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LUO Converter Based Grid Connected PV System Using Intelligent Neuro Fuzzy MPPT Algorithm

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ABSTRACT: This project is geared toward the implementation of a Neuro-fuzzy based mostly most electrical outlet chase in electrical device Less Grid Connected PV System in conjunction with Reactive Power Compensation. one diode model is employed for PV array and simulation study is performed exploitation MATLAB. within the Neuro-fuzzy logic controller, voltage and current area unit taken as inputs and therefore the effective price of A.C current appreciate the most electrical outlet is that the output. A DC-DC Luo device is employed for maintaining DC input to the electrical converter at varied conditions of irradiation and temperature. This project is enforced in mat research laboratory simulation.

KEYWORDS: REGULATOR IC, DSPIC30F2010 CONTROLLER, LUO CONVERTER, IRF840 MOSFET, TLP250 OPTO-DRIVER IC.

I. INTRODUCTION

This project is aimed at the implementation of a Neuro-fuzzy Based Maximum Power Point Tracking in Transformer Less Grid Connected PV System along with Reactive Power Compensation. A single diode model is used for PV array and simulation study is performed using MATLAB. In the Neuro-fuzzy logic controller, voltage and current are taken as inputs and the effective value of A.C current corresponding to the maximum power point is the output. Thus in addition to supplying voltage by the inverter without Transformer for compensate the reactive power not exceeding its power rating. This results in utilization of PV system at night and at periods of low irradiation. Rules relating the input and output of Neuro-fuzzy Logic Controller are written and simulation is performed. A DC-DC LUO Converter is used for maintaining DC input to the inverter at various conditions of irradiation and temperature. Gating pulses to the inverter are generated by PI (Proportional integral) controller. Simulation model of a 1000W solar panel is developed and results are obtained with Fuzzy logic controller for different irradiation and temperature conditions. Results show the effectiveness of the proposed method in utilizing the PV system. This project is implemented in MATLAB simulation.

II.RELATED WORKS

Tyler J. Formica *et al* discussed the challenges with the reliability of current solar photovoltaic systems and the key reliability bottlenecks, with a focus on the ROI. In this paper, the different warranty structures offered by companies, the return on investment (ROI) challenges, the reliability concerns, and candidate solutions to these concerns associated with solar energy systems. However, the failures could also be attributed to hardware components since there was no investigation beyond restarting the inverter, and hardware failures are also capable of inducing software shutdowns, Sandeep Anand *et al* proposed a transformer-less grid feeding current source inverter for solar photovoltaic system. In this paper, an inverter that suppresses the earth leakage current without using an isolation transformer, thereby increasing the efficiency and reducing cost as compared to conventional current source based solar inverter is proposed. However, if significant unbalance in capacitor voltages is observed, a zero sequence based controller can be designed.

Albert Alexander Stonier *et al* proposed an intelligent based fault tolerant system for solar fed cascaded multilevel inverters. This research proposes an efficient power electronic interface whose switching action is stimulated

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by the intelligent controller. The fault detection given requires monitoring devices for the individual panels, which makes the system more complex and expensive, Andreas Spring *et al* proposed a grid influences from reactive power flow of photovoltaic inverters with a power factor specification of one. In this paper, the understanding of the impact of a high number of renewable energy systems on the distribution network, and the new conditions that arise due to the high number of renewable energy systems. The utilization rate of the cables and transformers is increased. This means that the real utilization rates are higher than the simulated ones, M. Nawaz *et al* presented a model predictive control strategy for a solar-based series-resonant inverter in domestic heating. In this paper, control techniques do not predict the response of the system in advance; hence, a feed-forward model predictive control (MPC) strategy is proposed.

Mohamed A. Awadallah *et al* presented a paper on the effects of solar panels on distribution transformers. This paper presents a two-step study on the effects of SP on distribution transformers via simulation and experiments. Experimental results conclude that under the worst case loading scenario the transformer lifetime expectancy is anticipated to decrease by 8.3%, Aditya Shekhar *et al* proposed a harvesting roadway solar energy—performance of the installed infrastructure integrated PV bike path. In this paper, the incident solar energy from roadways, it is possible to maximize the utilization of land dedicated toward transportation. However, the ability to generate useful energy from solar irradiation is limited by the land constraint due to its dispersed nature, Seyed Ali Arefifar *et al* implemented an improving solar power pv plants using multivariate design optimization. In this paper, a detailed multivariate study of PV plant design is presented, resulting in an improved technique to increase the potential benefits of solar plants with lower capital costs. However, there are still issues remaining for solar power plant designers to reflect on for improvements.

III. PROPOSED METHOD

LUO CONVERTER

A single section grid connected system supported icon voltaic system through high gain single switch dc to dc Nilotic convertor is projected. during this novel topology the one section grid is connected to PV-Wind system followed by Nilotic convertor and single section Voltage supply electrical converter. The voltage fluctuation issues of PV systems square measure overcome by most electrical outlet following methodology. The Nilotic convertor inherits the benefits compared to alternative DC-DC to convertor topologies. The results square measure valid with Mat workplace simulation and DSPIC30F2010 controller. the most power is taken as reference and it's compared with actual power, the PI controller based mostly grid synchronization is achieved for reactive power compensation.

Nilotic convertor is that the style of buck boost convertor which will increase or decrease the input voltage. conjointly the convertor maintains the input current continuous, thanks to this advantage convertor provides higher potency. Diode that is on the market within the Nilotic convertor provides protection.

The elements like input inductance and condenser and output inductance and output dc link condenser helps to figure in continuous conductivity mode with reduced stress on its devices and its elements. Depends on the duty cycle the operation of mode will be dynamical.

P&0, FUZZY LOGIC CONTROLLER & GRID SYNCHRONISATION

In PV applications numerous power point tracking scheme are available to enhance the efficiency, accuracy, reliability of the system. This work first investigates maximum power point tracing methods like P&O, fuzzy logic and FUZZY algorithm. Then the buck integrated boost converter and MLI are interfaced and verified using hardware and MATLAB Simulation. In this chapter the block diagram MPPT controllers, buck integrated boost converter and MLI of the proposed system are discussed.

The major elements of the system are a PV array, Converter, MPPT controller, FL controller and Inverter linked with the load. The major purpose of the following section is to track the MPP during the operating conditions of the PV module.

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BLOCK DIAGRAM

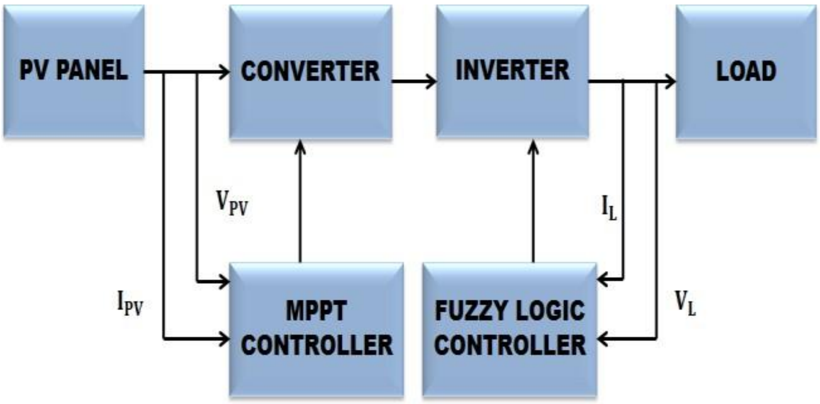

Fig.No.1 Block diagram of proposed PV system

FUZZY LOGIC CONTROLLER

The most popular and simple method for MPPT is P&O technique. Due to the slow convergence speed and output oscillation in steady state around the point of maximum power the efficiency of P&O is low. If the system work near to the region of MPP produces a duty cycle increase or decrease which rely on PV voltage changes. This creates an oscillation in output of MPPT in steady state. To neglect the produced oscillations and to obtain a stable and steady output voltage tracking of maximum power using fuzzy is utilized.

For controlling non linearity and uncertainty based related to PV system this technique is utilized. An intelligent fuzzy based MPPT is presented to trace the optimum power point of the PV module. The proposed technique relies on input and output variable selection. FMPPT algorithm is duty cycle command for varying the operating point of PV module to get high output power. The known input variables utilized for FMPPT are PV curve slope and slope variation.

PERTURBATION AND OBSERVATION BASED MPPT

Perturbation and Observation ways area unit used wide in PV array to trace most power due to their easy structure and demand of less parameter for measuring. They operate by distressing (i.e. increasing or decreasing) the array voltage sporadically and compares the PV output power with the previous perturbation cycle. If the ability is increasing, then the perturbation can incessantly propagate within the same direction for successive cycle else the perturbation direction gets modified. therefore, the terminal voltage of array is flustered for each cycle. The formula can oscillate around and produces loss to PV panel beneath slowly variable or constant condition of atmosphere. This mitigation is resolved by dynamical the comparison logic of the P&O formula of the parameters for the 2 preceding cycles and therefore the perturbation stage was bypassed. AN alternate thanks to cut back the perturbation step is to decrease the ability loss round the P&O. However, a lot of power are lost because of the slow method of formula throughout the variable atmospheric conditions.

Depending on the size of inductor and the switching frequency the perturbation size has to be selected to turns off the switch properly before the next turn on signal. In many PV systems the perturbation & observation method drifts the operating point of array to the maximum power point periodically for any output voltage. The algorithm operates well when the irradiance is varying slowly but it fails to trace the point of maximum power when the irradiance is changed suddenly by having slow dynamic response.

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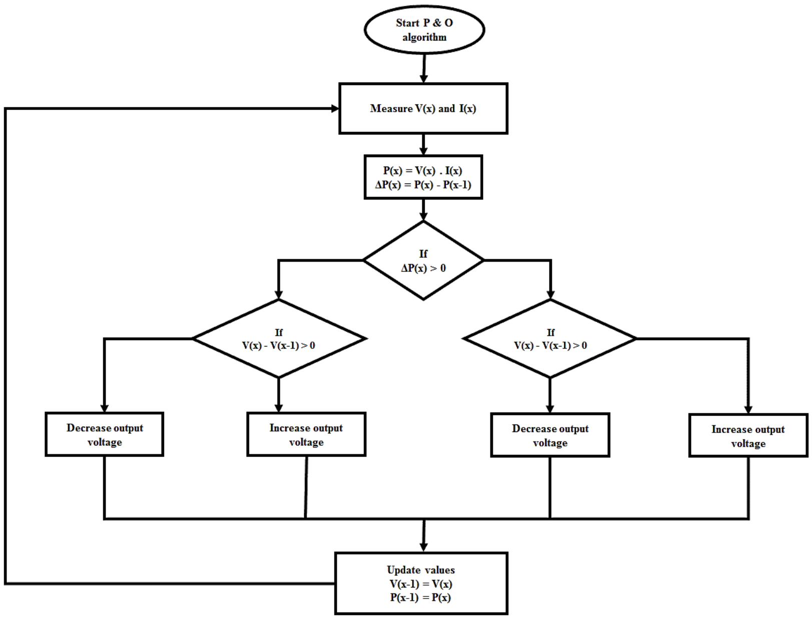

Fig.No.2 Flow chart for P & O algorithm

GRID SYNCHRONIZATION

The Grid synchronization management technique victimization PI controller is shown in fig.no.4.3. the first link voltage of PV electrical converter (Vdc) is taken and forward to a coffee pass filter to reduce the shift ripples. The distinction of the filtered DC-link voltage and reference voltage (Vdc*) is fed to PI controller to manage the DC-link voltage.The voltage error (Verr) in ordinal sampling instant is given as

$$\Delta v_{err}(n) = v_{dc}^{*}(n) - v_{dc}(n)$$

The yield of the PI controller at ordinal sampling time is

$$i_{inv}^{*}(n) = i_{inv}^{*}(n-1) + K_{P1}\big(\Delta v_{err}(n) - \Delta v_{err}(n-1)\big) + K_{I1}\Delta v_{err}(n)$$

Where K_{P1} and K_{I1} are quotient and integral gain of the dc voltage controller. The outputs of the voltage controllers and the height amplitude of the active currents that are integrated with the grid voltages to provide the reference currents for the PV electrical converter. By this management methodology, the PV electrical converter will offer the native load with a most current up to reference worth. If the necessities of load are larger than the generation from PV, then extra currents are obtained from the grid.

IV. SIMULATION AND HARDWARE RESULTS

The procedure of the proposed work is verified through MATLAB/ SIMULINK software platform. The same is also experimentally verified by using DSPIC30F2010 controller. Table No.1 represents the parameters specification/ratings of the solar system and LUO Converter

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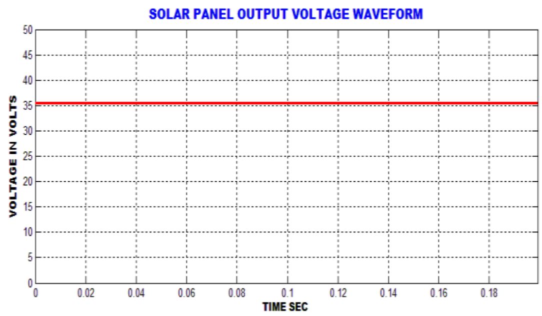
COMPONENTS	RATINGS/ SPECIFICATIONS
Number of panels	**1**
Number of cells in series	**36**
Cell	**125mm×31.25mm**
Open Circuit voltage	**21.4 V**
Optimal operating voltage	**16.8 V**
Short circuit current	**1.21 A**
Optimal operating current	**1.19 A**

Table No.1 Specifications for Solar panel



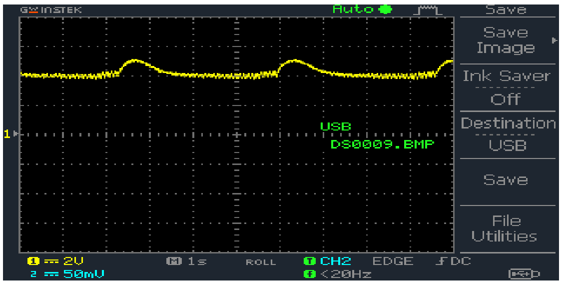
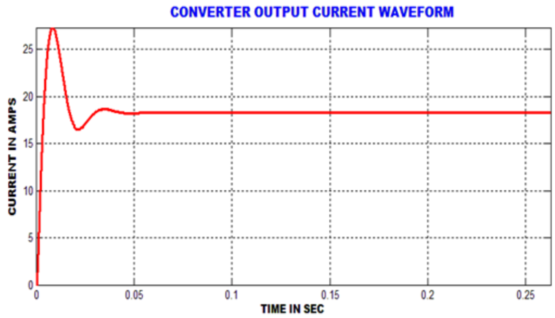


Fig.No.4 Simulation and hardware results of Input DC voltage waveform to the LUO converter (35.6 V)



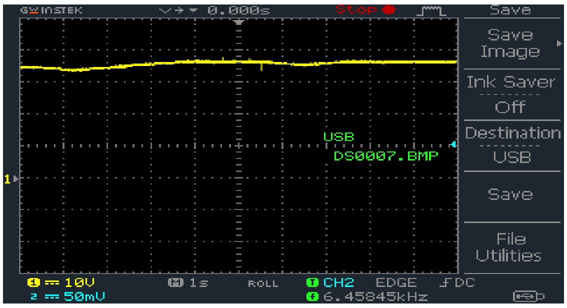


Fig.No.5 Simulation and hardware results of Input current waveform from the LUO converter

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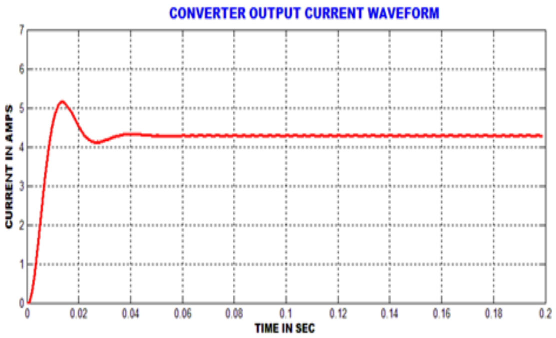


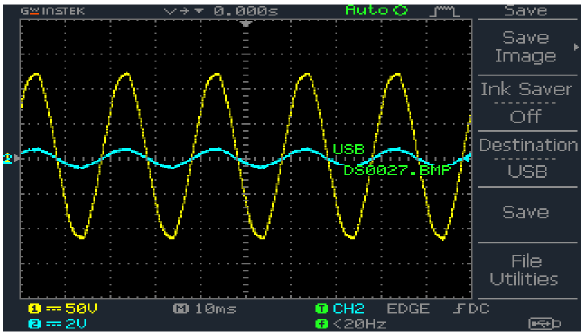
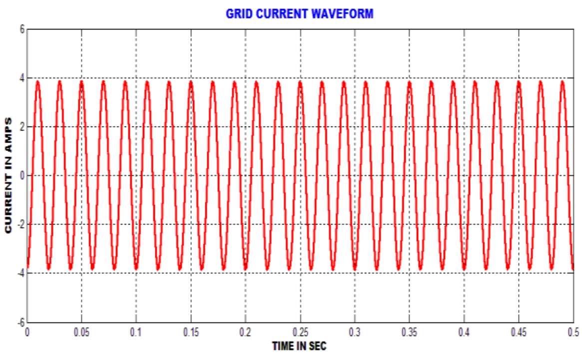


Fig.No.6 Simulation and hardware results of Output DC current waveform of the LUO converter



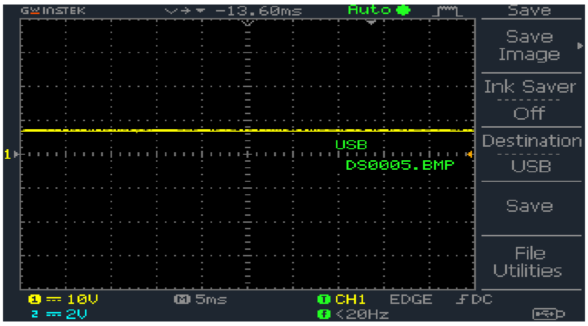


Fig.No.7 Simulation and hardware result of Grid current waveform

This shows grid voltage and current waveform; it indicates both are in phase. This achieves near unity power factor operation. This system looks likes STATCOM device.

V. CONCLUSION

CONCLUSION

A new reliable DG system based on PV as source, with only a LUO converter followed by an inverter stage has been successfully implemented. The mathematical model developed for the proposed DG scheme has been used to study the system performance in MATLAB. In addition, it has been established through simulation that the two controllers, digital MPPT fuzzy logic controller and PI controller which are designed specifically for the proposed system have exactly tracked the maximum powers from both the sources. Maintenance free operation, reliability and low cost are the features required for the DG employed in secondary distribution system. The steady state waveforms captured at grid-side show that power generated by the DG system is fed to the grid at unity power factor. The voltage THD and the current THD of the generator meet the required power quality norms recommended by IEEE. The proposed scheme easily finds application for erection at domestic consumer sites in a smart grid scenario.

FUTURE SCOPE

- LUO converter can be replaced by SEPIC converter for increasing the output voltage gain.
- Fuzzy logic MPPT algorithm can be replaced with Grey Wolf Optimization for increasing the efficiency of the converter.

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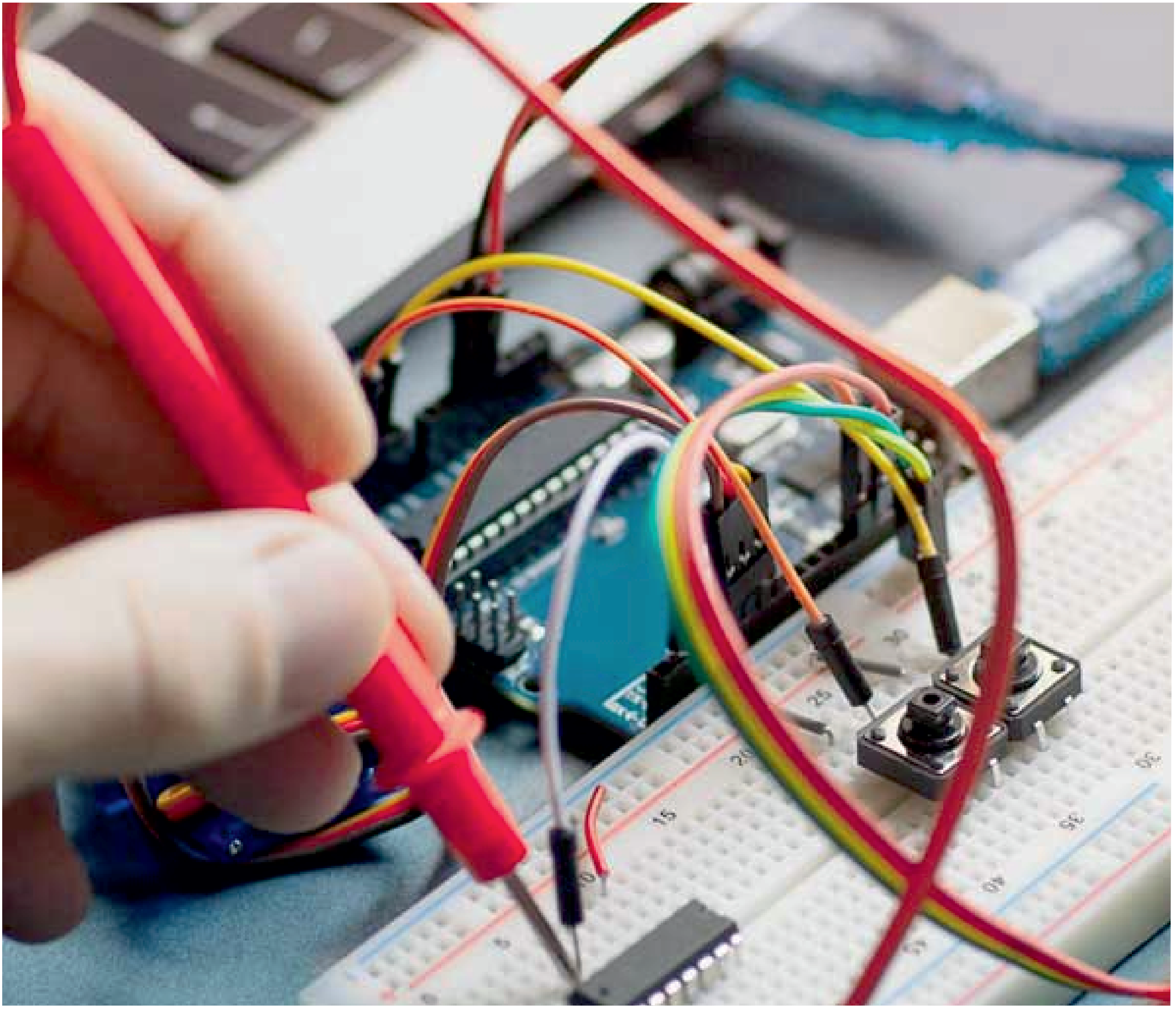
REFERENCES

1. Formica, T. J., Khan, H. A., & Pecht, M. G. ,2017,'The Effect of Inverter Failures on the Return on Investment of Solar Photovoltaic Systems', IEEE Access ,Vol.5 ,pp.21336-21343.
2. Anand, S., Gundlapalli, S. K., & Fernandes, B. G. ,2014,' Transformer-Less Grid Feeding Current Source Inverter for Solar Photovoltaic System', IEEE Transactions on Industrial Electronics, vol. 61,no.10,pp. 5334–5344.
3. Stonier, A. A., & Lehman, B.,2017,' An Intelligent Based Fault Tolerant System for Solar Fed Cascaded Multilevel Inverters', IEEE Transactions on Energy Conversion,vol.33,no.3,pp.1047-1057.
4. Spring, A., Wirth, G., Becker, G., Pardatscher, R., & Witzmann, R. ,2016,' Grid Influences From Reactive Power Flow of Photovoltaic Inverters With a Power Factor Specification of One', IEEE Transactions on Smart Grid, vol.7,no.3, pp.1222–1229.
5. Nawaz, M., Saqib, M. A., & Kashif, S. A. R., 2017,' Model predictive control strategy for a solar-based series-resonant inverter in domestic heating'. Electronics Letters, vol.53,no.8,pp. 556–558.



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