Innovative Journal for Opportunities and Development in Science & Technology,
Volume 1,Issue 9, May 2021
Paper Id: – IJ2021V1I9 -17A-E,
ISSN 2582-6026

SOLAR POWERED AUTOMATED IRRIGATION SYSTEM BASED ON SOIL MOISTURE USING AURDUINO

[1]Suraj Nehe, [2]Vishwajeet Aher, [3]Rahul Dhadge, [4]Vishal Tayade, [5]S.J.Aher

[1]UG Scholar, Electrical Engineering Dept., AVCOE, Sangamner.
[2]UG Scholar, Electrical Engineering Dept., AVCOE, Sangamner.
[3]UG Scholar, Electrical Engineering Dept., AVCOE, Sangamner.
[4]UG Scholar, Electrical Engineering Dept., AVCOE, Sangamner.
[5]Assistance Professor, Electrical Engineering Dept., AVCOE, Sangamner
[1]surajnehe99@gmail.com
[2]vishwajeetaher101@gmail.com
[3]rahuldhadge1998@gmail.com
[4]vishaltayade8412@gmail.com

ABSTRACT:- A photovoltaic energy transformation framework for changing over sunlight based force into useable DC at 5V to 15Vhas been proposed and carried out which can be utilized for charging batteries of low force gadgets like cell phones. The energy got from the photovoltaic module is unregulated. In any case, for charging Lithium particle batteries, we require around 11.5V consistent DC supply. Thusly the 18V unregulated DC got from the PV module is ventured down up to 12V by DC-DC support converter. For productive use of photovoltaic energy transformation framework, it is vital for plan a greatest force point following (MPPT) framework. The idea of MPPT is to naturally shift a PV cluster's working point in order to get most extreme force. This is fundamental in light of the fact that the PV cell has a very low conversion efficiency and it is necessary to reduce the cost of the overall system. The power delivered by array increases to maximum as the current drawn rises and after a particular value, the voltage falls suddenly making the power drop to zero. This frequent rise and drop reduces the efficiency drastically, to avoid this the algorithm keeps tracking the maximum power point in the photo voltaic arrays there by keeping the output almost at a constant value given that the illumination of the sun stays within a particular range. The efficiency is also is maintained at its perfect level.

I. INTRODUCTION

In this chapter we get to know the specifications of the components used for the demonstration of the solar powered irrigation. It also gives the functional abilities of the

Innovative Journal for Opportunities and Development in Science & Technology,
Volume 1,Issue 9, May 2021
Paper Id: – IJ2021V1I9 -17A-E,
ISSN 2582-6026

components. The functions of the components are explained from the functional block diagram of the project shown in figure

The functional setup consists of the following,

1. Solar Panel
2. Boost converter
3. Battery
4. Motor pump
5. PIC microcontroller
6. MPPT

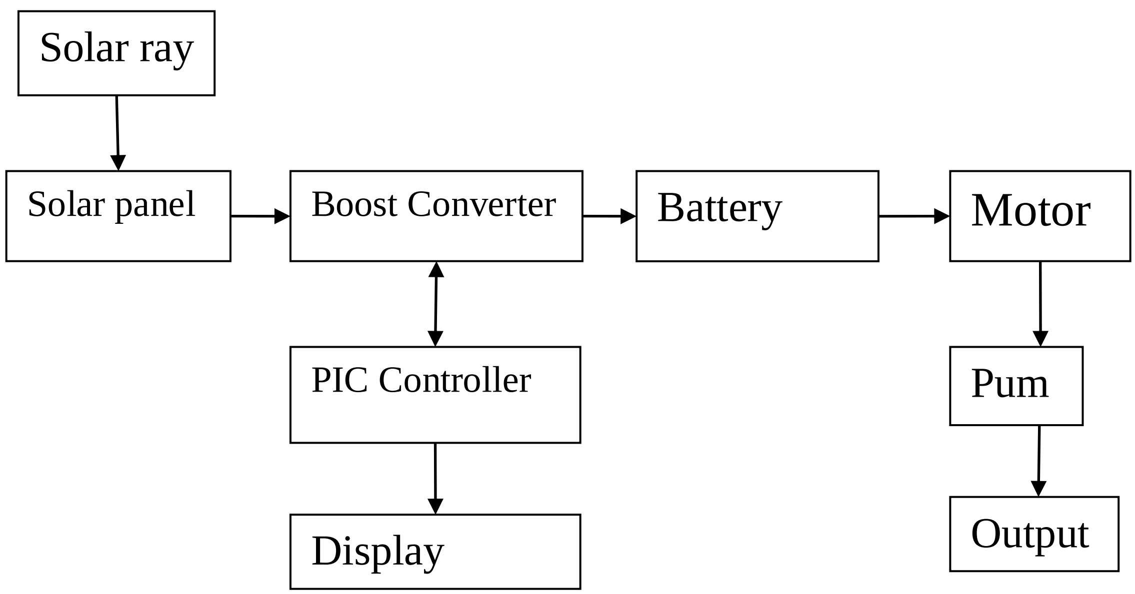

Fig1: Block Diagram

1.1 OBJECTIVE OF THE PROJECT

The use of new efficient photovoltaic solar cells (PVSCs) has emerged as an alternative measure of renewable green power, energy preservation and request side administration. Attributable to their high beginning expense, PVSCs have not yet been completely an appealing option for power clients who can purchase less expensive electrical force from the utility lattice. Be that as it may, they can be utilized broadly for water siphoning and air conditioning in remote and isolated areas, where utility power is not available or is too expensive to transport. This method

Innovative Journal for Opportunities and Development in Science & Technology,
Volume 1,Issue 9, May 2021
Paper Id: – IJ2021V1I9 -17A-E,
ISSN 2582-6026

aims to pump water using solar panel (Renewable energy source) only, so that the power supply cost is reduced and reliability is increased.

II. CIRCUIT DIAGRAM

The overall circuit diagram of the solar powered irrigation pump setup is given.

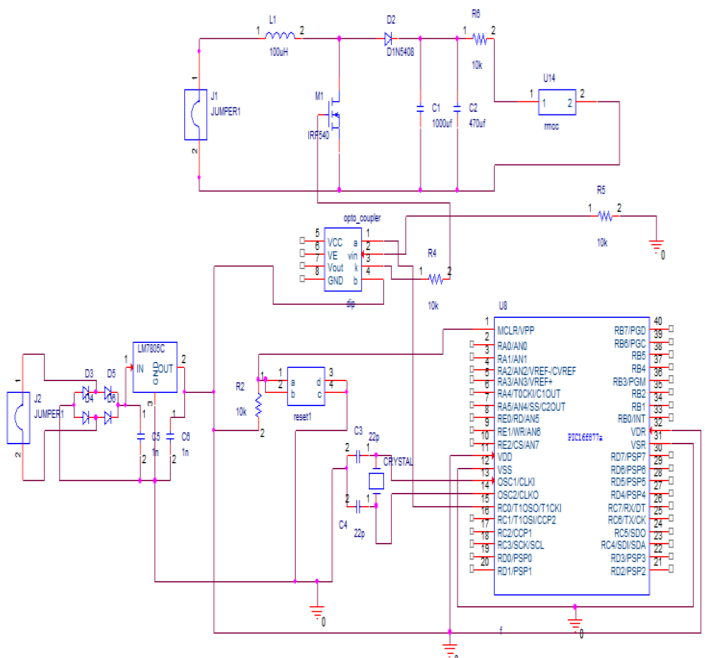

Fig 2: Circuit diagram

2.1 PCB DESIGN

The Printed Circuit Board designed specifically for the controller and the converter setup of the SPIP setup is below.

a) Front side

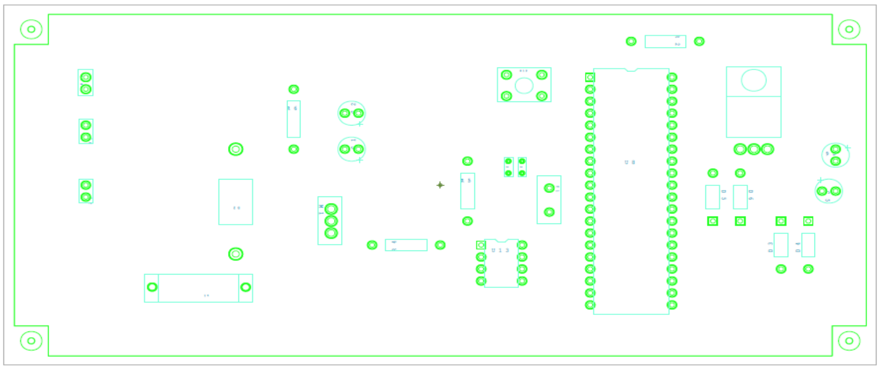

Fig 3: PCB front side design

B) Back side

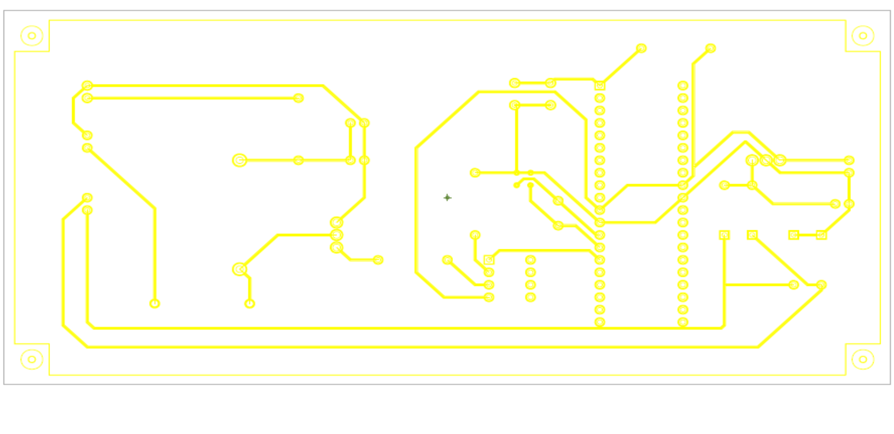

Fig 4: PCB back side design

III. PHOTOVOLTAIC CELL PANEL

A Solar photovoltaic panel is a packaged and connected assembly of photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each panel is rated by its DC output power under standard test conditions and typically ranges from 100 to 320 watts.

The efficiency of a panel determines the area of a panel given the same rated output – an 8% efficient 230 watt panel will have twice the area of a 16% efficient 230 watt panel. Because a single solar panel can produce only a limited amount of power, most installations contain multiple panels.

3.1 Four types of PV cells

- Selective – Emitter Cell (SEC)
- Emitter wrap- through cells (EWC)
- Thin Film Photovoltaic
- Single Crystal Silicon Cells

3.2 Single-Crystal Silicon Cell Construction

- The majority of PV cells in use are the single-crystal silicon type.
- Silica (SiO_2) is the compound used to make the cells. It is first refined and purified, then melted down and re-solidified so that it can be arranged in perfect wafers for electric conduction. These wafers are very thin.
- The wafers then have either Phosphorous or Boron added to make each wafer either a negative type layer or a positive type layer respectively. Used together these two types treated of crystalline silicon form the p-n junction which is the heart of the solar–electrical reaction.
- Many of these types of cells are joined together to make arrays, the size of each array is dependent upon the amount of sunlight in a given area.

3.3 The Photoelectric Effect

- The photoelectric effect relies on the principle that whenever light strikes the surface of certain metals electrons are released.
- In the p-n junction the n-type wafer treated with phosphorus has extra electrons which flow into the holes in the p-type layer that has been treated with boron.
- Connected by an external circuit electrons flow from the n-side to create electricity and end up in the p-side.

- Sunlight is the catalyst of the reaction.
- The output current of this reaction is DC (direct) and the amount of energy produced is directly proportional to the amount of sunlight put in.
- Cells only have an average efficiency of 30%

3.4 Pros and Cons of Solar Electricity

- Expensive to produce because of the high cost of semi- conducting materials, which could be avoided by reducing manufacturing costs.
- The PV Manufacturing Research and Development Project focuses on increasing manufacturing capacity so that the cost of manufacturing will decrease. They aim to achieve break even costs.
- However, solar energy contributes positively to the nation’s energy security because it is produced domestically, reducing reliance on energy imports.
- The industry is still relatively new and extremely hi tech allowing for the creation of more jobs in the American market.
- The government has many incentives program which vary from state to state, but they exist to encourage investment in forms of alternative energy.
- Does not require the transportation of hazardous materials across country.
- Sunlight is a free abundant source

Fig. 5- solar panel

IV . OPERATION OF BOOST CONVERTER AND MPPT

4.1 BOOST CONVERTER

4.1.1 Operating principle

The key principle that drives the boost converter is the tendency of an inductor to resist changes in current by creating and destroying a magnetic field. In a boost converter, the output voltage is always higher than the input voltage. A schematic of a boost power stage is shown in Figure 1.

(a) When the switch is closed, current flows through the inductor in clockwise direction and the inductor stores some energy by generating a magnetic field. Polarity of the left side of the inductor is positive.

(b) When the switch is opened, current will be reduced as the impedance is higher. The magnetic field previously created will be destroyed to maintain the current flow towards the load. Thus the polarity will be reversed (means left side of inductor will be negative now). As a result two sources will be in series causing a higher voltage to charge the capacitor through the diode D.

If the switch is cycled fast enough, the inductor will not discharge fully in between charging stages, and the load will always see a voltage greater than that of the input source alone when the switch is opened. Also while the switch is opened, the capacitor in parallel with the load is charged to this combined voltage. When the switch is then closed and the right hand side is shorted out from the left hand side, the capacitor is therefore able to provide the voltage and energy to the load. During this time, the blocking diode prevents the capacitor from discharging through the switch. The switch must of course be opened again fast enough to prevent the capacitor from discharging too much.

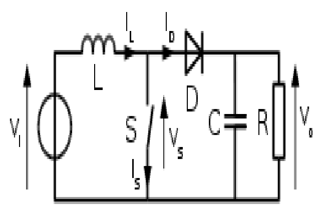

Fig. 6: Boost converter schematic

The basic principle of a Boost converter consists of 2 distinct states in the On-state, the switch S (see figure 5.1) is closed, resulting in an increase in the inductor current;in the Off-state, the switch is open and the only path offered to inductor current is through the fly-back diode D, the capacitor C and the load R. This results in transferring the energy accumulated during the On-state into the capacitor.The input current is the same as the inductor current. So it is not discontinuous as in the buck converter and the requirements on the input filter are relaxed compared to a buck converter.

V. CONCLUSION

From the perceptions made above, we presume that the framework created is equipped for separating greatest force from the photovoltaic module simultaneously giving a managed DC supply. The outcomes got from try are in synchronization with the hypothetical outcomes. The encompassing temperature of the framework is accepted not to change for a sensibly significant time-frame (around 5 minutes). Be that as it may, for all intents and purposes, this may not be the situation. The protection may change in a few minutes. In such cases, we need to get the reference voltage from the short out current of the PV board. The worth acquired can be hooked as the reference voltage and MPP can be gotten naturally with no manual intervention. Most industrially accessible sunlight based boards are fit for creating power for in any event twenty years. The regular guarantee given by board makers is more than 90% of evaluated yield for the initial 10 years, and more than 80% for the second 10 years. Boards are required to work for a time of 30 to 35 years.

REFERENCE

[1] Ramos Hernanz, JA. CampayoMartin,JJ. Zamora Belver,I.,LarrangaLesaka,J. , ZuluetaGuerrero,E. p • \Modeling of photovoltaic module., International Conference on Renewable Energies and Power Quality (ICREPQ • f10) Granada (Spain), 23th to 25th March, 2010.

[2] Francisco M. Gonzalez-Longatt, • \Model of photovoltaic Module in Matlab.., (II CIBELEC 2005).

[3] Huan-Liang Tsai, Ci-Siang Tu, and Yi-Jie Su, Member, IAENG, •\Development of generalized photovoltaic model using MATLAB /SIMULINK., Proceedings of the World Congress on Engineering and Computer Science 2008,WCECS 2008, October 22 - 24, 2008, San Francisco, USA .

[4] M.G. Villalva, J.R. Gazoli and E.R. Filho, ―Comprehensive approach to modeling and simulation of photovoltaic array‖, IEEE Trans on Power Electronics, Vol. 24, n°5, pp. 1198-1208,May 2009 .

[5] SavitaNema, R.K.Nema, GayatriAgnihotri, ―Matlab / simulink based study of photovoltaic cells / modules / array and their experimental verification‖, International Journal of Energy and Environment, Volume 1, Issue 3, 2010 pp.487-500.

[6] S. Rustemli, F. Dincer, ―Modeling of photovoltaic panel and examining effects of temperature in Matlab/Simulink‖ Electronics and Electrical Engineering, ISSN 1392 – 1215, 2011. No. 3(109).

[7] Sera, Dezso, Teodorescu, Remus and Rodriguez, Pedro, ―PV panel model based on datasheet values,‖ International Symposium on Industrial Electronics, 2007. ISIE 2007. IEEE, November 2007, pp. 2393 - 2396.

[8] SyafrudinMasri, Pui-Weng Chan, ―Development of a microcontroller-based boost converter for photovoltaic system‖, European Journal of Scientific Research ISSN 1450-216X Vol.41 No.1 (2010), pp.38-47 ©

[9] Matlab and Simulink, The Math works, Inc. as of September 2010, http://www.mathworks.com.

[10] D.P Hohm and M.E. Ropp, ―Comparative study of maximum power point tracking algorithms‖, Progress in Photovoltaic: Research and Applications, 2003, 11:47-62.

[11] Manoj Kumar, F. Ansari, A.K. Jha ―Maximum power point tracking using perturbation and observation as well as incremental conductance algorithm‖,IJREAS , ISSN 2294-3905, Vol.1,Issue 4 (2011), pp.19-31.

[12] Pandiarajan N., Ramaprabha R., RanganathMuthu, ―Application of circuit model for photovoltaic energy conversion systems‖, research article.

[13] Vikrant A. Chaudhari, ―Automatic peak power tracker for solar pv modules using dspace software‖, Master thesis.,Maulana Azad National Institute of Technology, Deemed

[14] S. Masri and P. W. Chan, "Design and development of a dc-dc Boost converter with constant output voltage", IEEE, International conference on Intelligent and Advanced systems (ICIAS), June 2010.

[15] AsmarashidPonniran and Abdul Fatah Mat Said.,"DC-DC Boost Converter Design for Solar Electric System", International conference on Instrumentation, Control and Automation, October 20-22 (ICA 2009) Bandung.

[16] SyafrudinMasri and Pui-Weng Chan, "Development of a Microcontroller-Based Boost Converter for Photovoltaic System", European Journal of Scientific Research. ISSN 1450-216XVol.41No.1,pp.38-47. http://www.eurojournals.com/ejsr.htm

[17] Diary R. Sulaiman, Hilmi F. Amin, and Ismail K. Said., "Design of High Efficiency DC-DC Converter for Photovoltaic Solar Home applications", Journal of Energy and Power engineering, 2009.

[18] Muhammad H. Rashid, Power Electronics Circuits, Devices, And Applications, 3rd edition, University of West Florida, Pearson Prentice Hall, 2003.

[19] Ned Mohan, Tore M. Undeland, and Williams P. Robbins, Power Electronics: Converters, Applications, and Design, 3rd ed., John Wiley &Sons: USA, 2003. P.Sathya et al. / International Journal of Engineering and Technology (IJET) ISSN

[20] B.M Hasaneen; Elbasse; (2008) "Design and Simulation of DC/DC Boost Converters". Power system conference, MEPCON, 12th international middle east, 2008, pp: 335-340.

[21] Chao zhang; Dean Zhao; Jinjing Wang; Guichang Chen; "A modified MPPT method with variable perturbation step for photovoltaic system". Power electronic and motion control conference, IPEMC' 09, IEEE 6th International, 2009, pp: 2096-2099.

[22] K. H. Hussein; I. Muta, T. Hoshino; and M. Osakada; "Maximum power point tracking: An algorithm for rapidly chancing atmospheric conditions" IEE proc.-Gener. Transm. Distrib., Vol. 142, pp. 59-64, 1995.

[23] Abu Tariq; Jamil Asghar, M.S; "Development of microcontroller- based maximum power point tracker for photovoltaic panel, Power electronic conference, IEEE, 2006.