Project Report

on

SOLAR ARRAY FED BLDC MOTOR

Submitted in partial fulfilment of the

requirement for the award of the

Degree of

BACHELOR OF TECHONOLOGY

in

ELECTRICAL AND ELECTRONICS ENGINEERING

by

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May, 2020

DECLARATION

We declare that the work presented in this report titled "**Solar Array Fed BLDC Motor**", submitted to the School of Electrical, Electronics and Communication engineering, Galgotias University, Greater Noida, for the Bachelor of Technology in Electrical and Electronics Engineering is our original work. We have not plagiarized unless cited or the same report has not submitted anywhere for the award of any other degree. We understand that any violation of the above will be cause for disciplinary action by the university against us as per the University rule.

Place: Greater Noida

Date: 04 May 2020

Signature of the Student

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Apeksha Chauhan (1615105005)

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School of Electrical, Electronics and Communication Engineering

CERTIFICATE

This is to certify that the project titled **"Solar Array Fed BLDC Motor''** is the bonafide work carried out by Vishvendra Singh and Apeksha Chauhan, during the academic year 2019-20. We approve this project for submission in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Electrical and Electronics Engineering, Galgotias University.

Dr. Pratima Walde

Project Guide(s)

The Project is Satisfactory / Unsatisfactory.

_____ _____

Internal Examiner (s) External Examiner

Approved by

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Dean

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ABSTRACT

Nowadays solar energy is the best renewable energy resources when rather the conventional energy resources. The cost of running the solar powered pumps is cheaper to run, lower maintenance cost and lower operation. This project deals with the operation of the Luo (DC-DC) converter in solar PV array fed BLDC motor drive water system like an Direct current converter between the solar photo voltaic array and soft starting of brush less DC motor because of its higher efficiency. There are several types of DC-DC converters, a Luo converter is selected and it is used to get the Maximum power and output from motor as well as PV Array. The intermediate Luo converter with semiconductor switches has the features of minimizing the ripple current when we check the output result and give infinite region for maximum power tracking. The positive output Luo converter performs the changes from positive input source to positive output load source. To avoid the high frequency switching losses the electronically commutated brushless DC with voltage source inverter can be operated at elementary frequency which results in higher efficiency. The cutting-edge vogue has been to use brushless direct current additionally recognized as b.l.d.c. motors to make the operation greater reliable more environment friendly and less noisy. compared to brushed motors with the equal electrical energy output they are moreover lighter. BLDC motors are being used in most of the modern-day devices.

The various working conditions such as dynamic, starting and steady state performances has to be demonstrated and simulated by suitable simulated results using MATLAB/Simulink environment.

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CHAPTER 1

INTRODUCTION

1.1 GENERAL

This project manages the activity of the Luo (DC-DC) converter in sun-powered PV exhibit nourished LUO converter as a halfway DC-DC converter amidst the sunlight-based PV cluster and the beginning of BLDC drive. From the few sorts of DC-DC converters, the Luo converter is chosen and it is utilized to extract the most electrical electricity which is on hand from the Solar cluster and BLDC Drive. The middle Luo converter with semiconductor switches has the highlights of decreasing ripple current in its yield and give an endless region for extreme power following (MPPT). The positive yield Luo converter plays out the progressions from the positive input source to a positive yield load source. To maintain a strategic distance from the high-frequency misfortunes the electronically commutated brushless DC with voltage source inverter can be worked at a rudimentary frequency which results in higher effectiveness

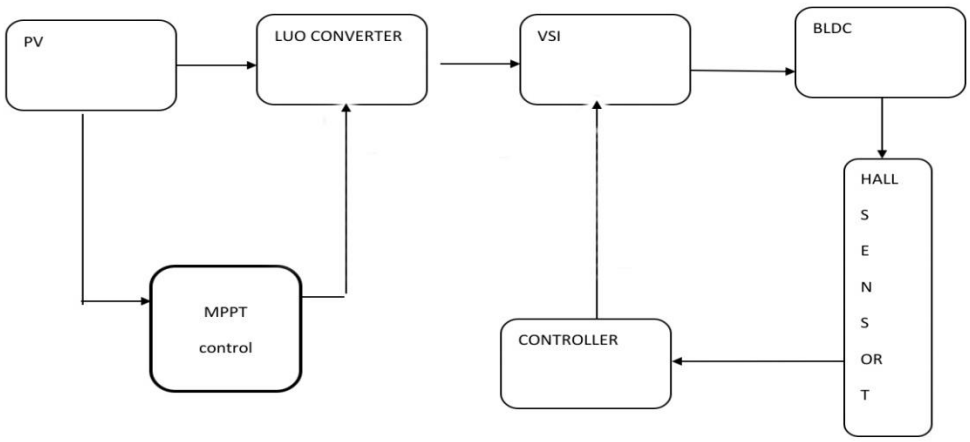
1.2. EXISTED SYSTEM:

in attendance are plentiful converter-controlled BLDC engine is accessible, like to a buck-boost converter, Luo converter, Sepic converter, Cuk converter, every single one the converter topologies relies upon the detailed application, as regards every solitary such converter Luo having the most excellent execution.

1.3. PROPOSED SYSTEM:

The system consists of solar array feeding dominance to the system, BLDC motor impel with an encoder for electronic commutation, Luo converter, a three-phase voltage informer inverter for supplying post to the BLDC initiative, INC MPPT for greatest faculty extraction from sun and pic controller. while MPP is reached to the finishing degree a Duty ratio is shaped by the IC MPPT and this responsibility ratio is converted flipside to switching pulse by comparing with high frequency saw tooth signal and this indicate is convey to the MOSFET.

1.4. BLOCK DIAGRAM:



1.5. ADVANTAGES:

1) Fast dynamic response
2) Reliability
3) Renewable

1.6. APPLICATION:

1) Drive Application
2) Renewable Application

1.7. TOOLS REQUIRED:

1) **HARDWARE:**
   DSP Controller

2) **SOFTWARE:**
   MATLAB

1.8. BLOCK DIAGRAM EXPLANATION:

- Solar panel
- DC to DC converter
- Inverter
- Bldc motor
- Mppt controller

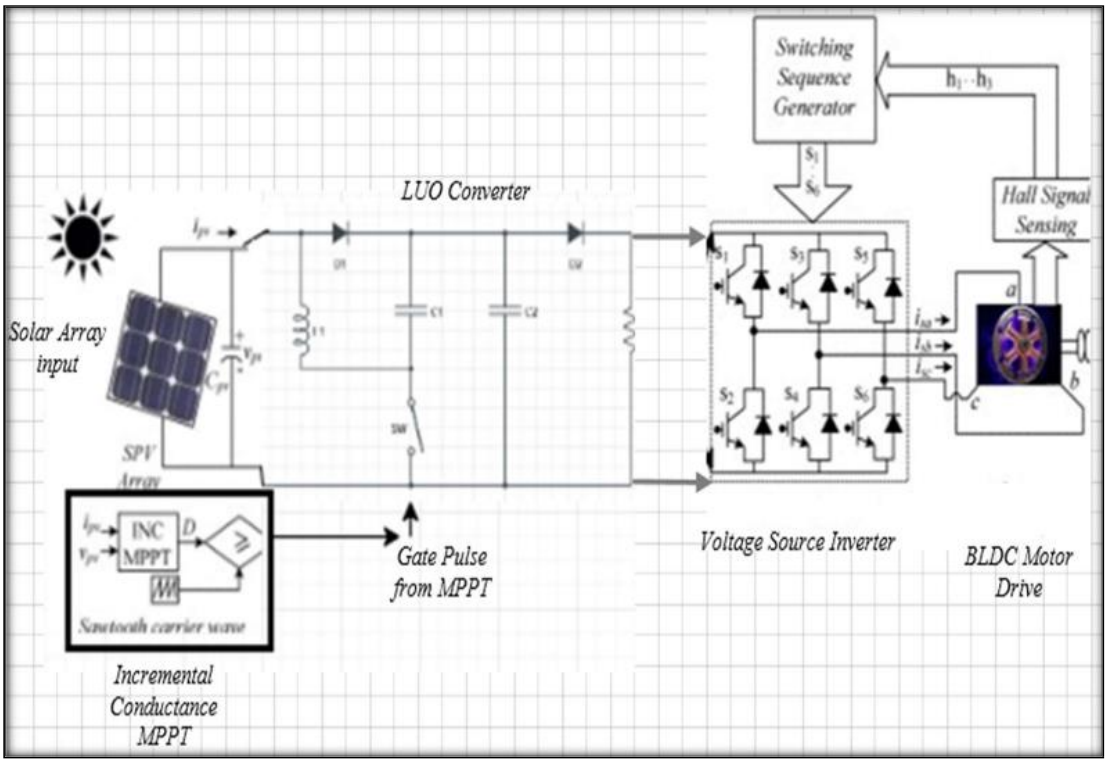


Fig.1.1. Proposed System

CHAPTER 2

DETAILS OF COMPONENTS OF PROPOSED SYSTEM

2.1. PHOTOVOLTAIC ARRAY

Solar energy collapse on the planet and this energy are altered over into electrical energy by Photovoltaics. The PV panels are ready from semiconductor material. These PV panels grant a maintenance-free, secure and steadfast environmental open authorization trace for a elongated time. A primarily solar cell is pp-n junction diode. The diode current equation is given by:

$$I_D = I_S\,[(^{q*v/KT}) - 1\,] \ldots\ldots (1)$$

An I_D is the current flowing in the diode; I_S is the diode saturation current

VD is the diode voltage, K is for the Boltzmann constant and T is the temperature rely on the I_S.

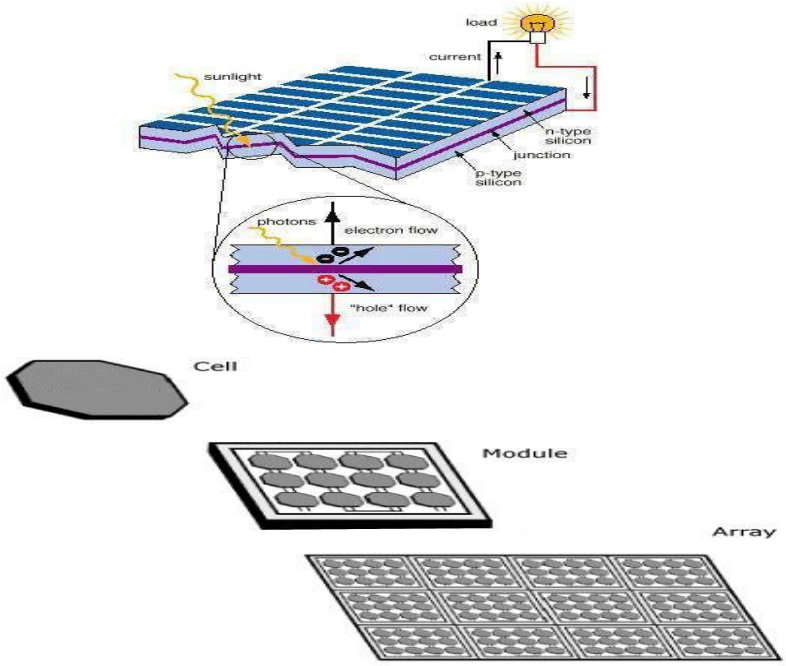


Fig.2.1. Solar PV Array

Table No.1. Standard Test Condition

Parameter	Value
Air Mass	1.5AM
Solar Irradiance	1000 w/m^2

2.2. LUO CONVERTER

Luo converter is a dc -dc boost converter it converts the +ve enter voltage to the clear-cut +ve output voltage. in attendance are a range of manner of Luo converter viz, super lift, self-lift, re- lift, triple lift, and quadruple lift. Every one of these converters are gotten from the unsophisticated track of the Luo converter. They exhibit the despondent switching losses and great efficiency together with other dc-dc converters. Luo converters will give the enhanced output stream characteristics as it should be to the inductor in the output location. This configuration of the Luo converter is operational for MPPT tracking.

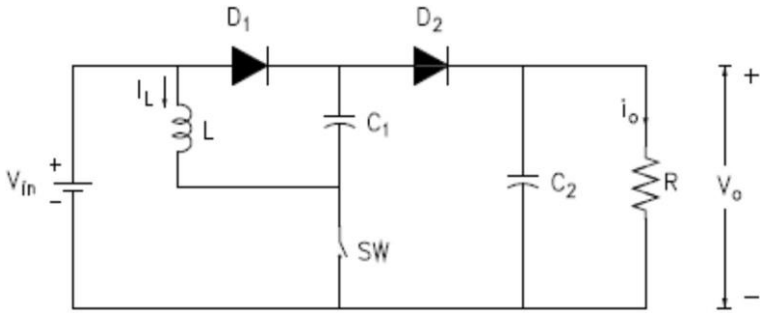


Fig.2.2. Classic luo converter

The +ve output luo converts +ve input voltage to +ve output voltage. here are something else sorts of Luo converters viz, self-lift, re-lift, triple-lift, fourfold pinch and super-lift, the mainstream of this gotten from the basic circuit. Luo converters have negligible switching losses and premier efficiency the between the other DC-DC converters. Voltage lift Technique has been employed to project area of high-pressure voltage reward converters. It reduces the treasure of responsibility ratio and as well the make of resistance elements. Luo converters provides an enhanced output in progress characteristics suitable to the inductor in the output which find time for this configuration successful for MPP tracking. The morals of the fundamentals of the Luo converter is considered by bearing in mind the ON/OFF switching periods.

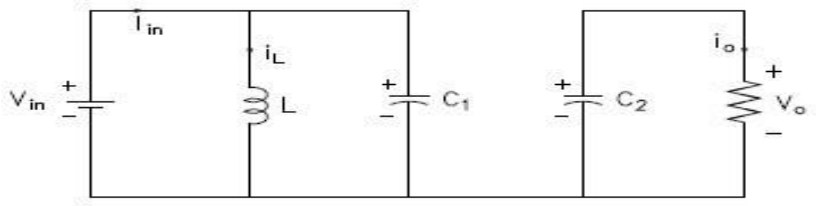


Fig.2.3**.**

Closed switch condition for luo converter

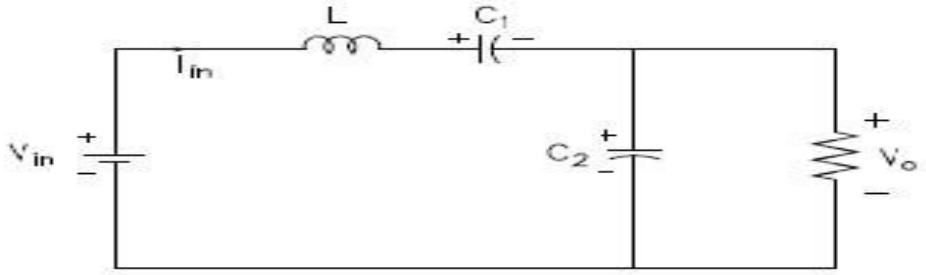


Fig.2.4 Open switch condition for luo converter

In Fig. 2.3 when the switch S is shut, a voltage near capacitor C_1 is charged to V_{in}. The current iL_1 flow inductor L_1 increments with voltage V_{in}.

In Fig. 2.4 when S is opened, the iL_1 reduction with voltage (V_o -2 V_{in}). Therefore, the rippling of the inductor current iL_1

$$\Delta_{iL1}=\frac{V_{in}}{L_1}dT=\frac{V_O-2V_{in}}{L_1}dT$$

$$V_O=\frac{2-d}{1-d}V_{in}$$

$$G=\frac{V_O}{V_{in}}=\frac{2-d}{1-d}$$

Table No.2. Design Value of L U O Converter

Parameter	Value
Duty Ratio	0.5
Load Resistance	180Ω
Capacitor C1=C2	524μF
Inductor,L	8.64mH
Input Voltage,V_{in}	148V
Output Voltage,V_O	285V
Switching Frequency	10kHz

2.3. BrushLess DC Motor:

The dynamic demonstrating of the BLDC engine is administered by the accompanying equation particular as

$$V_{an} = R_a i_a + p\lambda_a + e_{an} \quad (1)$$

$$V_{bn} = R_b i_b + p\lambda_b + e_{bn} \quad (2)$$

$$V_{cn} = R_c i_c + p\lambda_c + e_{cn} \quad (3)$$

where Van, Vbn and Vcn are the per stage voltages, p speaks to the differential operator, Ra, Rb and R care protections per stage, ia, ib and ic are current flows, ean, ebn and ecn speaks to back emf and λ_a, λ_b, and λ_c speaks to transition linkages. V_{an}, V_{bn} and V_{cn} is additionally given as,

$$V_{an} = V_{ao} - V_{no}, V_{bn} = V_{bo} - V_{no} \text{ and } V_{cn} = V_{co} - V_{no} \quad (4)$$

Where V_{ao}, V_{bo}, V_{co} are the 3 stagge voltages and V_{no} is the unbiased voltage alluded to the 0 reference potential as appeared in Fig.

The flux linkages are given as,

$$\lambda_a = L_s i_a - M(i_b + i_c) \quad (5)$$

$$\lambda_b = L_s i_b - M(i_a + i_c) \quad (6)$$

$$\lambda_c = L_s i_c - M(i_a + i_b) \quad (7)$$

Where L_s is the self inductance per stage and M is the shared inductance of the windings. Also for star aassociated 3 stage windings of the stator,

$$i_a+i_b+i_c = 0 \quad (8)$$

The transition linkages can be communicated as,

$$\lambda_x = (L_s + M).i_x \quad (9)$$

Where x indicates abc (for example terminals of stage). The adapted equation by using equations (1)-(3) and (8),

$$pi_x = (V_{xn} - i_xR_x - e_{xn})/(L_s+M) \quad (10)$$

The developed electromagnetic torque is expressed as,

$$T_e = (e_{an}\, i_a + e_{bn}\, i_b + e_{cn}\, i_c)/\omega_r \quad (11)$$

someplace ώr is the rotor rate in electrical rad/sec. This beginning for the torque faces computational concern at zero speed as actuated emf's are zero. Henceforth, it is reformulated by communicating back-emf as an ingredient of put which be able to be jotted down as,

$$e_{an} = k_b f_a(\theta)\omega_r \quad (12)$$

$$e_{bn} = k_b f_b(\theta)\omega_r \quad (13)$$

$$e_{cn} = k_b f_c(\theta)\omega_r \quad (14)$$

Substituting equations (12)-(14) into equation (11), the torque equation becomes,

$$T_e = k_b\{f_a(\theta)\, ia + f_b(\theta)\, i_b + f_c(\theta)\, i_c\} \quad (15)$$

where kb is the back emf constant and $f_a(\theta)$, $f_b(\theta)$ and $f_c(\theta)$are rotor position function having a maximum magnitude of plus or minus 1 and is given as,

$$f_a(\theta) = 1;\ \text{for } 0<\theta<120^\circ \quad (16)$$

$$f_a(\theta) = \{(6/\pi)(\pi-\theta)\}-1;\ \text{for } 120^\circ<\theta<180^\circ \quad (17)$$

$$f_a(\theta) = -1;\ \text{for } 180^\circ<\theta<300^\circ \quad (18)$$

$$f_a(\theta) = \{(6/\pi)(\theta-2\pi)\}+1;\ \text{for } 300^\circ<\theta<360^\circ \quad (19)$$

The functions for b and c chapter be able to be calculated by by means of a 120° and 240° phase difference correspondingly. The torque balance equation is given as,

$$T_e = T_L + B\omega_r + J.\ (2/P).d\omega_r/dt \quad (20)$$

where T_e is developed electromagnetic torque, T_L is load torque, B represents the frictional coefficient in Nms/rad, P is the number of poles and J represents the moment of inertia in kg-m^2.The capability of nonpartisan terminal as for zero potential (V_{no}) is required to be considered so as to evade unbalance in connected voltage. Substituting equation (4) in equation (1) to (3) and adding them together gives,

$$V_{ao} + V_{bo} + V_{co} - 3V_{no} = R(i_a + i_b + i_c) + (L_s+M)(pi_a + pi_b + pi_c) + (e_{an} + e_{bn} + e_{cn}) \quad (21)$$

Substituting equation (8) in equation (21) one gets,

$$V_{ao} + V_{bo} + V_co - 3V_{no} = (e_{an} + e_{bn} + e_{cn}) \quad (22)$$

Thus,

$$V_{no} = \{V_{ao} + V_{bo} + V_{co} - (e_{an} + e_{bn} + e_{cn})\}/3 \quad (23)$$

A dynamic model of a BLDC motor is represented in equations (1)-(23).

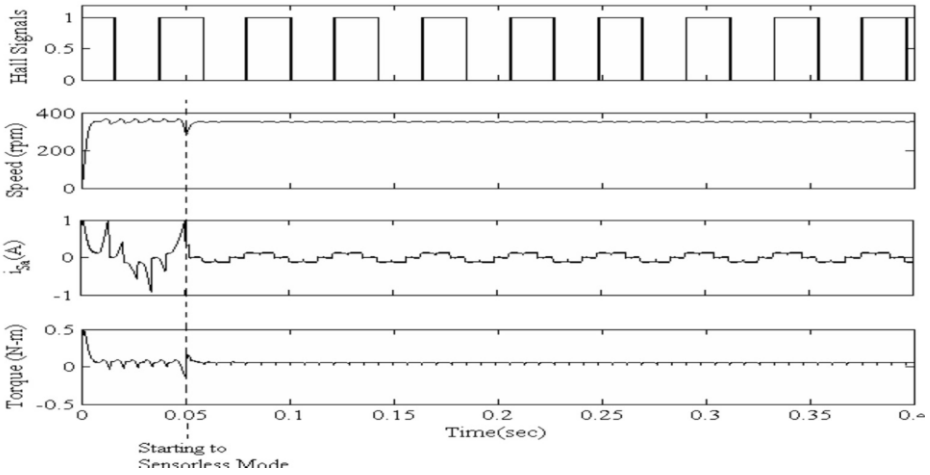


Fig.2.5. Different output of proposed system

Table No.3. BLDC Motor Drive Specification

Parameter	Value
Rated Speed	2500rpm
Rated Power	60W
Rated Voltage	24VDC

2.4. INVERTER CONCEPTS AND BASICS:

The dc-ac converter, in the main called the inverter, changes over dc power to ac faculty faculty at desired yield voltage and compulsory repeat. The dc rule enlargement to the inverter is in receipt of from a modern country dispose or from a pivoting alternator through a rectifier or a battery, verve segment photovoltaic exhibit framework or magneto hydrodynamic generator. The outlet capacitor over the in a row terminals of the inverter gives a predictable dc acquaintance voltage.

2.4.1 Voltage source inverters

D.C to A.C power converters is recognized as inverters. As such, an inverter is a path that changes over a D.C. running into an AC command at required yield voltage and frequency. The AC yield voltage may well be flat at a predetermined or inconsistent frequency. This transformation container be accomplished also by proscribed turn-on and turn-off gadgets. For short and means warrant outputs, the authorization plans are as it should be but for excessive authority outputs, thyristors must be used. The yield voltage waveforms of a perfect inverter have to to be sinusoidal.

The voltage waveforms of nearby inverters are, in any case, non-sinusoidal and restrict accurate distortion. Square wave or semi-square wave voltages strength be commendable for minute and medium power applications, and for high applications low, twisted, sinusoidal waveforms are required. The yield repetition of an inverter is forbidden by the quantity at which the semiconductor gadgets are bowed on and off by the inverter discipline hardware. The consonant substance of the yield voltage preserve be inadequate or diminished for the most part by exchanging procedures of open abstain brawn semiconductor gadgets.

The D.C. check key in to the inverter force be a battery, energy component, sun- oriented cells or other D.C. source. Be that as it may, in generally current applications, it is optimistic by a rectifier. This outline of A.C. to D.C. converter and D.C to A.C inverter is notorious as a D.C edge converter since it is a two-organize static reappearance converter in which AC organize at system repetition is redressed and after that sifted in D.C bond before creature bespoke to AC at a changeable frequency.

A voltage source inverter is one in which the D.C. Source has very few or unimportant impedance. In other words, a voltage inverter has jelled D.C Voltage resource at its contribution terminals on description of at a low level inside impedance, the passenger terminal voltage of a voltage font inverter ruins ominously dependable with varieties in burden. It is, all along these lines, alike correct to a specific engine and multi-engine drives.

VSI CALCULATIONS:

The output of the VSI for phase 'a' is expressed as,

Van = Vdc / 2 for S1=1; (34)

Van = -Vdc / 2 for S2=1; (35)

Van = 0 for S1=0, S2=0; (36)

Where V_{dc} is the D C link voltage and the values for S_1 and S_2 as one and Zero represent the on and off condition of the IGBT's $S_1$and S_2. At the point when switch S_1 and S_4 are One then stage 'an' and 'bn' are associated and the present ($i_a = i_b$) moves through the engine windings and the third stage 'c' stays in running condition. The condition for line voltage V_{ab} is given as,

$$V_{ab} = V_{dc} = R_a + L_a \, di_a/dt + e_{an} + R_b + L_b \, di_b/dt + e_{bn} \quad (37)$$

If,

$$L_a = L_b = L,\ R_a = R_b = R,\ i_a = i_b \text{ and } e_{ab} = e_a + e_b \text{ then,}$$

$$V_{dc} = 2.R.i_a + 2\ L.di_a/dt + e_{ab} \quad (38)$$

Where ia is current in the line (phase current) of the motor. Similarly, the other combine

C.

CHAPTER 3

CONVERTER COMPARISON AND MPPT

3.1.CONVERTER SELECTION

The voltage proportions reasonable by the DC-DC converters are outlined in Fig. 7. make out that simply buck converter shows a linear link between the regulation (duty ratio) and output voltage. The luo preserve lower or spread the voltage ratio with building block advance for a duty ratio of 50%.

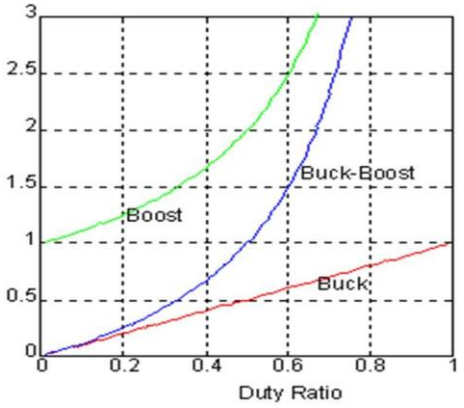


Fig.3.1. Comparison of Voltage ratio

3.2. LUO CONVERTER

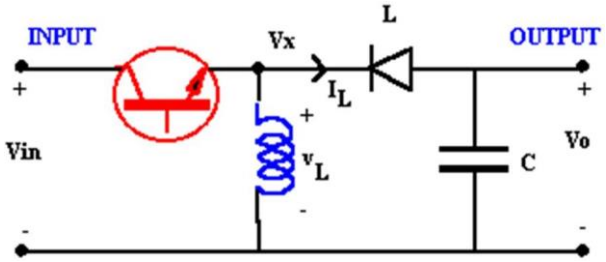


Fig.3.2. Luo converter circuit diagram

when the transistor is ON the continuous conduction mode for the Luo converter V_x and when the transistor is off then the condition becomes $V_x = V_o$. For 0 net current change over a period of time the average voltage across the inductor is 0.

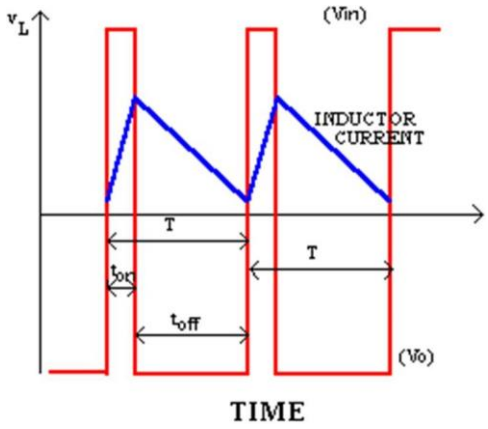


Fig.3.3. luo converter waveforms

$$Vint_{ON} + Vot_{OFF} = 0$$

the voltage ratio will be

$$\frac{Vo}{Vin} = -\frac{D}{(1-D)}$$

The corresponding current will be

$$\frac{Io}{Iin} = -\frac{(1-D)}{D}$$

Since the Duty Ratio "D" is everywhere in the abundance of zero and one the yield voltage can vary between zero and one than the in rank voltage in size. The negative signal shows an inversion of the yield voltage of the Luo converter.

3.3. CUK CONVERTER

Every one of the converters like the buck, boost and Luo converters every exchanged animation simultaneously with news and yield utilizing the inductor, the examination depends on voltage preserve equilibrium over the inductor. The CUK converter utilizes capacitive get-up-and-go swap over and examination depends on the tinge parity of the capacitor.

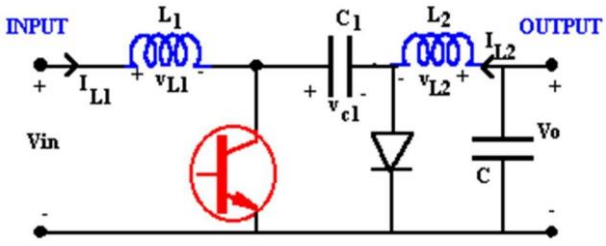


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Fig.3.4. **CUK Converter**

the current over the inductors is basically ripple free because On the off chance that we accept, when we look at the charge balance for the capacitor C1.

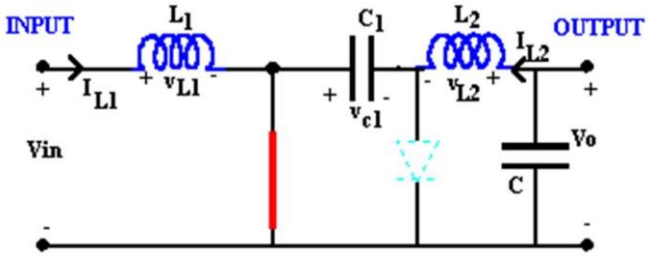


Fig.3.4.1. CUK "ON-STATE"

what is more, I_{L1} is the current in C1. Exactly when the transistor is OFF, the diode conducts and the I_{L2}.

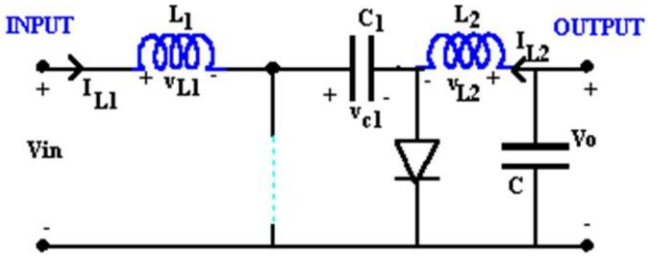


Fig.3.4.2. "OFF-STATE" of CUK converter

$$I_{L1} t_{ON} + (-I_{L2}) t_{OFF} = 0$$

no net capacitor voltage rise in OFF state , the final current is zero

which gives

$$\frac{I_{L2}}{I_{L1}} = \frac{(1-D)}{D}$$

The inductor flows coordinate the information and flows, hence utilizing the power consrvation rule

$$\frac{Vo}{Vin} = -\frac{D}{(1-D)}$$

As the theory says

“Accordingly, the voltage comparison is parallel to the Luo converter. The upside of the CUK converter is that the information and yield inductors give rise to a even undercurrent at the two sides of the converter though the buck, boost and Luo converter no a lesser amount of than one region with pulse current.”

4.2. Maximum Power Point Tracking Algorithms

As was newly clarified, MPPT computations are elemental in PV applications on the argument that the MPP of a sunlight based embark fluctuates with the enlightenment and temperature, therefore the consumption of MPPT calculations is requisite subsequently as to get hold of the nearly everyone great might from a sun oriented cluster. Over the before decades, abundant strategies to discover the MPP has been fashioned and distributed. These methods diverge in plentiful angles, for example, mandatory sensors, all-around nature, cost, a scope of adequacy,building speed, restore next after enlightenment as perfectly as hotness change, apparatus requisite for the execution or prevalence, together with others. A sum check of 19 distinctive MPPT calculations can be found.

In the midst of these systems, the P&O and the InCond calculations are the generally extensively recognized. These methods produce the upside of a austere manipulation thus far they additionally take disadvantages, as will be appeared. discrete strategies needy on different principles are fuzzy common sense control, neural network, incomplete amicable trail voltage or abruptly trail current,recent breadth, and consequently forth. A fat portion of these strategies yield a in close proximity furthermost and a few, analogous to the bitty receptive trail voltage or diminutive out current, give out an approximated MPP, not the fastidious one. In mainstream conditions, the V-P bend has impartial a free a large amount extreme, as a result it's no matter which but an issue. Be that as it may, if the PV cluster is in part shaded, nearby are a range of maxima in these bends. subsequently as to lessen this issue, a little calculations have been executed.

4.2.1. Hill-climbing techniques

Mutually P&O and Incremental conductance calculations depend on the "hill climbing" standard, which comprises of heartrending the occupation drive of the PV exhibit toward the corridor in which limit increments. Hill climbing procedures are a good number prevalent MPPT techniques as of their simplicity of execution and heroic execution once the elucidation is consistent. The remuneration of the two strategies are the straightforwardness and depressed computational strength they need. The inadequacies are equally notable: motions around the MPP and they can acquire deep in thought and pursue the MPP off itinerary accompanied by fleetingly shifting environmental conditions.

4.2.2. Perturb and observe

The P&O control is as well called "hill climbing", however, the two names pass on to a alike shrewdness relying upon how it is executed. Hill climbing includes an annoyance on the obligation sequence of the influence converter and P&O a vexation in the functioning voltage of the DC edge between the PV exhibit and the brawn converter. On tally of the Hill-climbing, grating the obligation round of the authority converter infers changing the voltage of the DC crossing point between the PV exhibit and the intensity converter, accordingly the two names allude to a comparable strategy. In this system, the suggestion of the final annoyance and the suggestion of the endure amplification in the ability are utilized to opt the next subsequently perturbation to be. On the off prospect that at hand is an increment in the power, the perturbation to be reserved an akin line of attack and on the off coincidental that the right diminishes, at that goal followed by the subsequently perturbation must be on the other way.

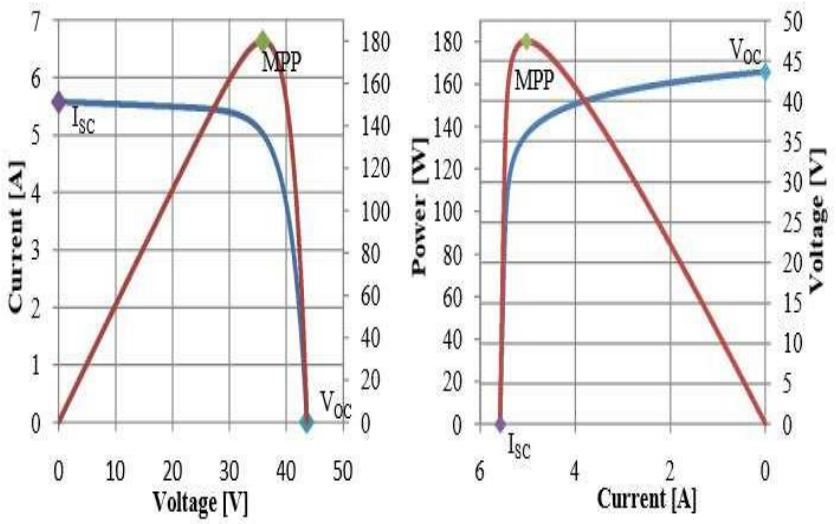


Fig.3.5. Wave Form of MPPT

Based on these facts, the algorithm is implemented. The procedure is rehashed until the MPP is come to. At that point the working point sways around the MPP.

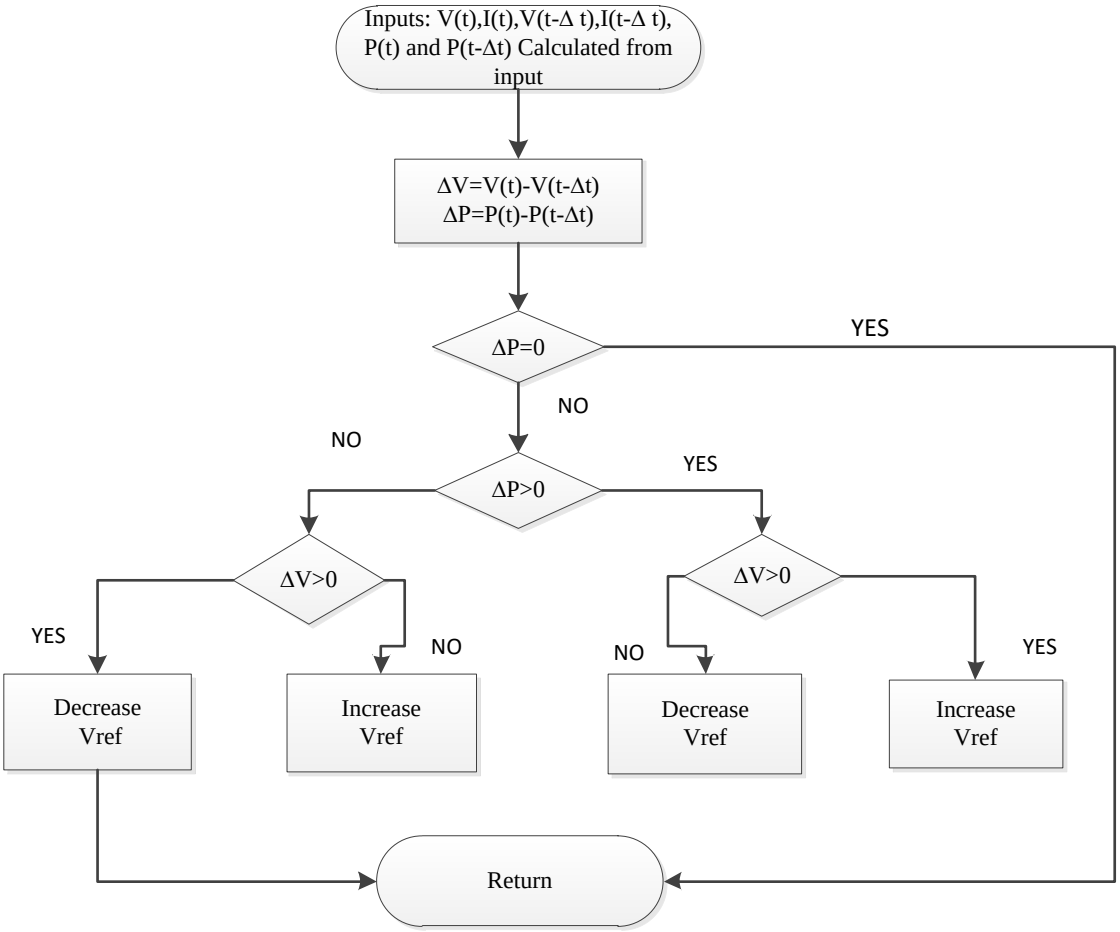


Fig.3.6. Flow Chart of P&O

3.4.3Incremental conductance

The incremental conductance deviousness depends on the method that the prejudice of the bend restrict versus voltage (current) of the PV module is nought at the MPP, affirmative (negative) on its absent and harmful (positive) on the right.

- $\Delta V/\Delta P = 0$ $(\Delta I/\Delta P = 0)$ at the MPP
- $\Delta V/\Delta P > 0$ $(\Delta I/\Delta P < 0)$ on the left
- $\Delta V/\Delta P < 0$ $(\Delta I/\Delta P > 0)$ on the right

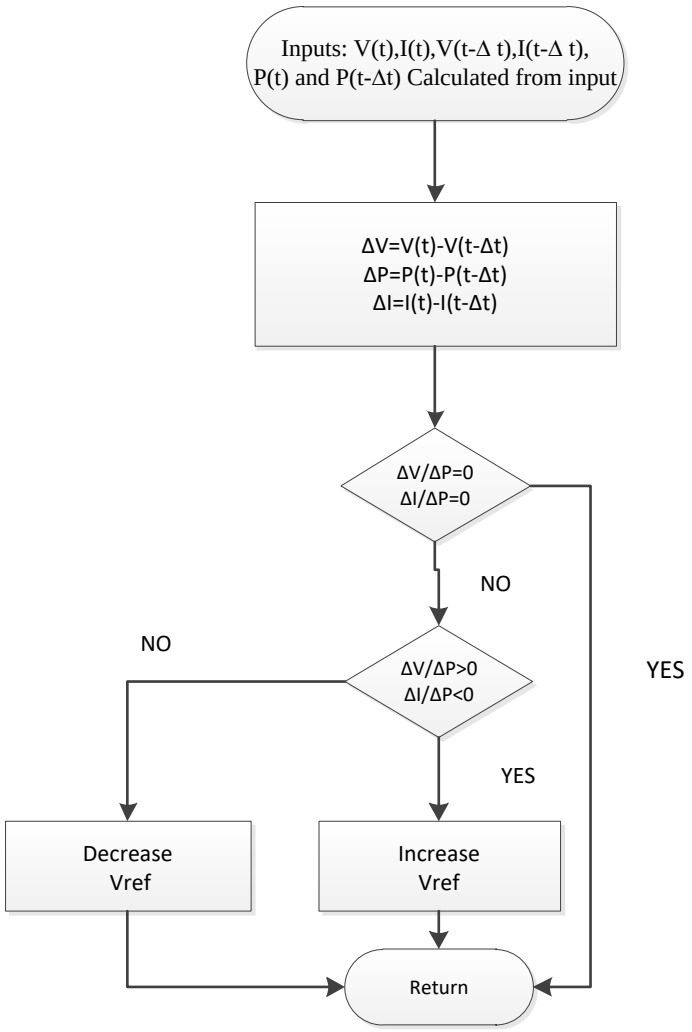


Fig.3.7. Flow Chart Of INC Algoritham

By looking at the growth of the authority versus the totaling of the voltage (current) between two consecutives tests, the adjustment in the MPP voltage can be resolved.

In cooperation P&O and Incremental conductance policy how agile the MPP is be as tall as to rely upon the limit of the increment of the situation voltage. The disadvantages of these methods are for the on the whole piece two. The foremost and important one is that they tin without greatly of a stretch disregard about the MPP if the explanation changes quickly. If nearby be supposed to be an occurrence of phase transforms, they imprint the MPP great, in set alight of the reality that the cash is high priority and the bend does not carry on evolving. Be that as it may, as soon as the light changes next a slant, the bend in which the calculations are based changes constantly with the light, accordingly the adjustments in the voltage and stream are not clearly for the reason that of the irritation of the voltage.

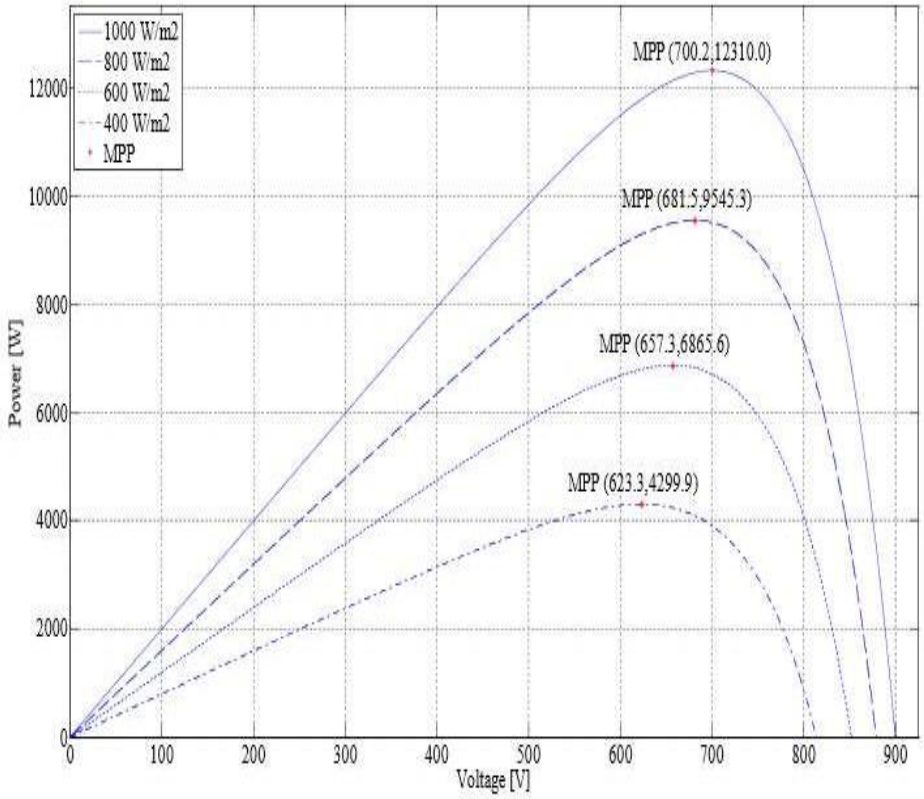


Fig.3.8. Wave Form Of incremental conductance MPPT

4.3. MPPT Advantages:

1. Enhanced Efficiency
2. Sustained system, no repeated shut down of PV power.
3. greater than before operation time.
4. Has played a chief character in popularizing solar power.

CHAPTER 4

HARDWARE DETAILS

4.1. RECTIFIER:

To do the full wave correction, we use a bridge rectifier. We use the basic arrangement of rectifier, there are basically 2 diodes (say D_2 and D_3) are directing while the other two diodes (D_1 and D_4) are in an off extreme amid the period t = 0 to T/2.Accordingly, for -ve cycle of the information, the forwarding diodes are D_1 and D_4. In this manner, the extremity over the heap is the equivalent.

4.2. FILTER:

"So as to acquire a dc voltage of 0 Hz, we need to utilize a low pass channel. So, a capacitive filter circuit is utilized where a capacitor is associated at the rectifier output& a dc is acquired over the separated waveform is basically a dc voltage with irrelevant ripples &it is at last fed to the load"

4.3. INVERTERS:

"DC to AC converters is known as inverters. The capacity of an inverter is to change a dc input voltage to a symmetrical ac yield voltage of wanted magnitude and recurrence. The yield voltage could be fixed or variable at a fixed or variable frequency. A variable yield voltage can be gotten by fluctuating the input dc voltage and keeping up the gain of the inverter constant."

4.4. CONTROLLER-PIC:

"PIC represents the Peripheral Interfacing Controller. We are utilizing PIC 16F877A for creating switching pulses to the staggered inverter. The Pic microcontroller is driven by means of the driver circuit in order to help the voltage activating sign to 9V.To maintain a strategic distance from any harm to microcontroller because of the immediate going of 230V supply to it we give an isolator as an opto coupler in a similar driver."

4.5. MICROCONTROLLER UNIT:

PIC 16F877A MICROCONTROLLER

INTRODUCTION:

"We are utilizing PIC 16F877A for delivering switching pulses to the staggered inverter. in instruct to consume individuals' vectors which don't set up any regular genre voltage at the inverter posts. This dispenses with common sort voltage besides it is utilized to dispose of capacitor voltage unbalancing. The microcontroller is obsessed through the driver route in enjoin to provide for the voltage activating hint at to 9V.To holiday left from any impair to microcontroller for the reason that of the direct disappearing of 230V contribute to it we present an isolator as an optocoupler in a comparable driver circuit."

PIC MICROCONTROLLER FEATURE:

The microcontroller has the following features:

1. High-Performance RISC CPU:

1] Every part has its own - set rules with the immunity of code branches, which are 2-cycle

2] Up to 8K x 14 expressions of flare list Memory, Up to 368 x 8 bytes of facts Memory (RAM), Up to 256 x 8 bytes of EEPROM information Memory. It is a terrific one

3] DC – 20 MHz clock is operating speed input DC – 200 ns guidance cycle

4] Learns 35 Single-word rule, therefore it has easy usage.

Circumferential Features:

1] Timer0: 8-bit clock/counter with 8 – bit prescaler. It is employed for synchronization

2] Timer1: 16-bit clock/counter with Prescaler, can be incremented in middle of Sleep

3] Timer2:8-bit clock/counter with the 8-bit period register, prescaler, and postscaler
Two Capture, Compare and some PWM modules, having following highlights

4] Capture is a 16-bit, worst case scenario. resolution is 12.5 ns

5] Compare is 16-bit, worst case scenario. resolution is 200 ns

6] PWM greatest resolution is 10-bit

2. Synchronous Serial Port (SSP) with SPI (Master mode) and I^2C(Master/Slave)

1] Universal Synchronous Asynchronous Receiver Transmitter with 9-bit address

2] Parallel Slave Port (PSP)8 bits wide with external RD

3. Analog features:

It has an analog Comparator module with:

1] 2 simple comparators

2] Programmable on-chip voltage reference (VREF) module

3] Programmable input multiplexing from gadget inputs and inner voltage reference subsequently 3 sections.

4. CMOS Automation:

1] It has the accompanying highlights:

2] Low-control, high speed Flash/EEPROM
innovation

3] Fully stable plan

4] Wide working voltage run (2.0V to 5.5V)

5] Commercial and Industrial heat ranges

6] Low-control utilization

4.5.1. Outline of PIC 16F877:

PIC 16F877 is a champion amid the largely dynamic microcontroller from Microchip. This controller is extensively old for explore present-day applications in perspective on its ease, varied level of use, from top to toe gauge, and ease of openness. It is essence for applications, for instance, android check applications, estimation devices, belief, and therefore on. The PIC 16F877 skin the entire of the sectors which present-day microcontrollers foreseeably have. The celebrity of a PIC16F877 computer chip shows up as hunt.

Fig.4.1.PIC 16F877

Attributes of PIC16F877

The PIC16FXX configuration has more residential and twisted highlights at what time disputed with its older arrangement. The vital highlights of the PIC16F877 organization are indexed beneath.

Generic Features

1. High-execution RISC CPU.
2. ONLY 35 straightforward word directions.
3. All single cycle directions with the exception of program.
4. Operating rate: clock input (200MHz), guidance cycle (200nS).
5. Up to 368×8bit of RAM of information memory, 256×8 of EEPROM (information memory), 8k×14 of blaze memory.
6. Pinout perfect to PIC 16C74B, PIC 16C76, PIC 16C77.
7. 8 dimensions intense equipment stack.
8. Cut-in capacity (up to 14 sources)
9. Different kinds of tending to modes (immediate, Indirect, relative tending to modes).
10. Power on Reset (POR).
11. Power-Up Timer (PWRT) and oscillator start-up clock.

Crucial Features:

1. The greatest working frequency is 20MHz.
2. Streak program memory (14-bit words), 8KB.
3 The information memory (bytes) is 368.
4. The EEPROM information memory (bytes) is 256.
5. 5 input/yield ports. -
6. 3 clocks.
7. 2 CCP modules.
8. 2 sequential correspondence ports (MSSP, USART).
9. PSP parallel correspondence port
10. 10bit A/D module (8 channels)

Analog Features

1. 10bit, up to 8 channel A/D converter.
2. Brown Out Reset function.
3. Analog comparator module.

Distinct Features

1. Multiple times delete/compose cycle improved memory.
2. Multiple times delete/compose cycle information EEPROM memory.
3. Self-programmable under programming control.
4. In-circuit sequential programming and in-circuit troubleshooting ability.
5. Single 5V, DC supply for circuit sequential programming
6. WDT with its very own RC oscillator for solid activity.
7. Programmable code insurance.
8. Power sparing rest modes.
9. Selectable oscillator alternatives.

Pin Diagrams

The PIC16F877 microprocessor is clear in a number of sorts of bundles. As indicated by the style of exploitation and use, these bundles are separated. The push charts of a PIC16F877 put in diverse correspondence that gain appeared in the cost underneath.

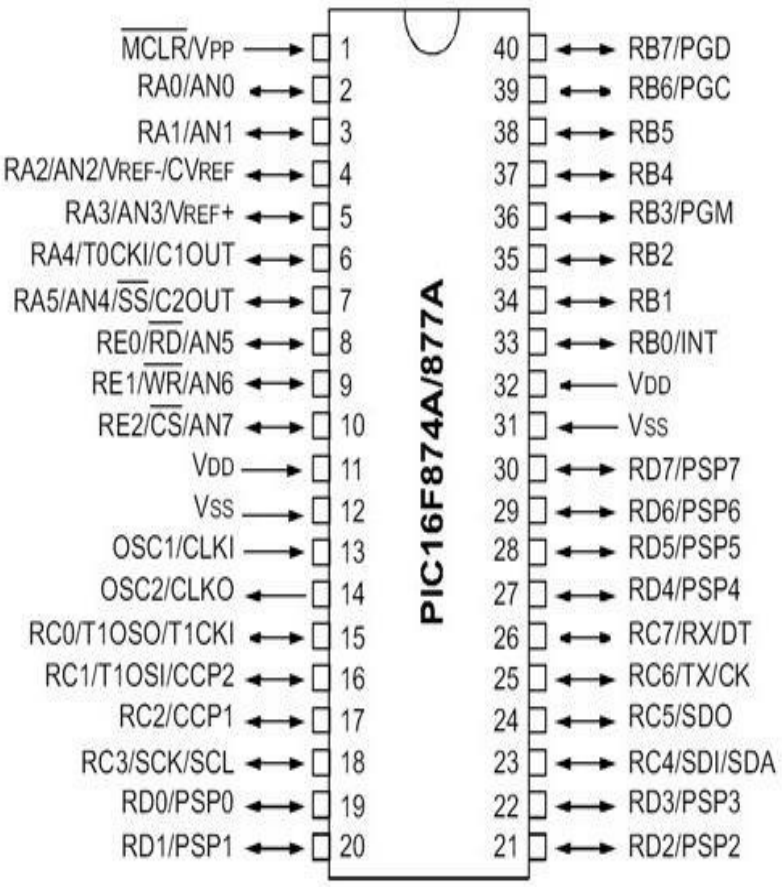


Fig.4.2.: PIC Microcontroller Pin Diagram

Timer modules in PIC 16F877

The PIC 16F877 necessarily has 3 clock modules. These dial module terminals are additionally multiplexed with uncommon capacities for delightful nursing of proxy capacities. These device modules are as a rule indicated by the metaphors TIMER-0, TIMER-1, and TIMER-2. These modules assistance to make diverse timing and including capacities inside the chip.

PWM Mode (PWM)

In Pulse Width inflection mode, the CCPx twig delivers up to a 10-bit motion PWM yield. Since the CCP1 glue is multiplexed with the PORTC information latch, the TRISC<2> crumb have got to be unfurnished to succeed the CCP1 fuse a yield. The cost demonstrates a rearranged honest outline of the CCP module in PWM type

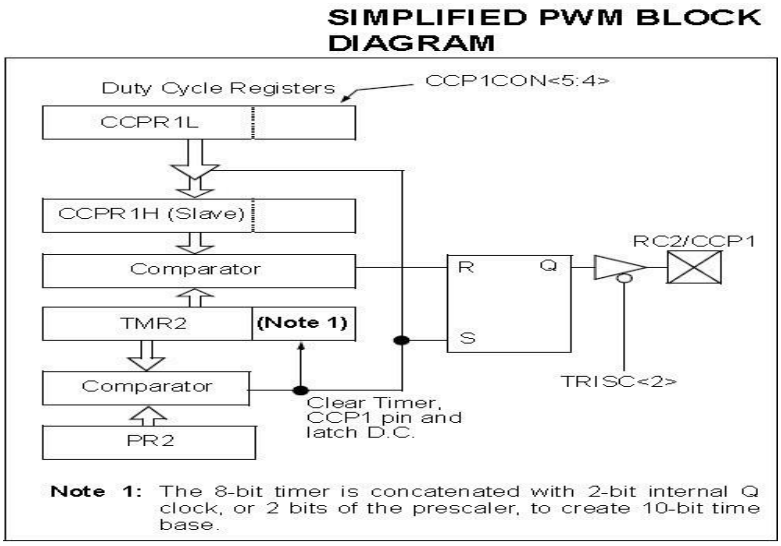


Fig 4.3 PWM Mode Block Diagram

Structure for Pulse Width Modulation Operation

The following steps should be taken when configuring the CCP module for PWM operation:

1. Set the PWM period by writing to the PR2 register.

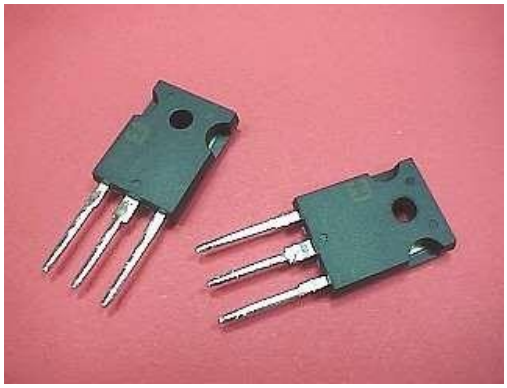
2. Set the PWM duty cycle by writing to the CCPR1L register and CCP1CON<5:4> bits.

3. Make the CCP1 pin an output by clearing the TRISC<2> bit.

4. Set the TMR2 prescale value and enable Timer2 by writing to T2CON.

5. Design the CCP1 module for PWM activity.

4.6. MOSFET SWITCH



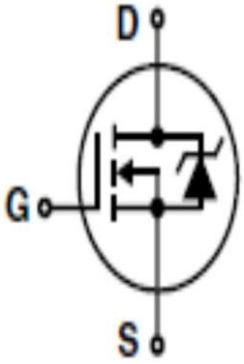


Fig.4.4. Mosfet Switch

DEFINITION OF MOSFET

(Metal Oxide Semiconductor sphere end product Transistor). The nearly everyone prominent and broadly utilized kind of sports ground crash transistor (see FET). MOSFETs are any NMOS (n-channel) or PMOS (p-channel) transistors, which are manufactured as freely bundled discrete parts for elevated authority applications specifically as by a lot of millions inside an introverted cut (IC). In our task, the MOSFET transform is linked with the essential circuit. at this juncture we tolerate two changes to be unequivocal

- Main switch S_m
- Auxiliary switch S_a

The beat to these switches is set utilizing microcontroller PIC16F877A through a driver circuit. In PIC16F877A the beat of 5V is bent which is sent to the driver circuit, this wane is enhanced to about 12V DC, that is sent to the MOSFET alter Sm and Sa in isolation.

4.6.1. MOSFET AS A SWITCH

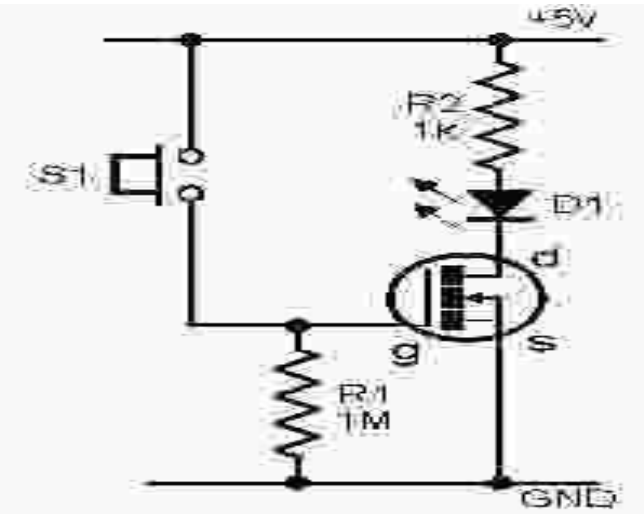


Fig.4.5 Circuit of Mosfet

A field transistor facility in a deeply the identical as a path to the transistor that we comprise pretty of late explored out of the ordinary avenues on the topic of with the exclusion of that the core flow torrent is constrained by an electrostatic field. A FET has an incredibly auspicious stance that no portray streams into the check key (called the entryway), the deep present is crooked on and off by the dimension of voltage on the door.

Attributes

• Ultra-Low On-Resistance

- r DS(ON) = 0.052Ω (Typ), VGS =10V

• Simulation Models

-Temperature Compensated PSPICE® and SABER©

Electrical Models

-Spice and SABER©Thermal Impedance Models

• Peak Current vs Pulse Width Curve

• UIS Rating Curve

CHAPTER 5

SIMULATION RESULTS AND HARDWARE SETUP

5.1 SIMULATION REPRESENTATION OF SYSTEM

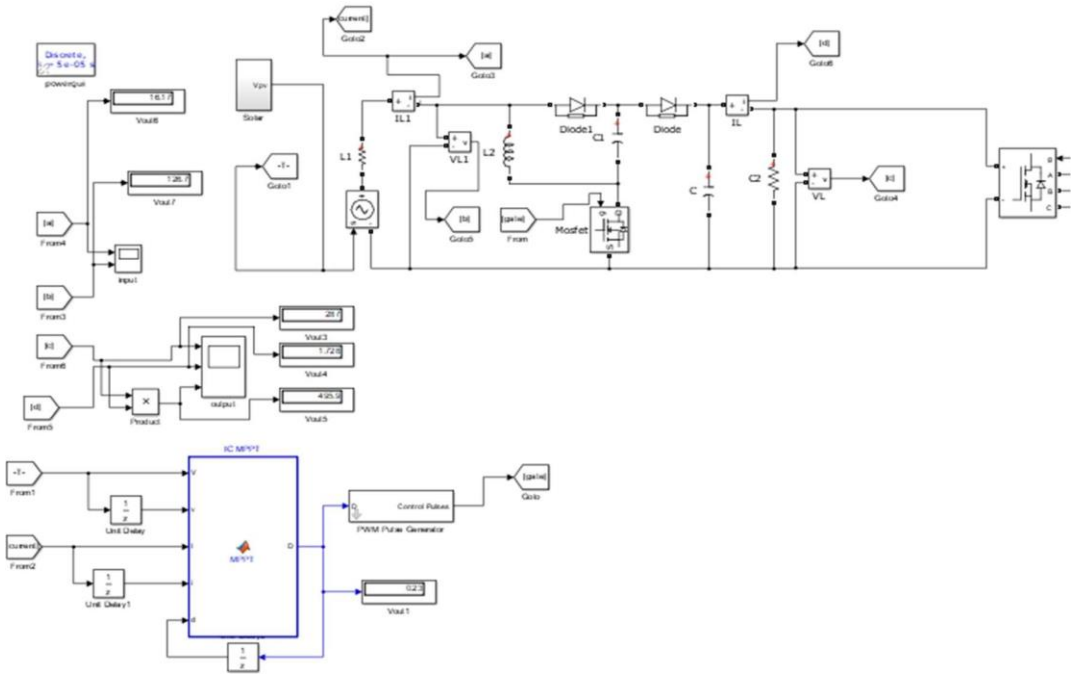


Fig.5.1. Simulink Model Of Proposed System

5.2 SIMULATION RESULT OF SYSTEM

The system output the tempo of 750 rpm as soon as simulated for the calculated system. The converter output voltage obtained is 280 V. Output energy is moreover obtained. These are the fallout of a academic simulation. practicable implementation bottle be altered appropriate to the change in the environmental condition. Fig.5.2. shows the output modern of Luo converter.

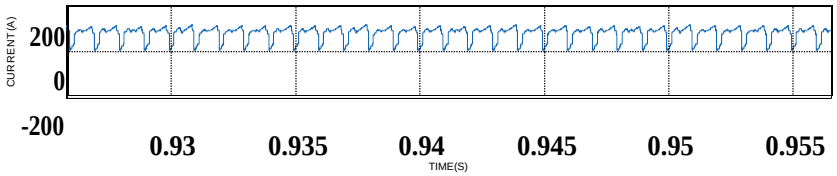


Fig.5.2. output current of luo converter

The gating pulses for the switches 1,3 and 5 are provided by the MPPT which are shown in Fig.5.3.

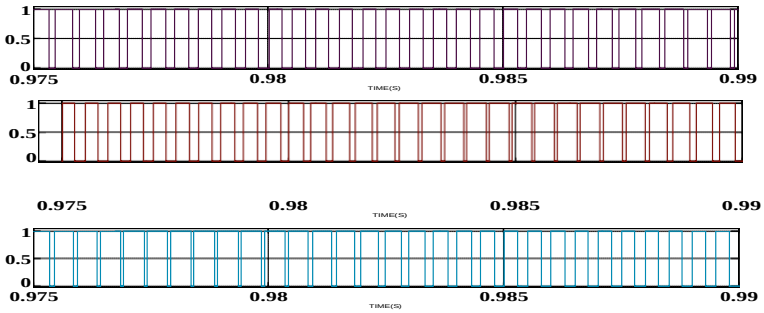


Fig.5.3. Gate Pulses

The gating pulses shown in Fig.5.3. are for upper switches of the voltage source inverter These pulses are inverted and given to the lower switches for getting VSI operation. The other simulation results of voltage source inverter and BLDC motor drive are shown in the in the following figures.

The simulation results are shown in the following figures.

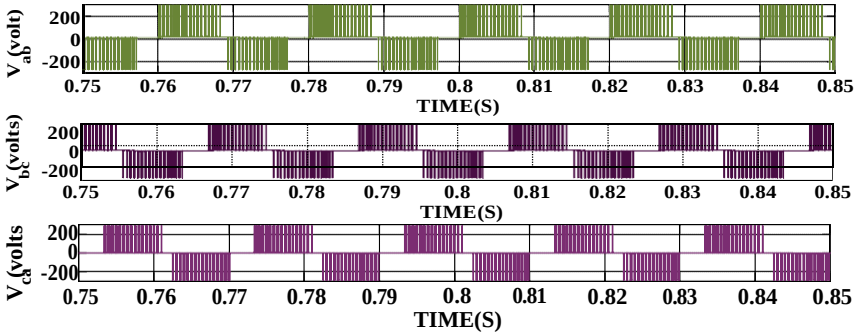


Fig.5.4. line voltages of VSI inverter

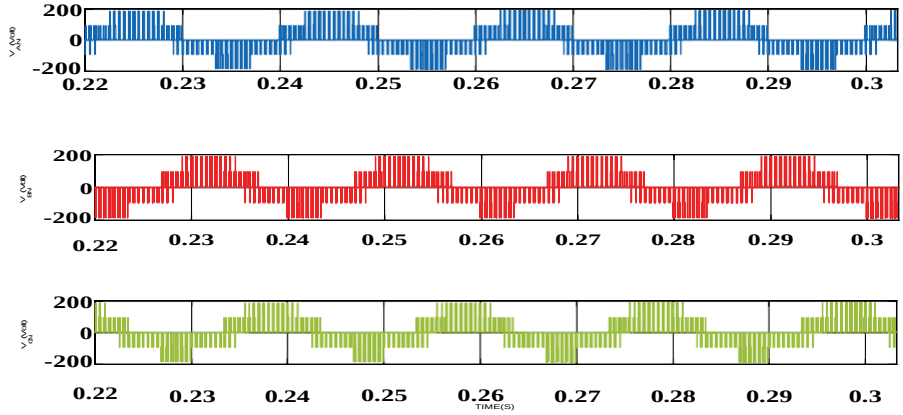


Fig.5.5. Phase voltages

Fig.5.6 and 5.7 shows the various solar array indices like solar array voltage and solar array current

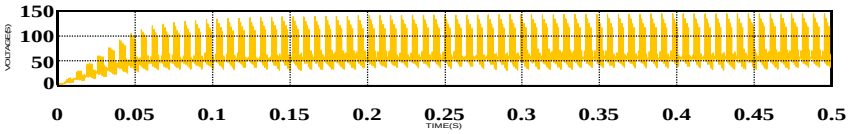


Fig.5.6. Voltage of solar array

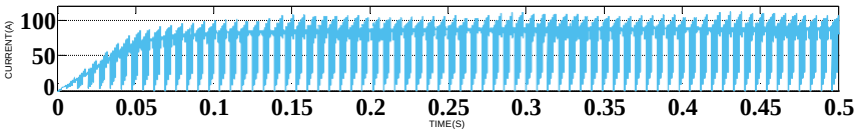


Fig.5.7. Current of solar array

Following figures shows simulation results of BLDC motor drive like speed, torque, stator current, and angle.

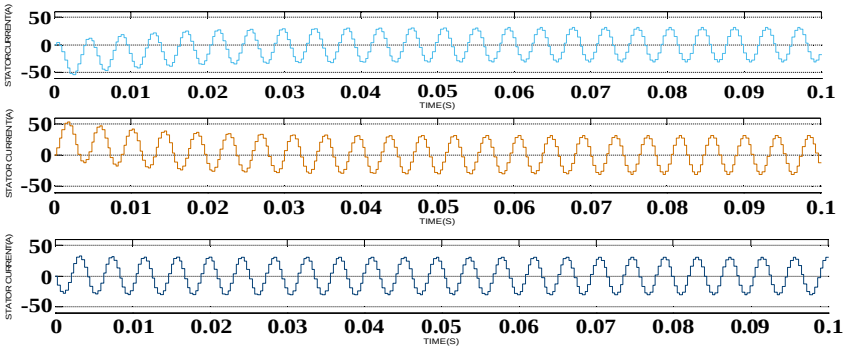


Fig.5.8. Stator Current

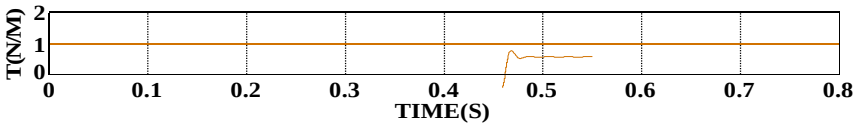


Fig.5.9. Torque

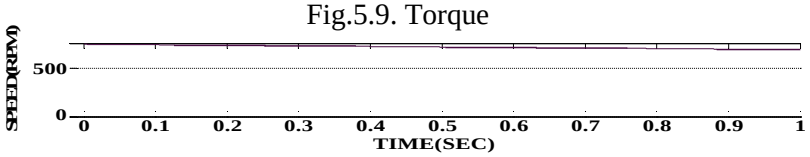


Fig.5.10. Speed

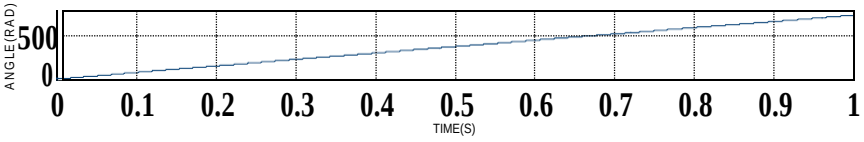


Fig.5.11. Angle

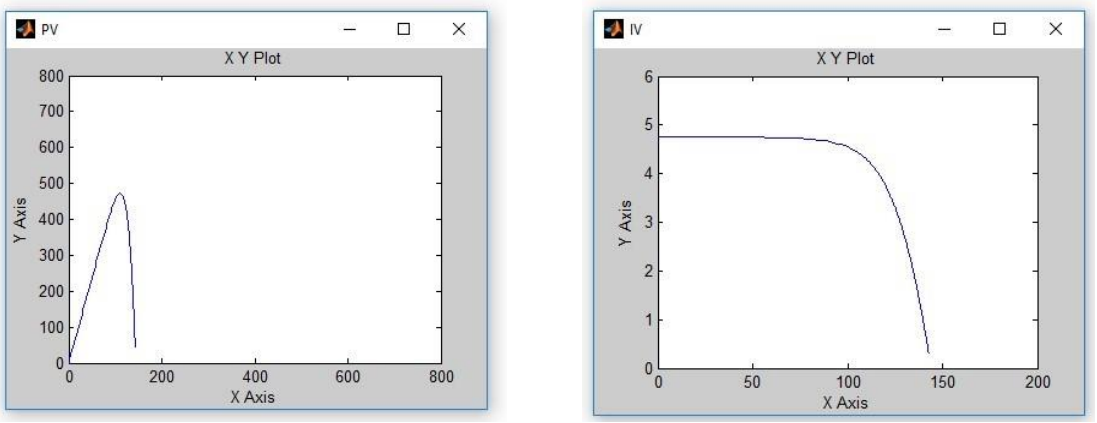


Fig.5.12. Output voltage of PV And Power of PV

CONCLUSION

Conversation of solar energy into the electrical energy with the help of a solar cell. For large scale applications, we are using the solar array. For getting the maximum power from solar array we are implementing the incremental conductance MPPT. This INC algorithm gives the switching pulses to the switch of the Luo converter. It is a dc-dc boost converter which gives the positive output voltage and this voltage is fed into the voltage source inverter (VSI) which works in 120° conduction mode and converts the dc voltage into ac voltage. It also reduces the losses causing by the high-frequency switching operation. In this proposed system we have used the BLDC motor which has higher efficiency than other motors which can be used for water pumping, irrigation.

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