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DC-DC Boost Converter with Constant Output Voltage for Enhancement Efficiency of Solar Cell using Simple Mirror

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Abstract:
The main purpose of this new paper is to introduce a design of Enhancement of efficiency of solar cell to drive load. In that we use optic lenses such as parabolic lenses or simple mirror to enhance the efficiency of solar cell. With enhancement we use the boost converter to generate regular output voltage. After generation of regular output voltage we store that energy using battery of input 12V. Output of battery is DC voltage, to drive AC load we use inverter for DC-AC volt converter. Inverter produces AC output voltage by using that we drive AC load. Experimental works were carried out with the designed boost conversion software which has an electric power rating of 40 Watt and 12 V outcome voltage operated in constant conduction mode at 20 kHz switching frequency. The test results show that the proposed design displays a good performance. This kind of research paper explains a practical approach to improve the efficiency of solar power panel by the use of mirrors mechanism. These kinds of reflectors are cheap, easy to handle, not so difficult to use and need no extra equipment or devices to work.

Keywords: Efficiency improvement, simple mirrors, concentrated photovoltaic, Boost converter, Inverter, Dc motor, Limit switch.

I. INTRODUCTION

The sunlight is main energy source on the planet. All fossil fuels used today are indirect kinds of solar powered energy. On Earth all renewable and non-renewable energy sources all are the indirect or direct varieties of solar energy. Hence photo voltaic energy is essential for all things those can be found on Earth. Therefore collecting energy from sun is very good and beneficial idea. As we all are know the Sun is very big alternative energy source. We can take massive amount power from sun to do our day to day activity. Currently, photo voltaic (PV) based solar component development started with strict silicon solar panels. Consequently flat-panel type |solar powered energy enthusiasts have their technology advantages in manufacturing and assembly. Nowadays use of solar electrical power for domestic and professional purpose is increases because of after using of sun power no any harmful pollutant are stay on Earth. Pertaining to that reason development in solar power generation product is increases. Mobile-panel, Spherical sun power electrical generator, Hybrid solar power electrical generator etc are the recently made concepts in photo voltaic market. Solar powered energy uses solar panel to convert sun irradiation into electricity using photovoltaic (PV) effect. The output volts of a solar-panel are varying depending on sun irradiation and temperature [2]. Because direct sunlight irradiation and temperatures changes, output voltage changing as well. Since the voltage produced is rising and falling, a lot of electronic digital equipment |are not able to be straight connected. As a result, a DC-DC boost ripping tools with regular output volts is needed. The |raise converter will step up the solar power electrical voltage to the suitable voltage required by electronic equipment's. Intended for AC electrical equipment's, the device requires an additional AC-DC inverter which converts the regular DC voltage to AC voltage. This system is called dual electric power processing stage system. In that In among boost Converter and inverter we use battery to save voltage and which will assist to run tool big time. For this required voltage can be produce the usage of small solar panel with optic lenses such as replicate or parabolic lenses. Parabolic lenses or mirror each one is optic improved lenses are used in task to raise the solar power electrical getting power to produce volt quality. Using such |an improved lenses we can produce large output voltage from small solar |solar power electrical. Concentrated photovoltaic can capable to acquire solar electric power at moments of low solar irradiation, that isn't very possible in only photo voltaic panel [1].

II. LITERATURE REVIEW

Using of renewable sources generation of electricity is now day becomes popular. To generate electric power from solar panel and use storage devices to store electricity for night time or other that the electricity generation time in increases [6]. In that hybrid concept for circuitry is developed [6] [5]. In than basically this concept is used in car, motors wheelchairs [5] [6].

Generation of electricity using simple solar panel is very hard because of sun is rise at East side and set at West side. Hence whatever electricity is generated using simple solar panel is less because of sun direction. To overcome this disadvantage in solar panel researcher starts use of Mobile solar panel for generation of electricity [5]. Using of this phenomena day time voltage is increase. For cars this method is very useful by using this 2-3 hours of car can drive using this electricity [5]. Enhance efficiency is required for all motors also those are run using solar power electricity. To drive AC or DC motor constant output voltage is required. To generate constant output voltage Boost converter is connected to solar panel which boost the output voltage of solar panel and helps to drive DC motor without short-circuit [2]. Also using this

voltage also AC motor can drive using inverter circuit after Boost converter [2] [3]. To enhance efficiency of solar power DC–DC boost converters with new coupled inductor for the solar power applications [3]. This has to achieve high step-up voltage gain by adjust the turn's ratio of the coupled inductor and varying the capacitor with proper rating of all the parameters. It is recycled the energy stored in the leakage inductor of the new coupled inductor is giving high efficient of proposed converter [3]. To charge small devices new solar devices are developed [4]. Solar sun power generator is used for small as well as big equipment for drive purpose [3].

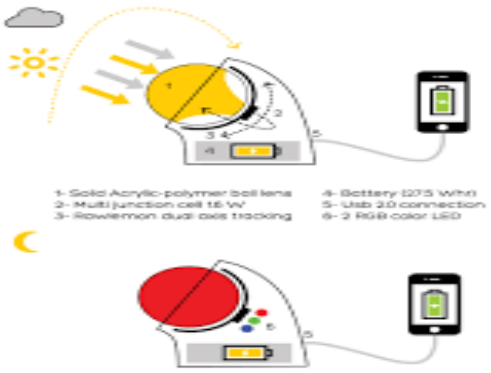

Figure.1. Spherical solar sun power generator

Above fig 1 is shows the spherical sun power generator is used for the charging of mobile phone. This device is very use full which collect energy day as well as night time also [4]. Spherical solar power generator is collect day time energy from sun and also collects night time energy from moonlight [4].The beta Ray comes with a hybrid collector to convert daily electricity and thermal energy at the same time. While reducing the silicon cell area to 25% with the equivalent power output by using our ultra-transmission Ball Lens point focusing sun, solar panels tend to be aesthetically uninspiring.

III. DEVELOPED SYSTEM

A) SYSTEM BLOCK DIAGRAM

Fig 2 shows the block diagram of developed system. In block diagram basically we see the solar panel with automatic optic lenses such as parabolic lenses or simple mirror, output of this is DC voltage.

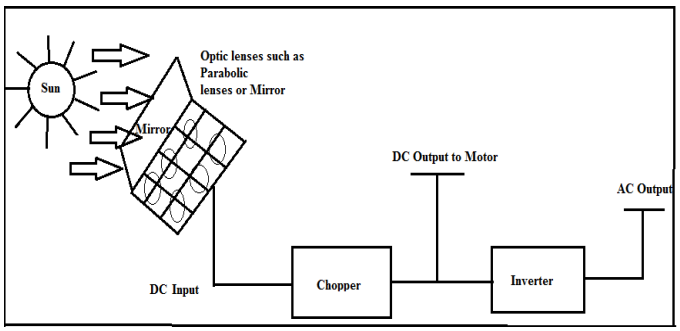

Figure.2. Block diagram of developed system

After that we connect Chopper i.e. Boost converter which is DC to DC converter. Boost converter converts variable DC voltage into constant DC voltage. Using we charge battery of 12V. After battery we connect Inverter to battery i.e. DC to AC converter. Inverter produces AC output voltage. After that we connect AC load to drive using 12V AC voltage.

B) CIRCUIT DIAGRAM OF DEVELOPED SYSTEM

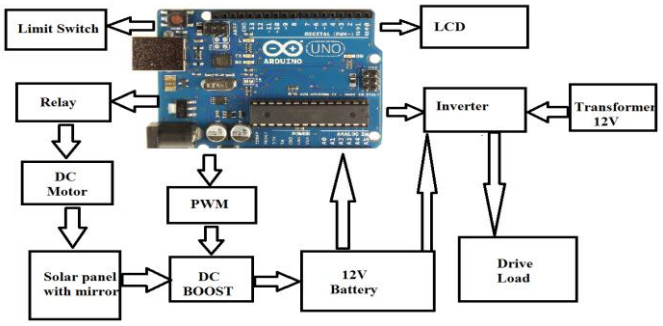

Figure. 3. Circuit diagram of developed system

Fig 3 shows the overall circuit diagram of our system. In that we use solar panel with optic lenses here we use simple mirror as optic lenses. Mirror is connected to solar panel which is automatically rotate according to sun direction, because of that when panel gaining power is reduces at that time by using of mobile mirror it starts increasing which result in as compare with only solar panel its efficiency ratio is higher. Then we use boost converter circuit which convert solar panel DC voltage into constant DC voltage. In our system we use batteries to store energy produced by solar panel. We place battery to charge in between DC-DC boost converter and DC-AC inverter. Battery stores DC voltage which we can able to use for DC or AC equipment's. We use Ardvino uno IC kit which produce 3PWM waves which we applied as gate pulse to switching MOSFET in Boost converter and 2PWM pulses are required in inverter circuit. As per the PWM pulse voltage boosting is measured in circuitry. Boost converter voltage is constant voltage.

Input of boost converter is variable but it produces constant output voltage which prevents battery from high or low load voltage. Whatever output voltage comes from solar panel with mobile mirror and boost converter constant output voltage both are displayed on 16*2 LCD display. Power supply is used to generate power for Arduino uno kit. To convert DC voltage into AC voltage we use 4-matrix inverter. Which convert DC-AC voltage which comes from battery backup using inverter we connect AC equipment to our system. We use up to 40W AC motor which connects to inverter. To increase power up to 40W we use 20W solar panel with mobile mirror. Mirror helps to increase voltage using reflection technique of rays. Mirror reflects rays when solar panel cannot able to clip energy from sun. We collect large output voltage from solar panel because of mirror reflections using with solar panel.

IV. BASIC OPERATION

A) Boost Converter

The rise converter is a medium of power transmitting to execute power absorption and injection from sun –panel to grid-tied inverter. The method of electricity consumption and injection in increase converter is executed by an aggregate of four additives which is often inductor, digital transfer, diode and outcome capacitor. The relationship of the lift converter is shown in fig4.

The manner of strength absorption and injection will represent a switching cycle. In other phrase, the regular output volts is managed by way of the switching on and off time period. At regular switching rate of recurrence, adjusting the on / off period of the switch is known as pulse-width-modulation

(PWM) switching. The switching obligation cycle, p is described as the ratio of the on period to the shifting time period. The energy absorption and injection with the relative period of switching period will function the converter in unique modes called continuous leasing mode (CCM) and broken, interrupted conduction mode (DCM).

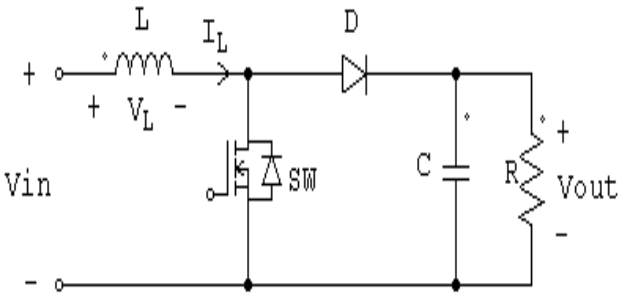

Figure.4. Schematic of Boost Converter

B) Experimental setup of our Project Experiment

Fig.5 shows the actual setup of our experiment diagram in that we use 20W solar panel and simple mirror. Here we place solar panel horizontally and mirror was connecting vertically but in automatically rotated. We are doing mode wise operation in this our system. Here we make 4 modes, first for i.e. mode0 is for initialization mode and this mode mirror is on steady state condition.

Then mode 1 is for adjust mirror, in this mirror goes down word direction which is located horizontally to solar panel. Then in mode 2 we take snap short for the different voltage levels with and without mirror. In next mode i.e. mode 3 we take panel in upward direction when voltage level decreases rotation of mirror stop and it take reading for our efficiency graph.

Then again using next mode4 we rotate mirror downward as per the high voltage requirement get from the solar panel. We use solar power generation for operating arudino ic and lcd display and again we generate high voltage from using above all circuitry and charge the 12V battery.

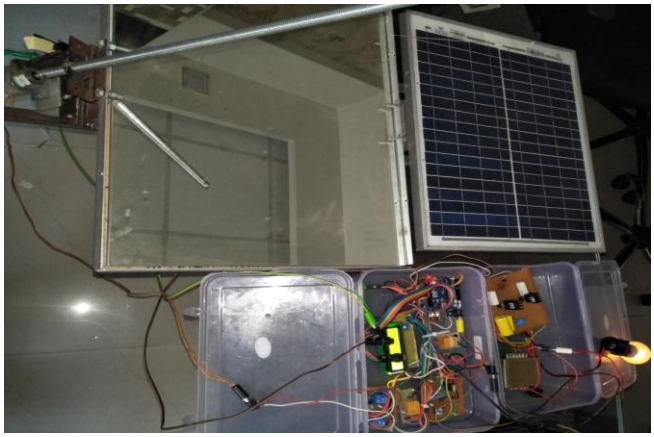

Figure.5.Our Experiment solar panel with auto rotate mirror

Fig.6 Shows the DC motor which connects in between solar panel and mirror in circuitry. Which operate using run command in our circuitry. This rotates after power supply and tracks the output voltage of solar panel and move mirror according to sun rays.

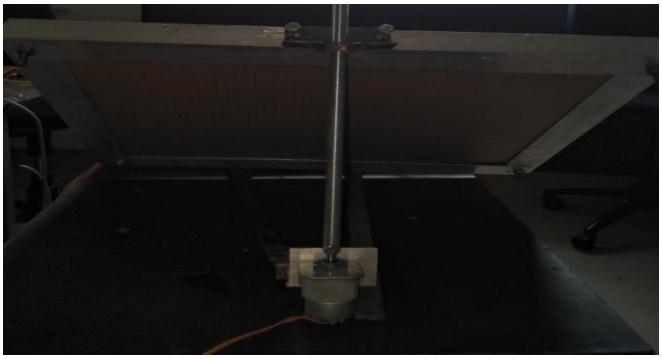

Figure.6. DC motor which rotate mirror in Experiment

V. SIMULATION AND EXPERIMENTAL RESULTS

A) Simulation results for Boost converter

Based on proposed design, computer software Proteus 8 is use to simulate our circuit. Fig7 shows the simulation for with mirror and without mirror for solar panel.

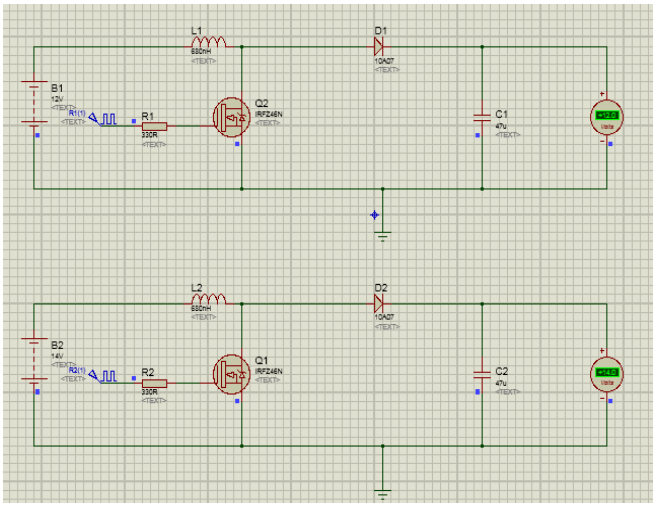

Figure.7. Simulation output of DC Boost converter

B) DC Boost results on power supply

Fig 8 shows the output waveforms which generated at the end of the DC boost circuit in our developed system.

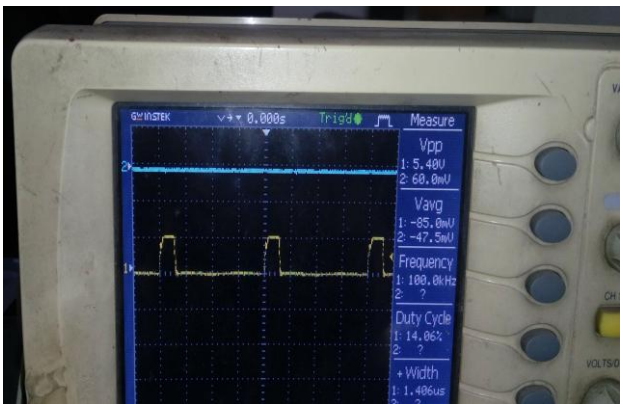

Figure.8. DC boost circuit output

C) Output voltage for the solar panel with mirror and boost converter output with load charging

Fig 9 shows solar panel output with mirror which is enhance efficiency with the mirror as compare to normal solar panel and here we compare that output voltage with the DC Boost with the load hence here battery is charging. While charging

DC boost output which we shows on red line in the graph which is constant which is in between 11.5 to 12V.

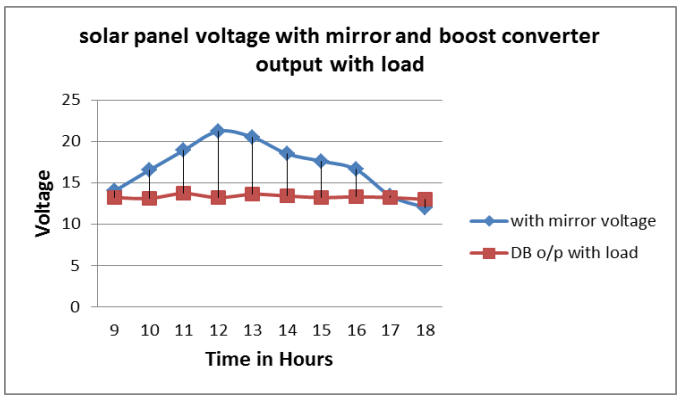

Figure.9. Graph of solar panel voltage with mirror and boost converter output with load

D) Output voltage graph for solar panel with and without mirror

Fig 10 shows the graph for solar panel with and without voltage. Blue line shows the solar panel voltage with mirror and red line shows the solar panel voltage only i.e. no mirror.

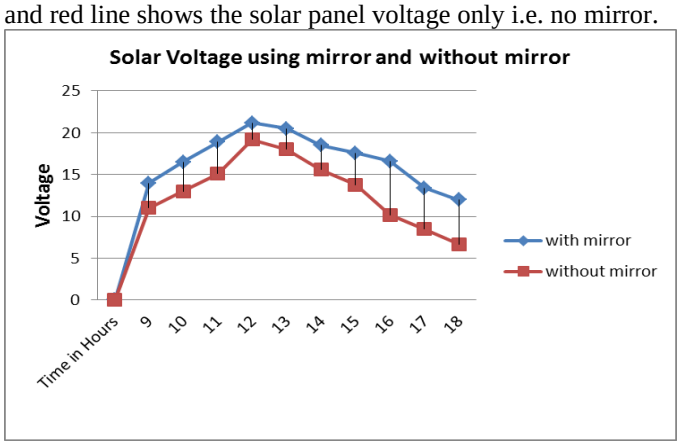

Figure.10. Solar panel voltage with and without mirror

VI. CONCLUSION

Based on the above analysis, the following conclusions can be reached:

1. Due to the seasonal changes using only flat solar panel collector certain amount of energy is generated to enhance that we use optic lenses such as simple mirror.
2. We compare output voltage comes from only solar panel and solar panel with mirror. Simple mirror works as concentrator which helps concentrate light on solar panel and using that extra scattering of light voltage level of solar panel is increases.
3. We design DC boost converter which produces constant 12V DC using that load will charge and also design Inverter to drive the AC load.

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