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Sun Tracking Solar Inverter

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***Abstract* - we propose a sun tracking solar inverter project that uses solar energy to charge battery and then the DC battery is used to power an AC load using inverter circuit. Our solar panel is used to constantly charge the 12V DC battery using charge controller circuitry. And once we turn on the load switch the battery charge is inverted and stepped up from 12V DC to around 140 – 150 V AC using step up transformer. This is now provided to the AC load. Thus, our system successfully powers AC load using a solar panel and battery.**

Index Terms: AC, DC, Solar Energy

I. INTRODUCTION

There is already frequent occurrence of copyright infringement and disclosure of personal information cases The need of running AC Loads on solar energy leads us to the design of Solar Inverter. Some of the appliances run on 150-170 volts AC, the Solar Inverter will be the heart of the Solar Energy System. It not only converts the low voltage 12 volts DC to the 150-170 volts AC that runs most appliances, but also can charge the batteries if connected to the utility grid as in the case of a totally independent stand-alone solar power system. These are special inverters which are designed to draw energy from a battery, manage the battery charge via an on-board charger, and export excess energy to the utility grid. In order to increase the efficiency of the solar panel, the panel should always face towards the sun.

II. LITERATURE SURVEY

A. Energy Sources

An energy resource is something that can produce heat, power life, move objects, or produce electricity. Matter that stores energy is called a fuel. Human energy consumption has grown steadily throughout human history.

There are two type of energy sources

1) Non Renewable Energy Sources

Non-renewable energy comes from sources that will run out or will not be replenished in our lifetimes—or even in many, many lifetimes. Most non-renewable energy sources are fossil fuels: coal, petroleum, and natural gas. Carbon is the main element in fossil fuels.

2) Renewable Energy Sources

Wind, solar, and biomass are three emerging renewable sources of energy. Renewable energy is generally defined as energy that is collected from resources which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.

B. Required input data

Solar PV system includes different components that should be selected according to your system type, site location and applications. The major components for solar PV system are solar charge controller, inverter, battery bank, auxiliary energy sources and loads (appliances).

1) Size and Rating of Solar Panel – converts sunlight into DC electricity.
2) Solar charge controller – regulates the voltage and current coming from the PV panels going to battery and prevents battery overcharging and prolongs the battery life.
3) Size of Inverter – converts DC output of PV panels or wind turbine into a clean AC current for AC appliances or fed back into grid line.
4) Size of Battery Bank – stores energy for supplying to electrical appliances when there is a demand.
5) Load – is electrical appliances that connected to solar PV system such as lights, radio, TV, computer, refrigerator, etc.
6) Type of Connection of Solar Panel
7) Energy from Solar Panel as per Daily Sun lights
8) Select Type of connection of Batteries in Battery Bank

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C. MODELLING OF 50WATT SOLAR INVERTER

Now let's begin,
Suppose we have to design an inverter for load of 40 Watts and required backup time for batteries is 1 Hour and we have to model a Solar Inverter than Inverter ratings, Required No of Solar Panel and No of batteries are calculated as follows.
Inverter should be greater 25% than the total Load

40 x (25/100) = 10
40+10 = 50 Watts
This is the rating of the UPS (Inverter)
Now the required Back up Time in Hours = 2.5 Hours
Suppose we are going to install 4.5Ah, 6 batteries,
6V x 4.5Ah = 27Wh

Now for One Battery (i.e. the Backup time of one battery)
27Wh / 40W = 0.675 Hours
But our required Backup time is 1 Hour.
Therefore, 1/0.675 = 2→ i.e. we will now connect two batteries each of 4.5Ah, 6V.
So this is a 12 V inverter system, now we will install two batteries (each of 6V, 4.5Ah) in Parallel. Because this is a 6V inverter System, so if we connect these batteries in parallel, then the Voltage of batteries 6V remains same, while it's Ah (Ampere Hour) rating will be increase

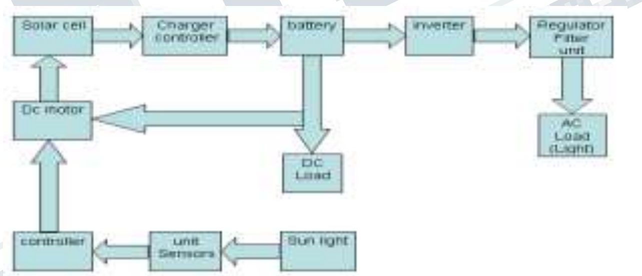
1. In parallel Connection, Voltage will be same in each wire or section, while current will be different i.e. current is additive e.g. I1+I2+I3…+In = 4.5Ah +4.5Ah = 9Ah
2. In Series Circuits, Current is same in each wire or section while voltage is different i.e. Voltage is additive e.g.V1+V2+V3….Vn. For The above system if we connect these batteries in series instead of parallel, then The rating of batteries become V1+V2 = 12V while the current rating would be same i.e. 4.5Ah.

We will now connect 2 batteries in parallel (each of 4.5Ah, 6V), therefore for two Batteries it will be 9 Ah 6V, Now Required Charging Current for these two batteries (Charging current should be 1/10 of batteries Ah) → 9Ah x (1/10) = 0.9A
Now the required No of Solar Panels
P = VI
P = 6V x 0.9 A
P = 5.4 Watts
This is our required watts for solar panel (only for battery charging, and then battery will supply power to the load), Now
5.4W/3W = 2 Solar panels
Or 5.4W/6 = 1 Solar panels

III. PROPOSED MODEL

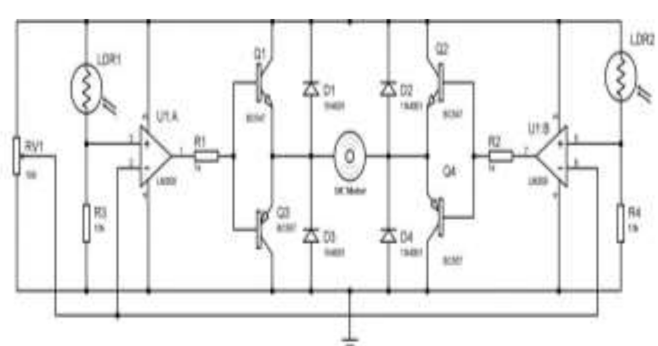
Here we propose a sun tracking solar inverter project that uses solar energy to charge battery and then the DC battery is used to power an AC load using inverter circuit. Our solar panel is used to constantly charge the 12V DC battery using charge controller circuitry. And once we turn on the load switch the battery charge is inverted and stepped up from 12V DC to around 140 – 150 V AC using step up transformer. This is now provided to the AC load. Thus, our system successfully powers AC load using a solar panel and battery.

A. Block Diagram of Sun Tracking Solar Inverter



it consists of Three sections:
Section A: Sun Tracking
Section B: Inverter
Section C: Temperature Display

B. Sun Tracking



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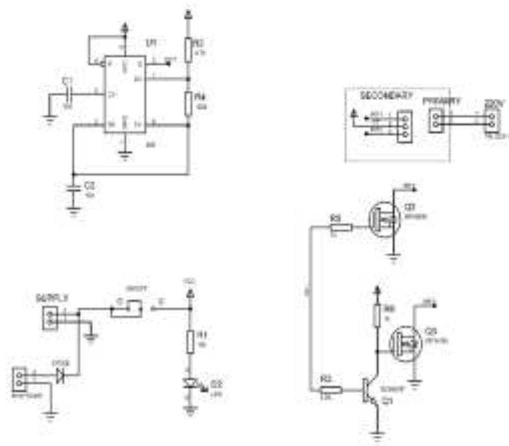
The heart of the above circuit is two voltage comparators made using LM358 Dual Op-Amp. We all know that when the intensity of light falling on a LDR increases, its resistance decreases. Here LDR is connected with a series resistor (R3 & R4), hence when the intensity of light falling on a LDR increases, voltage across corresponding resistor (R3 or R4) increases.

The output of the voltage comparator will be high when the voltage at non-inverting terminal (+) is higher than the voltage at the inverting terminal (-).Inverting (-) terminals of both comparators are shorted and connected to a variable resistor (RV1), which is used to set the reference voltage. Thus the sensitivity of both LDRs can be adjusted by varying the 10K pot shown on the left side of the circuit diagram. When the light falls on a LDR increases, voltage at the non-inverting (+) terminal of corresponding comparator increases and its output goes HIGH.

INPUT A	INPUT B	OUTPUT C
0	0	STOP
0	1	CLOCK_WISE
1	0	ANTI_CLOCKWISE
1	1	STOP

The direction of motor rotation is controlled by theH-Bridge formed by the complimentary symmetry transistors BC547 and BC557. Consider the case when the output of first comparator (U1:A) is high and output of second comparator (U1:B) is low. In this case transistors Q1 and Q4 will turns on and the resulting current rotates the motor in clockwise direction. Consider the case when the output of the first comparator is low and the output of the second comparator is high. In this case transistors Q2 and Q3 will turns on and the resultant current rotates the motor in anticlockwise direction. If the output of both comparators are low, transistors Q3 and Q4 turns on, but no current will flow through the motor. Similarly, if the output of both comparators are high, transistors Q1 and Q2 turns on, but no current will flow through the motor. The DC Motor should be connected to the panel in such a way that, the rotation of motor rotates the panel in the direction of movement of the Sun

C. Inverter

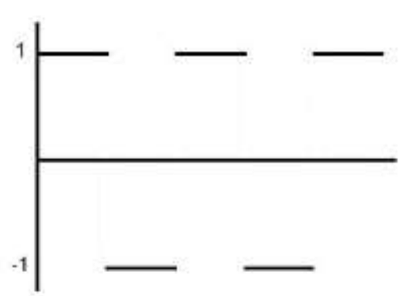


This PCB consists of IC 555, transformer, switching network using transistors, solar panel & 12v battery. When the switch is ON, the current from the battery flows and LED glows indicating that the switch is ON. The solar panel which is exposed to sun light generates current which flows towards the battery to charge the battery.

IC 555 is used to control the transistors of switching network. Pin no.3 of Timer IC controls the transistors Q1,Q2& Q3.

Timer IC switches on Q2 for approx. 0.02 msec than it switches Q1 and this goes on. Q2 is ON for positive cycle and Q3 is ON for negative cycle when base of Q1 is high.

output DC wave form



This output is given to primary winding of transformer as input and we get 150v-170v AC output from secondary winding of the transformer.

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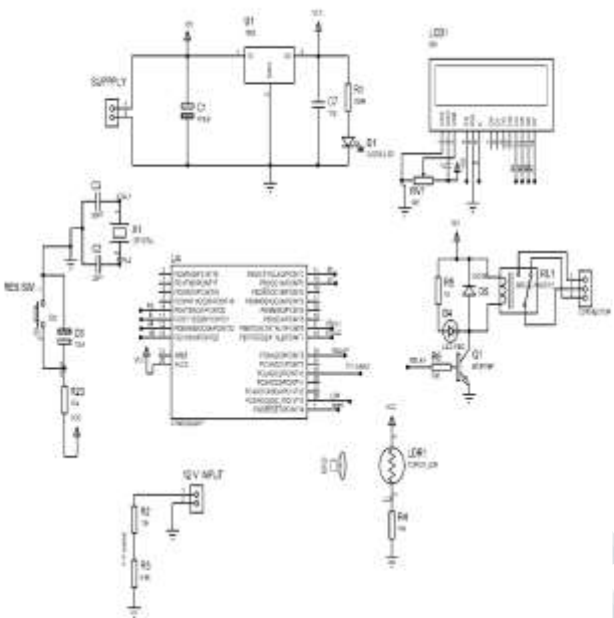
D. Temperature Display



This circuit consists of Crystal circuit, Display, ATMEGA328P, voltage regulator circuit, relay circuit, Temperature sensor and Light Dependent Register.
Crystal circuit is used to produce clock pulses which helps in processing microcontroller. Just below Crystal circuit we have Reset button which we can use to reset microcontroller.
IC 7805 is voltage regulator. It is used to maintain the voltage which runs whole PCB. The adaptor which we have used to run microcontroller and Display is of 12v but the circuit runs on 5v. Thus here IC 7805 converts the 12v adaptor voltage into 5v.
Relay circuit is used to switch on/off during night mode/day mode respectively.
During day mode, Relay is off & the circuit works directly on solar panel. During night mode, Relay is on and the circuit works on battery.
In Display we have showed temperature in degree Celsius , Day/Night mode, voltage value of battery.
Temperature sensor gives analogue value to the microcontroller and microcontroller converts analogue value to digital value and it displays on LCD display.
LDR is used to check whether its Day or night and output is given to Relay circuit.
If its Day, Relay will be Off and if its Night Relay will be On.

IV. CONCLUSION

From this we observed that this solar inverter is producing electricity free of cost by using solar energy so, its eco-friendly, pollution free and can be used for domestic appliances as well as for industrial purpose on three phase.
In this project, we made an inverter which is sufficient to supply the power to domestic load and we have indicated on the LCD display battery terminal voltage and the output voltage. From this observation, the user can get the idea about the availability of the power.
The project described is valuable for the promising potentials it holds within, ranging from the long run economic benefits to the important environmental advantages.
With the increasing improvements in solar cell technologies and power electronics, such type of project are beneficial in many applications.

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