Design And Implementation Of Intelligent Solar Energy Charge Controller With PV System By MPPT.

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ABSTRACT

This thesis aims to design a simple and effective charge controller with maximum power point tracker for photovoltaic system. It provides theoretical studies of photovoltaic systems & modeling techniques using equivalent electric circuits. As, the system employees the maximum power point tracker (MPPT), it is consists of various MPPT algorithms & control methods. The results validate that MPPT can significantly increase the efficiency & the performance of photovoltaic system.

Keyword : - *maximum power point tracking(MPPT), photovoltaic(pv), buck converter, boost converter*

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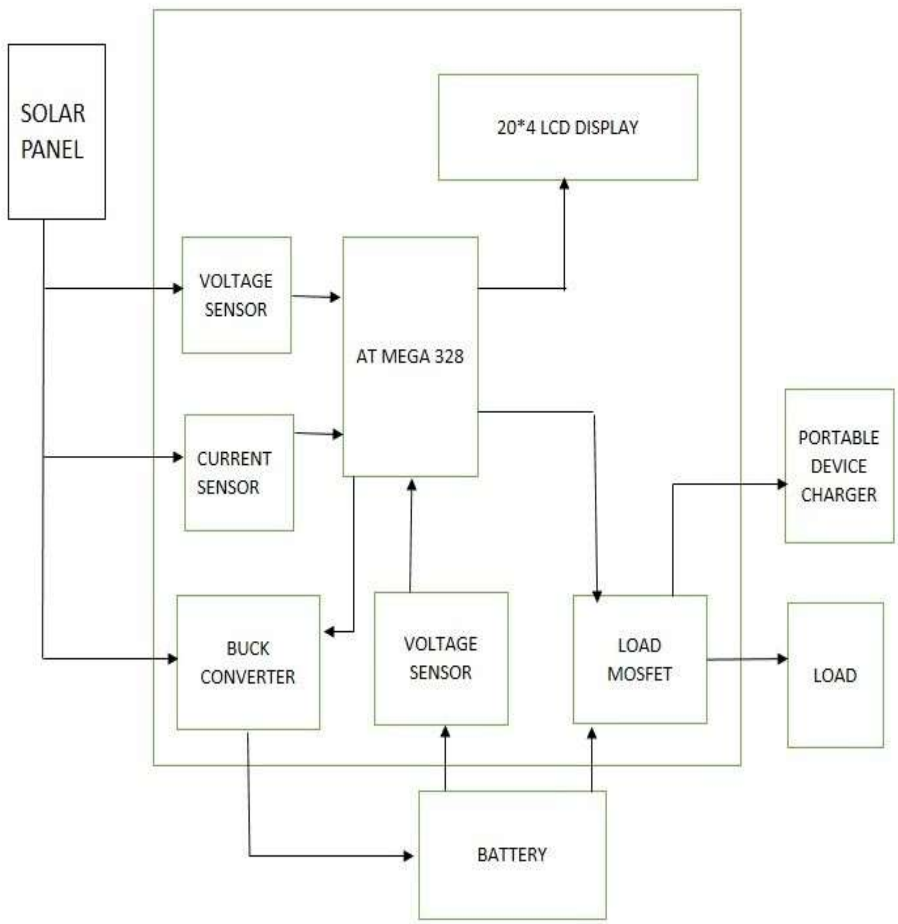
1. INTRODUCTION

In a world of increasing energy demand, it is imperative to come up with innovative solutions to reduce & conserve energy use. There is a significant interest in creating an environmentally friendly system that will save money on electricity & maximize the cost return on investment for solar panels. The goal of the project is to create a stand-alone off-the-grid photovoltaic (PV) system that utilizes maximum power point tracking (MPPT) to obtain the most efficiency. Due to the inherent losses that occur in photovoltaic systems, it is essential that the maximum power is extracted. The objective is to create an extremely efficient magnitude controller that will be capable to monitor the power generated by the photovoltaic array & deliver the maximum amount to the battery bank during varying atmospheric conditions.

In order to implement maximum power point tracking, data from several different sensors will be fed into a microcontroller. Here the MPPT algorithms will clarify the incoming current and voltage from the PV panel as well as the battery to calculate what amount of power should be used to charge the battery. The microcontroller can then physically change the voltage by driving the buck and boost DC-DC converters in the circuitry.

Within the charge controller, several features have been added to increase the ease of use & allow for more thorough testing. In order to quickly view the status of the system, an LCD screen will be attached to the charge controller to display several values such as current, voltage, and temperature. In addition, this data will be transmitted wirelessly to a separate wireless transceiver that is attached to a computer. Along with the previously mentioned sensor quantities, the ambient irradiance on the solar panel will be measured and recorded to give further insight into how the system performs in varying atmospheric conditions.

2. BLOCK DIAGRAM



2. WORKING OF SYSTEM

In this we use a voltage tracking based system, in which we track the input for optimizing maximum power point. The TL494 IC is a fixed frequency variable duty cycle IC, it is operated as DC-DC converter and Tracker.

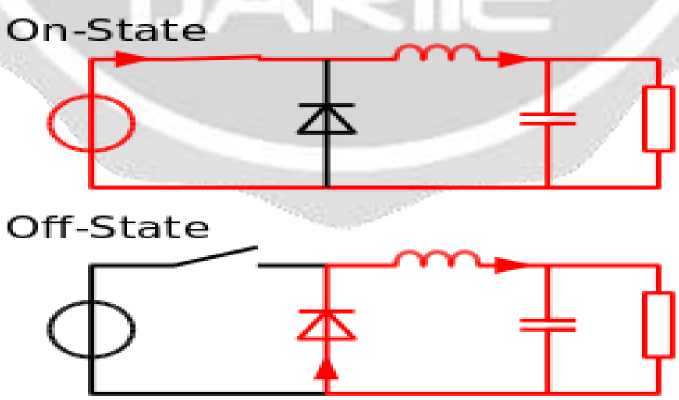
The TL494 has two in built comparator, we have use one comparator for to maintain output voltage constant whereas another for input voltage tracking purposes. We take overall day analysis on 100W solar panel for checking the operating voltage where achieves a maximum power point, we find that 13.5 to 14.5 panel voltage achieves maximum power. So if we track this i/p voltage then obtain maximum power every time. This is done by we use TL494 for that purpose, one comparator of TL494 IC compares the input voltage with ref value (set Value i.e. 13.5) i/p voltage lock to this value by adjusting duty cycle (it has inbuilt function). TL494 operates on the frequency of 22Khz by choosing CT & RT value and we use this IC in push pull mode, using centre tapped ferrite core transformer, we have use push pull amplifier based on IRF3205 MOSFETs which will derived through BC547 & BC557 transistor. The output of ferrite core transformer is rectified through a schotky diode and filtered through LC type filter to get pure dc output voltage.

3. DESCRIPTION

1. This project is divided into two parts.one is the without MPPT and another is with MPPT.
2. In without MPPT, we can directly connected PV module to load and measure the voltage and current by voltmeter and multimeter. Then, calculate the power.
3. In with MPPT, buck-boost converter circuit is connected between the PV module and load. Then, see the power on the LCD display.
4. Now, we have two power readings from two parts. So, we calculate the difference between the two powers in percentage.
5. So, this percentage is called as efficiency and then check the how many efficiency is increased.
6. From this project, we can show the increased efficiency using the MPPT charge controller than without MPPT used.

HARDWARE DISCRIPTION

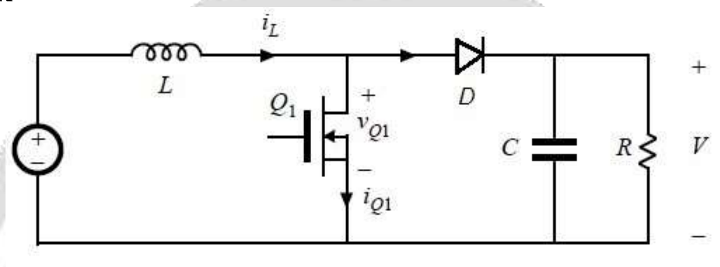
BUCK CONVERTER



A buck converter or voltage regulator is called a step down regulator as the output voltage is lower than the input voltage. In a simple example of a buck converter, a diode is connected in parallel with the input voltage source, a capacitor & the load, which represents output voltage. A switch is connected between the input voltage source & the diode & an inductor is connected between the diode & the capacitor. A pulse width modulation controller controls the switch. In this project the microcontroller will serve as a pulse width modulation source.

There are two stages in a buck converter topology. When the switch is closed the inductor absorbs power as its current increases. Due to this power absorption the output voltage is greater than the input voltage. The capacitor current can point in either direction depending on the difference between the inductor current & load current. In Figure the capacitor is charging on the left & discharging on the right.

BOOST CONVERTER



As with the buck converter, the boost or step-up converter circuit consists of a switch, a diode, an inductor & a capacitor. Their positions in the circuit change in comparison to the buck converter. In this case the switch is in parallel with the input voltage source, the capacitor & the load. The inductor is placed between the input voltage source and the switch and the diode is placed in-between the switch & the capacitor. A simple boost circuit with the components mentioned above is shown in Figure. The switch is shown as a transistor. Just like in the buck converter case there are two separate stages in this boost converter topology. When the switch is on or closed the input voltage is used to increase the inductor current as energy is stored in the inductor. The switch acts as short circuit path to maim the RC part of the circuit on the right side of the diode. The diode prevents the capacitor from discharging the output voltage to ground. The second stage is encountered when the switch is opened or off. The tendency of inductor to resist changes in current enables the boost in voltage. When the inductor is charging it acts as a load & stores energy. In this state the inductor acts as an energy source & the output voltage produced during its discharge is related to the rate of change of current, not the input voltage, so allowing a difference between the two voltages. The inductor current is used to charge the capacitor and their by boost the output voltage. As the output voltage increases the current decreases.

4. CONCLUSION

In this project, we have implemented MPPT charge controller system based on buck-boost converter is very efficient to increase the efficiency of solar system and provide the maximum power to load. This system is helpful to reduce the cost of generating power than other techniques of generating power. From this technique. We can increase 25-30% efficiency. Here we implement less system complexity. That means, if we used voltmeter and ammeter to measure the voltage and current. Then, some mistakes are occurred at taking readings. Power does not get accurate. So, we used to LCD display to show directly voltage, current and power. That’s why, we get the accurate power when the buck-boost converter circuit is connected. But in without MPPT we have to use voltmeter and multimeter to measure voltage and current for calculate power.

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