INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

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GRID SYNCHRONIZATION OF PHOTOVOLTAIC CELL WITH MPPT

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Accepted Date: 15/03/2016; Published Date: 01/05/2016

Abstract: The optimization of energy consumption in the world is increasing day by day but the generation of the same is not increases by that rate of consumption and if we try to improve our generation, there are not availability of sources for generation of energy. Hence to improve energy generation we are considering the non conventional energy sources. This kind of researches concentrates on the elemental technologies, and now a management system is needed to manage these technologies to maximize energy efficiency. In this paper the proposal is that the system management of photovoltaic system to load. It has been done by using the MATLAB software. In this paper perturb and observe based mppt for photovoltaic system is done for the development of solar technologies.

Keywords: MPPT(maximum power point tracking), PV(photovoltaic), P&O(perturb and observe), INC(incremental conductance).

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Access Online On:

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How to Cite This Article:

Pravin Y. Lute, IJPRET, 2016; Volume 4 (9): 39-46

PAPER-QR CODE

INTRODUCTION

Renewable energy systems such as photovoltaic power generation, wind power generation and fuel cells are receiving a huge attention globally. Eco friendly power generation is the best feature of renewable energy systems. Renewable energy systems emit no pollution into the atmosphere when they generate electricity. However, most power plants such as thermal power generation and nuclear power generation plants have produced most of the power supply. But, Thermal and nuclear plant establish a danger impacts in the world. On the other hand, renewable energy systems are very clean on a large scale from the perspective of return of investment. In this paper, we propose a management system to maximize the efficiency of a photovoltaic power system in application's aspect. When the load on the power station increases. For such purpose we synchronize our system to the Grid to overcome low power problems. The inverter must convert the renewable energy stored in the battery bank into pure sinusoidal voltage that tracks the grid voltage in amplitude, frequency and phase. For this purpose the inverter must be synchronized with grid. The interconnection of photo voltaic (PV) system with a Grid requires an accurate control of synchronism between converter and grid. The parameters including voltage, phase and frequency of both systems need to be synchronized. There are different types of techniques developed to achieve synchronization but the system used in this study is simple, reliable, requires small area for installation and need small circuitry.

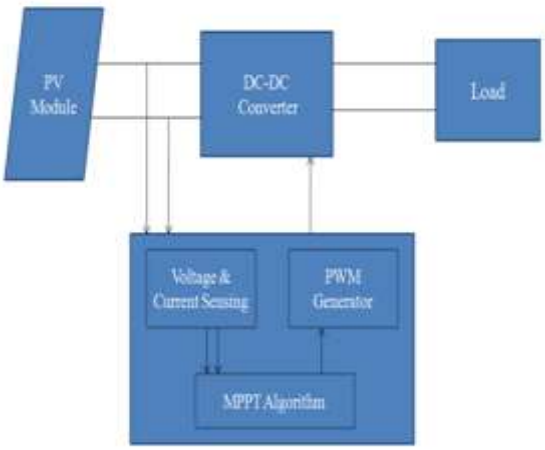

Fig 1: Layout of the implemented system

METHODOLOGY

1.1 PERTURB AND OBSERVE MPPT ALGORITHM

The algorithm involves introducing a perturbation in the panel operating voltage. Modifying the panel voltage is done by modifying the converter duty cycle.

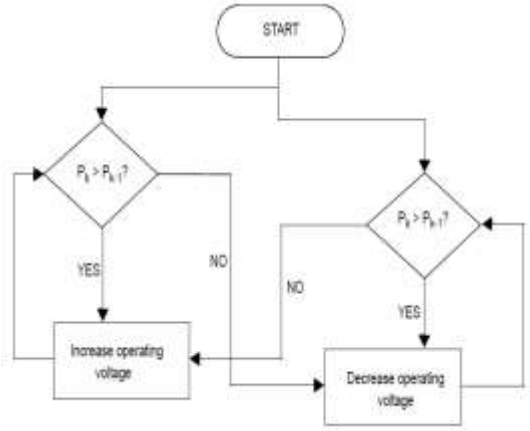

Fig 2.1.1: Algorithm of P&O MPPT

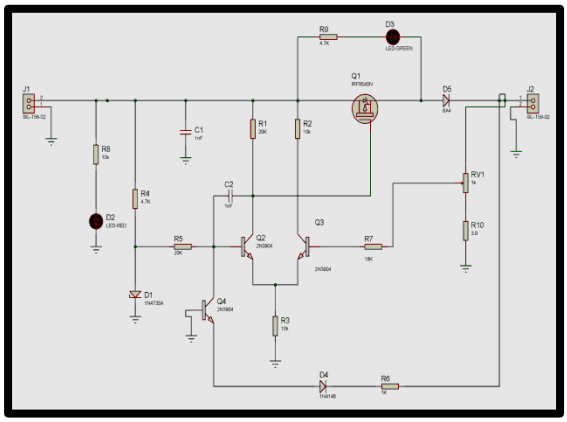

Fig 2.1.2: Circuit Diagram of MPPT on Proteus

1.2 INVERTER

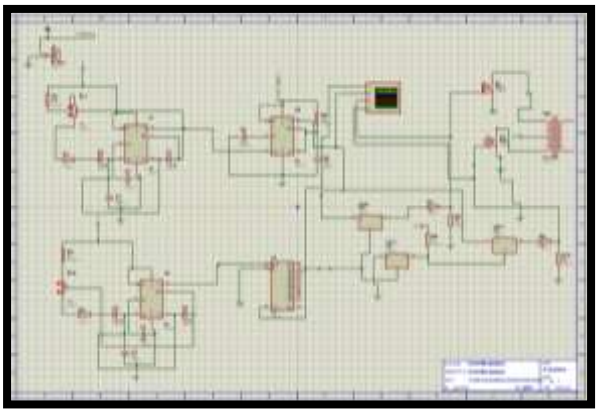

Fig 2.2.1: Circuit Diagram of Inverter on Proteus

In renewable systems (solar cell) the output is DC. It is modified to Ac by use of inverters. The output level of AC magnitude is small. For that, we are used transformer to increase the magnitude level.

The inverter usage will start from small level (like computers) to higher level (high voltages direct current transmissions).

Here, the use of inverter is same to convert from DC to AC. The output of solar section is DC. This DC quantity is converted into AC. The output of the AC is interfaced with grid power (AC).

1.3 TRANSFORMER

A transformer is an electrical device used to convert AC power at a certain voltage level to AC power at a different voltage, but at the same frequency. The transformer is based on the working principle of “Faradays Law of Electromagnetic induction”. In this project, we used only the step up transformer not the step down transformer. Here we step up a 12V ac into 230 V ac.

The supply is given to the primary of the transformer. The voltage induced in the secondary due to induction. In the secondary coil voltage is related with primary coil voltage with turns ratio.

Energy losses in transformers are due to a number of factors: these are copper losses in the coils themselves due to material resistance, core losses due to hysteresis eddy current (the reluctance of the material's magnetic domains to reverse during each electrical cycle).Step-down transformer form one phase is taken to give auxiliary supply to microcontroller and also to detect zero crossing to synchronize solar frequency with grid frequency step up transformer is used to increase the voltage.

1.4 GRID

Generally grid means interconnected substations. It is the junction between the two sub stations. If anyone substation voltage value gets damaged due to some interrupted conditions, it give the same value without interruption.
Here, the output of solar panel DC is converted into AC .The output AC is interfaced with grid. The frequency matching is very important for solar grid interfacing.

GRID SYNCHRONIZATION

In an alternating current electric power system, synchronization is the process of matching the speed and frequency of a generator or other source to a running network. An AC generator cannot deliver power to an electrical grid unless it is running at the same frequency as the network. If two segments of a grid are disconnected, they cannot exchange AC power again until they are brought back into exact synchronization. There are five conditions that must be met before the synchronization process takes place. The source (generator or sub-network) must have equal line voltage, frequency, phase sequence, phase angle and waveform to that of the system to which it is being synchronized. Light bulbs were connected between the generator terminals and the system terminals (or more generally, to the terminals of instrument transformers connected to generator and system).

RESULTS

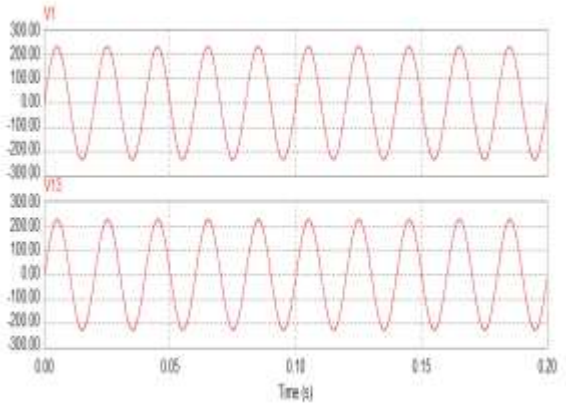

Fig. 4.1: Results from grid and PV system

The results form first are taken from grid voltages and current of single phase of grid and in the second results the output which are taken after synchronization which are same as the grid results

CONCLUSION

Synchronization of the photo-voltaic system with a grid represents real time monitoring of the both system and used to share the load of the distributed system. The generation of power through PV system is more economical, easy and reliable because sun light is available. We have used this power as a backup source and also used in case when demand of power increases. Such system can easily solve or reduce the problem.

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