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Design and Implementation of Direct Driven Solar Water Pumping System

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ABSTRACT

In today's era, the world is going towards the extinction of conventional energy sources. And also, the non-conventional energy sources are emerging as the new world's energy sources that are never going to extinct. Solar is one of the non-conventional energy sources that have the ability to generate reliable energy that is clean in form and can be used as and when required (provided a storage facility should be available). Thus, due to advantages, we are using solar energy which can be used to pump water at a proposed site.

Keywords: Solar Energy, Conventional Energy Sources, Reliable Energy, Pumping System, DC Motor.

INTRODUCTION

PROJECT BACKGROUND

Renewable electricity reassets in general, and Solar Energy supply in particular, has the capacity to offer electricity that may be transformed into power. The sun electricity is enough and no different supply of renewable electricity is like sun electricity. The sun-powered pumping device may be used anywhere, however it's far right for rural regions which might be dealing with electricity crisis. Due to geographical position, areas in India have enough sunshine at some point of the year, which makes it best vicinity for usage of sun electricity. Small farms, villages, and animal herds in make bigger international locations require hydraulic output energy of much less than a kilowatt. Many of those capacity customers are too a long way from an electrical grid to economically faucet that supply of energy, and engine-pushed pumping has a tendency to be prohibitively steeply-priced in addition to unreliable because of the excessive fee of bought fuel, inadequate protection and restore capabilities. A sun-powered pump is a regular pump with an electric powered motor. Electricity for the motor is generated on-web website online thru a sun panel, which converts sun electricity to direct current (DC) power. Because the character of the electric output from a sun panel is DC, a sun-powered pump calls for a DC motor if it's far to perform with out extra electric components. If a pump has an alternating-current (AC) motor, an inverter might be required to transform the DC power generate with the aid of using the sun panels to AC power. Due to the extended complexity and fee, the decreased performance of an AC device, maximum sun-powered pumps have DC motors. A DC motor has been used to force the sun electricity pump device.

PROBLEM STATEMENT

Keeping in view the dearth of energy in rural and faraway regions, water pumping need to be developed so as to conquer this trouble of power shortage. Thus, water pumping has come to be a promising software of PV energy. Therefore, the proposed project title is "**DESIGN AND IMPLEMENTATION OF DIRECT DRIVEN SOLAR WATER PUMPING SYSTEM".**

PURPOSE OF STUDY

Main objectives of this project are as follows:

- Replacement of Non-Renewable energy resources by renewable energy resources.
- Utilization of solar energy.
- Production of electricity in remote area.

LITERATURE SURVEY

1. Analysis and Design of a Solar Charge Controller Using Cuk converter

D.C. Riawan and C.V. Nayar,
Senior Member, IEEE Department of Electrical and Computer Engineering Curtin University of Technology, Perth, WA 6845, Australia
Abstract
The paper presents a scheme for transferring power from the photovoltaic (PV) modules to a battery using a solar charge controller based on a Cuk dc/dc converter. The converter is configured in parallel power transfer mode (PPT) to achieve higher efficiency. PWM control with maximum power point tracking algorithm is used to extract maximum power from the PV modules. Mathematical modeling and field test results using multi crystalline

photovoltaic modules have been carried out to verify the effectiveness of the control scheme.

Summary

The context of this research paper presents, the way of obtaining maximum power from solar photovoltaic polycrystalline cells under varying temperature and solar radiation level. For this MPPT (Maximum Power Point Tracking) device is being used between the PV array and the load to extract maximum power. Since efficiency has always been a major factor for any system, here it is necessary to use the converter which have higher efficiency, for this a simple dc/dc Cuk Convertor with specific power electronics devices is been used in PPT configuration.

2. Solar energy harvesting for irrigation water pumping system

Nandikesh Pushparaj[1] Nitin Gupta[2] Vikas Gupta[3] Mahmadasaf A. Mulla[4] Dept. of EE, MNIT Jaipur, SVNIT Surat

Abstract

This paper deals with the design and modeling of stand-alone photovoltaic (PV) water pumping system for rural and irrigational purpose. The efficiency of the PV module can be improved by operating at its maximum power point irrespective of insolation level. Maximum power point tracking (MPPT) becomes poor when PV receives non-uniform insolation which effect efficiency of the water pumping system. An induction motor (IM) is used to drive the water pump which has the wide range of speed operation. The Perturb and Observe (P&O) method with the help of DC-DC converter is able to track the maximum power point in the changing isolation conditions. The speed control of IM drive is achieved by v/f control algorithm which improves the dynamics of the PV fed water pumping system. The proposed system is modeled in the MATLAB/Simulink environment to test the performance of system. Simulated results under various insolation levels of the proposed system have been presented.

Summary

From the look at of this studies paper it's miles been decided that the authors has focused on renewable strength reassets as traditional strength reassets are have a tendency to wipe out soon. Solar strength availability is more in assessment to special strength reassets in Indian environmental state of affairs so using that strength as an entire lot as brilliant make bigger is primary objective. Hence they've got determined to layout stand -on my own sun Water pumping device for irrigation purpose. In evaluation to this truely they've got determined to collect a pumping device with VSI (voltage supply inverter) primarily based totally completely without a doubt controller in case you need to successfully, conventionally & successfully run the pumping device.

This paper is comprising of primary tiers which might be device configuration and designing of factors. The crucial circuit of controller includes of sun energy as an input, inductor, capacitor, energy digital switch-load, diode, MPPT circuitry and VSI primarily based totally completely without a doubt motor manage unit. They have used the Ac 3 segment squirrel cage induction motor and converted it to a pump.

The VSI is operated as required output for the reason that gate and switching pulses are managed with the beneficial useful resource of using switching pulse generator and manage circuit. In designing tool they've got designed the PV array kind and its precise rating, designed the increase convertor at the aspect of its factors and arrangement, the charge of dc hyperlink capacitor, dc hyperlink voltage as in keeping with circuit is calculated, in the long run designing of pump. After this complete procedure, the subsequent degree is to govern the price of the motor strain carried out in sun water irrigation device, so that they have attempted many strategies to govern this motor strain in the long run after complete trials they used V/F manage of induction motor for particular controlling of motor strain.

Last degree is that they have designed and advanced a Simulink version in MATLAB SIMULINK. This layout device is examined beneathneath short situations and regular kingdom condition, furthermore they've got examined it beneathneath each variable environmental situations for trying out its long time durability. This device is simulated and decided simply so it's all parameters are right. This paper gives the sun water irrigation pumping device. This now no longer unusualplace device is low charge, clean to cope with and has controller which operates in tiers for acquiring most strength from PV array. Also they've got managed the waft of water through pump with the beneficial useful resource of using v/f manage method. In final this invention might be very beneficial in inexperienced strength technology and examined in diverse climate situations.

Design, Modeling and simulation of a PV water pumping system

V.Boscaino 1, G. Cipirani2, G. Dargo3, V.Di Dios4, MG Ippolito5 Department of Electrical and Computer Engineering DEIM-University of Palermo, Italy

Abstract-

Electric pumps can not be fed in the ones regions in which they may be now no longer linked to the electrical public distribution grid. In the ones regions, it's miles beneficial to feed electric powered pumps by way of the energy generated from renewable power sources plants. Among these, the Solar Water Pumping System feed electric powered pump way to the energy generated via way of the photovoltaic plant. In this paper, an entire SWPS is completely designed, modelled and simulated in MATLAB environment .The proposed implementation is a beneficial device for SWPS testing.

Summary-

As we recognise that Solar Water Pumping System is turning into famous and the usage of Solar Water Pumping System is growing in lots of far off regions due to its benefit that it could stand by myself with out absolutely connecting it to grid. The most important additives of the Solar Water Pumping System are: PV plant, electric powered pump, digital manipulate machine, electric powered cables hydraulic pumps, and tanks. The motor may be both a dc everlasting magnet which has an smooth manipulate approach however wishes common renovation or may be an induction one that wishes to be fed with the aid of using a DC/AC or a DC/DC plus DC/AC convertor however calls for much less renovation and are much less stricken by partial shading condition, however with the aid of using the use of an induction motor, electricity losses and price of the machine will increase ensuing in lower of reliability which may be very crucial in far off regions wherein common renovation isn't always possible. This paper provides the dynamic analysis, design, and modeling of a sun water pumping machine the use of an induction motor with none garage tank fed with the aid of using a unmarried DC/AC stage.

METHODOLOGY

1. Simulation
2. Hardware implementation

SIMULATION

MATLAB software was used for simulation of boost charger or the PWM based charge controller which is the most important part of the entire project. The entire simulation process was carried out in three parts- Firstly the simulation of constant DC voltage source boost regulator was carried out. In this, fixed DC supply was given as input and fixed DC was obtained at the output side.

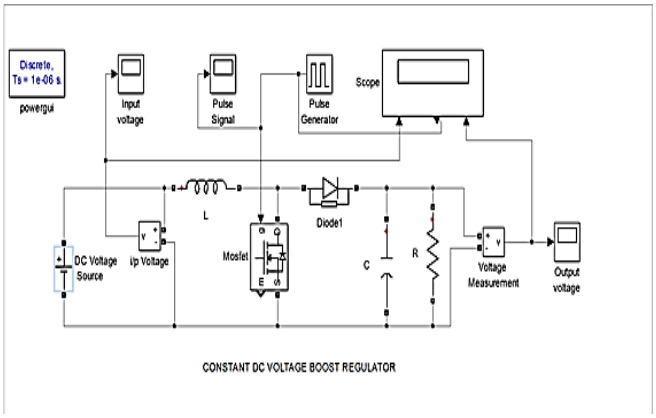

Fig1- Constant DC voltage source boost regulator

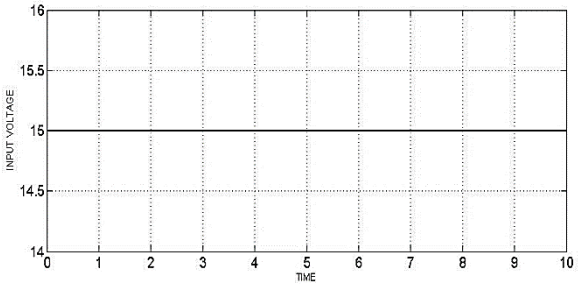

Fig2- Constant Input DC applied voltage

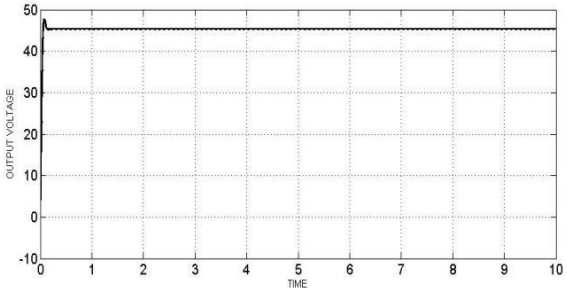

Fig3- Constant Output DC voltage

Secondly the simulation of variable input voltage boost converter (with open loop arrangement) was carried out. In this the input provided was a variable DC supply and the output obtained was also variable DC in nature

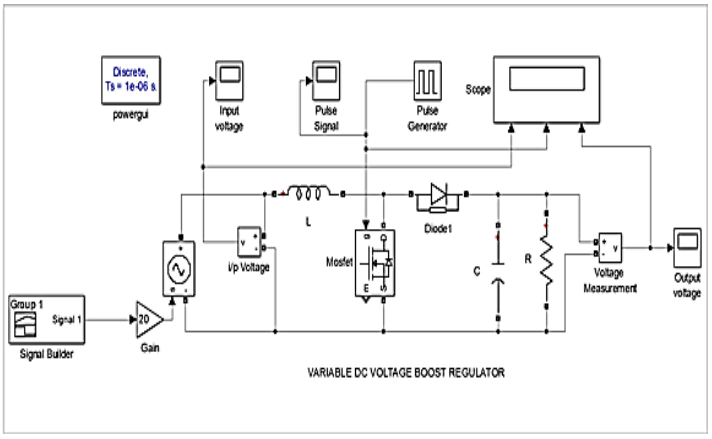

Fig-5 Circuit Diagram for Variable Input Voltage Boost Converter

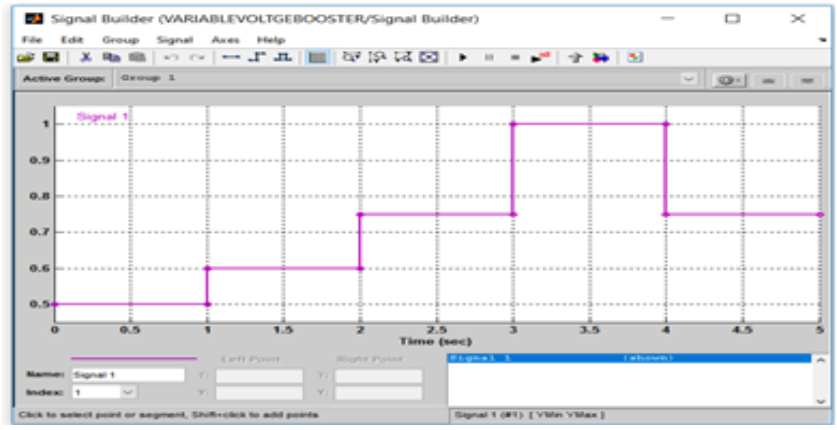

Fig-6 The variable signal developed using Signal builder

The associated input waveform applied to the input of Boost-Converter is given as follow:

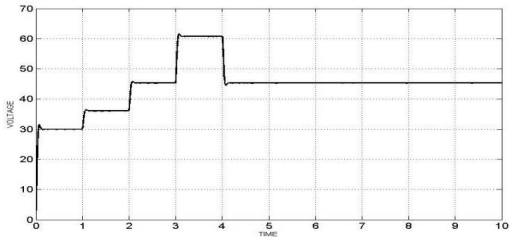

Fig-7 Variable Step input DC applied voltage to Boost-Converter

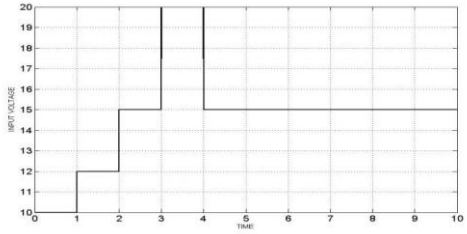

Fig-8 Variable Step Output obtained across Boost-Converter

In the final stage of simulation, the simulation of closed loop variable input voltage boost converter was carried out. In this the input provided was variable DC whereas the output obtained was fixed DC. Thus, in the final stage of simulation we got the desired output in the form of fixed DC voltage even if the given input supply was variable. This concluded the working of solar charge controller.

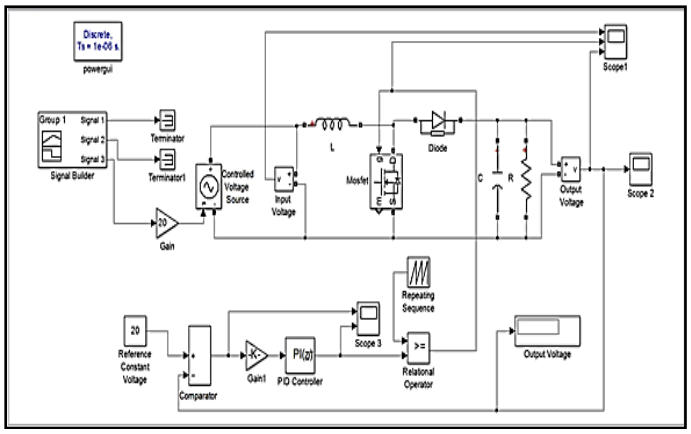

Fig-10 Closed loop circuit for variable input signal of Boost-Converter

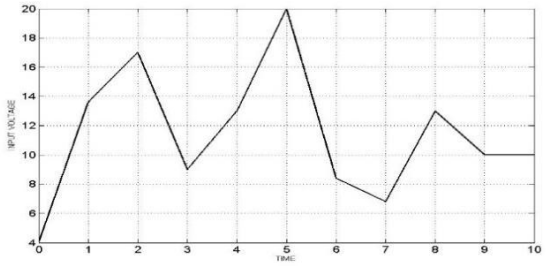

Fig-11 variable input signal

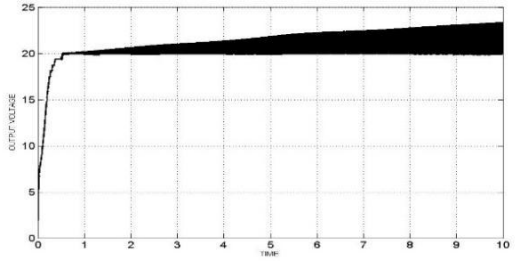

Fig-12 Fixed DC output

HARDWARE IMPLEMENTATION

In hardware implementation, we used a one hundred fifty Watt rated sun panel for conversion of sun strength into electric strength. The voltage score of sun panel as cited with inside the consumer guide become 22.7 V (VOC) and the output received while uncovered to daylight become 21.forty-four V which is sort of equal to the given value. This ensured the right operating of sun panel. The output terminals of the sun panel are linked to the PWM primarily based totally sun rate controller of score 12V/24V and 10 A which is chosen in keeping with the score of the sun panel. A battery of 12 V, 12Ah is attached to the rate controller to serve the cause of presenting reference voltage, and it additionally serves as a backup for the whole system. The battery receives charged via way of means of the electric strength supplied via way of means of the sun panel. The load terminals of the rate controller are linked to a DC pump of 10 Watt that's used to pump water from the delivery tank and via pipes this water is transported with inside the garage tank and the sphere in keeping with the want of the personnel.

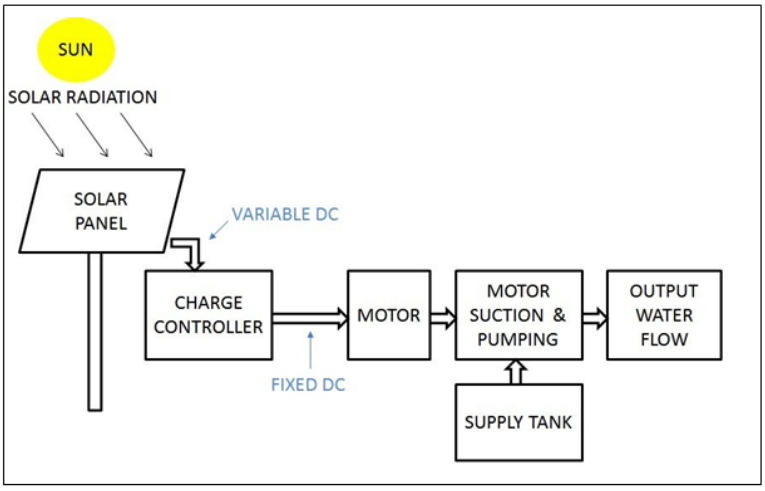

Fig:13 Block diagram of DC solar pumping system

COMPONENTS

SR.NO	NAME OF COMPONENT	SPECIFICATIONS	QUANTITY
1	Solar panel	Microtek module mtk150 Watt /12V	1
2	Solar charge controller	12/24 Volts 10 Amp	1
3	DC battery	Model - slv12 voltage – 12V, Current - 12 Ah	1
4	DC motor with pump	5 Watt	1
AUXILIARIES			
5	Pipes	0.5 inches	As required
6	Pipe elbows/bends	0.5 inches	9
7	Pipe connectors	0.5 inches/12mm	1
8	Ball valves	0.5 inches	2
9	End cap	0.5 inches	1
10	Nails and screws	1inch / 2inch	As required
11	PVC glue	-	1
12	Hacksaw	-	1
13	Screwdriver	-	1
14	Tester	-	1
15	Plier	-	1
16	Switch and switch box	5Amp	1
17	Connecting wires	6mm thickness	As required
18	Water storage tanks	2.5 litre capacity	2
19	Wooden base	Size 5 X 2 ft.	1
20	Metallic stand	3 ft. high with panel base of size 5X2 ft.	1
21	Wire clips and pipe clips	4mm/ 1 inch	As required

Table (1) - List of components

CONCLUSION

The design and implementation of direct driven solar water pumping system has been successfully achieved in this prototype laboratory model. We have developed this model on the PWM based technique, which was further implemented in Solar Charge Controller. Throughout the project, various software were explored. The project enables us to achieve the various program outcomes, in development of ourselves. We have experienced working individually as well as in team, developing our work ethics. Preparing for seminars developed leadership qualities within us that helped in conducting investigation of complex problems. With this project we have done a lifelong learning which will help us in developing our environment and society**.**

ACKNOWLEGEMENT

Each and every effort requires a positive support from the many peoples and areas. We would like to thank our respected HOD Prof. N. M. LOKHANDE. Who permitted and allowed us to carry out project work using the facilities available in the department. We wish to extend our thanks to the guidance which we receive from our project guide Prof. SACHIN L. SARAWADE.

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