Maximum Power Point Tracking of Solar Panel Using Inverse Sepic Converter

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Abstract: *The Sun based vitality is rapidly progressing as an essential method for renewable energy resources. More vitality is obtained by tracking the solar panel, by placing the panel remains related to the sun at a right edge to the beams of light. It illustrates the point of interest of outline and development of a model for solar tracking system with two degrees of opportunity, which recognizes the sunlight by means of photocells. The control circuit for the sun powered tracker depends on a PIC16F877A microcontroller (MCU). This is modified to recognize the sunlight through the photocells and afterward trigger the motor to position the solar panel where it can get most extreme sunlight.*
Index Terms: *MPPT, Solar Tracking Method, Inverse SEPIC Converter, LDR.*

I. Introduction

Introduction to Inverse SEPIC converter in MPPT allow us to use of new possibilities in efficient software controlled power supplies. In several markets, demand is increasing for well-organized non-inverting dc/dc converters that can control the operation either in buck or boost mode, decreasing or increasing the input voltage to a desired synchronized voltage with minimum cost and component count. The purpose we are using has covered 100W inverse SEPIC (single ended primary inductor converter) are also called as zeta translator. The inverse SEPIC is a charge controller. The uniqueness consists of driving the topology synchronously using microchip components, approaching the efficiency over 95% at 6A. The zeta converter has several advantages like input to output DC insulation, buck boost capacity and produce the constant output current (Iout), but it is not easy to control. The compensation of the new inverse SEPIC translator is one and the same as buck boost functionality as the SEPIC, but the continuous output current provided a clean, low ripple output voltage. This low-distortion output translator can be used to control certain types of load such as LEDs which are receptive to the ripple voltage. The zeta translator offers the identical DC isolation between the Input and Output as the SEPIC translator and can be used in high reliability system.

I. 2. Solar Tracking Method

The Sun Monitoring System (SMS) was able to programmed and place the panel perpendicular to the direction of sun as far as the intensity of light is visible. The selective component of the system is that it must suppose to choose the sun as controlling source rather than the earth as its reference. Their dynamic sensors continuously observe the light intensity and tilt the panel almost near the path where the intensity of light is at its peak level. In the event that the sun gets undetectable e.g. in shady climate, then without tracking the sun, the SMS continues to rotate the panel exactly in opposite way to the rotation of earth, until its rate of rotation is similar to that of earth's rotation. Due to this property while after some time e.g. 30 minutes when the sun again gets visible, the PV panel is accurately in front of the sun.

2.1 Need for Solar Tracking Method

Comprehensively temperature alteration has expanded the interest and asks for environmentally friendly, essentiality of power energy acquired by the renewable energy sources like solar power. The end user would incline towards the tracking system rather than a fixed ground system. Since:

- The proficiency increments by 30 to 60%.
- The space essential for a sun oriented recreational zone is diminished, and they keep the same amount of productivity.
- The event of return venture is decreased.

Checking the direction of sun from east to west will resolve the proficiency of the solar power by 30 to 60% depending upon whom you ask and where you are in the world. Near the equator, you could have the maximum advantage from monitoring the sun.

2.2 Working of Solar Tracking method

First we have to arrange photo conductors at right angles to the posture of sunbeams. So photo conductors just grab the immediate radiation from the sun.

- Because of the immediate radiation more photon produces EMF due to photoelectric impact.
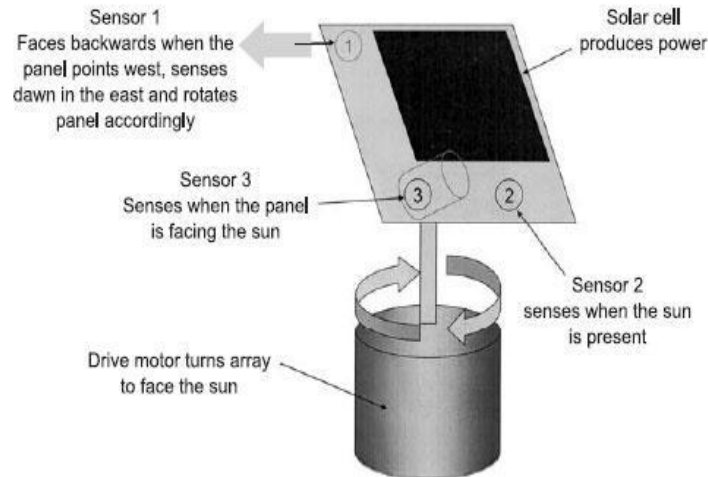- Location of the photo conductors is shown in below figure.

Figure1. Position of the sensor

When the sun gets the immediate radiation then the circuit is in off condition.

- But when sun moves from its place, Photo conductors don't get any light emission and circuit comes in ON condition.
- Solar beams conferred on the PV cell straightforwardly wrapping its most extreme Area.
- Due to the PV impact the current produced in the circuit and this current is sparing in the battery.
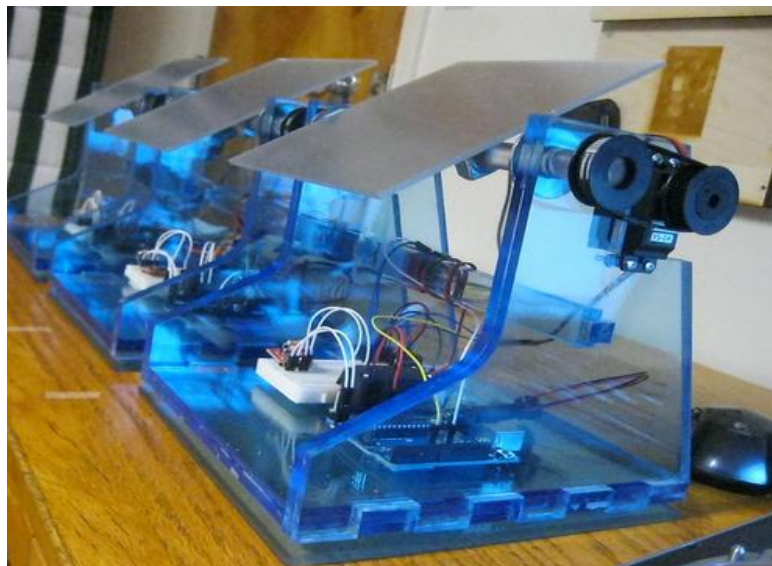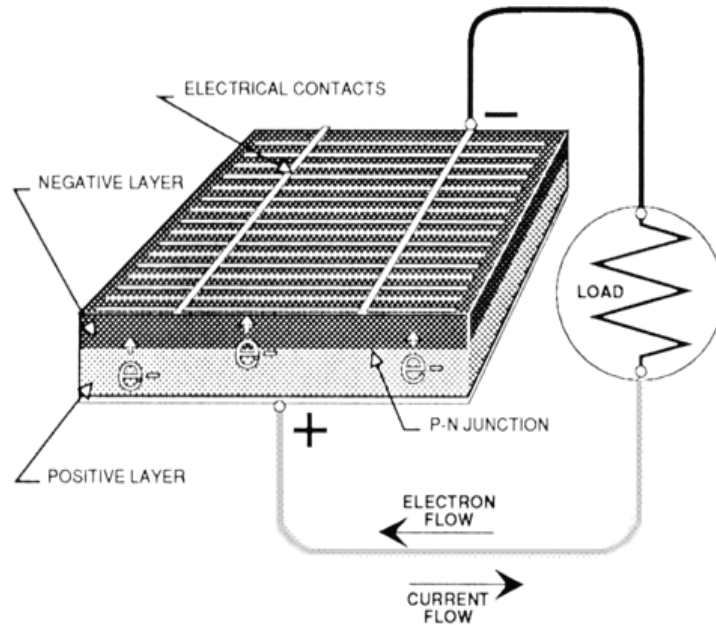

Figure1. (a): sun position

Figure1.(b): Solar panel

Sunlight is the method of the response.
- The output current of this response is DC and the measure of vitality created is straightforwardly relative to the measure of sunlight.
- Cells just have a normal efficiency of 30%.

2.2 Advantages of Solar Tracking
- **The preservation of non-renewable vitality sources**
  Power from the sunrays makes the use of decreasing common sources like coal, oil and gas. Nowadays, we are living in a specially challenging atmosphere everywhere usage of energy is increasing at a shocking rate. It is very important to conserve the fossil fuels from the earth's surface and other usual resource, not only for better environment but also for capability of upcoming generation to gather their individual needs.

- **Low-grade Rates of waste and toxic substances**
  Sun oriented force system minimizes the measure of abundance creation. For an instance, complete procedure of changing over coal to electrical energy gives a part of dust, unnecessary garbage, leakages of pollutant, dangerous flue gas, and wasteful vitality, thermal vitality, water and land. Toxic substances from fossil fuels are unpreventable. Flue gas like carbon dioxide (co2), Nitrogen Oxide (NO), sulphur dioxide (Sio2), each of the substances can have a harmful cause on cultivation, needs of human being's. Hazard's of ecosystem is also being demolished. In addition to this, the polluted substances from kerosene are meant for illumination point of view is condensed with the utilization of sun oriented force systems, furthermore the reduction in usage of diesel generator makes the generation of power.

- **Offsetting the Green House effect**
  Sun oriented force system generates electrical vitality without charitable means off Carbon Dioxide (CO2). One solar array system can compensate approximately 6 loads of Carbon Dioxide emissions directed from 20 years of existence.

- **Reducing the usage of power**
  Sun radiation system enhances the vitality skill, so it is extremely valuable for 3rd world countries. Vitality from sun radiation system reduced the expenses of Non-nuclear power resources for developed zone, it is less cheap for commercial and industrial purpose to running their performance. It leaves the usage of solar energy systems to produce the more power mainly for the future generation in distant zone.

- **Reduction in Discarding of Dry Cell Batteries**
  Tiny dehydrated battery cells are used for appliance like transferable radios and flashlights, although they are frequently used in remote area wherever there is absence of electrical energy. Hence, the effect from

these dehydrated battery cells can have harmful effect on water and soil. Solar power decreases the need for using dehydrated battery cells and therefore limits the hazard of contamination.

II.   Need For Mppt

MPPT stands formaximum power point tracker. An MPPT will raise the current while lowering the voltage such a process is nothing but dc-dc conversion. It takes the dc input from the PV panel converting into ac and again converting it back into different dc voltage/current to exactly match with the battery voltage/current.

MPPT will exchange the current and voltage but still can have the same power. For an example:

1amps at 100volts = 100watts;
10amps at 10 volts = 100watts;
1volt at 100amps = 100watts;

Note that voltage is lower as the current is raised but still has the same power. MPPT uses this technique to check the output voltage of panel and compares it to the battery voltage while increasing the current, subsequently fix the best power that solar panel can generate to charge the battery and converts it into better voltage to get maximum current into battery, most commonly used in off grid and RV(recreational vehicles) solar system.

MPPT is an enhancement of charge controller, it is a battery charger and load controller integrated with LED driver which signifies the efficient tracking method that increases the energy from the PV module. MPPT accomplish more function to develop the system efficiency.

Maximum power can be produced by placing the DC-DC converter b/n the PV panel and the battery. The duty cycle of this converter is varied until to get the peak power point so that we can match the source impedance from PV module to that of Load impedance.

3.1 VOLTAGE BASED MPPT

It has estimated that the Peak power point of a specific PV module is exactly 0.75 times that of open circuit voltage of the module. Subsequently the reference voltage can be obtained by measuring the open circuit voltage which provides an advance control voltage scheme to convey the panel voltage to the peak power point. But there is a problem in this method is that open circuit voltage of the module may vary with the temperature. As a result if the temperature value changes, then the module open circuit voltage also changed so we need to check the open circuit voltage of the module all the time. Therefore the load should be disconnected from the module to measure the open circuit voltage. Because of which the power at this moment won't be used.
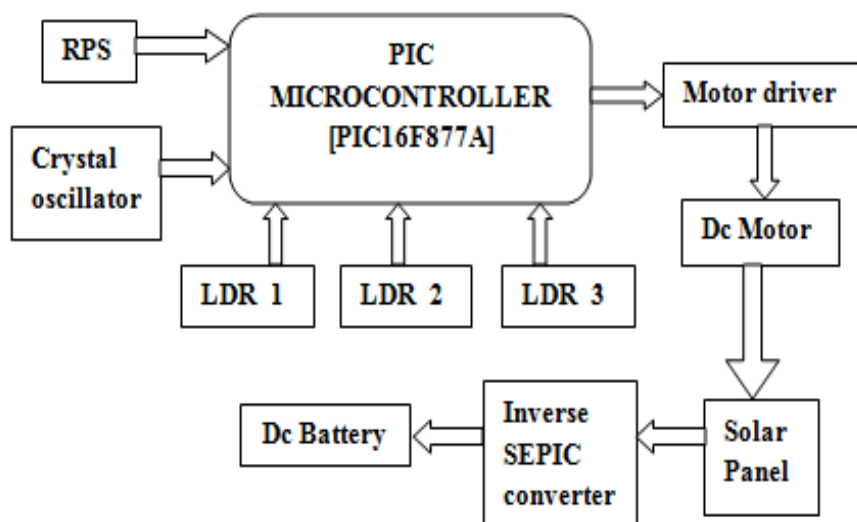
Fig 2. Proposed Block diagram

III. Inverse Sepic Converter

The purpose of inverse SEPIC contains the necessary information regarding the application is to build a 100W battery charger. It is also known as zeta converter. The uniqueness of driving this topology synchronously by using Microchip components, basically approaching the efficiency greater than 95% at 6A. There insist is increasing the well-organized non-inverting DC/DC converters to work either in buck or boost mode with component count and minimal cost. The principal of inverse SEPIC converter is suitable for this function. The whole execution of a regulator and charge library uses only 1k words of program space along with 55 bytes of RAM.
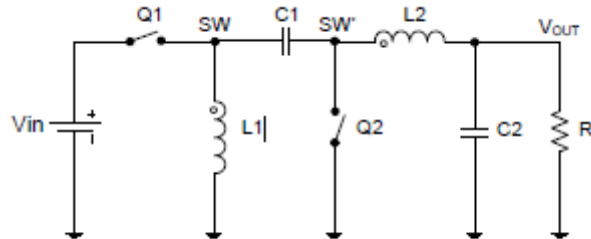

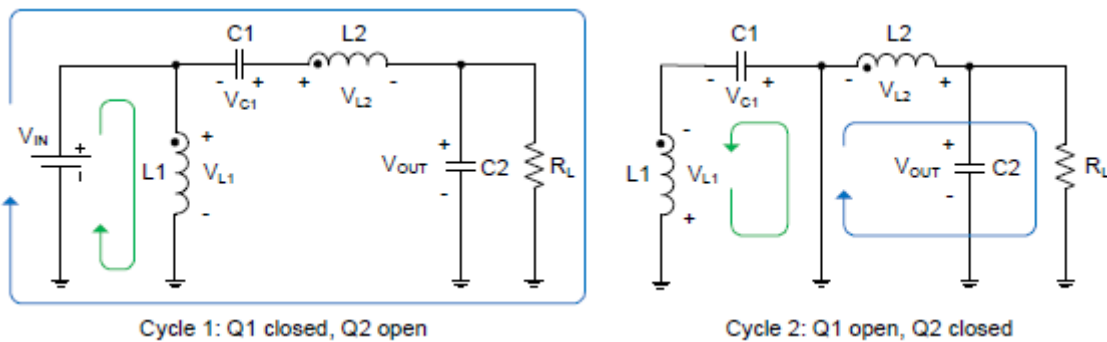**Figure 3. (a) Inverse SEPIC Converter Power train**

Figure 3. (b) Switching cycle of Inverse SEPIC Converter

In the first cycle, Q1 is closed and the current begins to flow in the primary inductor L1 and through the load via the coupling capacitor C1 and inductor L2. In the second cycle, Q2 is closed and the energy stored in the L2 inductor is delivered to the load. The energy stored in the main inductor L1 will be reset to its initial value through the coupling capacitor C1.
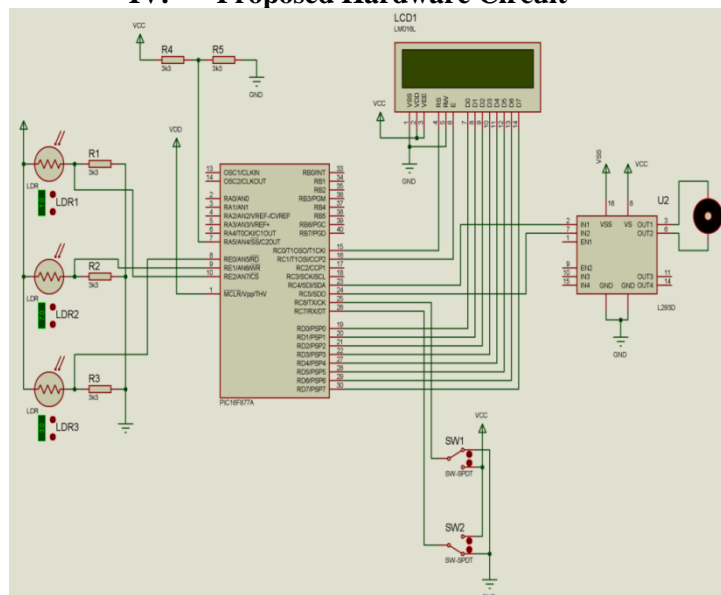
IV. Proposed Hardware Circuit

Fig 4: Proposed hardware circuit

V. Experimental Setup

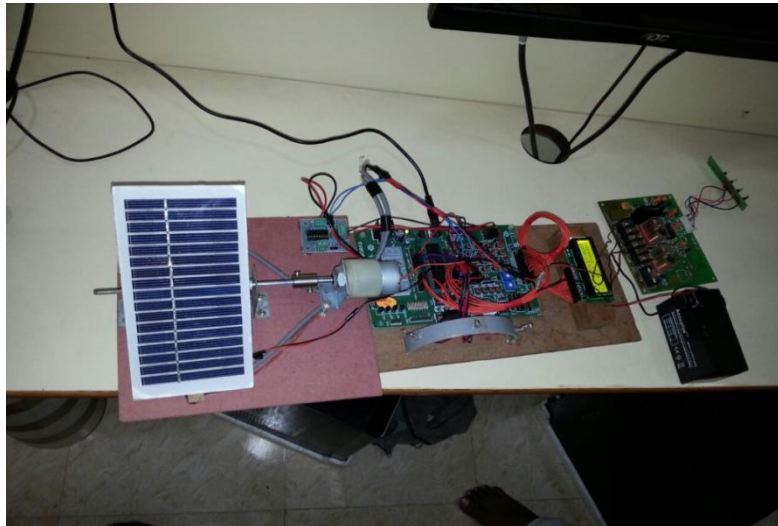Experimental setup of the project is as shown in the figure below.

Fig 6: Hardware module

VI. Conclusion

DC/DC boost translator is designed using PIC microcontroller and a Single axis solar monitoring model is developed. The hardware model is designed and constructed. The results of the hardware model are compared with simulation results using MPlab software. The panel output voltage and the Boost translator output voltage of the hardware circuit is compared with the simulation result of PV cell and the Boost translator. So we can conclude that system is capable to observe and follow the light intensity in order to obtain maximum output power. This output voltage can be applied to any appliance load. In this project output is applied to the inductive load (CFL).

Acknowledgement

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