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Grid Connected PV/Wind Hybrid System with Improved Power Quality

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Abstract:
In this paper, a control strategy for power flow management of a grid connected hybrid photovoltaic (PV) wind battery based system with an efficient high gain SEPIC (DC-DC) converter is presented. The proposed system aims to satisfy the load demand, manage the power flow from different sources, inject the surplus power into the grid, and change the battery from the grid as and when required. And in this project we proposed new gain DC-DC converter (SEPIC) with a gain range nearly 10 to 15 here we proposed a close loop feedback as fuzzy logic controller. In a input system P&O with fuzzy logic techniques is proposed in MPPT for solar and wind. A three phase full bridge bidirectional converter is used for feeding ac loads and interaction with the grid with grid synchronization. Finally this analysis is made and achieved by Matlab tool.

I. INTRODUCTION

In this existing system a control strategy for power flow management of a grid-connected hybrid photovoltaic (PV)–wind battery-based system with an multi-input transformer coupled bidirectional dc–dc converter is presented, normal P&O method MPPT techniques is used for solar. And the DC-DC converter system is proposed in open loop. The interesting complementary behaviour of solar isolation and wind velocity pattern coupled with the above-mentioned advantages has led to the research on their integration resulting in the hybrid PV–wind systems. For achieving the integration of multiple renewable sources, the traditional approach involves using dedicated single-input converters one for each source, which are connected to a common dc-bus. However, these converters are not effectively utilized, due to the intermittent nature of the renewable sources. In addition, there are multiple power conversion stages which reduce the efficiency of the system. A significant amount of the literature exists on the integration of solar and wind energy, as a hybrid energy generation system mainly focuses on its sizing and optimization. The sizing of generators in a hybrid system is investigated. In this system, the sources and storage are interfaced at the dc-link through their dedicated converters. Other contributions are made on their modeling aspects and control Hybrid PV–wind-based generation of electricity and its interface with the power grid are the important research area, have proposed a multi-input hybrid PV–wind power generation system which has a buck/buck– boost-fused multi-input dc–dc converter and a full-bridge dc–ac inverter. This system is mainly focused on improving the dc-link voltage regulation. In the six-arm converter topology proposed , the outputs of a PV array and wind generators are fed to a boost converter to match the dc-bus voltage.

II. PROPOSED SYSTEM:

In proposed system, a control strategy for power flow management of a grid connected hybrid photovoltaic (PV) wind battery based system with an efficient high gain SEPIC DC-DC converter is presented. The proposed system aims to satisfy the load demand, manage the power flow from different sources, inject the surplus power into the grid, and change the battery from the grid as and when required. And here we proposed fuzzy with P&O techniques, this DC-DC converter system is proposed by close loop (FUZZY). Not many attempts are made to optimize the circuit configuration of these systems that could reduce the cost and increase the efficiency and reliability.

III. MAXIMUM POWER POINT TRACKING:

Now a day's MPPT algorithms are necessary in PV applications because the solar will generating some power but it is not sufficient to operate to get the maximum power point tracking technique is used, Solar panel varies with the irradiation and temperature of the sun, so the use of MPPT algorithms is required in order to obtain the maximum power from a solar array. If the solar power is used for maximum power point tracking, the control technique is to get the efficient output from the solar power .some off the MPPT algorithm,
Are there they are given below:

1) Hill-climbing techniques
2) Perturb and observe
3) Incremental conductance
4) Fractional short circuit current
5) Fractional open circuit voltage
6) Fuzzy logic
7) Neural networks

IV. ADAPTIVE P&O AND FUZZY MPPT TECHNIQUE:

This method uses existing inputs of P&O algorithm such as differential power and differential voltage. The proposed change in this algorithm is to replace comparing and switching methods with fuzzy logic approach. Four categories of FLC with new inputs are used and Five proposed variables are N (Negative), ZE (Zero), PS (Positive small), P (Positive), and PB (Positive big). After ΔP and ΔV are calculated, they are converted into linguistic variables and then the output ΔD is generated by looking up in a rule base table as shown in Table I, which consists of 25 rules. This algorithm uses Mamdani method to determine the output. For the defuzzification, the common centroid of area (COA) is used.

V. ADAPTIVE P&O AND FUZZY ALGORITHM FLOW CHART:

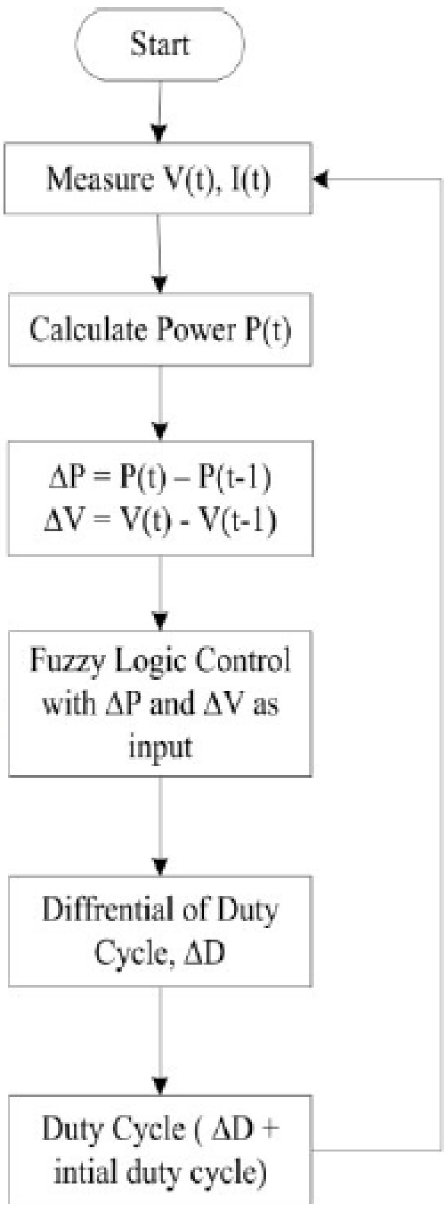

Figure.1.a: Flow chart of Adaptive P&O and fuzzy method

Step by step operation of P&O method maximum power point tracking (MPPT) is shown in Fig4 MPPT protect that you get the most power possible from the solar panels at any point in time to get the maximum efficiency. It is somewhat effective during low amount of sun light. These calculated result in an output that delivers maximum amount of current at the required voltage at any point in time of tracking. During low amount of light situations it will compensate for that level and find the valid point at which the solar cell delivers its maximum amount of power output.

VI. MODIFIED SEPIC CONVERTER BLOCK DIAGRAM:

The modification of conventional SEPIC converter is accomplished by including the diode Dm& the capacitor Cm. The designed converter can produce the voltage 10 times higher than the input voltage.

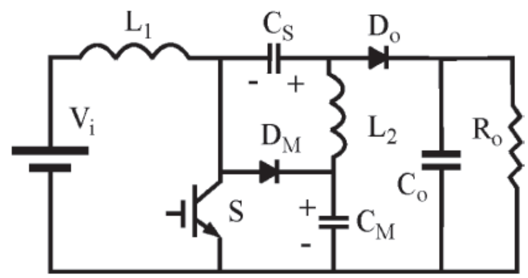

Figure.2. Modified SEPIC Converter Block Diagram

VII. SOFTWARE BLOCK DIAGRAM:

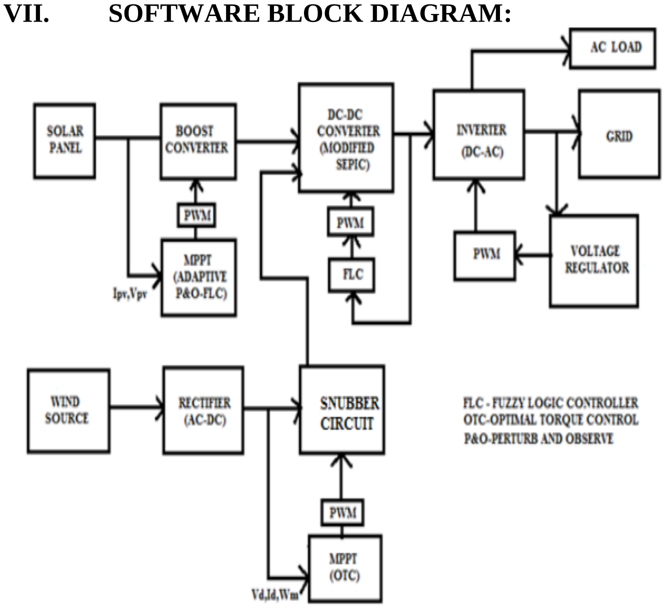

Figure.3. Software Block Diagram

VIII. HARDWARE BLOCK DIAGRAM:

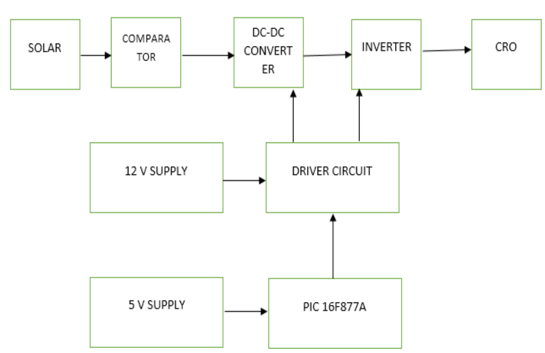

Figure.4. Hardware Block Diagram

IX. HARDWARE BLOCK DIAGRAM EXPLANATION:

- Input supply:- AC and solar
- Rectifier: It is converted into AC TO DC Supply.
- Driver circuit: -It can be used to amplify the 5V pulses to 12V for using transistor technology and provided isolations for using opto-coupler. It has two functions,
  - Amplification
  - Isolation
- Pulse generator: - Here we have used PIC microcontroller to make a switching signal.

A. Controller board:

- By using controller board PWM pulses are generated. PIC controller is used to generate the pulses. 5V DC supply is given to the PIC controller board. Generated PWM will be below 5V. To operate the MOSFET need to give 9-12V pulses. Driver circuit is used here to increase the pulses amplitude.

Figure.5. Controller Board

B. Driver circuit:

- To driver circuit below 5V pulses are given. Role of the driver circuit is Amplification and isolation. Transistors are used to amplify the pulses and optocoupler IC is used to provide the isolation between main circuit and controller circuit. 12V supply is individually used to operate the transistors and optocoupler.

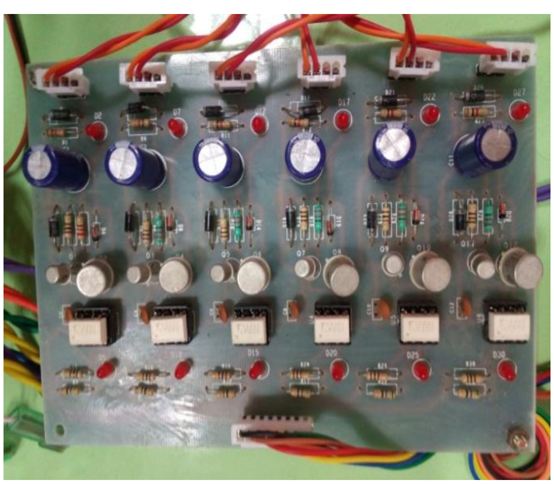

Figure.6. Driver Circuit

X. MAIN CIRCUIT WITH MODIFIED SEPIC CONVERTER:

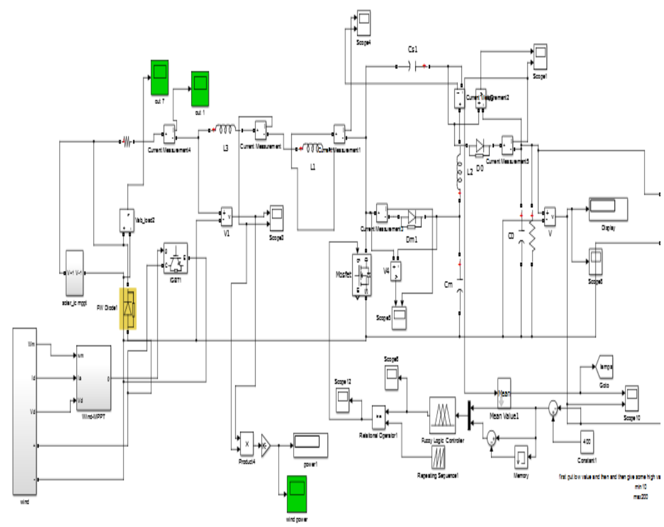

Figure.7. Main Circuit with modified SEPIC converter

XI. GRID CIRCUIT:

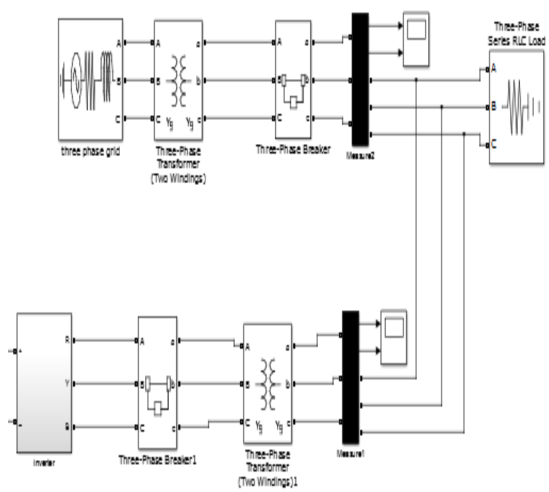

Figure.8. Grid Circuit

PV PANEL DESIGN:

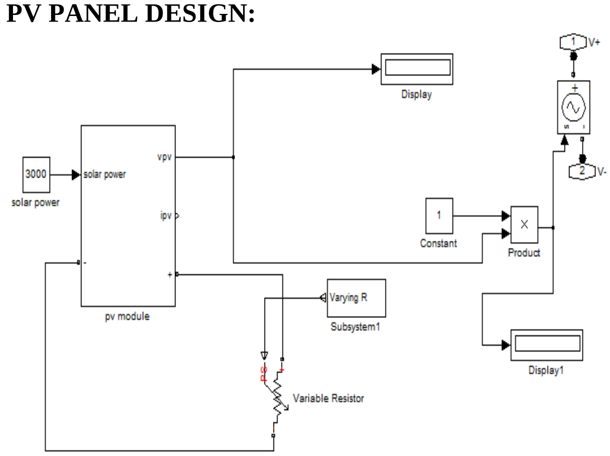

Figure.9. PV panel design

INPUT VOLTAGE:

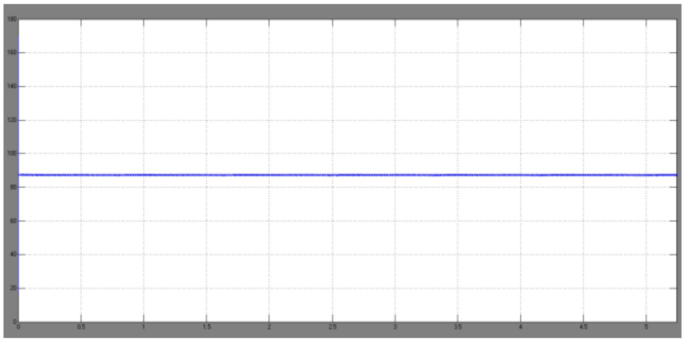

Figure.10. Input voltage

SWITCHING PULSE FOR INVERTER:

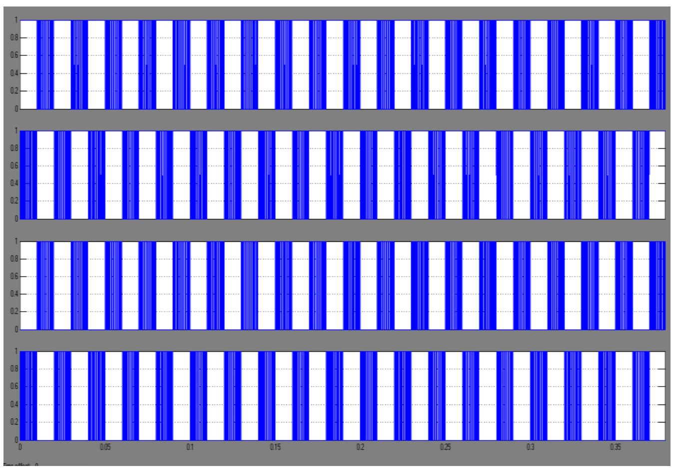

Figure.11. Switching pulse for inverter

Actually here inverter is used to get the ac supply to grid. Grid connection is not possible it need three condition one is phase, voltage and frequency so it need four switches for that switches required gate pulse it is shown in Fig8

TOTAL HARMONIC DISTORTION (THD):

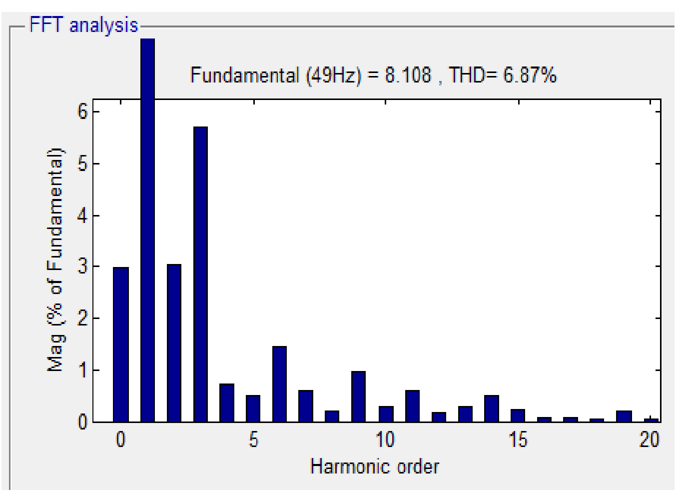

Figure.12.THD

The harmonic of existing system is somewhat high it is shown in Fig13; to overcome this process proposed system is used. This analysis is proposed by fast Fourier transform (FFT).

Fuzzy output:

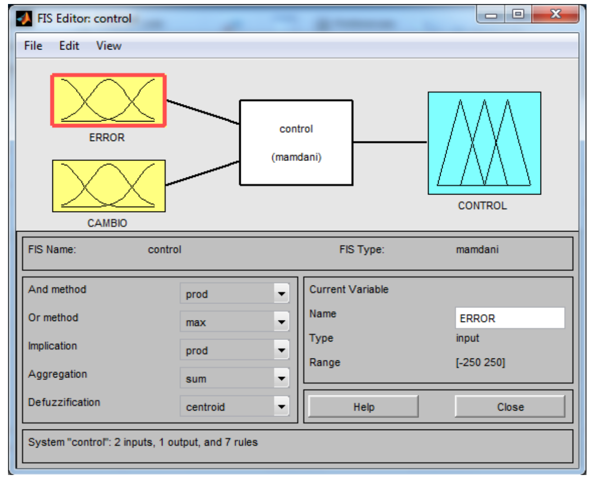

Figure.13. Fuzzy Output

XII. SIMULATION CIRCUITS AND OUTPUTS:

MAIN CIRCUIT:

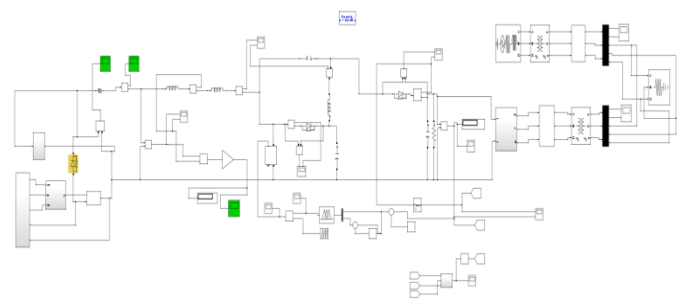

Figure.14: Main circuit

SOLAR MODEL:

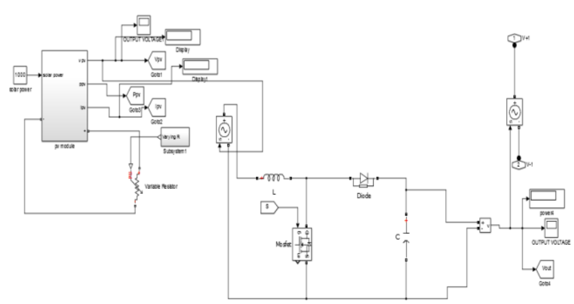

Figure.15. SOLAR MODEL

WIND MODEL:

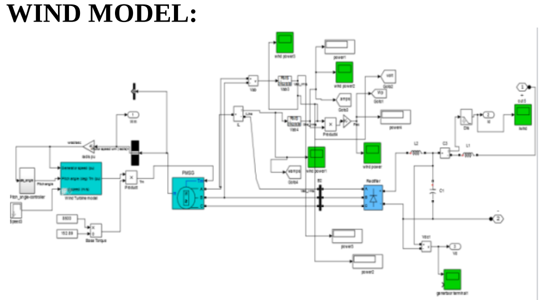

Figure.16. Wind Model

MPPT P&O WITH FUZZY:

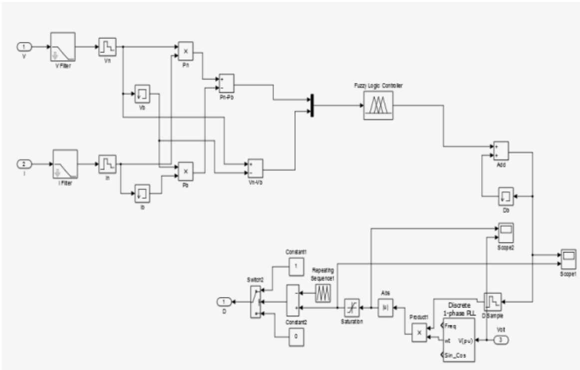

Figure.17. MPPT P&O WITH FUZZY

OUTPUT VOLTAGE:

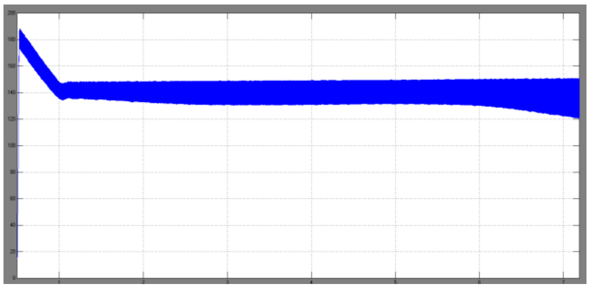

Figure.18. Output Voltage

Here our set value is 140v.

GRID VOLTAGE&CURRENT:

Upper axis is voltage lower axis is current 150V nearly 3A.

Figure.19. Grid Voltage & Current

XIII. CONCLUSION:

A grid-connected hybrid PV–wind- power with MPPT with fuzzy is proposed. The proposed hybrid system provides an elegant integration of PV and wind source to extract maximum energy from the two sources. In this system, a control strategy for power flow management of a grid connected hybrid photovoltaic (PV) wind battery based system with an efficient high gain SEPIC DC-DC converter is presented. The proposed system aims to satisfy the load demand, manage the power flow from different sources, inject the surplus power into the grid, and change the battery from the grid as and when required. And here we proposed fuzzy with P&O techniques, this DC-DC converter system is proposed by close loop (FUZZY).Not many attempts are made to optimize the circuit configuration of these systems that could reduce the cost and increase the efficiency and reliability Detailed simulation studies are carried out to ascertain the viability of the scheme. The experimental results obtained are in close agreement with simulations and are supportive in demonstrating the capability of the system to operate either in grid feeding or in stand-alone modes. The proposed configuration is capable of supplying uninterruptible power to ac loads, and ensures the evacuation of surplus PV and wind power into the grid.

XIV. REFERENCES

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