Review on designing of solar inverter

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Abstract: *This paper depicts design & simulation of the solar inverter used for solar power generation,. The various components of the solar inverter are designed for investigating the outcome through simulation. The output voltage is controlled by varying the duty cycle through various types of switching techniques and the simulation results are compared. The MATLAB tool is used for the virtual performance of solar system & to analyze the output of hardware with MATLAB output which introduces the usage of the proposed novel techniques.*

Key Words: *Duty cycle, solar system, PV (Photovoltaic) cell Module, MOSFET (Metal Oxide Semiconductor Field Effect Transistor), GA Technique, Low Ripple.*

1. INTRODUCTION:

Solar energy has turned into a popular alternative energy source to meet certain demands around the world due to the instability of oil and coal prices with global. Cooking food, water distillations and some other uses are most common for daily needs. As a result the demand of electrical power is increasing day by day to fulfill the daily needs. Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis, It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. The large magnitude of solar energy available makes it a highly appealing source of electricity. Among them, the solar power energy based on photovoltaic (PV) system is the most promising sources as its conversion and control is simple, clean, unlimited, easy to maintain, A PV solar system is becoming popular nowadays because of its high .reliability, high modularity and pollution free characteristics Based on their functional and operational requirements, PV systems can be categorized into two sections including the grid-connected system for decreasing the power from the utility and the other off-grid system for providing the load. converting solar irradiance directly into electricity and generally consists of the PV array, Maximum Power Point Tracker (MPPT) Controller, DC-DC buck converter, charge controller, inverter and lead acid battery**.** Since the aggregate sun oriented irradiance that achieves the surface of the earth differs with the time of day, season, area and climate conditions, a maximum power point tracker (MPPT) device is used between the array and load to trace maximum power output of the PV array and also for matching the impedance of the electrical load.

2. DESIGN of Solar System:

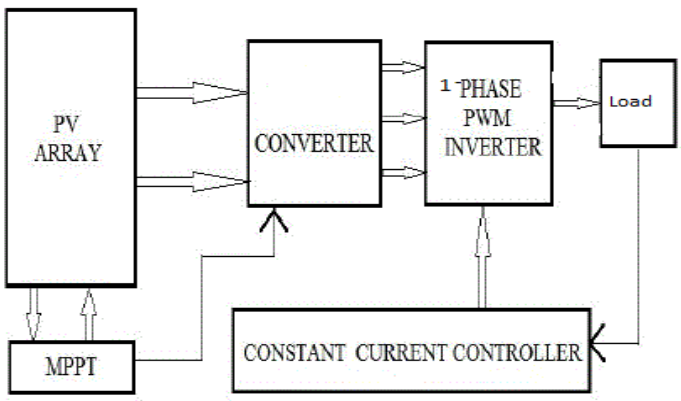

Fig 1. Block diagram of the developed solar system

The objective of this paper was to develop a simple and robust solar system for the rural areas Therefore, the solar panel was used to convert the available sun light into electrical energy. This energy was used to charge the battery via a charge controller. Then the stored energy in the battery is utilized to drive the DC loads. On the other hand, an inverter was connected with the battery for AC loads. After installation successfully, the system can produce the power and can possible to supply it easily. Fig.1 shows the block diagram of the solar developed system.

3. DEVELOPMENT OF THE SYSTEM:

This section presents a description of the various components of a generic solar energy system design including PV array, Maximum Power Point Tracker (MPPT) Controller, DC-DC buck converter, charge controller, inverter and lead acid battery**.**

SOLAR MODULE : There are various types of solar module but this topology used monocrystalline silicon solar cells due to its high efficiency.

solar Cell Type	Efficiency-Rate	Advantages	Disadvantages
Monocrystalline Solar Panels (Mono-SI)	~20%	High efficiency rate	Expensive
Polycrystalline Solar Panels (p-Si)	~15%	Lower price	Sensitive to high temperatures; lower lifespan & slightly less space efficiency
Thin-Film: Amorphous Silicon Solar Panels (A-SI)	~7-10%	Relatively low costs; easy to produce & flexible	shorter warranties & lifespan
Concentred PV Cell (CVP)	~41%	Very high performance & efficiency rate	Solar tracker & cooling system needed (to reach high efficiency rate)

4. Mathematical modelling of INDEPENDENT HOME SOLAR SYSTEM :

The proposed independent solar home system that gives the imperative power for a residential unit consists of PV array with MPPT controller, charge controller, buck converter, battery, inverter and load. For estimating the size of the PV array, the required average peak power (Ppv) has to be calculated which can be done using the given equation (1)

$$P_p = E_{D\,/}\,\eta_V\,\eta_R T_{sh} * S_F \quad \text{.....(1)}$$

Where,
ED= average daily energy demand
η_V = inverter efficiency,
η_R = efficiency of the charge controller,
Tsh= peak sun hour and
SF = safety factor

The total dc current required can be determined by dividing the average peak power with the system dc voltage as given in equation (2)

$$I_{dc} = P_{p\,/} V_{dc} \quad \text{…….(2)}$$

Finally, the total number of series ($N_{sm)}$ and parallel Modules (N_{pm}) to form the PV array can be evaluated by applying the equation (3)

$$N_{tm} = V_{dc}/V_{nv} * I_{dc}/I_{ra} = N_{sm} * N_{pm} \quad \text{.....(3)}$$

5. CHARGE CONTROLLER:

The fundamental task of the charge controller is to manage and control the current flow between PV array and battery

In this work, a proper charge controller is designed to control the flow of power either from the PV solar array or the battery to meet the demand and also, monitor the charging and discharging of the battery.

6. INVERTER MODELLING :

The majority of the appliance in a domestic building generally use AC current, whereas PV module and battery bank are power wellspring of DC current. The major purpose of the inverters is conversion of DC power into AC, adjusting the frequency of the output AC power.

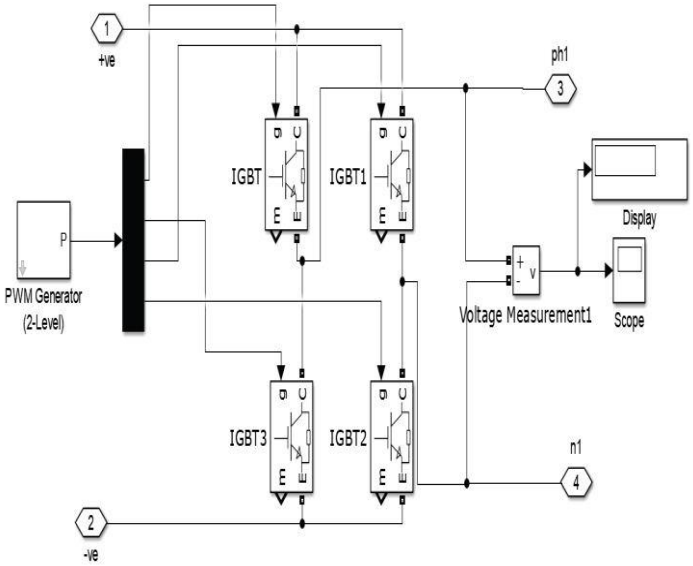

Fig 2: Designing of Inverter

7. SIMULATION RESULTS

The result of the proposed inverter model gives satisfactory results

8. CONCLUSION:

This paper presents a simple but an efficient independent solar system in MATLAB/SIMULINK environment that can fulfil the residential daily load demands. In addition, a generalized mathematical description for the determination of the size of PV array, battery, charge controller and inverter has been proposed in order to model the system.

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