Abstract: In this paper the photo voltaic (i.e. PV) system is used with the SEPIC converter (i.e. single ended primary inductor converter) and MPPT (maximum power point tracker) by using fuzzy logic. The fuzzy logic controller is used for gaining high efficiency by outputting crisp values to the SEPIC for converting dc to dc that is a buck/boost converter for converting dc voltage level. The inverter is used for transforming dc to ac and reducing harmonics for better ac output.

Keyword: PV, solar panels, inverter, fuzzy logic, SEPIC, MPPT

I. INTRODUCTION

In the recent decades the photovoltaic energy that is solar energy is gaining interest from all over the world. The applications in electrical power of the solar energy has been increased to a significant level. The PV modules are used in generation of electrical energy, multiple panel converts the collected solar energy into electrical energy. The solar panel harnesses the solar energy from the sun, the basic principal of the solar to electric conversion is the conversion of photons energy into electrical energy. The output of the solar panels varies according to the variation in the sunlight, humidity, temperature, wind speed, and other factors. The MPPT that is maximum power point tracker is used to increase the output energy of the solar panels that are used with a SEPIC that is single ended primary inductor converter. The SEPIC converter are used for converting dc to dc i.e. buck and boost operations. The SEPIC converter changes its output according to the duty cycle from the controller’s signal.

The Buck and boost converter have ability to increase and decrease the input voltage. Therefore the converter is able to convert energy at every radiation levels. The CUK and the SEPIC converters both are used for providing either high/low output voltage as compared to input voltage. The PV panels give an exponential curve for the current and the voltage where the maximum power comes at knee of curve [1][2]. After then the MPPT uses method to analyze maximum power point, the method/process is known as the perturb and observe (i.e. P&O) [3][4]. The researchers have been using the PI controller to use for dc to dc converters, as in literature [5][6][7]. Authors uses PI controllers along with the MPPT, but there is limitations of the PI controller and is sensitive to the parameters and variations, i.e. weather conditions. Hence, there is a need to apply the converter that can be used as effective and can work on all conditions.

Nowadays there exist many controllers like neural, AI, fuzzy logic and from all of these the fuzzy logic is simplest one to work with system. The fuzzy logic has been gaining a large amount of attention from all over the world and is used or almost every applications that are in the market right now. The fuzzy logic has gained this much of attention from the world because of the use of fuzzy logic controller, the controller can be used in converters, motor control, and many other processes and methods [8][9][10]. In this paper multi-level inverter with the photovoltaic system along with the fuzzy logic controller (FLC). The mathematical model of system and simulation are shown by using the MATLAB Simulink.

II. THE PROPOSED SYSTEM

The dc to dc converter is used to convert and increase the output of the solar panel from the low voltage into high voltage and the increased output voltage is then fed to the inverter to further convert it to the AC voltage. In this paper the maximum voltage output of the solar panel depends upon the maximum power [11][12] and hence the controller changes its frequency to maintain level with the changing voltage and hence the duty cycle of the PWM changes.

The Figure 1 shows the circuit diagram used in the SEPIC converter with the MPPT and the fuzzy logic controller. The fuzzy logic controller design is selected from the mamdani method. The SEPIC uses single electronic switch for switching purpose.
Photo Voltaic Mppt and Inverter using Fuzzy Logic

The fuzzy logic controller is based on the mamdani method that works on the membership function. The method works on 3 process like shown in the figure 4. Input variable of fuzzy logic controller are output voltage and the output of FLC is the duty cycle of the PWM signal that helps in regulation of the output voltage from the PV array, as shown in the figure 5& figure 6.

Figure 3 shows the block diagram of the Photovoltaic system that includes PV array, MPPT, SEPIC, LOAD, FLC and other small components. The MPPT and the fuzzy logic controller outputs the duty cycle to the buck/boost converter for maximizing the output from the PV panels. The PV arrays outputs the DC voltage which is then fed to the SEPIC converter and after that the SEPIC converter boosts the output voltage for getting maximum power output.
Table 1 showing different fuzzy rules on which it is working.

<table>
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<th>$e'$</th>
<th>N-II</th>
<th>N-I</th>
<th>Z</th>
<th>P-I</th>
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Figure 7 and figure 8 showing three dimensional surface corresponding to the table 1 value.

III. SIMULATION

The simulation shown are generated using the MATLAB.

Figure 9: Current vs Radiations

Figure 10: Power vs Voltage characteristics.
IV. CONCLUSION

The FLC based MPPT for SEPIC converter and the inverter system for the solar panel electrical power application has been shown in this paper and the performance of inverter has been functioning better then other single phase inverter and the FLC based inverter provides much better inverter output.

REFERENCE