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Design and Implementation of a PV Array to Support Grid Systems with the Help of an Embedded Systems

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ABSTRACT: This paper introduces Design and Implementation of a renewable energy systems such as PV and fuel cells to fulfill the demand. Smart Grids are introduced to make the grid operation smarter and intelligent manner.It can acquire parameters of measuring points in the grid regularly. From the PV we can generate the power with the help of sunlight and it was given to boost converter. The boost converter steps up the voltage and given to voltage source converter. The voltage source converter acts as a stabiliser and produces constant power to the grid. The proposed vision of introducing viable Smart Grid (SG) at various levels in the Indian power systems has recommended that an advanced automation mechanism needs to be adapted. Smart grid operations, upon appropriate deployment can open up new avenues and opportunities with significant financial implications. This work presents various Smart grid initiatives and implications in the context of power market evolution in India.

KEYWORDS: PV array; smart grid; VSC; Boost converter; MPPT controller

I. INTRODUCTION

The renewable energy generation technology such as PV has been widely applied for increasing demand of high power. A micro-grid consists of distributed generation (DG) (micro-turbines, PV cells, fuel cells, wind generator typically) and energy storage devices (flywheel, capacitors, batteries, etc.)The PV system is powered by the solar energy which is abundantly available in nature. So these energy sources can be used to bridge the gap between supply and demand during peak loads. It is necessary to have a device that can monitor and control the operation of the micro-grid. In addition, Micro grid are creating new smart grid technology requirements in the areas of automation, management and control of alternative energy sources with energy storage devices. Grid codes are set up to specify the relevant requirements for efficient and secure operation of power. There are many algorithms which help in tracing the maximum power point of the PV module. But here we are using perturb and observe algorithm Perturb and observe (P&O) method.

II.RELATED WORK

The Smart Grid (SG) system typically deals with different issues involving security and Power Quality (PQ) improvement. An UPQC itself inserts harmonics into the system that affects the system stability for sensitive loads. The excitation of Modified UPQC converters are obtained from PV (Photo-Voltaic) panel. [1]. Based on simulation results, and further as a novel contribution in this work, a prototype of MPPT based PV system is designed using Perturb and Observe algorithm and Buck-Boost type of DCDC Converter [2]. The algorithm used to track the real GMPP under any PSC patterns and under any weather conditions with improving the tracking speed and reducing the PV output power oscillations at the steady state [3]. In this article, a SOFT-MPPT algorithm has been proposed which, in a simple way, aims to improve both the steady state as well as the tracking performance of both P&O algorithms. An adaptive step size is used to track the MPP, which provides a faster tracking performance [4]. The proposed algorithm identifies the attainment of the steady state and then stops the artificial perturbations. This stops the oscillations around the MPP and provides a steady power output from the PV panel at the MPP value. The SOFTMPPT algorithm is also able to detect any change in operating conditions [5]. The energy storage efficiencies of the BESS are considered to optimize the operational cost of the MG. Two quadratic functions are verified and utilized to formulate the efficiencies of BESS in both charge and discharge process [6]. The model consists of a temperature and humidity sensor module, actuator devices, capable of changing the above mentioned parameters and a control unit [7]. The conventional P&O

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method is simple, but there would be highly vibration near the maximum power point As a result, the oscillation of the operating point is reduced and the power generation efficiency is increased [8].

III. PROPOSED ALGORITHM

The conventional d-q control strategy is the most popular methodology, also known as dq current control. The measured voltage and current are transformed into dq quantities and the outer control loop generates the dq current references and the inner current loop regulates the dq current and generates the appropriate switching pulses. This control is implemented in voltage source controller (VSC)controller in the Simulink. An average VSC model was used for the simulation and this model does not require PWM switching, instead it used the reference voltage waveforms.

Solar power generation is the most promising renewable power generation technologies which has been used in the proposed work. In normal time solar cells are used to produce the power generated from the sunlight and give it to the grid with the help of boost and voltage source converter.Depending upon the temperature of sunlight is reflected to the pv array it produces power and give it to the grid. Therefore the grid distributes the power to the load such as industries and companies etc.

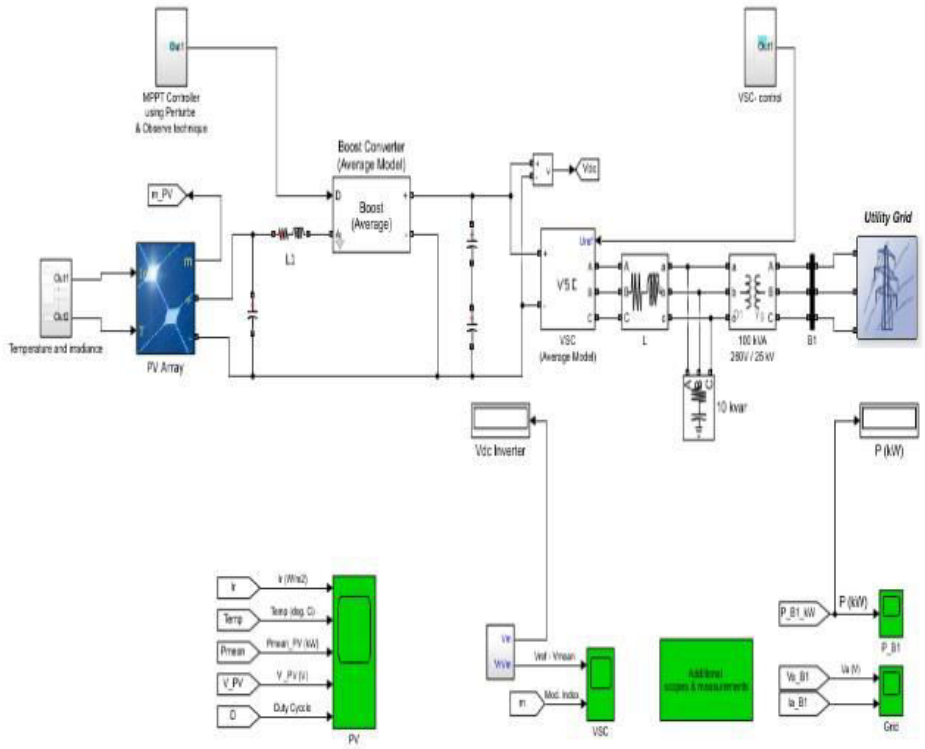

FIG. 1 PROPOSED BLOCK DIAGRAM

Smart grid is developed to intelligently transmit and consume the power source supply. The system needs a reliable and secure energy source that is not entirely dependable on the fossil fuels. Therefore, smart grid is a essential goal of many countries and adopting the renewable energy sources into their grid network falls under this goal Smart grid systems are integrated with smart meters, intelligent sensors, bidirectional two-way information sharing among the energy sources and consumers availability. The availability provides the system with an ability to successfully achieve and manage the energy deliverability to the consumers while consumers having the right to make decision. Even though many researchers have been carried out in the field of smart grid but there are still a lot of challenges to explore when

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the renewable energy sources are integrated. To ensure the smooth and effective deployment renewable energy sources into smart grid system, an efficient energy management strategy in smart grid should be given a serious consideration. Successive energy management strategies always are dependable on the requirements from all the connected sources and alleviate the interconnectivity between various resources. Smart grid is facilitated to reduce the energy costing at the customers' side and creating a reliable control, supervision and coordination helps to optimise the electricity generation distribution from various sources for various applications. The SCADA and ZigBee are two supervisory systems are used in smart grid to ensure a reliable energy source flowing. It is been the most common form of energy storage for the grid. In this method, it is used to store the power from the pv and fuel cells . Then, the stored energy is retrieved through the converter system to feed the distribution side.

IV. SIMULATION RESULTS

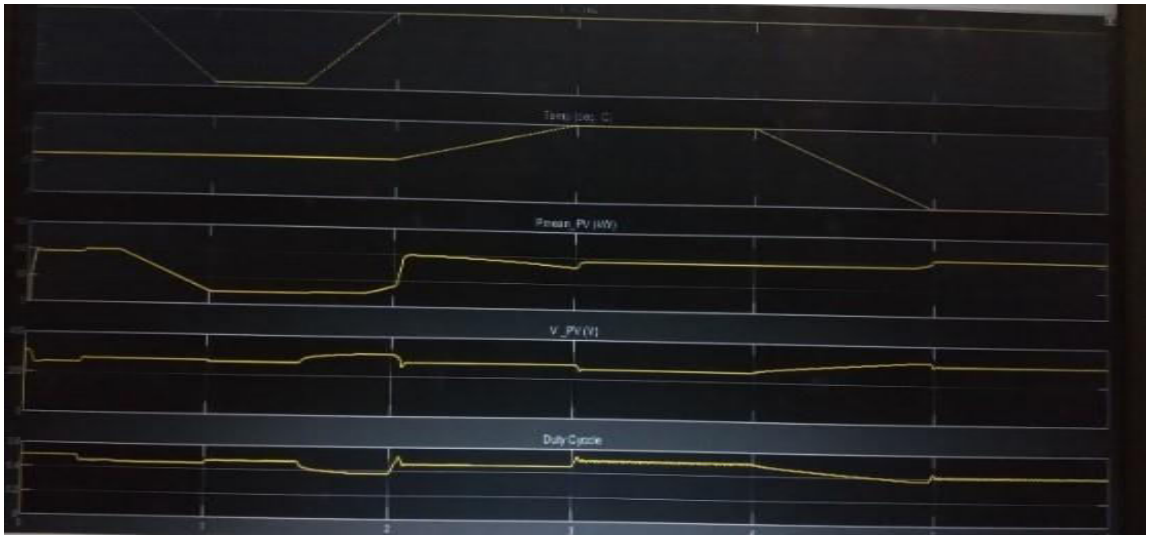

FIG. 2 SIMULATION OF A PV

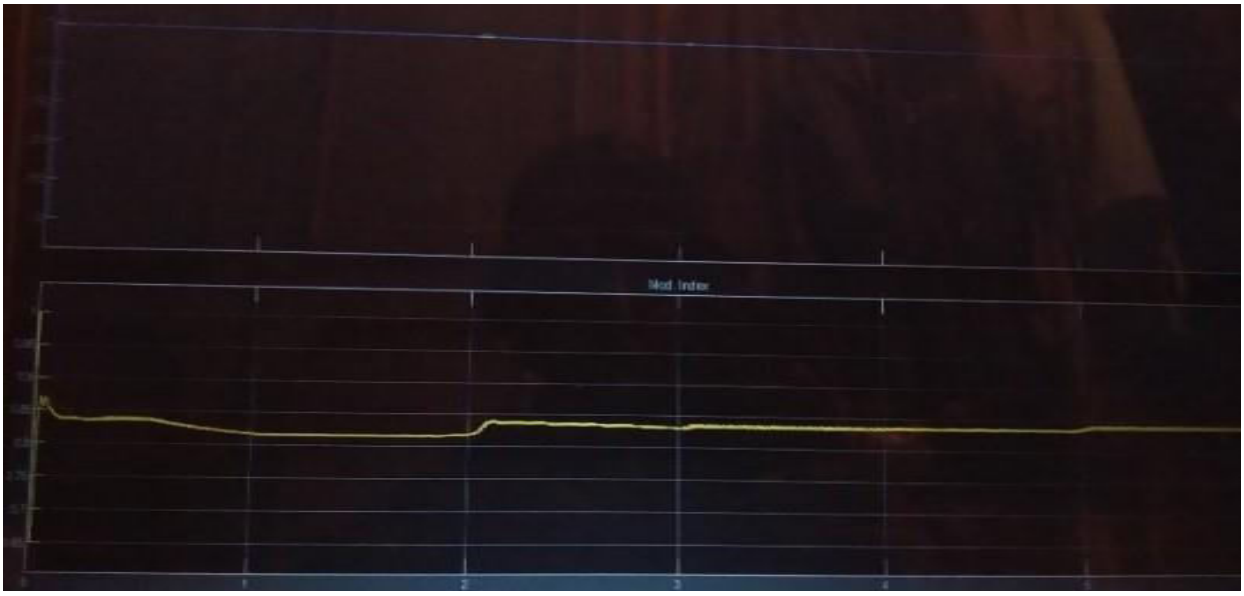

FIG. 3SIMULATION OF A VSC

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V. CONCLUSION AND FUTURE WORK

India's energy generation and consumption are on high growth rate Smart Grid Technology can intuitively overcome these issues. Therefore we have to balance the power with respect to current and voltage in future demand. In addition, Micro grid are creating new smart grid technology requirements in the areas of automation, management and control of alternative energy sources with energy storage devices. Grid codes are set up to specify the relevant requirements for efficient and secure operation of power system for all network users and these specifications have to be met in order to integrate wind turbine into the grid. The simulation results shows the addition power required by grid is been supported by renewable energy systems to balance the connected load.Further, various prospects of sustainable energy and off-grid solutions, Rural Electrification (RE) and evolution of Micro Grid along with various policies and regulatory affairs of India. In addition, Micro grid are creating new smart grid technology requirements in the areas of automation, management and control of alternative energy sources with energy storage devices. Indian Power Strategy along with its pitfalls in various technical and non-technical themes, with an organized approach to evolve the conceptualization of Smart Grid. It can be helpful to the government. From this we can conclude that the power can be delivered to all the end users with the help of renewable energy resources. Currently, the nation ranks to be 4th largest in installed power generation capacity using RES and 3rd largest in investment and implementation of smart grids, which will be a trend setter for emerging economies to pursue "green" and sustainable energy. In future additionally we can tie up with various renewable energy resources to distribute the power to the grid to larger extent. We can implement the same set of work to the place where severe fluctuation in load will be there. The work can be done with expert system to make a grid smarter. Also, few more work related to micro grids and hybrid energy with energy storage system are premeditated to complete by near future. Upon the finalizing of the entire study, the further research perspective would deliberately act as an advocate to discover the rank and strategy of nation's development in power and energy with respect to current and future energy demand.

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BIOGRAPHY

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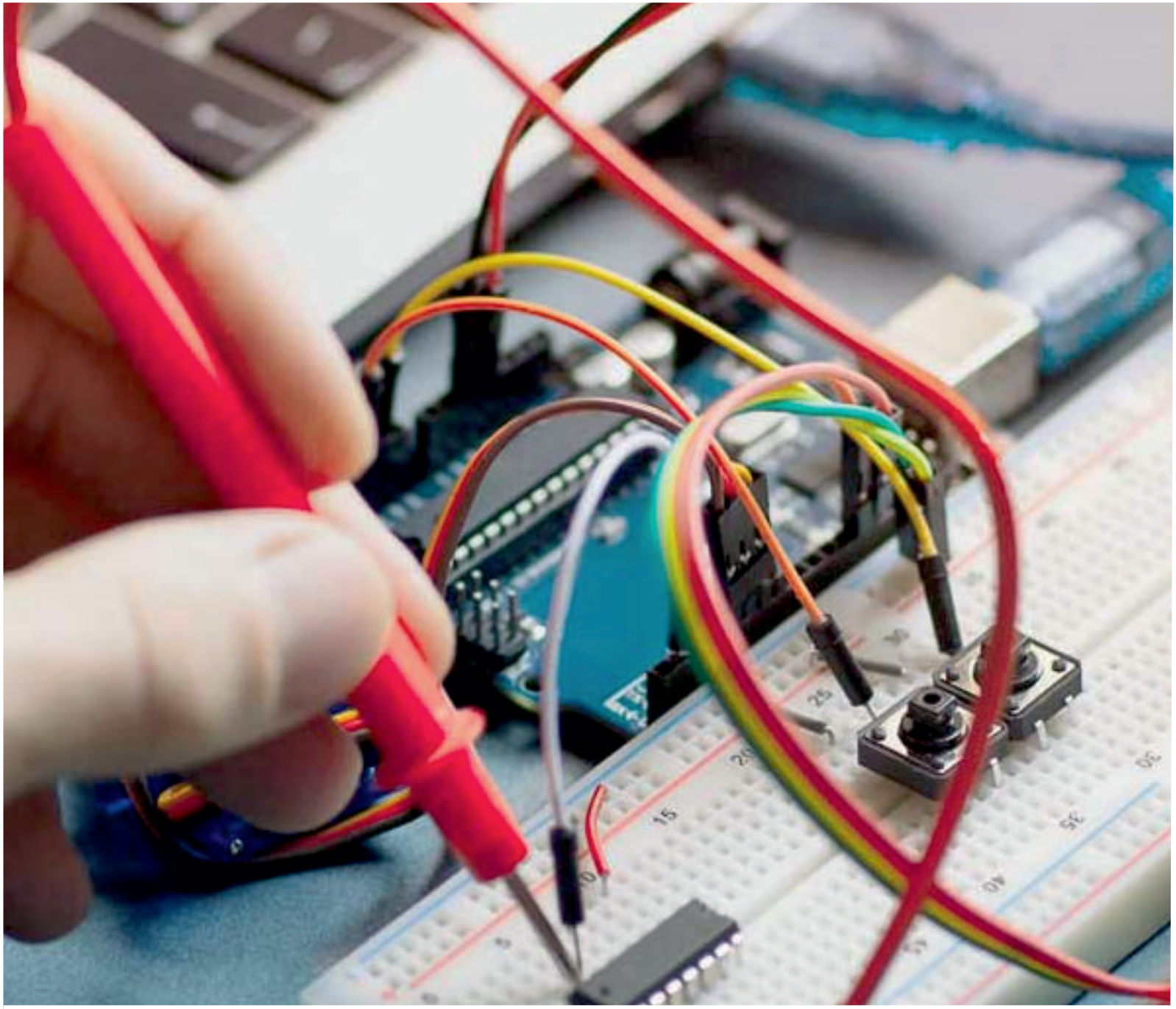

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