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Concept Designing of a Solar Photovoltaic UPS System with Sunlight Tracker

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Abstract: ***This paper defines the design of UPS system with the help of sun tracking system, as a source for chargingthe battery to provide the backup power when the regular power source fails. This authentication is provided by obtaining the theoretical calculation of output power, output current and output voltage which are developed due to solar radiations. In this system, if the primary load is not in use, then the power is automatically switching over to secondary load. Basically, an UPS is electrical equipment that is used at the time of emergency. The battery bank is charged with the help of solar photovoltaic cell. This paper proposed an approach to understand the peak power point of the sun based on analysis of the open-circuit voltage of the PV panel. This project provides the power supply to a load which is uninterruptible, by automatically selecting the supply from the main source or inverter.***

Keyword: UPS, Sun tracking system, PV module.

I. INTRODUCTION

Renewable energy is the most abundant source of energy in the whole world. It is the natural source of energy with no pollution. There are various improvements has seen in the solar panel technology. Energy output by solar is dependable with the factors like solar intensity, ambient temperature, speed of wind. We can extract the higher efficiency of the sunlight only when the sun is perpendicular to the surface of solar cell, as the panel mounts itself according to the sun's position throughout the day. Therefore, we use solar tracker or MPPT to increase the efficiency. By using the solar tracking system, the photovoltaic panel is perpendicular to the sun radiation during working hours in order to increase the output. A battery bank can be used to store the solar energy and provide the backup supply when there is no sunshine. An UPS system(uninterruptible power supply) is electrical device which provides emergency power backup to the load when the main supply source fails. There are different types of UPS system, which are used according to the need of the consumer. Generally, a modular UPS is having higher availability than a monolithic, double conversion and on-line UPS system. However, most of the consumer still uses monolithic UPS in a stand-alone or redundant parallel configuration. This paper defines various UPS system and calculate its effect on UPS reliability. It also describes which main design should be implemented to attain the maximum output. If the power transfer between the PV source and the load is not optimum, then the output of the PV system will be negatively affected. In this paper we are using various equipment's like Solar PV module, BMS (battery management system), MPPT (maximum power point tracking), Automatic switching, microcontroller, Relay circuit etc. the PV module is connected with the MPPT to extract the maximum power point and move according to the sun's direction. The BMS is connected to the system for maintaining the stored solar energy when there is a cloudy weather, the battery is charging through the solar energy. This system will work automatically when the main supply cuts in a frequent manner. So for that we use a microcontroller which is connected to the switch. Further we add relay to the system for normally open and closed the circuit whenever required. For testing we uses a bulb which is drawing power from the main source and when the power fails it is automatically connected to the UPS. The automatic power supply system is necessary for the consumers who want to draw uninterruptible power from various sources. For example, the software companies are working on the computers so it is required to attain the uninterruptable power supply all the time, otherwise the computer could be turned off.
The various components which we have used are listed below with their working:

A. Solar PV system

A solar panel also known solar module, photovoltaic module or solar photovoltaic panel is a panel which is an assembly of various photovoltaic cells. The solar panel or PV system can be used to generate the solar energy in the larger amount and supply the electricity in the commercial as well as residential applications. Each panel is rated by its DC power output under standard conditions (SC), and ranges from 100W to 450W. A PV system basically includes solar panels array and a battery and solar tracker system and interconnection wiring. In our design we considered about 10 crystalline panels, each have a maximum power output of 210W and the voltage and current rating of 11.05A at standard conditions (SC), irradiance is 1000 W/m² and Amp 1.5.

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For tracking the sun's direction, we use MPPT (maximum power point tracker) device to keep the PV panel perpendicular to the sun and further it is connected to the battery bank for the backup power.

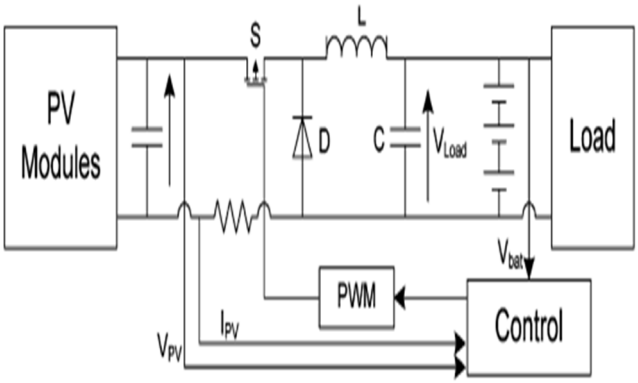
B. BMS

BMS stands for battery management system. There are different types of batteries present but we use li-ion battery. It is the best choice for battery as it has many advantages over other batteries. Like it has good energy density, good power rating, good charging and discharging capacity etc. basically, a number of cells, which are depending on the application we work, are connected in series. It is used to build a battery string with the required voltage.The Li-ion batteries are very sensitive. If the battery is overcharge and deep discharge, then it may cause damage to the battery efficiency, affects its lifetime, and also causes hazardous situations. So,it requires the adaptation of Battery Management System to maintain the battery to its safe operating range. The performance of the battery is varying over time so it is quite a challenge. It stores the extra energy generated which is not in use.

C. Battery

Battery used for the supply of our system to satisfies the requirement of the consumers.

D. MPPT



MPPT stands for maximum power point tracking. This device is used with solar module to extract the maximum power from the sun with proper angle setup of panel. When any solar panel is connected through load its output power point might be at peak. There were quite a few methods to determine the peak point one of the most common method is using impedance therefore by changing the impedance we can easily shift the operating point towards peak point.

In this project to transfer the from source circuit to load we use convertor since module draw DC devices, DC-DC convertor is used.to reach the peak power point we will alter the duty ratio which will result in change in impedance as seen by the panel.

We cannot fix the duty ratio as the climate conditions may vary.There are various algorithm for its implementation. We can use microcontroller to apply this algorithm.

E. Automatic Switching

The main objective of this project is to provide continuous supply to the load, by automatically selecting the supply from any source. As we know that the power cuts frequently and causes many problems everywhere specially in industries, households, hospitals, offices etc. which are required to be prevented. An alternate of this must be used in this. So, we use automatic switches in this to overcome that problem. A microcontroller (ATmega328) is used. The output signal from the is given to the relay, which switches on the appropriate relay to maintain an continuous power supply to the load. Microcontroller is connected with the switches, which gives the input signals. Now the output will beobserved by using a bulb drawing power from the mains initially. On the failure of mainsupply, the load gets supply from the other available sources.

F. UPS System

An UPS stands for uninterruptible power supply and it is also known as battery backup system. when the regular source of power fails itprovides backup power or we can say the when voltage level drops to an unacceptable level It managesthe connected device with proper shutdown. The design and size of a UPS system defines how long itwill supply power.

II. VARIOUS UPS SYSTEM

Different UPS havedifferent unit of power protection. A common UPS will consist of one of these technologies:

1) Double conversion,
2) Standby,
3) And line interactive.

A. Double-conversion (online) UPS

Theyare source of flawless, pure and consistent nearly perfect output power despite of the condition of mains powersupply. The name itself describes that it converts the power twice, firstly AC input supply to DC then back to AC.While AC input converted to DC all of its distortion, voltage fluctuation and other noise factor were stabilize using a capacitor. Then secondly for regular supply it is again converted to tightly monitored AC supply. We can have different AC output frequency.they never need to change to DC power in light of the fact that UPS frameworks with this innovation work on confined DC power 100% of the time and have a zero-transfer time.

B. Standby

This is one the most commonly used technology of ups system. In this type of ups system, a battery backup is used to store the charge which is later used while distorted supply or power interruptions.In this type of ups system while unsafe voltage delivery they automatically switch to battery which provide safety to the equipment.This type of device can be used with security systems, entry-level computers, consumer electronics, POS systems, and various another device.

C. Line Interactive UPS

This technology is mostly used when there are very few and minor fluctuation in this, we never get to the battery power. In this type of UPS, we use autotransformer to regulate the voltage fluctuation related distortion without switching to the battery. These provide power when we have power breakdown due to voltage surge or overvoltage or undervoltage like situation.
Line interactive UPS technologyis typically used for home theater electronics, PCs, gaming systems, network equipment, consumer electronics,and entry-to-mid-range servers

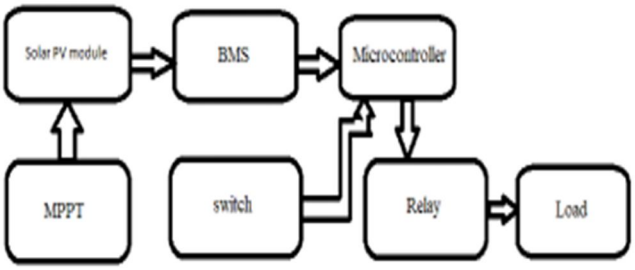


FIG: BASIC MODULE

III. CONCLUSION

With the help of this method, it is possible to accommodate the load to the PV system, follow with the MPPT however the conditions of the weather may vary. In developing countries, where power failure is regular, it is needed to improve UPS systems. It will provide the backup power supply to the equipment's in the industries, household, hospitals, offices etc. when the voltage level drops to an unacceptable level.

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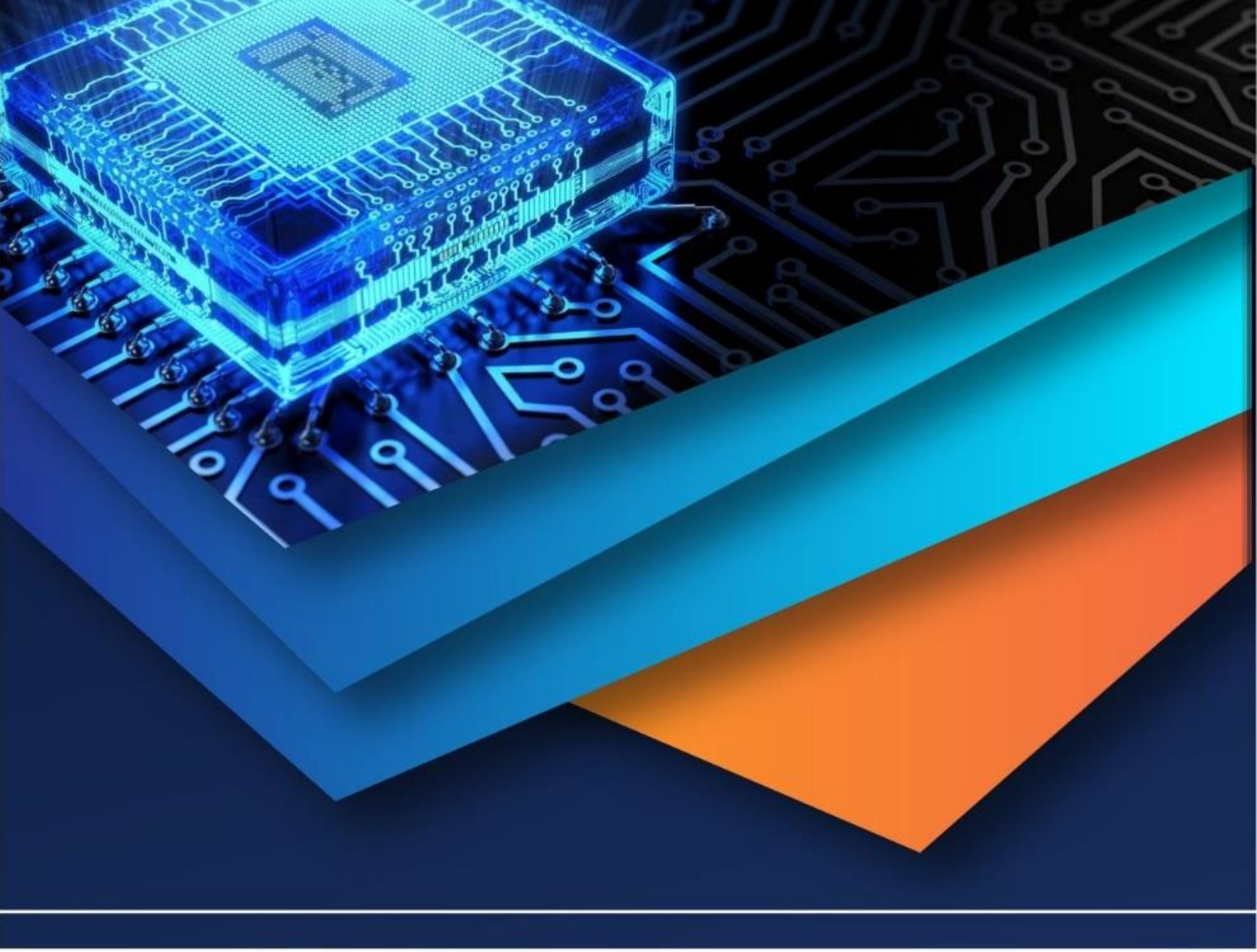

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