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# Efficient Battery Charging System with Solar Energy Using Luo Converter

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**ABSTRACT:** In the modern world, the utilization of the renewable energy has become more evitable,at environmental concern. Hence the need for the conversion process of the non conventional energy sources into electricity is developed. The paper explains a new conversion process offering constant voltage at the output irrespective of the load. This system can be used for charging two batteries of different ratings at constant voltage. Thus, this system can be utilized for charging the solar car batteries as the charging capacity of these cars are different. This can be achieved by using luo converter which is noted for its ripple free output and higher efficiency. The boost converter used here performs the boost conversion process.

**KEYWORDS:** renewable energy, solar cars, luo converter, boost conversion

## I.INTRODUCTION

The requirement of the renewable energy has become inevitable in the industrious world.The various renewable energy sources like sun, wind, fuel cell, etc always require a converter module in order to meet the energy needs. However, the DC – DC converters finds their advantages in the renewable energy conversion processes. There are various types of DC-DC converters like buck, boost, buck-boost, etc are used depending upon the need of output power ratings of the loads to be connected. Hence the Luo converter is preferred for this project because of its following advantages. (i) System stability in any operating condition, (ii) Good static and dynamic performance in terms of rejection of input voltage disturbances and load changes (iii) It has ability to reduce ripple voltage and current levels without reversing polarities. The Luo converter performing a boost operation is used in this project. The main objective of this project is to charge two differently rated batteries at constant voltage with luo converter performing boost operation in an efficient manner. Thus the project can contribute for the charging of batteries using solar energy at constant voltage. The primary function of the system is to charge battery at constant voltage. This can be achieved with two luo converters being connected in parallel that being controlled by using the STM controller.

## II. LITERATURE SURVEY

Implementation [1] of the hardware of Self Lift Negative output Luo Converter using MPPT for PV Applications. The incremental conductance MPPT tracks the maximum power from PV panel and transfers to the load. The PV panel is designed by using equivalent circuit of PV cell. The output obtained from the solar panel contains more ripples. The ripples will produce more fluctuations. By using self-lift negative output luo converter the unregulated output will be converted into regulated voltage and stepped upto the higher voltage.

In this paper[2]investigatesthe relationship between current sharing difference and circulating current for two parallel connected dc-dc converters. In the proposed algorithm a new figure-of-merit called Droop Index is introduced,

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which is a function of normalized current sharing difference and losses in the output side of the converters. This algorithm minimizes the circulating current and current sharing difference between the converters. Although there may exist a trade-off between current sharing difference and voltage regulation, The proposed Droop Index method gives better performance and low voltage regulation. The detailed analysis and design procedure are explained for two dc-dc boost converters connected in parallel. The effectiveness of proposed method is verified using MATLAB simulation.

The paper[3]explains the positive output elementary super lift-Luo converter (POESLLC) is a type of DC/DC converters. This DC/DC converter has attractive advantage of a high voltage transfer gain as compared with other conventional DC/DC converters. Because of the voltage and load variations and also switching operation, the dynamic and static performances of the POESLLC are nonlinear and time-varying. In order to achieve an excellent performance, a nonlinear controller is required. In this paper, a robust and fast response controller for voltage regulation of a POESLLC is presented. A PI and PWM sliding mode controller are combined to control a third order POESLLC. The proposed controller can be applied in the continuous conduction mode. Some simulations and experimental results are presented to show the effectiveness of the developed controller in different operating conditions. Furthermore, it will be shown that the developed controller is successful in suppressing the steady state error of the output voltage of the POESLLC as well as the number reduction of sensors.

The paper [4] involves the design output voltage and inductor current regulations of thenegative output elementary boost converter (NOEBC) operated in continuous conduction mode (CCM) using sliding mode controller (SMC) plus proportional double integral controller (PDIC). The NOEBC is a dc–dc converter that can provide high voltage transfer gain, high efficiency, and reduced output voltage and inductor current ripples in comparison with the conventional boost converter. Owing to the time varying switched mode operation, the dynamic characteristics of the NOEBC is non-linear and the designed SMC plus PDIC aims at enhancing the dynamic characteristics along with the inductor current and the output voltage regulations of the NOEBC. The proposed SMC is more appropriate to the essentially variable-structured NOEBC when represented in the state-space average based model. Here, the PDIC suppresses the steady state error and excellent initial start-up response of NOEBC in spite of input supply voltage and load resistance variations. The performance of the SMC plus PDIC is verified for its robustness to perform over a broad range of working conditions in MATLAB/Simulink models as well as in the experimental with the comparative study of a SMC plus proportional-integral-controller (PIC). Simulation and experimental results are presented.

In this paper [5] presents the application of a DC-DC Boost Converter for solar powered traffic light equipment for traffic control. The proposed system gives a high performance of the solar powered traffic light equipment whose adaptability are very attractive for the solar array power tracking in dynamic environments. The input is a solar panel that supplies a voltage of 12 V which is used for this application. The DC Boost converter is successfully implemented using a low cost microcontroller.

## III. EXISTING SYSTEM

The existing system consists of the solar energy conversion using a boost converter, which is shown in figure1.And its connected parallel and the control of the circulating current can be done with the help of the use of the droop resistance thus avoiding the changes in the circulating current to the load.

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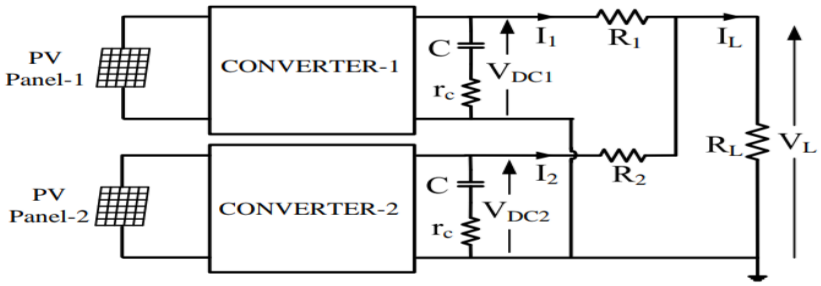


**Fig.1.** circuit diagram of the boost converter

The major drawbacks of the existing system are as follows: The charging current of the output capacitor is discontinuous resulting in larger capacitor size and EMI issues.The converter cannot step-down the voltage which is crucial for many applications like PV. To extract the maximum power from a PV panel there can be sometimes where you may need to step-down. Hence, this converter cannot provide you a large limit of maximum power point tracking.There is no isolation from input to output which is very critical in many applications like the power supply of gate driver of power semiconductors.The converter is difficult to control. The transfer function of this converter contains a right half plane zero which introduces the control complexity. Although the buck converter is free from this disadvantages.

## IV. PROPOSED SYSTEM

The proposed system for the efficient load sharing of voltage can be achieved by the following procedure. The block diagram of the system has been shown in figure2. The supply from the source is not adequate that it has to be boosted by using a converter. The Positive output parallel connected Luo converter performing boost operation is used to step up the voltage from the solar panel and the PI algorithm is used to control the process to get an error free result.

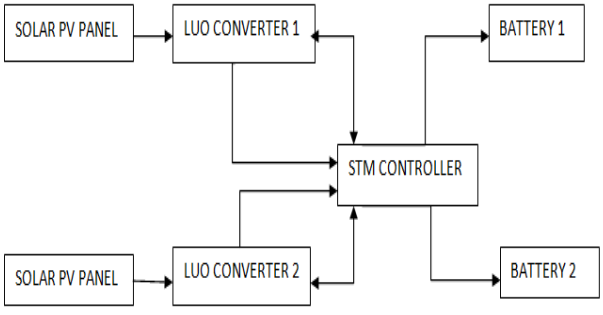


**Fig.2**Block diagram of the proposed charging system

The outputs of the converters are provided to the STM controller. The voltage sense switching is done by the STM controller. The output of the STM controller is shared at a fixed value between the loads.The positive output Luo converter is a newly developed advanced DC-DC converter. Properties of the proposed converter are: 1) robustness around the operating point, 2) good performance of transient responses under varying loading conditions and/or input voltage, and 3) invariant dynamic performance in the presence of varying operating conditions. The positive output

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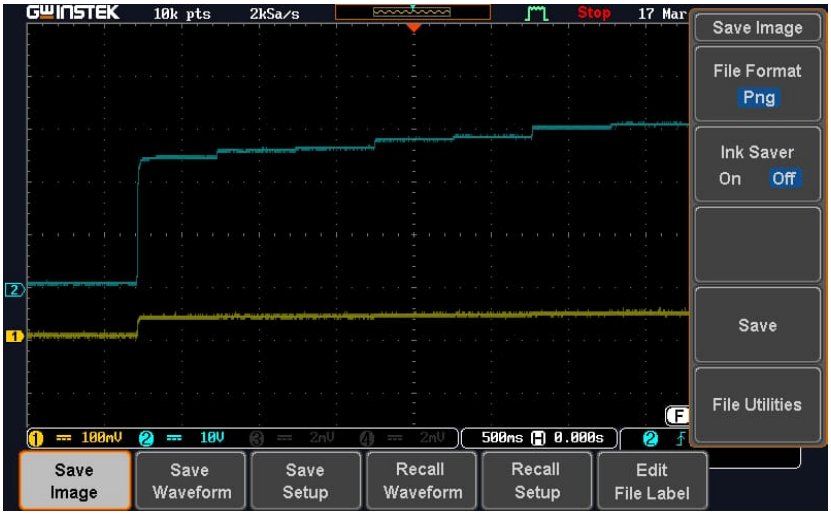
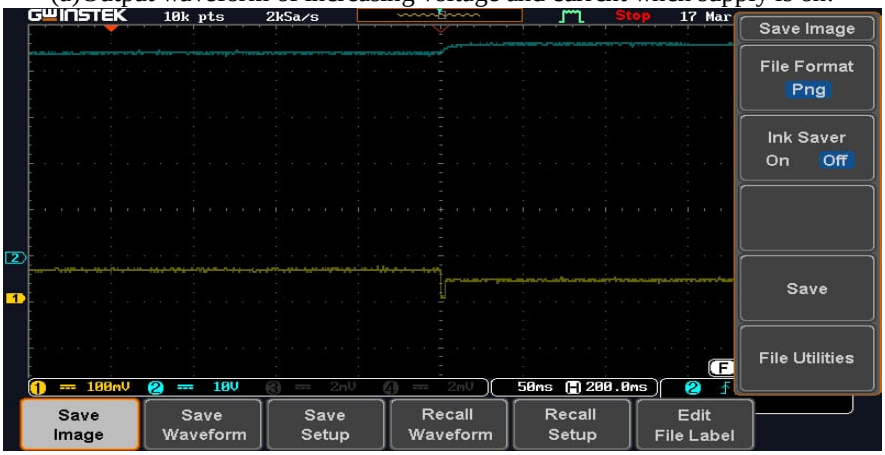
Super lift Luo converter performs the voltage conversion from positive source voltage to positive load voltage. In this project, the two Luo converter are connected in parallel performing the boost operation. The output of the converter set up is provided to the STM controller.The stm controller is programmed to perform the functions of the voltage switching and controlling process being the programs dumped in it. The STM controller incorporates the high performance ARM® Cortex™-M3 32-bit RISC core operating at a 72 MHz frequency, high speed embedded memories (Flash memory up to 32 Kbytes and SRAM up to 6 Kbytes), and an extensive range of enhanced I/Os and peripherals connected to two APB buses. A voltage regulator is a system designed to automatically maintain a constant voltage level. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

## V. RESULTS AND DISCUSSION

The prototype mode has been built to verify the performance of the proposed system. The output voltage of the converter has been measured with help of the DSO. The various stage of the results are shown in figure.3




(a)Output waveform of increasing voltage and current when supply is on.




(b) Output waveform of constant voltage at load side.

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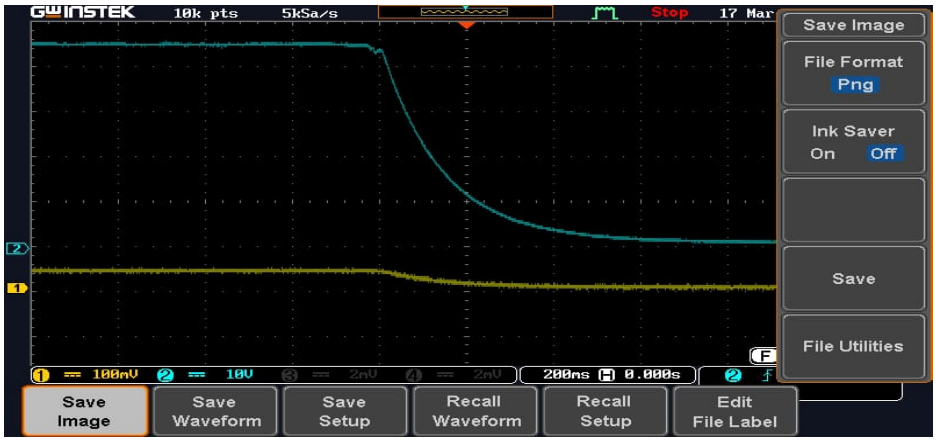


(c) Output waveform of decreasing voltage and current at load while supply is off.

**Fig.3**. Hardware prototype model results

The above results depicts the result of the load side voltages at the duration of supply on, supply off and the output waveform of the constant voltage at load side.

## VI. CONCLUSION

The project is developed for the enhancement of the battery charging process of different ratings at a common supply. The project thus finds its application in improving the development of ecofriendly vehicles.The future scope of the project is to support the growth of the utilization of renewable energy sources, reducing environmental pollution and the development of the converters with highest efficiency preventing minor errors and deviations thus promoting the scope for development of error free results.

## REFERRENCES

[1] M.Latha DeviM.R.FaridhaBanu P abiramiDesign and Hardware Implementation of Self Lift Negative output Luo Converter using MPPT for PV Applications, 978-1-5386-3817-0/18/$31.00_c 2018 IEEE

[2] Sijo Augustine, Mahesh K. Mishra, Senior Member, IEEE, N. Lakshminarasamma, Member, IEEE Circulating Current Minimization and Current Sharing Control of Parallel Boost Converters Based on Droop Index, Conference Paper · August 2013 DOI: 10.1109/DEMPED.2013.6645755, research gate.

[3] H. Kakigano, Y. Miura, and T. Ise, “Low-voltage bipolar-type dcmicrogrid for super high quality distribution,” Power Electronics, IEEETransactions on, vol. 25, no. 12, pp. 3066 –3075, Dec. 2010.

[4] I. Kondratiev, E. Santi, and R. Dougal, “Robust nonlinear synergetic

[5]Fang Lin Luo and Hong Ye, Advanced DC/DC Converters, CRC Press,London.

[6] V. Biolkova, Z. Kolka, D. Biolek,” State-space averaging (ssa) revisited:on the accuracy of ssa-based line-to-output frequency responses ofswitched dc-dc converters,” WSEAS TRANSACTIONS on CIRCUITS andSYSTEMS, Vol. 9, No. 2, pp. 81-90, Feb. 2010.

[7] A. Merdassi, L. Gerbaud, and S. Bacha, “Automatic Generation ofAverage Models for Power Electronics Systems in VHDL-AMS andModelica Modelling Languages,” Journal of Modelling and Simulationof Systems, Vol. 1, No. 3, pp. 176-186, 2010.

[8] J.-H. Park, J.-Y. Ahn, B.-H. Cho, and G.-J. Yu, “Dualmodule-based maximum power point tracking control ofphotovoltaic systems,”IEEE Trans. Ind. Electron., vol. 53, no. 4,pp. 1036–1047, Jun. 2011.

[9] M. Latha Devi, M. Chilambarasan, and C.SelvaKumar."Modeling and simulation of incremental conductanceMPPT using self lift SEPIC converter", 2014 InternationalConference on Circuits Power and Computing Technologies[ICCPCT-2014],pp-867-8722014 978-1-4799-2397-7/14/$31.00©2014 IEEE.

[10] M.Chilambarasan, M. E., M. Latha Devi, and M.RameshBabu. "Design and Simulation of Self Lift Positive Output LuoConverter Using Incremental Conductance Algorithm forPhotovoltaic Applications", Applied Mechanics and MaterialsVol. 622 (2014) pp 51-58 © (2014) Trans Tech Publications,Switzerlanddoi:10.4028/www.scientific.net/AMM.622.5

[11] M. Latha Devi,, and M. Chilambarasan."Design andsimulation of incremental conductance MPPT using self liftcukconverter", 2013 International Conference on Renewable Energyand Sustainable Energy (ICRESE), pp-319-325 2013. 978-1-4799-2075-4/13/$31.00 ©2013 IEEE