulators, and other electronic circuits.

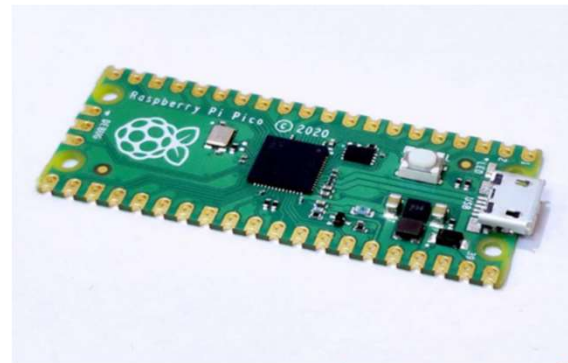


- **MOSFET Switch** : MOSFET switches control flow of current by applying voltage to gate terminal. Fast, efficient, and versatile devices used in a wide range of applications.

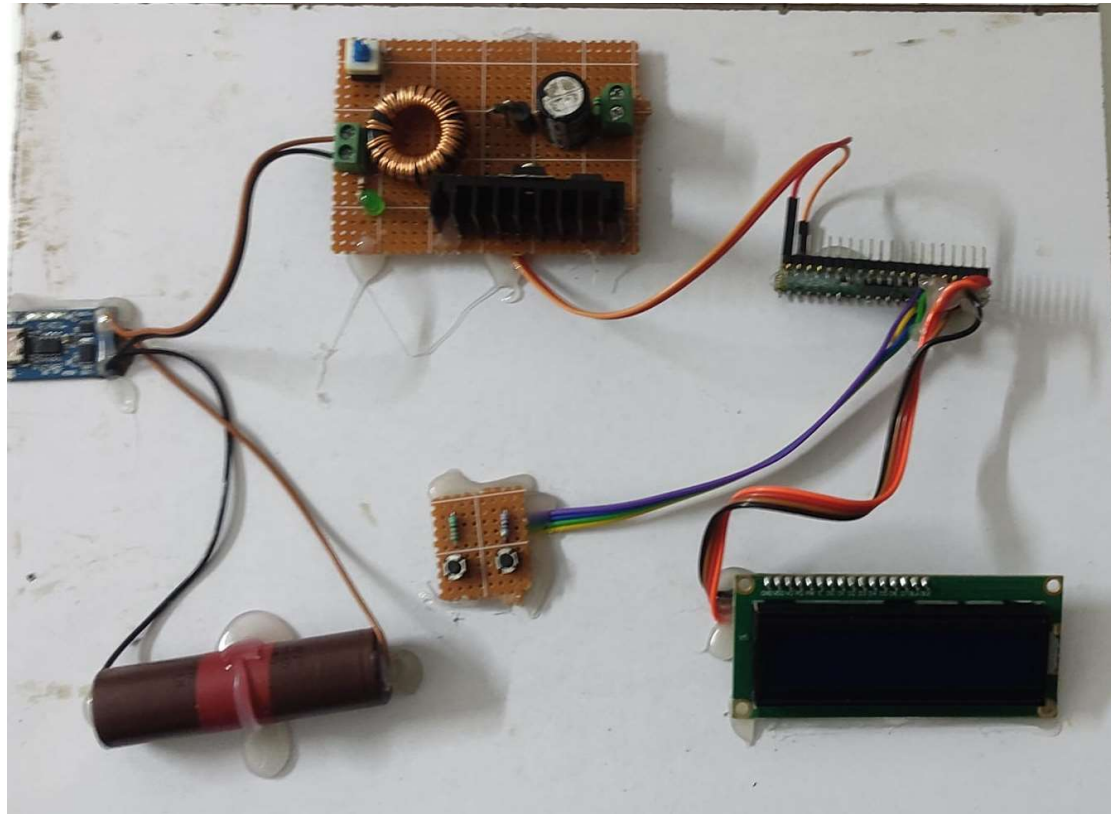


- **Raspberry Pi Pico:**

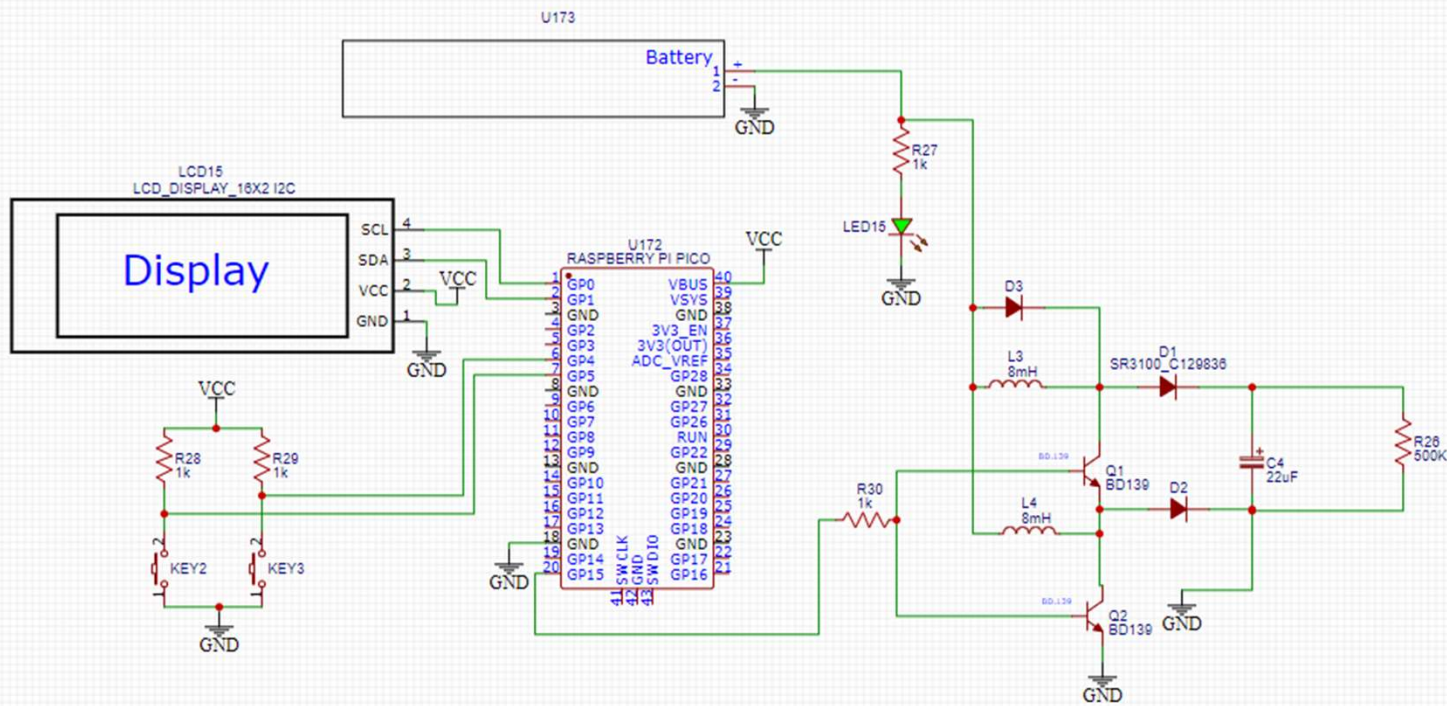
Raspberry Pi Pico is a low-cost microcontroller board with a dual-core ARM Cortex M0+ processor and 264kB of SRAM. It can be programmed in MicroPython or C/C++ and used to control electronic devices and sensors. Pico has 40 GPIO pins, 2 SPI buses, 2 I2C buses, 2 UARTs, 3 ADCs, and 16 PWM channels.



Hardware Circuit



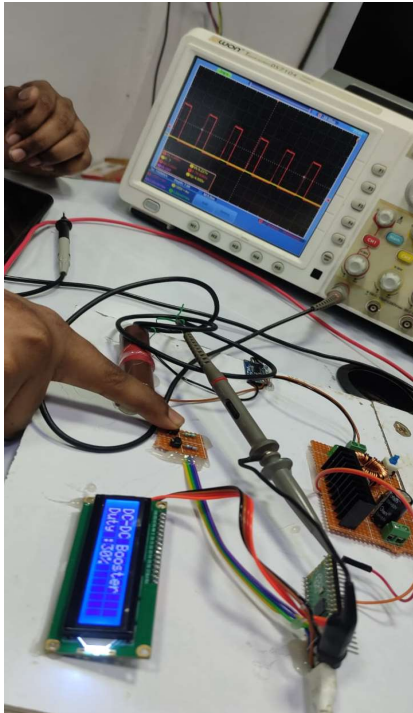
Schematic Diagram:



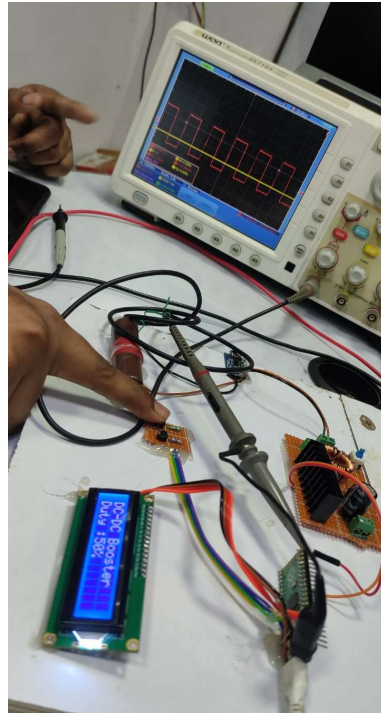
Result Table :

Input Voltage	Duty Ratio	Output Voltage
4V	10%	53.7
4V	20%	63.4
4V	30%	70.8
4V	40%	77.9
4V	50%	84.2
4V	60%	93.8
4V	70%	101.2
4V	80%	104.3
4V	90%	110

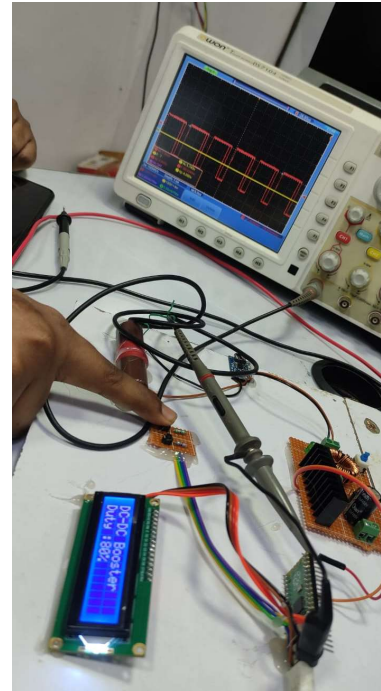
CRO Waveform:



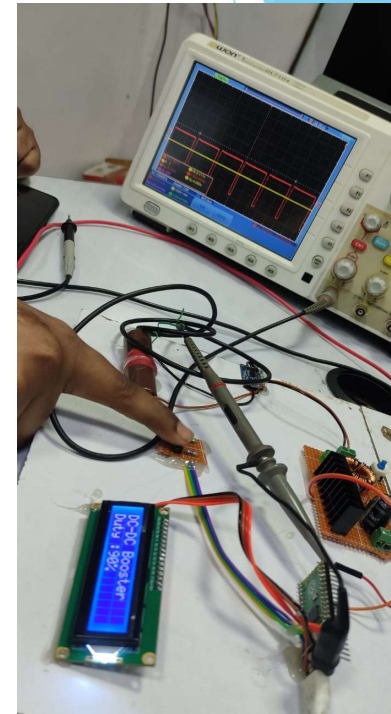
Duty cycle at 30%



Duty cycle at 50%



Duty cycle at 80%



Duty cycle at 90%

Advantages:

- The interleaved quadratic high gain DC-DC converter presents a promising solution for achieving high efficiency.
- High gain converter is suitable for High voltage and less current applications.
- Interleaved quadratic high gain DC-DC converters have a common ground between the input and output sides, which simplifies system design and reduces safety hazards.
- Boosting of high gain dc-dc conversion will be done.

Conclusion:

- ▶ For an input of 4 volts an output of 110 volts generated.
- ▶ The Gain of a Interleaved Quadratic Converter is increased to 30 gain.
- ▶ Efficiency of power conversion increased.

THANK YOU