This week, research and simulations have been made about boost converter design and analysis. Boost Converter is a switching power supply used to boost DC (Direct Current) voltage. It is generally used to step up a low DC voltage to a higher DC voltage. This is why the Boost Converter is widely used, especially in applications where a low voltage source is used, such as portable electronics.

For example, the power supply used to charge a mobile device usually includes a converter to convert AC voltage to DC voltage, and then the Boost Converter raises the voltage of the battery to a higher voltage level, providing the voltage needed to charge the mobile device. The Boost Converter can also be used in systems powered by a low voltage source such as solar or wind power.

According to the researches on the working mechanism of the boost converter, firstly the switching element (usually a MOSFET) is turned on and DC voltage is applied to the coil of the inductor. When the switching element is turned off, the induced voltage is transferred to the load side by means of the diode. As the magnetic field in the inductor begins to decrease, the induced voltage begins to decrease. The switching element is turned on again and the magnetic field is regenerated by applying a new voltage to the inductor. Due to the change of the magnetic field, the voltage in the inductor increases again and this is transferred to the load side via the diode.

After learning the working logic of the Boost Converter, a design was created and a simulation application was carried out. In this circuit, totem pole topology was preferred as the mosfet driver. Totem pole driver is a driver circuit used to enable high speed switching of transistors. It is often used in power conversion applications, especially high current and high voltage applications. The totem pole driver consists of two opposite transistors: NPN and PNP transistors. These two transistors work synchronously with each other during the switching process.

The totem pole driver is used to minimize the transition time between two switching operations. This is important in high frequency switching applications because the shorter the switching time, the higher the efficiency. Totem pole driver provides high efficiency by minimizing this transition time.

In this circuit, an RCD snubber structure has been added as a precaution against voltage fluctuations that may occur during switching. RCD snubber is a snubber circuit used to protect against high voltage transitions that may occur due to switching in boost converters or other switching power supplies. RCD is a combination called resistor-capacitor-diode (Resistor-Capacitor-Diode) and is used to reduce the high voltage fluctuations that occur during the switching of the switch. For this reason, it is aimed to prevent damage to the circuit by putting an RCD snubber on the circuit.

The time constant (Tr) of high voltage fluctuations occurring during the switching of the switch must be calculated. It depends on the characteristics of the switch and other components used. The capacitance (C) of the capacitor in the snubber circuit must be calculated. This depends on the time constant of the high voltage transition occurring during the switching of the switch.

The value of the resistance (R) in the snubber circuit must be calculated based on the capacitance of the capacitor and the time constant of the high voltage transition occurring during the switching of the switch. It is aimed to measure the current on the coil by adding a 0.1ohm resistor to the circuit. The 50 ohm resistance at the output is provided by connecting two 25W 100 ohm resistors in parallel to the output. While selecting the mosfet the drain source voltage and the mosfet rise time are taken into account.

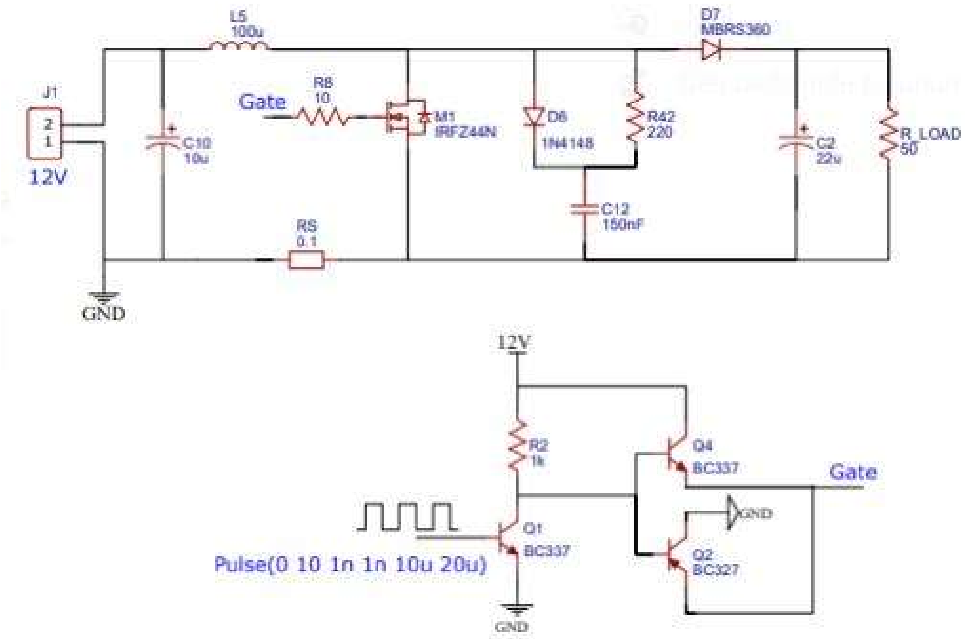

Figure-24: Boost Converter Driver Circuit with Totem Pole

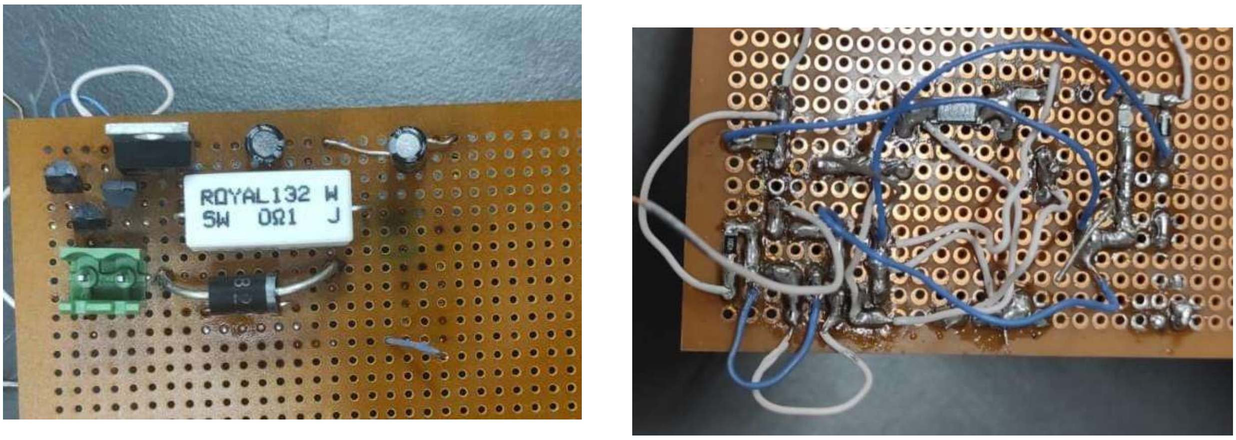

Figure-25: Installation of the Circuit on Pertinax

<table>
<tr><td rowspan="5">WEEKLY REPORT</td><td>Done Work Description</td><td>Week Number:</td><td>7</td><td>Page Number:</td><td>19</td></tr>
<tr><td rowspan="4">12-24V Boost Converter Design</td><td>Start Date</td><td colspan="3" rowspan="4">Workplace Officer Signature, Cachet</td></tr>
<tr><td>10.04.2023</td></tr>
<tr><td>End Date</td></tr>
<tr><td>14.04.2023</td></tr>
</table>

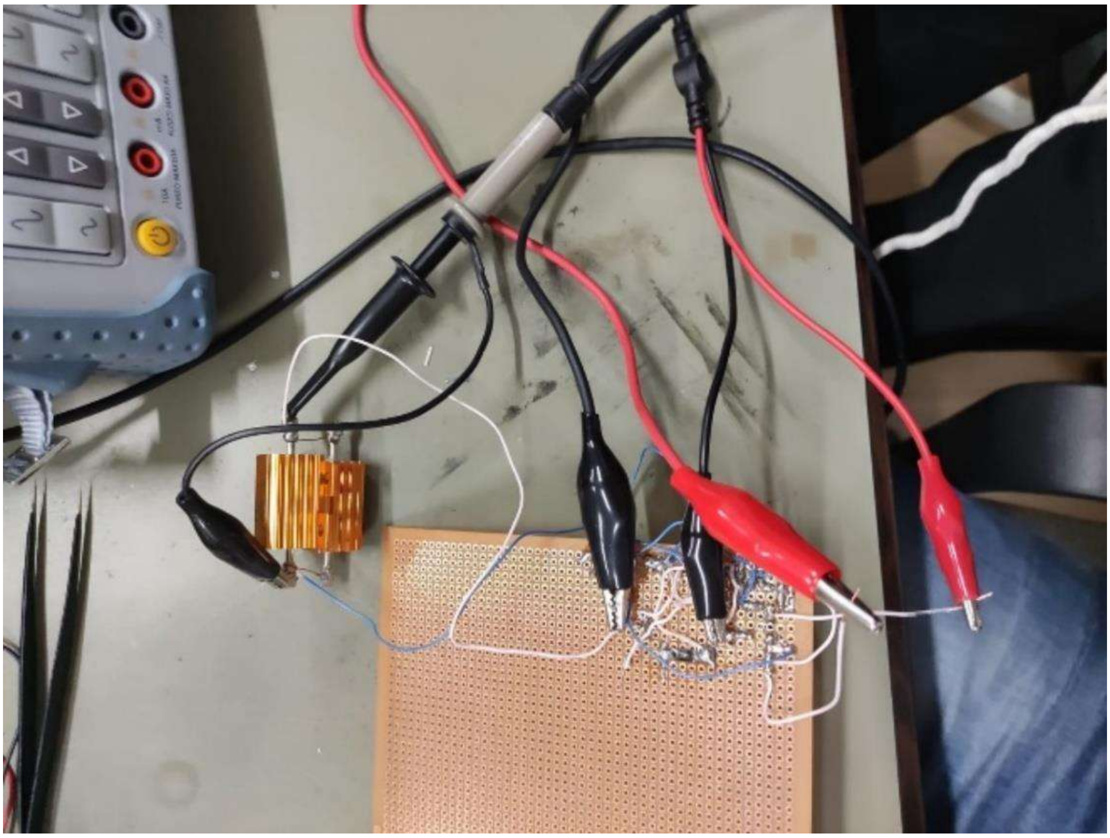

Figure-26: Taking Measurements

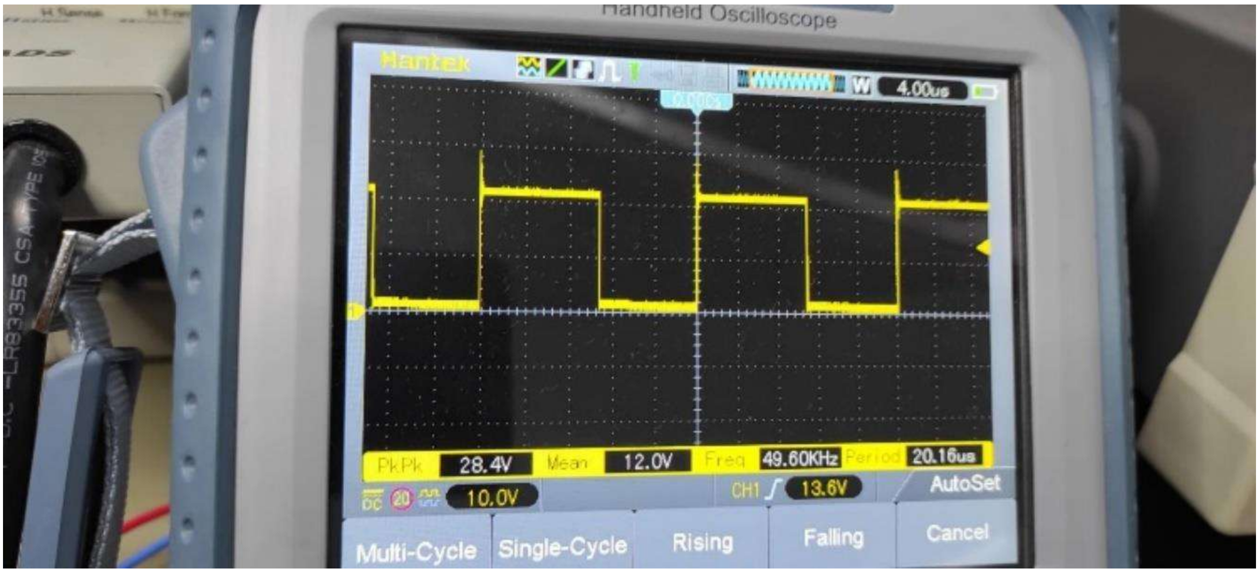

Figure-27: Gate – Source Signal

WEEKLY REPORT	Done Work Description	Week Number:	7	Page Number:	20
	12-24V Boost Converter Design	Start Date		Workplace Officer Signature, Cachet	
		10.04.2023			
		End Date			
		14.04.2023			

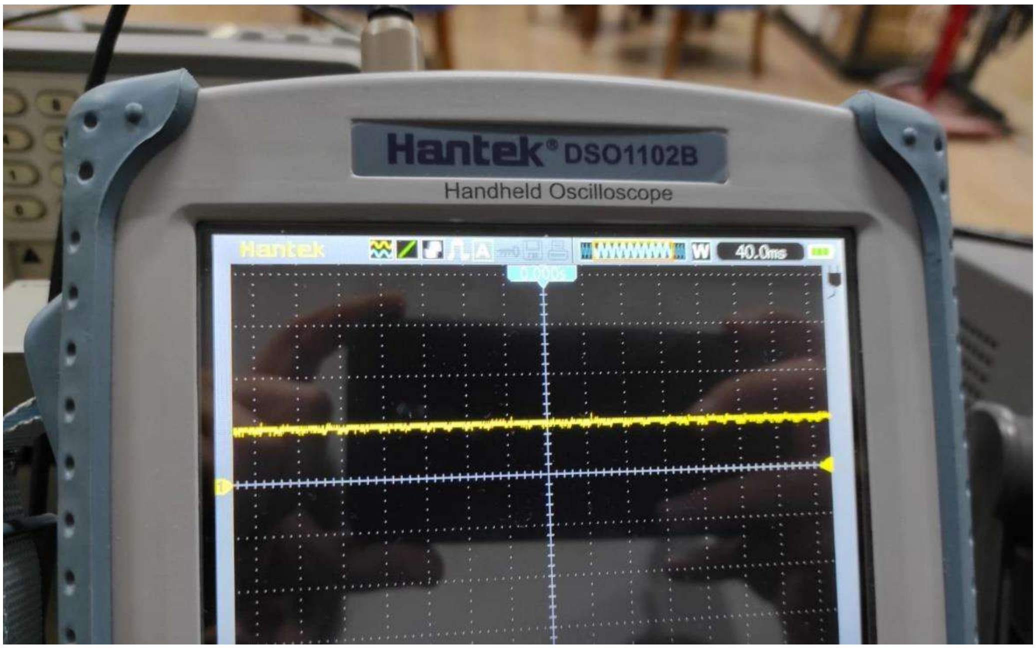

Figure-28: Output Voltage

Since this circuit is built in an open loop structure, it has a system that is affected by external factors. For this reason, there have been problems in producing a stable output and it has caused sensitivity problems in the status output values. The open loop system can also be insufficient in time-varying parameters. According to the researches it has been understood that the closed loop system is more useful and efficient than the open loop system.