ISSN 2250-3153

Fabrication of Embedded System for Dust Removal on Solar Photo Voltaic Cell

Poonam R. Chaudhari[*], Kuldeep Pande[**], Subroto Dutt[***]

[*] Department of Electronics Engg. Yeshwantrao College of Engg., Nagpur
[**] Department of Electronics Engg. Yeshwantrao College of Engg., Nagpur
[***]Department of Electrical Engg. Rajiv Gandhi College of Engg., Chandrapur.

Abstract- Turning over the pages of history it is found that the sincere effort are undertaken for gaining efficient output from solar energy but it has to face lot of shortcoming. While analysing toward different factor one of the factor is shadowing & effect of dust particle. In this topic the survey to this effect on overall performance of SPV is focused & an embedded System is design to solve this problem.

Index Terms- Challenges in SPV System, Performance of SPV on Intensity, Problem faced by SPV, Shadowing effect in SPV

I. INTRODUCTION

The significant challenged faced by 2000 era is "how to satisfy the overgrowing need of energy within limited resources??"

To answer this difficult question we have come forward with various renewable energy resources like wind, solar, tidal, biomass etc. And also with many alternative methods (to generate electricity from these sources).

The reliability of photovoltaic modules has always been one of the most important subjects as reliability and lifetime is the key for overall system performance and warranty. Photovoltaic (pv) reliability has gained attention as the photovoltaic industry has rapidly grown and the numbers of module makers have increased too. Pv systems produce power in proportion to the intensity of sunlight striking the solar array surface. The intensity of light on a surface varies throughout a day, as well as day to day, so the actual output of a solar power system can vary substantial. There are other factors that affect the output of a solar power system. These factors need to be understood so that the customer has realistic expectations of overall system output and economic benefits under variable environmental conditions over time.

II. MOST PROBLEMS REGARDING PHOTOVOLTAIC SYSTEMS

1. Power limitation by inverter to keep upper limit for line voltage
2. Partial shading in PV awnings by upper rows (Shadowing).
3. PV generator operating voltage below inverter input window.
4. Power loss due to undersized inverter
5. Gear thing or isolation faults
6. Bypass diode failure, faulty circuit breakers or switches (Given by: module, inverter, battery, conductors).
7. Dust accumulation

III. WHAT IS A SHADOWING?

The covering of some part of solar panel which distort the ray of light rather than absorbing which lead to low power output is known as shadowing.

The most obvious result of a shadow is a decrease in power output from the solar array. The amount of power loss is a function of the size and shape of the shadow, the geometrical and electrical lay-out of the cells in the array, and how the shadow falls across the particular solar cell array.

IV. CAUSES OF SHADOWING

1. Shade from building
2. Trees chimney obstacle
3. Clouds
4. Dust & Dirt
5. Snow & other light blocking obstacle
6. Improper Handling of SPV
7. Lack of Knowledge
8. Maintenance

V. UNDESIRABLE OUTCOMES

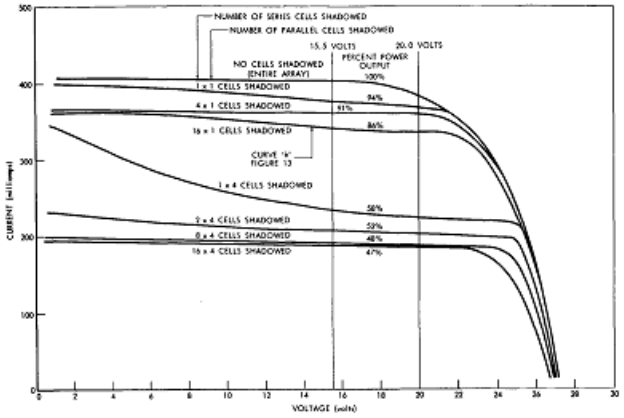
The undesirable out comes due to shadowing is:

1. Reduced energy Output
2. Mismatch Situation
3. Module Mismatch
4. Dominos Effect
5. Increased Temperature
6. Over Heating
7. Reduced Efficiency

VI. GRAPHICAL/PRACTICALLY REDUCED POWER RATIO

Series	*Parallel*	*Output power*	*Percentage*
1	*1*	*Output power*	*94*
4	*1*	*Output power*	*91*
16	*1*	*Output power*	*86*
1	*4*	*Output power*	*58*
2	*4*	*Output power*	*52*
8	*4*	*Output power*	*48*
16	*4*	*Output power*	*47*

Fig.No.1The Effect of a Shadow which Covers Different Numbers of Cells in Series and parallel



VII. FABRICATION OF EMBEDDED SYSTEM

To overcome the problem of solar panel caused due to dust accumulation the embedded system is design which will automatically sense the dust on panel with the help of sensor.
The output of the sensor will be the input to the microcontroller where the algorithm is written & according to the status of input the arm will be activated.

Thus the block diagram can be designed like:

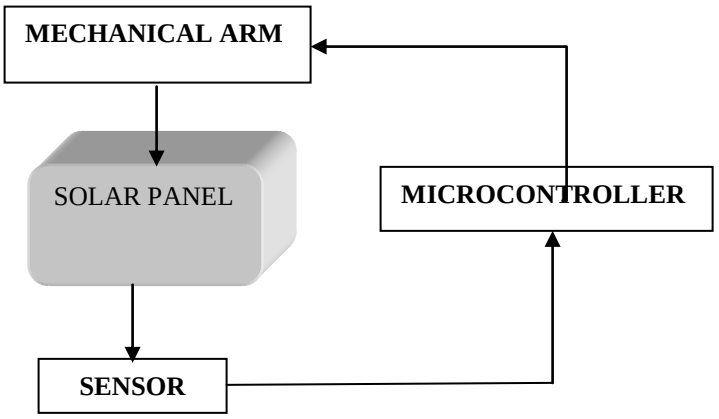
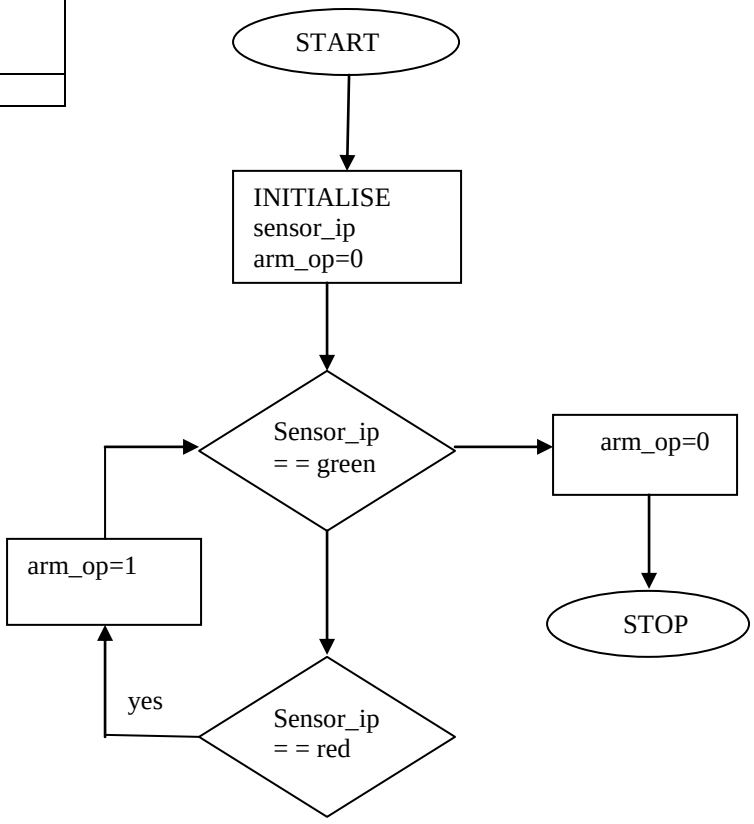


Fig. No. 2 Block Diagram

VIII. ALGORITHM

The flow chart for the algorithm is as follow



IX. ADVANTAGES

1. Low power consumption
2. Regular cleaning of solar panel
3. Reduce Maintenance cost
4. Increase performance of Solar panel

5. Reduce Battery related problem
6. Regulated power output from SPV System
7. Increase overall efficiency

X. DEMERITS

1. Cost of sensor
2. Dust Sensor are not readily available

XI. CONCLUSION

Keeping in account the overall performance of the SPV system the fabrication of such Automatic dust cleaner will overcome its demerits & will bring revolution in today's scenario where each & every country is facing the challenge of energy crises.

REFERENCES

[1] P.N. Botsaris, K.P. Anagnostopoulos, O. Demesouka, "Using axiomatic design principles for designing a simple and innovative product: A case study", International Journal of Design Engineering, vol. 1, No. 3, 2008 pp. 300-315.

[2] Skoplaki, E. and Palyvos, J.A., "On the temperature dependence of photovoltaic module electrical performance: A review of efficiency/power correlations", International Journal of Solar Energy, Elsevier 83, pp. 614-624, 2009.

[3] Zondag, H.A., De Vries, D.W., Van Helden, W.G.J., Van Zolengen, R.J.C., Van Steenhoven, A.A.,"The thermal and electrical yield of a PV-module collector", International Journal of Solar Energy, Elsevier, 72(2), 2002, pp. 113-28.

[4] Skoplaki, E., Boudouvis, A.G., Palyvos, J.A., "A simple correlation for the operating temperature of photovoltaic modules of arbitrary mounting", Solar Energy Materials & Solar Cells 2008, pp. 1393–1402.

[5] E. Molenbroek, D.W. Waddington, K.A. Emmery, "Hot spot susceptibility and testing of PV modules", IEEE, 1991, pp. 547-552.

[6] J. Isenberg, W. Warta, Realistic evaluation of power losses in solar cells by using thermographic methods, Journel of Applied Physics, 2004; 95(9): pp. 5200.

[7] A.Kaminski, B. Thuillier, J.P. Boyeaux, A. Laugier, " Application of infrared thermography to the characterization of multicristalline silicon solar cells" Proceedings of 5th International Conference on Intermolecular Interactions in Matter, Lublin (Poland), 2-4 September 1999, pp. 73-77.

[8] Sheng-Han Ho, Kuei-Hsiang Chao, Hang-Hui Wang, "Application of extension fault diagnosis method to malfunction, investigation of photovoltaic system", Proceedings of TAAI 2005, pp. 282-290.

[9] H. Hermann, W. Wiesner, W. VaaBen, Hot spot investigations on PV modules-new concepts for test standard and consequences for modules design with respectto bypass diode, Photovoltaic Specialists Conference, 1997, Conference Record of the Twenty Sixth IEEE, Sept. 30-Oct. 3, pp. 1129-1132

[10] Wang, M.H. and Chen, H.C., Application of extension theory to the fault diagnosis of power transformers, Proc. 22nd Symp. On Electrical Power Engineering, Kaohsiung, Taiwan, 21-22 Nov., 2010, pp. 797-800.

[11] F. Ancuta, C. Cepisca, "Thermographic analysis of PV fault systems", Proceedings of EPE 2010, 6th International Conference on Electrical and Power Engineering 2010, pp. 353-356.

[12] F. Ancuta, C. Cepisca, Analysis of PV Panels Faults by Thermography, Proceedings of EVER Monaco 2011, 31Apr -3 May, pp. 128.

AUTHORS

First Author – Poonam R. Chaudhari . Yeshwantrao college of Engg. Nagpur, bluestar_j@rediffmail.com
Second Author – Kuldeep G.Pande, M.Tech, Yeshwantrao college of Engg. Nagpur, ycce.kuldeep@gmail.com
Third Author – Subroto Dutt, . Raiiv Gandhi College of Engg., Chandrapur,subroto227@gmail.com