ENHANCING MICROGRID POWER QUALITY

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ABSTRACT: n this study, a microgrid-friendly power quality controller is developed. It is capable of meeting the unique requirements of microgrid power quality, such as harmonic high penetration and rapid voltage changes. It is advised that a dynamic voltage restorer (DVR) be added to a microgrid to improve voltage quality. The DVR is a DC to AC switching converter that syncs with the distribution system voltage and provides three single-phase AC output voltages in series with the distribution system's feeder. This device serves as a conduit between the client and the service provider. It is connected in series between the power supply and the load to reduce voltage fluctuations, spikes, and interruptions, which are the three main issues with power quality. One of the primary topics covered in this is the voltage dip and swell. The DVR, which responds to disturbances swiftly and flexibly, is the best and most valuable specialized power tool on the market today. Simulations demonstrate that the proposed design can reduce power quality issues such as voltage sag and swell..

Index Terms **-** Microgrid, Dynamic Voltage Restorer, Maximum Power Point Tracking, Voltage sag,Voltage Swell

1.INTRODUCTION

Microgrids are modern, small-scale grids that are placed in specific locations and consist of distributed energy sources and apps that can operate independently or in conjunction with the main power grid. It reduces system losses and reduces damage to key power lines. Because DERs do not always perform properly, power quality issues in the microgrid are substantially worse than in the regular grid.The Dynamic Voltage Restorer (DVR) is a solid-state device that supplies voltage to the system in order to adjust the voltage on the load side. Its primary function is to constantly monitor the load voltage waveform and inject electricity as needed during a sag or swell. The waveforms of the source and reference voltages must be the same size and phase angle. By comparing the reference waveform to the real waveform, any errors in the voltage waveform can be identified.

2.DVR

The Dynamic Voltage Restorer (DVR) is a device that adds voltage to the system in order to adjust the voltage on the load side. Its primary function is to monitor the load voltage waveform and inject power as needed if there is a sag. The waveforms of the source and reference voltages must be the same size and phase angle. By comparing the reference waveform to the real waveform, any errors in the voltage waveform can be identified.

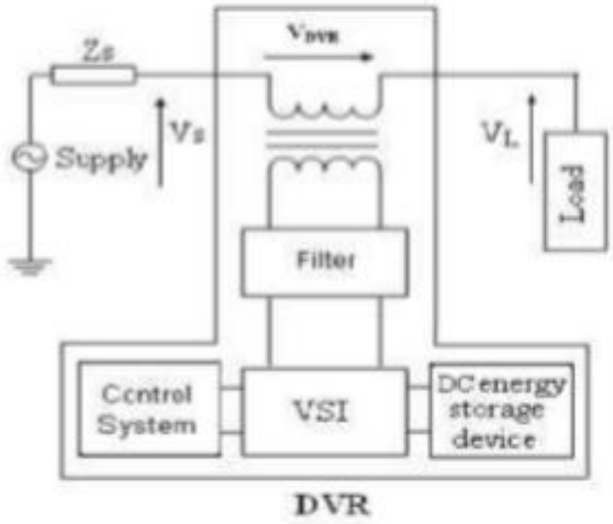

Fig. 1. In general, setting up the DVR.

There will be no sag as long as everything is working correctly, thus the DVR will be in standby mode and will not transmit power to the load. When there are voltage variations, such as voltage sag/swell, the DVR bridges the gap between the pre-sag voltage and the sag voltage by utilizing both actual and reactive power from the energy storage element.

3.PROPOSED METHOD

The proposed technique includes a standard power grid, a microgrid with a battery system, a photovoltaic system, a R load, and a harmonic load. They are all linked in a chain. Figure 2 depicts the proposed system's overall system configuration.

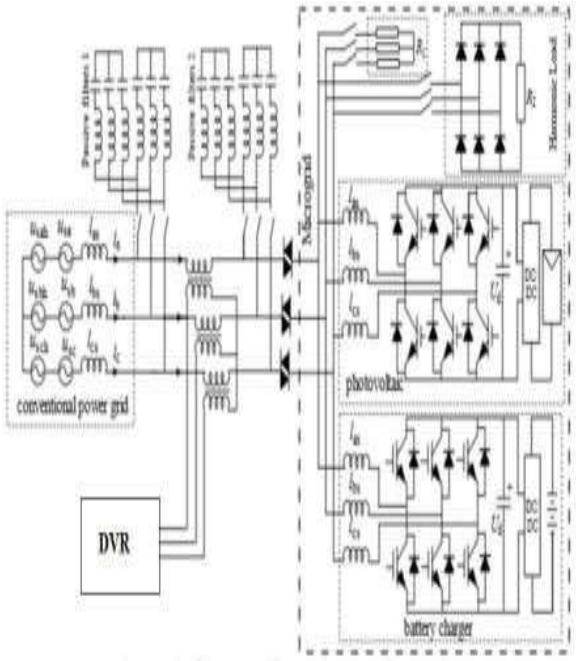

Fig 2. A diagram of the wiring for the proposed system.

4.SIMULATION RESULTS

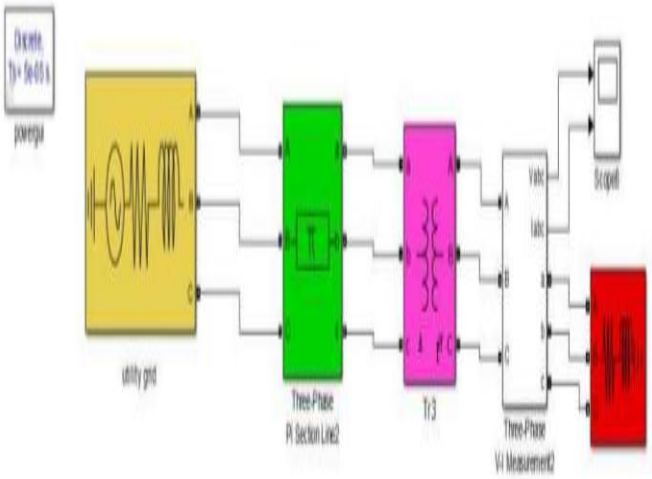

Fig 3 The regular grid's modeling

Figure 3 depicts the simulation of a normal grid with an RL load.The utility system is rated at 5000VAR. It's connected to a section of a transmission line that runs for 100 kilometers..

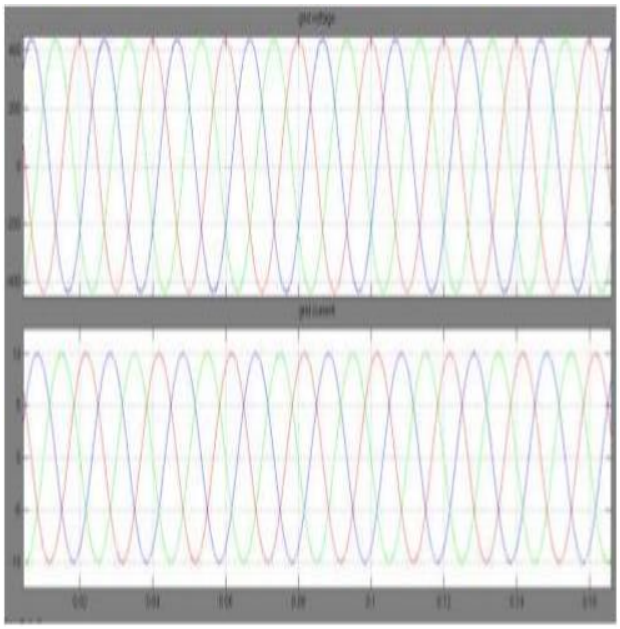

Fig 4 The outcomes of a typical grid exercise

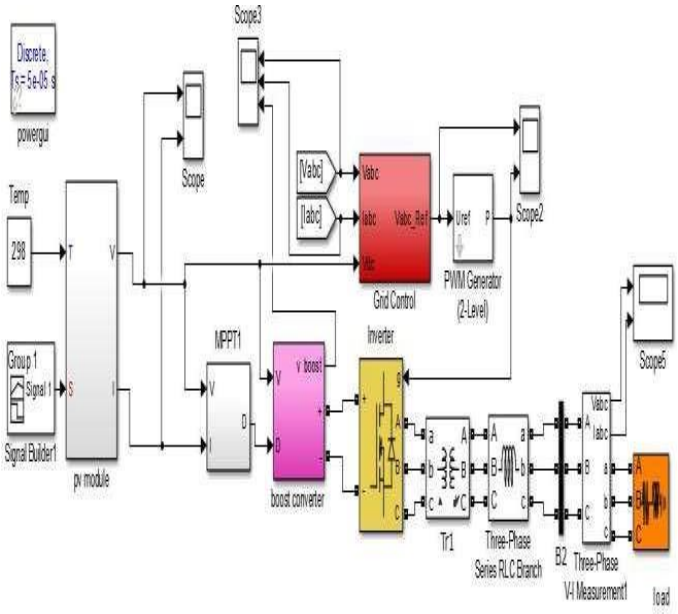

Fig 5 MPPT simulation of a solar photovoltaic system

Figure 5 depicts a simulation of a PV system with RL load.In this scenario, 140V is generated by series connecting four PV panels. The input voltage to the boost converter is 140 V, while the output voltage is 400 V.

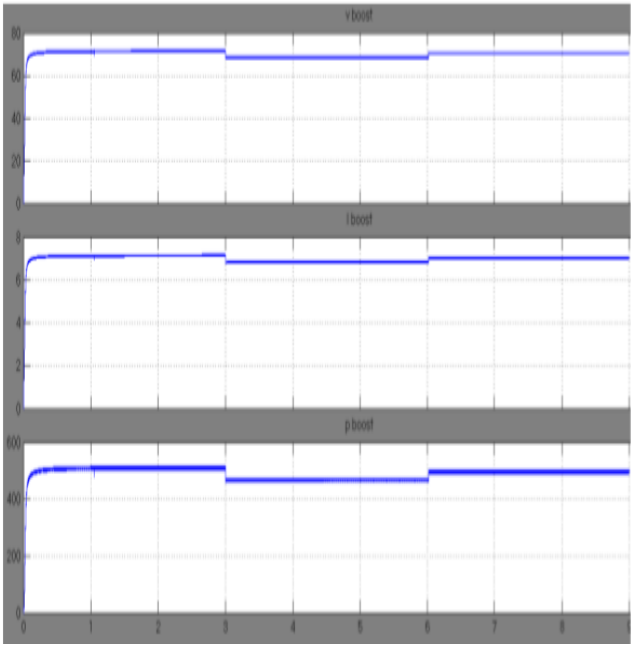

Fig 6 Voltage, current, and power waves produced by a boost converter

Figure 6 depicts the boost converter's 400 V output voltage. The MPPT is tested with solar irradiances of 1000W/m2, 500W/m2, and 800W/m2.

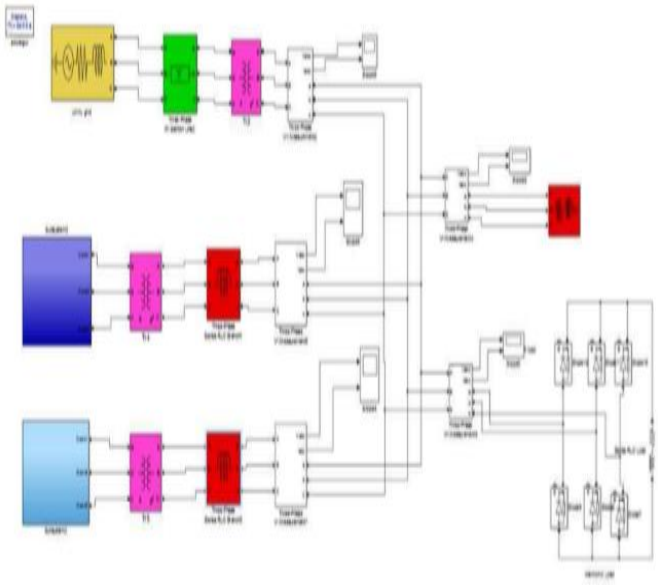

Fig 7 . System simulation without DVR

The PV and battery system is connected to the main power grid and then simulated. This architecture lacks a DVR application.

Figure 8 depicts the outputs gathered when the DVR is not used in conjunction with a mixed grid-connected system. In this example, the entire system is connected to both RL and harmonic loads.

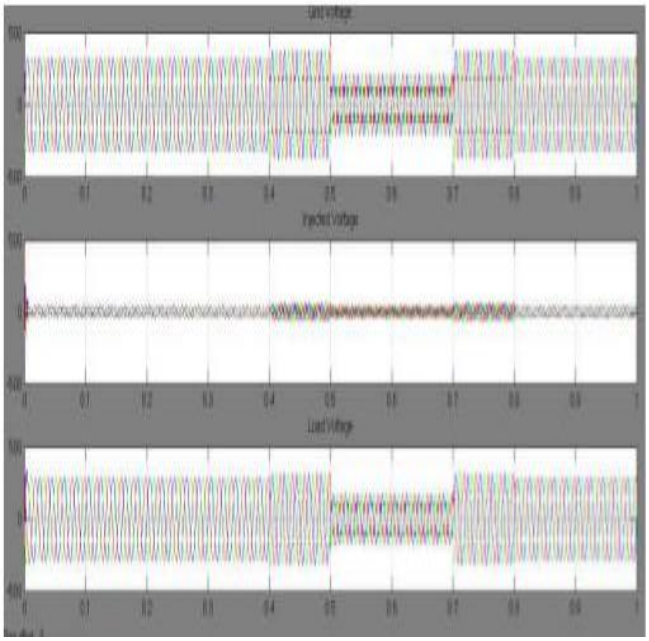

Fig 8 .Simulation output of system without DVR

5.CONCLUSION

We demonstrate a digital voltage recorder (DVR) that can aid in the resolution of power quality issues in microgrids, such as voltage sags and swells. When the DVR is operational, voltage cannot sag or rise, and the RMS voltage at the sensitive load point remains around 90%. Simulations in Matlab have shown that the proposed strategy works.

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