IJIREEICE

ISSN (Online) 2321 – 2004
ISSN (Print) 2321 – 5526

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 4, Issue 5, May 2016

Solar Based Water Pump

Samata Shirahatti[1], Payal Sonasale[2], Sarita Wahile[3], Prof. A. R. Suryawanshi [4]

Dept. of Electronics and Telecommunication, Pimpri Chinchwad College of Engineering, Nigdi, Pune,

Savitribai Phule Pune University, India[1,2,3,4]

Abstract: Nowadays consumption of fossil fuel increasing at faster rate. Due to constant power cuts we have to select another alternative for pumping system. Solar energy which is abundant in India can be used for this purpose. We have developed a system to solve this problem. This system can work well in cloudy conditions as well. We are using variable frequency drive which reduces effect of surge current. System uses solar energy which is pollution free.

Keywords: Three phase inverter, Solar Panel, Micro-controller motor, three phase Induction Motor.

I.INTRODUCTION

Solar energy is available in abundant form in India. We can use this energy to help the farmers for irrigation purpose. Farmers are facing lots of problems due to constant power cuts. We can use this energy to help the farmers for irrigation purpose. Inclusion of solar energy as power source will help to reduce this problem. Solar energy is best among all the sources of renewable energy. By using solar energy the system can be made less expensive and highly efficient Variable frequency drive provides greater efficiency and reduces the energy consumption .The system is useful for farmers for irrigation as we are introducing solar based variable frequency drive for pumping purpose.

II. METHODOLOGY

Solar based VFD system works as follows:
Solar panel will convert the solar energy to DC voltage. The output of solar panel which in case will vary from 250 to 500V is given to the filter capacitor and 3 phase inverter. Here 3 phase inverter is operated in 180 degree conduction mode i.e. three IGBT are on at a time. It consists of 6 IGBT which will be triggered through microcontroller via IGBT diver TLP250. The microcontroller is powered by 5V. The inverter converts the DC from solar panel to the

Three phase AC drives the motor when triggered through microcontroller.
Microcontroller gets total 2 feedbacks one feedback is from output of solar panel through resistive network in terms of voltage which signifies the proper working of solar panel. The second feedback is from inverter circuit in terms of current from CTs which signifies voltage and current from three phases R, Y and B. Based on this feedback Microcontroller generates the control signal required to drive the IGBT (inverter) which drives motor. The system requires multiple power supply for six IGBT Driver and microcontroller which are fulfilled with the help of Switch mode power supply. There is no need of any battery, we can directly connect the panel to the inverter and the output of the inverter can be connected to a three phase motor. By varying the PWM pulses this system tries to maintain the constant V/F ratio.

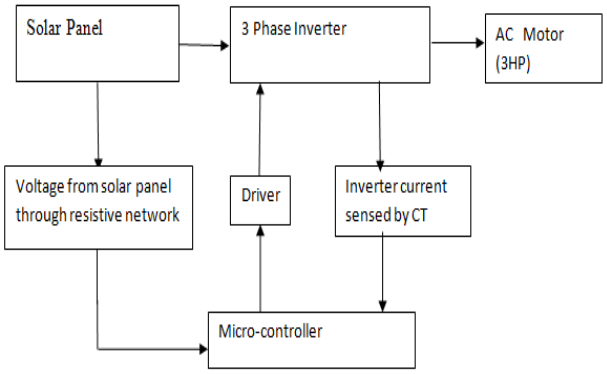

Fig.1 Block Diagram

1. Solar Panel
Photovoltaic panels are the interface with the primary energy. Photovoltaic are best known method for generating electric power by using solar cells to convert energy from sun into a flow of electrons. We are using 13 solar panels of 230Watt in series with Voc of 44.44V and Vmp of 36.7V.

2. Three Phase Inverter
A device that converts DC power into AC power at desired voltage and frequency is called an Inverter. Three phase inverter is used which will work in 180 degree conduction mode. This inverter will drive the motor. Here IGBT is used as a switching device. IGBT-IKW25N120T2 is used in this system which provides highest efficiency is reached due to the best compromise between switching and conduction losses.

3. Driver TLP250
In our system TLP250 has given 16V supply. Therefore it gives 16V PWM pulses to IGBT. The driver gives the output as a supply voltage that is 16 V when the input of PWM pulse is high. This Driver provides the isolation also that means the input side that is controller side is separated from power side to protect the controller side.

4. Current Transformer
Current-sensing transformer is an alternative to shunt resistors and Hall Effect sensors to measure or sense the current .These sensors use the principle of a transformer,

Copyright to IJIREEICE

IJIREEICE
ISSN (Online) 2321 – 2004
ISSN (Print) 2321 – 5526
INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 4, Issue 5, May 2016

where the ratio of the primary current to the secondary current is a function of the turns ratio. Main advantage of this CT is that it provides isolation and used for high current application. CT senses the current through the inverter and that current is get converted into DC voltage through the diode bridge and resistive network .In this system we are checking that whether that voltage is in between 1.5V to 3.2V .This is safe operating voltage for this system. If voltage is less than 1.5V then dry run condition will occur and if it is greater than 3.2V overload condition occur.

5. dsPIC30F2010

This controller is used for mainly for PWM generation which is given to IGBT drivers for switching. dsPIC30f2010 sense the two feedback one from solar panel which decides the weather solar.

III. DESIGN CONSIDERATION

We have designed a system for 3 HP i.e. 2238W load for input within the range of 250V to 500V.

IV. SOFTWARE IMPLEMENTATION:

SMPS Software Design:

The system requires multiple power supply for six IGBT Driver (requires 16 Volt supply) and microcontroller (requires 5 Volt supply) which are fulfilled with the help of Switch mode power supply. Design of SMPS is done through PI Expert. PI Expert Suite is a graphical user interface (GUI) program that takes your specifications and automatically generates a power conversion solution.

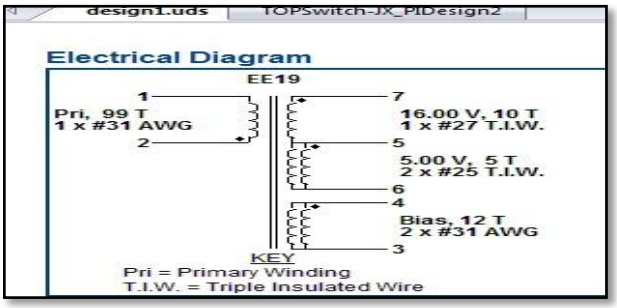

Fig 3. Electrical diagram for 16V and 5V

Three Phase Inverter Implementation

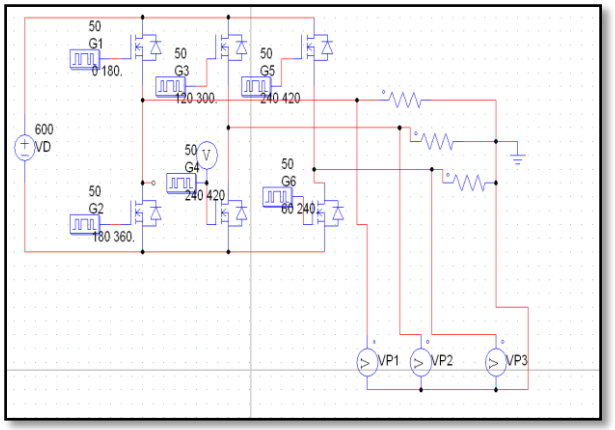

Fig 4. Three phase inverter circuit diagram

DC voltage obtained from PV array is converted into three phase AC voltage with the help Three Phase Inverter. Here 3 phase inverter is operated in 180 degree conduction mode i.e. three IGBT are on at a time. Software implementation of basic three phase Inverter Bridge as shown in figure done through PSIM software.

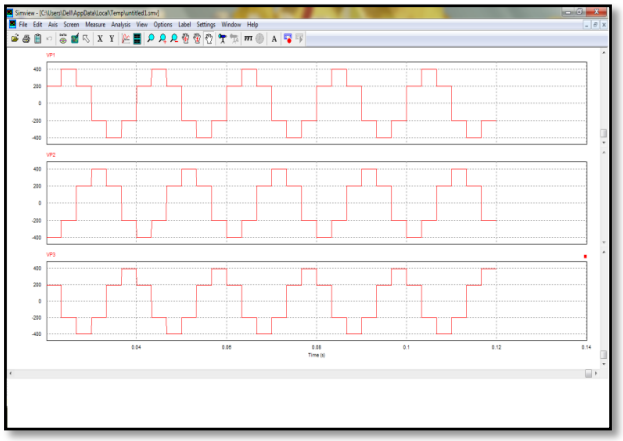

Fig.5. output waveform

V. FLOWCHART

Flowchart of proposed system is given below.

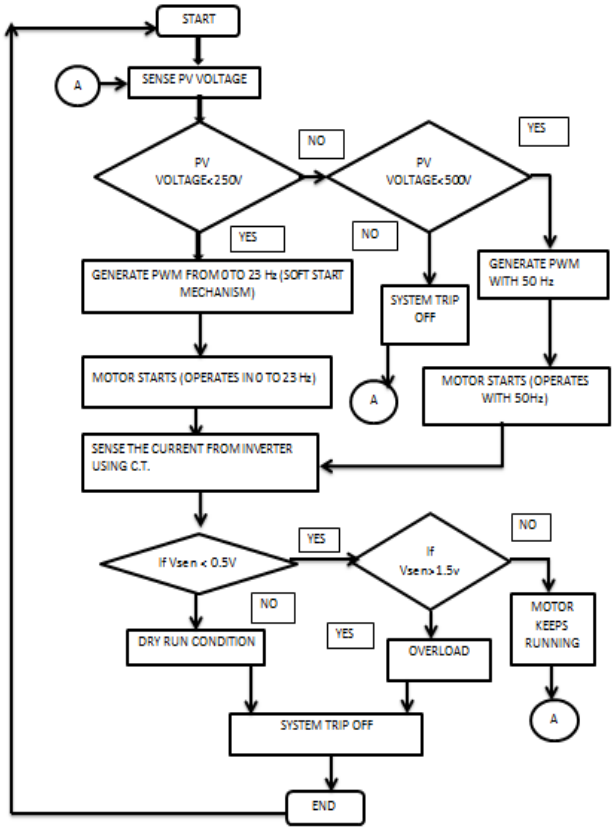

Fig 6. Flowchart

VI. RESULT

DC voltage from solar panel converted into three phase ac voltage using three phase inverter which is controlled by PWM pulses as shown in fig 7.

IJIREEICE

ISSN (Online) 2321 – 2004
ISSN (Print) 2321 – 5526

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 4, Issue 5, May 2016

Fig. 7. PWM output of two phase

We have also observed three phase waveform and line voltage waveform which is as shown in fig 8 and fig 9.

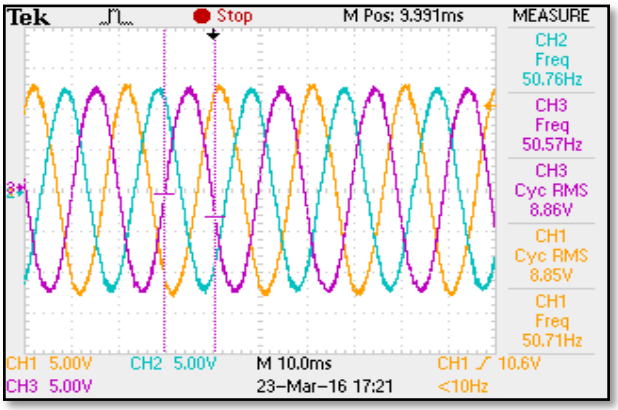

Fig 8. Three phase waveform

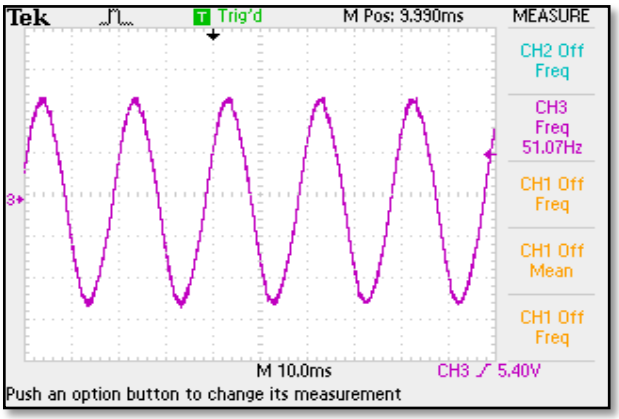

Fig 9. line voltage waveform

VII. CONCLUSION

In this paper we designed solar based VFD system which is helpful for farmers in today's scenario with high power cuts and less rainfall. In this study it is found that the speed control of motor using variable frequency drive can save energy. We have observed that VFD reduces high starting current of AC motor and thus minimizes effect of shock on both load and equipment. According to requirement we have designed the system and observed the three phase waveforms. Here, Soft start mechanism assures smooth transition in initial speed and greatly reduces motor wear and maintenance.

REFERENCES

[1] K. Pawan Kumar, Katuri Saikishore, "Analysis and simulation of solar powered water pump using three phase induction motor", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol.2, Issue 11, november.2013

[2] M.Bala Raghav, K.Naga Bhavya, Y.Suchitra G.Srinivasa, "Design of Solar Power Based Water Pumping System", International Journal of Engineering Research & Technology, Vol. 2, Issue 10, October 2013

[3] Hemant Ingle, N.N.Kasat, "Automated Solar Based Agriculture Pumping", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 11, November 2012

[4] Mahir Dursan and Semih Ozden, "Application of Solar Powered Automatic Water Pumping" in Turkey, International Journal of Computer and electrical engineering,vol.4, No.2,April2012

[5] Nafisa Binte Yousuf, Khosru M. Salim, Rafid Haider, Md. Rajin Alam "Development of a Three Phase Induction Motor Controller for Solar Powered Water Pump"

[6] C. Thanga Raj, Member IACSIT, S. P. Srivastava, and Pramod Agarwal Energy Efficient Control of Three-Phase Induction Motor", International Journal of Computer and Electrical Engineering, Vol. 1, No. 1, April 2009.

[7] P.S.Chaudhari, Dr. Pradeep M.Patil, Sharad S. Patil, P.P.Kulkarni, R.M.Holmukhe, "Comparison Of Performance Characteristic of Squirrel Cage Induction Motor by Three Phase Sinusoidal and PWM Inverter Supply using MATLAB Digital Simulation", Third International Conference on Emerging Trends in Engineering and Technology, 2010 IEEE

[8]J.Chauhan, P. Chauhan, T.Maniar,A. Joshi "Comparison of MPPT algorithms for DC-DC converters based photovoltaic systems" International Conference on Energy Efficient Technologies for Sustainability,IEEE April 2013

[9] Mrs DeepaliS.Shirke, Prof. Mrs.Haripriya, H.Kulkarni, "Microcontoller based speed control of three phase induction motor using v/f method" International Journal of Scientific and Research Publications, Volume 3, Issue 2, February 2013 1 ISSN 2250-3153

BIOGRAPHIES

Samata Shirahatti, She is currently studying in 8th semester of B.E degree in Electronics and telecommunication engineering in Pimpri chinchwad college of engineering, Pune. Her area of interest is power electronics and automation.

Payal Sonasale, She is currently studying in 8th semester of B.E degree in Electronics and telecommunication engineering in Pimpri Chinchwad College Of Engineering, Pune. Her area of interest is power electronics and communication system.

Sarita Wahile, She is currently studying in 8th semester of B.E degree in Electronics and telecommunication engineering in Pimpri Chinchwad College Of Engineering, Pune. Her area of

interest is power electronics, robotics and automation.

Ashok Suryawanshi, He has pursued bachelor's degree in electronics from Shivaji University, Kolhapur (MS) and master's degree from M.S. University, Baroda (GUJ). He is having more than 19 years of teaching experience. Presently he is working with pimpri chinchwad college of Engineering, Pune-44 since 2004 as assistant professor in Electronics & Telecommunication Dept. He has attended & Organized many workshops, seminars, conferences at Pune University, State, national and International level. His area of Interest is Power Electronics, Industrial Electronics, Renewable energy, embedded systems.

- **Awards and Honors**
- Life member ISTE (LM60510) since2008.
- Member IETE (M 234436) since 2013
- Received Best Teacher Award from Bharatiya Jain Sanghatna, Pimpri-Chinchwad, Pune.
- Received Best Student Welfare Officer (SWO) Award for 2011-12 from Board of Student Welfare, UoP.