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Transformer Less Based Inverter Controlling Dual Solar PV Arrays Operating Under Different Conditions

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ABSTRACT: A grid connected single phase transformer less inverter which can operate two serially connected solar photo voltaic (PV) sub arrays at their respective maximum power points while each one of them is exposed to different atmospheric conditions is proposed in this Method. Fuzzy Logic Controller (FLC) is proposed to overcome the problems of the existing MPPT controllers and to provide the dynamic power flow control through transmission lines. The fuzzy logic control are using to control of voltage source converter. Also a conventional PID control is using to damp a variation of output voltage. A single-phase DC/AC grid-integrated, transformer less and effective inverter for solar Photovoltaic (PV) systems. The combination of the two converters specifically DC/DC and DC/AC had inspired the development of this new financially cost effective inverter. This novel solitary stage converter has the capability to operate on both buck mode and buck-boost mode to harvest maximum power from two distinctive PV panels with the help of PI and hysteresis controller. The working principle and configuration of the proposed system are verified under equally, as well as incompatible climatological conditions and hence the system can endure an extensive deviation of voltage in both the PV panels. The topological structure of the inverter ensures that the common mode voltage does not contain high frequency components, thereby reducing the magnitude of leakage current involved with the solar panels well within the acceptable limit. The proposed method of the converter along with the derivation of its small signal model has been carried out. Detailed simulation studies are performed to verify its effectiveness. The prototype of the scheme has been fabricated. Detailed experimental validations have been carried out utilizing the prototype to confirm the viability of the proposed system.

I. INTRODUCTION

SINGLE phase Transformer less Grid Connected Systems (TLGCS) have become popular over the years due to its reduced size, weight, volume and increased operating efficiency However, in TLGCS the dc link voltage of the inverter needs to be high. As a result the number of modules that needs to be connected in series becomes large. When large number of modules are connected in series, power yield from the array gets substantially reduced when the modules are subjected to varied environmental conditions such as shading The topologies derived from H-bridge based inverter and the topologies presented in which use single photo voltaic (PV) source as their input are prone to this mismatched operating problem more because number of series connected modules are more. The topologies derived from neutral point clamped (NPC) based inverter are severely affected by mismatched operating problem as they require double the magnitude of PV voltage compared to conventional H-bridge based inverter topologies. In order to overcome the aforementioned problem attempts have been made to abstract maximum available power from each of the PV modules while they are exposed to mismatched. However, they are realized by having two stage configuration and thereby have a complex control algorithm, and their operating efficiency is low. Further, the efficiency of these schemes are highly dependent on the level of shading to which each of the subarrays are exposed. Schemes based on module integrated converters (MIC) and multi-input string inverters are also reported in the literature which also attempt to control each and every PV module present in the array However, they require the involvement of an additional dc to dc converter stage prior to the dc to ac inverter stage.

This additional stage involving several dc to dc converters increases the component count thereby reducing efficiency and reliability of the system. The aforementioned problems associated with MIC and multi-input string

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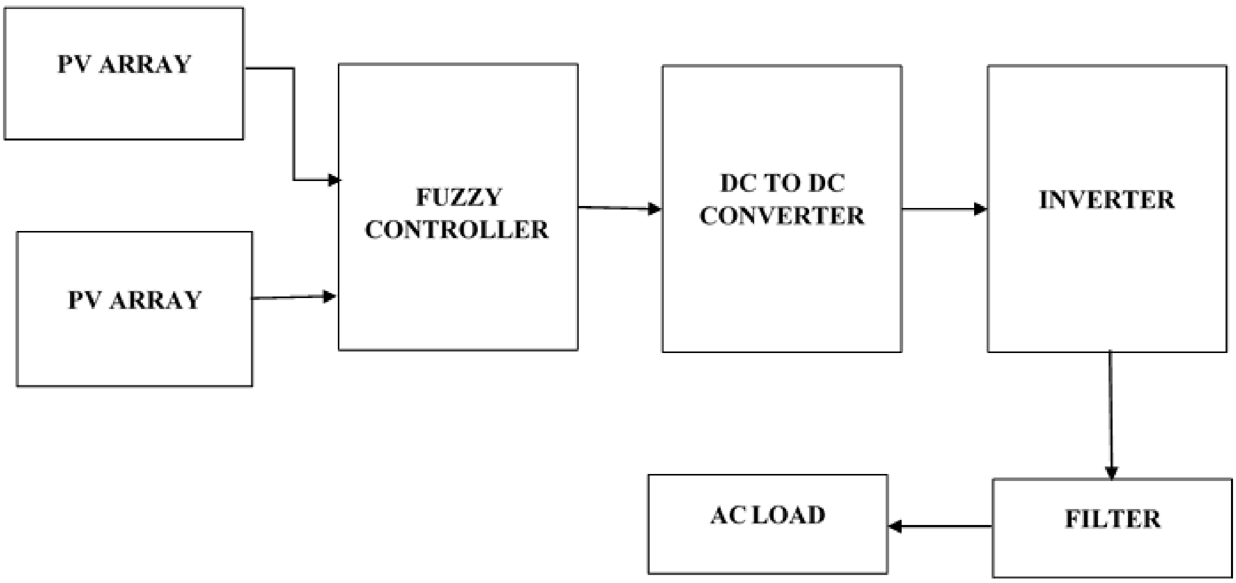
inverters are overcome in switched PV based system and voltage injection basedsystem at the cost of increasing the active component count leading to the decrement in efficiency and reliability of the overall system. Further, in case of voltage injection based schemes the shaded modules are bypassed. Hence to achieve sufficient DC bus voltage during shaded condition, number of modules to be included in a subarray needs to be more compared to that of the other schemes thereby increasing the cost of the system. In order to reduce the number of components and to simplify the control complexity, attempts have been made to form a subarray with desired number of PV modules connected in series as per the input voltage requirement of the particular system.

II. PROPOSED METHOD

In this method a new inverter topology which is derived by combining two half bridge inverters along with their respective ac bypass is proposed wherein two serially connected subarrays are controlled individually by these two half bridge inverters. Fuzzy logic has an advantage over other control methods due to the fact that it does not sensitive to plant parameter variations. The fuzzy logic control approach consists of three stages, namely fuzzification, fuzzy control rules PV array, and defuzzification. To design the fuzzy logic load frequency control, the input signals is the frequency deviation at sampling time and its change. The European efficiency of the scheme proposed in this method is found to be which is higher than that when all the subarrays are being operated under uniform environmental condition.

III. BLOCK DIAGRAM



BLOCK DIAGRAM EXPLANATION:

PV module is a group of cells connected in series or in parallel with the main

Objective to convert sunlight into electricity via the photodiode operation, the latter is explained by the p-n junction phenomenon and the produced current depends on the received irradiance and temperature In literature, various controllers have been proposed. Dahech et al. proposed a robust controller using both the back stepping and the sliding mode and this hybrid method offered a MPPT controller with high efficiency and low error of tracking Moreover, an adaptive SM-MPPT has been proposed method.

PV ARRAY:

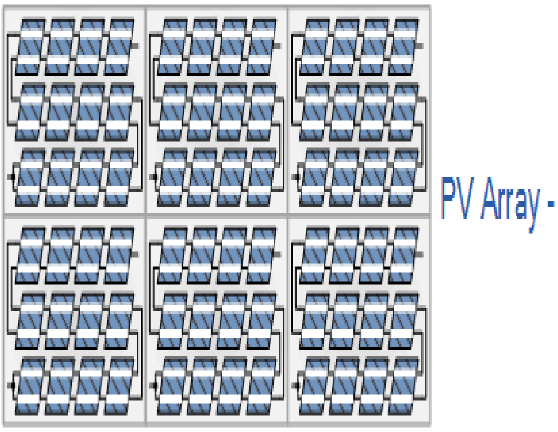


FIGURE PV ARRAY

Photovoltaic cells and panels convert the solar energy into direct-current (DC) electricity. The connection of the solar panels in a single photovoltaic array is same as that of the PV cells in a single panel. The panels in an array can be electrically connected together in either a series, a parallel, or a mixture of the two, but generally a series connection is chosen to give an increased output voltage. For example, when two solar panels are wired together in series, their voltage is doubled while the current remains the same. The size of a photovoltaic array can consist of a few individual PV modules or panels connected together in an urban environment and mounted on a rooftop, or may consist of many hundreds of PV panels interconnected together in a field to supply power for a whole town or neighborhood. The flexibility of the modular photovoltaic array (PV system) allows designers to create solar power systems that can meet a wide variety of electrical needs, no matter how large or small.

DC TO DC CONVERTER:

In this converter the first transistor is switched ON continually and for the second transistor the square wave of high frequency is applied to the gate terminal. The second transistor is in conducting when the on state and the input current flow from the inductor L through the second transistor. The negative terminal charging up the magnetic field around the inductor. The D2 diode cannot conduct because the anode is on the potential ground by highly conducting the second transistor**.**

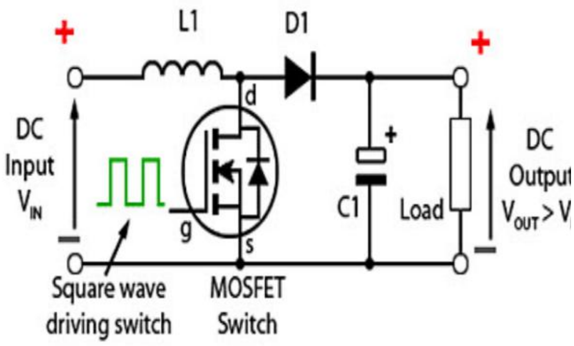


FIGURE DC TO DC CONVERTER

By charging the capacitor C the load is applied to the entire circuit in the ON State and it can construct earlier oscillator cycles. During the ON period the capacitor C can discharge regularly and the amount of high ripple frequency on the output voltage.

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INVERTER:

Transformer-less inverters utilizes high voltage DC as input which is converted to high voltage AC output by oscillators and H-bridge drivers, since there is no transformer great efficiency more than achievable, the only loss is from the MOSFETs of H-bridge. The high voltage DC source can be solar panels or battery. The low voltage DC is converted to high frequency AC and step-up by the tiny ferrite core transformer, ferrite core transformer can handle much higher power at better efficiency than bulky iron core low frequency transformer. The difference between a true transformer-less inverter and high frequency inverter which looks like transformer-less. Transformer-less inverter are relatively inexpensive due to absence of bulky iron core transformer which is the most expensive part of the inverter and now, there are no losses related to transformer so more efficiency.

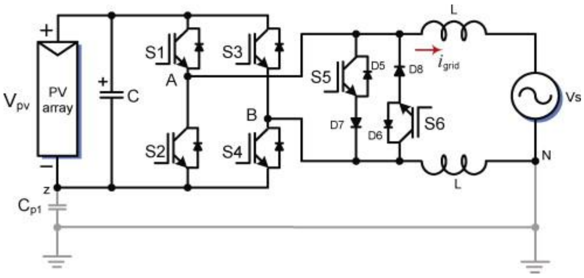


FIGURE 4.7 INVERTER TRANSFORMER LESS

AC FILTER:

High-frequency signals and control low-frequency signals, while capacitors do the reverse. A filter in which the signal flows through an inductor, or in which a capacitor presents a path to ground, introduces less attenuation to low-frequency signals than high-frequency signals and is, therefore, a low-pass filter. If the signal passes through a capacitor or has a path to ground through an inductor, then the filter presents less attenuation to high-frequency signals than low-frequency signals and therefore is a high-pass filter.

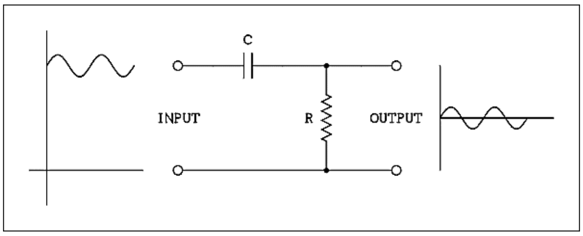


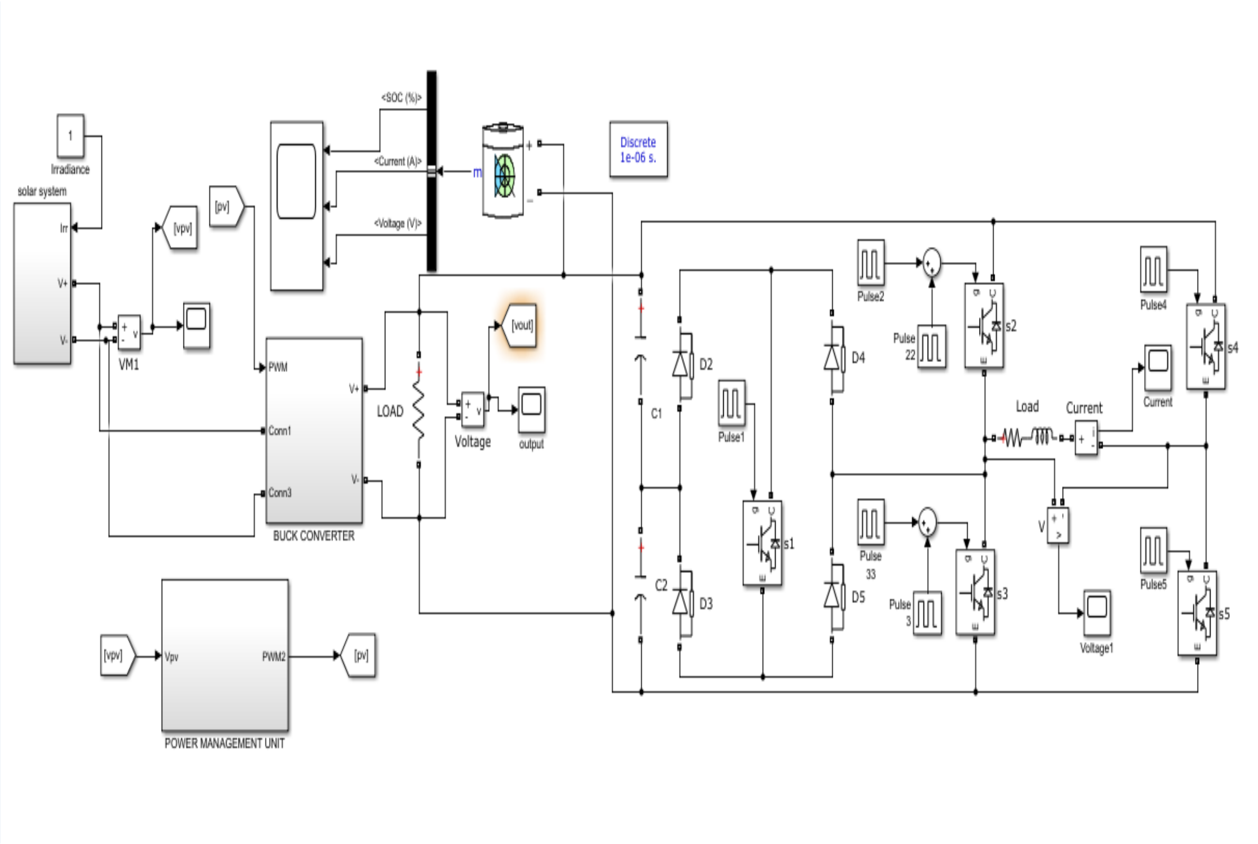
FIGURE AC FILTER CIRCUIT.

FUZZY LOGIC CONTROLLER

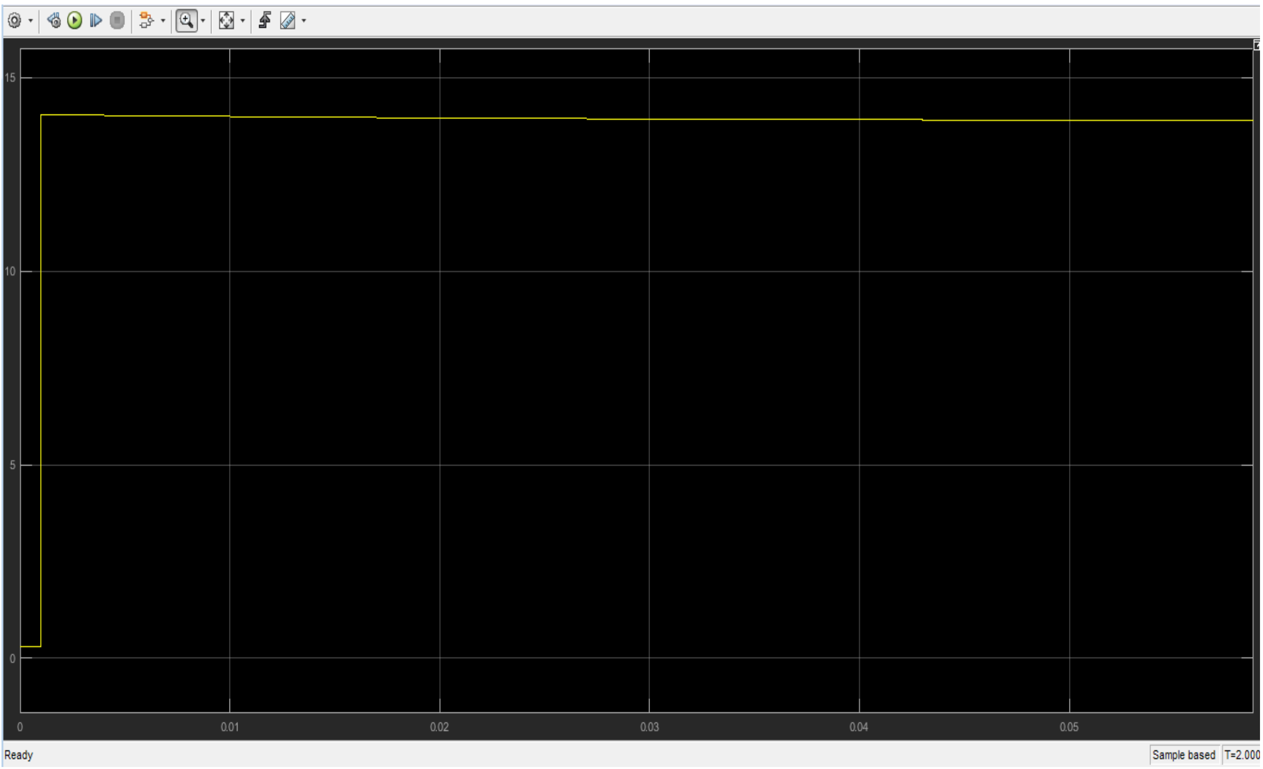
Fuzzy logic is a form of many-valued logic in which the truth values of variables may be any real number between 0 and 1. By contrast, in Boolean logic, the truth values of variables may only be 0 or 1. Fuzzy logic has been extended to handle the concept of partial truth, where the truth value may range between completely true and completely false. Furthermore, when linguistic variables are used, these degrees may be managed by specific functions. Usually fuzzy logic control system is created from four major elements presented on Figure fuzzification interface, fuzzy inference PV array, fuzzy rule matrix and defuzzification interface. Each part along with basic fuzzy logic operations.

IV. SIMULATION OUTPUT

- The MATLAB/Simulink model is developed for a general PV array based on manufacturer data and from the mathematical equations, the output presents the PV array operating current.
- After including all the equation explained above, we have a model that has a subsystem of PV array and inputs of environmental factors.
- Here, we have applied a ramp input for PV output voltage to produce the complete I-V and P-V graph



SOURCE WAVE FORM



➢ The proposed model can provide calculated current, voltage and power relationships for different environmental conditions of solar radiations and ambient temperatures.

➢ These I-V and P-V characteristics are produced by the proposed model for chosen PV array type through MATLAB/Simulink environment.

HARDWARE OUTPUT TABULATION:

Hardware	Specification	Input Ranges	Output Ranges
Generating power	Input source	0-230V	230V
Microcontroller	PIC (16f877a)	5V DC	5V DC
Rectifier	Input power	230V AC	12V DC
Boost converter	Converting the input supply	12VDC	24VDC
Inverter	Output power	24V DC	24V AC
Transformer	Output power	24v AC	230V AC
AC lamp	Output load	230V DC	4A

V. CONCLUSION

A grid connected single phase transformer less inverter which can extract maximum power from two sub arrays during mismatched operating condition is presented in this paper. Fuzzy logic control for high-performance control of grid connected three-phase PV inverter has been presented. The obtained results showed that the control system employing fuzzy control is very effective in producing stable and nearly sinusoidal wave forms of both voltage and current. The results proposed fuzzy control of inverter system is capable of generating quality PV power to the grid. Salient features of the proposed inverter are as follows number of series connected modules is less thereby reducing the effect of shading, two sub arrays can be operated at MPPT simultaneously, thus it is well suited for PV sub arrays operating under mismatched operating condition, decoupled control structure is employed to control the two component half bridges of the inverter, is achieved which is the highest compared to the topologies dealing with solar PVs experiencing mismatched operating conditions, the scheme is realized through single stage of power conversion leading to a considerable reduction in size, weight and volume,

REFERENCES

1. Ikken, N., Bouknadel, A., Haddou, A., Tariba, N.-E., El omari, H., & El omari, H. (2019). "PLL Synchronization Method Based on Second-Order Generalized Integrator for Single Phase Grid Connected Inverters Systems during Grid Abnormalities", 2019 International Conference on Wireless Technologies, Embedded and Intelligent Systems (WITS).
2. Mukherjee, S., Chowdhury, V. R., Shamsi, P., & Ferdowsi, M. (2017) "A voltage sensorless phase locked loop structure for single phase grid connected converter system", IEEE Energy Conversion Congress and Exposition (ECCE).
3. Ghosh, S. S., Nathan, K. S., Siwakoti, Y. P., & Long, T. (2019) "Dual polarity DC–DC converter integrated grid-tied single-phase transformer less inverter for solar application", The Journal of Engineering.
4. Rezwan, S., Hossain, S., Tasnim, S., & Rahman, M. M. (2018) "H2D4-Type Single Phase Transformer-Less Inverter with Reactive Power Control for Grid-tied PV System", 2018 International Conference on Smart Grid and Clean Energy Technologies
5. Chakraborty, S., Reza, S. M. S., Hasan, W., & Razzak, M. A. (2015) "Design of a transformer-less single switch-mode photovoltaic grid-connected boost inverter with immittance conversion topology", IEEE Innovative Smart Grid Technologies - Asia (ISGT ASIA)
6. Sifat Rezwan, Shafayet Hossain, SamihaTasnim and Md. Mizanur Rahman "Transformer-less Single Phase H2D4 Inverter with Voltage Controller for Grid-tied PV System", IEEE PES Asia-Pacific Power and Energy Engineering Conference (APPEEC)

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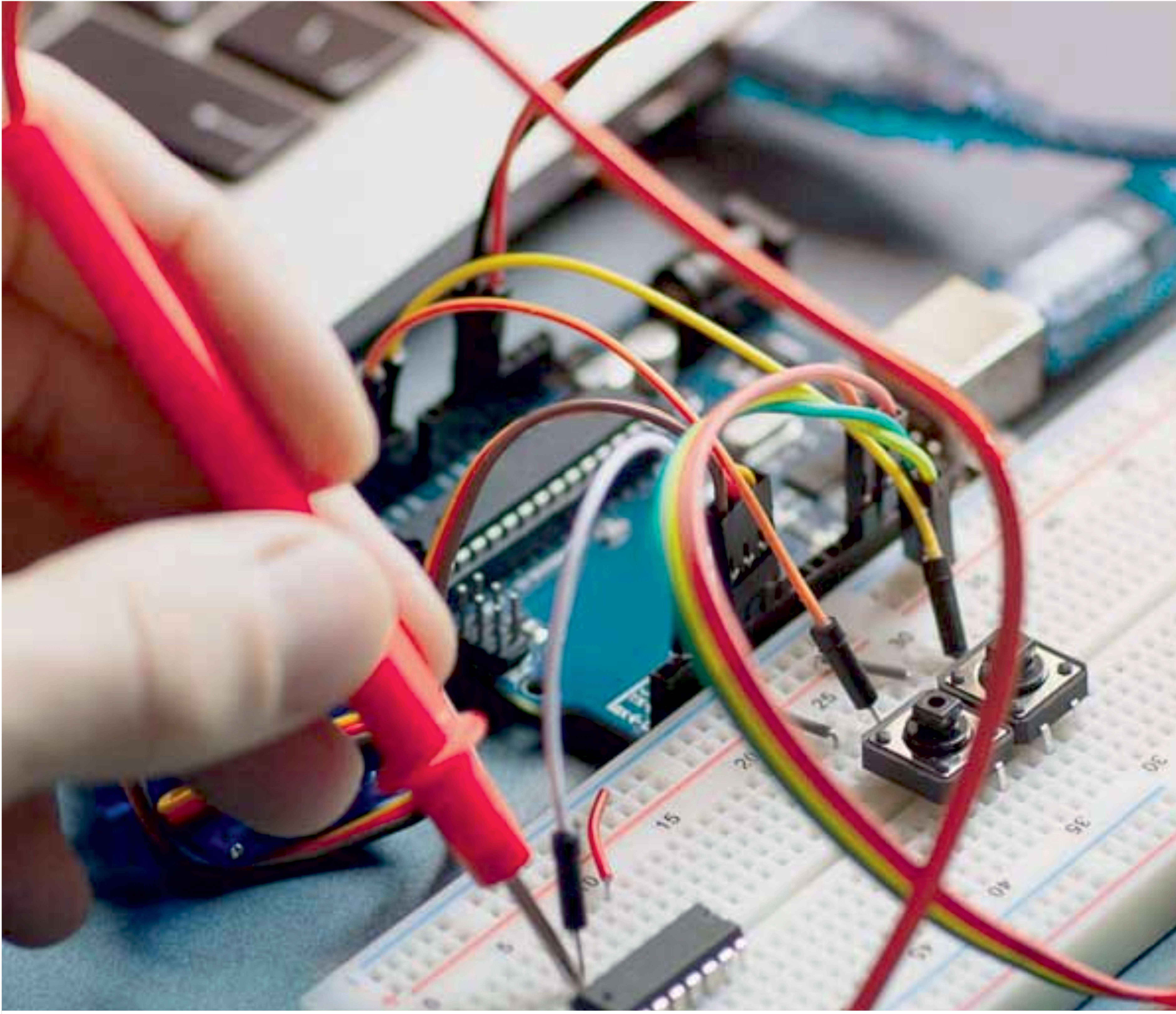
|| Volume 9, Issue 9, September 2020 ||

7. Wang, H., Yang, Y., &Blaabjerg, F. (2013) “Reliability-oriented design and analysis of input capacitors in single-phase transformer-less photovoltaic inverters”, Twenty-Eighth Annual IEEE Applied Power Electronics Conference and Exposition (APEC).
8. Abdeen, E., Gaafar, M. A., Orabi, M., & Youssef, M. (2019) "A Novel High Gain Single-phase Transformer-less Multi-level Micro-inverter", IEEE Applied Power Electronics Conference and Exposition (APEC).
9. Watanabe, H., & Itoh, J. (2017) “Isolated single-phase AC grid connected converter with small inductors and capacitors for micro-inverters", IEEE Applied Power Electronics Conference and Exposition (APEC).
10. Zhang, Y., Guan, S., & Zhang, Y. (2018) "Single-stage AC-AC Converter With Controllable Phase and Amplitude", IEEE Transactions on Power Electronics, Volume: 34, No: 7.



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