IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

MODELING AND SIMULATION OF HYBRID WIND/PHOTOVOLTAIC STAND-ALONE GENERATIONSYSTEM

Daniya Ashraf [1], Dharmindra Kumar [2]

1. Department of Electrical Engineering, RIMT University Mandi Gobindgarh,Sirhind Punjab, India.
2.Assistant Professor Department of Electrical Engineering, RIMT University Mandi Gobindgarh, Sirhind, Punjab, India.

ABSTRACT: Renewable energy sources have become a popular alternative electrical energy source where power generation in conventional ways is not practical. In the last few years the photovoltaic and wind power generation have been increased significantly. In this study, we proposed a hybrid energy system which combines both solar panel and wind turbine generator as an alternative for conventional source of electrical energy like thermal and hydro power generation. A simple control technique which is also cost effective has been proposed to track the operating point at which maximum power can be coerced from the PV system and wind turbine generator system under continuously changing environmental conditions. The entire hybrid system is described given along with comprehensive simulation results that discover the feasibility of the system. The model is intended to be used as an optimization and design tool for such hybrid systems applied to organic constructions. After an error analysis it was determined that this model predicted quite interesting results compared to the experimental data under various conditions. It is important to indicate that this analysis has been carried out so that in future, these power generation systems can be exploited and applied more efficiently in areas far from the public electricity grid.

Keywords:- Renewable energy, hybrid system, and photovoltaic

Introduction:

Environmentally friendly power is gotten from regular cycles that are renewed continually. In its different structures, it gets straightforwardly from the sun, or from heat created profound inside the earth. Remembered for the definition is power and warmth created from sun based, wind, sea, hydropower, biomass, geothermal assets, and biofuels and hydrogen got from sustainable assets. Hybrid energy frameworks are as yet an arising innovation. It is normal that innovation will keep on advancing later on, so it will have more extensive relevance and lower costs. There will be more normalized plans, and it will be simpler to choose a framework fit to specific applications. There will be expanded correspondence between segments. This will work with control, observing, and determination. At long last, there will be expanded utilization of force electronic converters. Force electronic gadgets are as of now utilized in numerous half and half frameworks, and as expenses go down and dependability improves, they are relied upon to be utilized to an ever increasing extent. Because of the basic state of mechanical fills which incorporate oil, gas and others, the improvement of sustainable power sources is persistently improving. This is the motivation behind why environmentally friendly power sources have become more significant nowadays. Not many different reasons incorporate benefits like bountiful accessibility in nature, eco-accommodating and recyclable. Numerous environmentally

friendly power sources like sun based, wind, hides and flowing are there. Among these sustainable sources sunlight based and wind energy are the world's quickest developing energy assets. With no discharge of poisons, energy transformation is done through wind and PV cells. Step by step, the interest for power is quickly expanding. Yet, the accessible base burden plants can't supply power according to request. So these fuel sources can be utilized to overcome any issues among organic market during top burdens. This sort of limited scope independent force creating frameworks can likewise be utilized in far off regions where regular force age is illogical. In this proposition, a breeze photovoltaic crossover power age framework model is examined and mimicked. A half and half framework is more profitable as individual force age framework isn't totally solid. At the point when any of the framework is closure the other can supply power.

Review of related literature

Baojia Wang et al (2018) Research on Hybrid Model of Garlic Short-term Price Forecasting based on Big Data Garlic prices fluctuate dramatically in recent years and it is very difficult to predict garlic prices. The autoregressive integrated moving average (ARIMA) model is currently the most important method for predicting garlic prices. However, the ARIMA model can only predict the linear part of the garlic prices, and cannot predict its nonlinear part. Therefore, it is urgent to adopt a method to analyze the nonlinear characteristics of garlic prices. After comparing the advantages and disadvantages of several major prediction models which used to forecast nonlinear time series, using support vector machine (SVM) model to predict the nonlinear part of garlic prices and establish ARIMA-SVM hybrid forecast model to predict garlic prices. The monthly average price data of garlic in 2010-2017 was used to test the effect of ARIMA model, SVM model and ARIMA-SVM model. The experimental results show that: (1) Garlic price is affected by many factors but the most is the supply and demand relationship; (2) The SVM model has a good effect in dealing with the nonlinear relationship of garlic prices; (3) The ARIMA-SVM hybrid model is better than the single ARIMA model and SVM model on the accuracy of garlic price prediction, it can be used as an effective method to predict the short-term price of garlic.

Angeliki Mavrigiannaki et al (2017) Development and testing of a micro-grid excess power production forecasting algorithms Traditional electricity grids lack flexibility in power generation and load operation in contrast to smart-micro grids that form semi-autonomous entities with energy management capabilities. Load forecasting is invaluable to smart micro-grids towards assisting the implementation of energy management schedules for cost-efficient and secure operation. In the present paper is examined the 24h forecasting of excess production in an existing micro-grid. Alternative input parameters are considered for achieving an accurate prediction. The prediction can be used for scheduling the charging process of a thermal storage during weekends based on excess power production levels.

JosephCarr (2017) Managing Smart Grids Using Price Responsive Smart Buildings the market is a tool used to efficiently allocate resources. Energy markets have been used to allocate generation and transmission resources at the level of the transmission and distribution system, with significant innovation on these markets occurring since deregulation in the 1990s. The advent of the Smart Grid and Smart Building have enabled these innovations to be brought to the level of the retail electricity market, where even individual buildings will be able to adjust their consumption based on price signals from the market. This paper gives a review of the development of energy markets and the technologies of the Smart Grid and Smart Building that are enabling their participation in the market at the edge of the grid. The open ADR communication protocol is examined as a means of communicating price information between the load and the utility. Finally, a hardware-in-the-loop Smart Building test setup is described. This test setup is used to compare the performance of baseline and price responsive controls, with a power reduction of 60% achieved during a period of peak consumption and grid congestion corresponding to a large price surge.

OBJECTIVES:

The primary goal of the theory is to carry out a force framework that is a half breed of both Photovoltaic and wind powers. The bit by bit destinations are:

i) To study and model PV cell, PV exhibit and PV boards

ii) To study the trademark bends and impact of variety of natural conditions like temperature and illumination on them

iii) To study the PV module's conduct under halfway concealing condition

PHOTOVOLTAIC ARRANGEMENT:

A photovoltaic energy framework is predominantly fueled by sun oriented energy. The set up of PV framework is showed in figure 2.1.

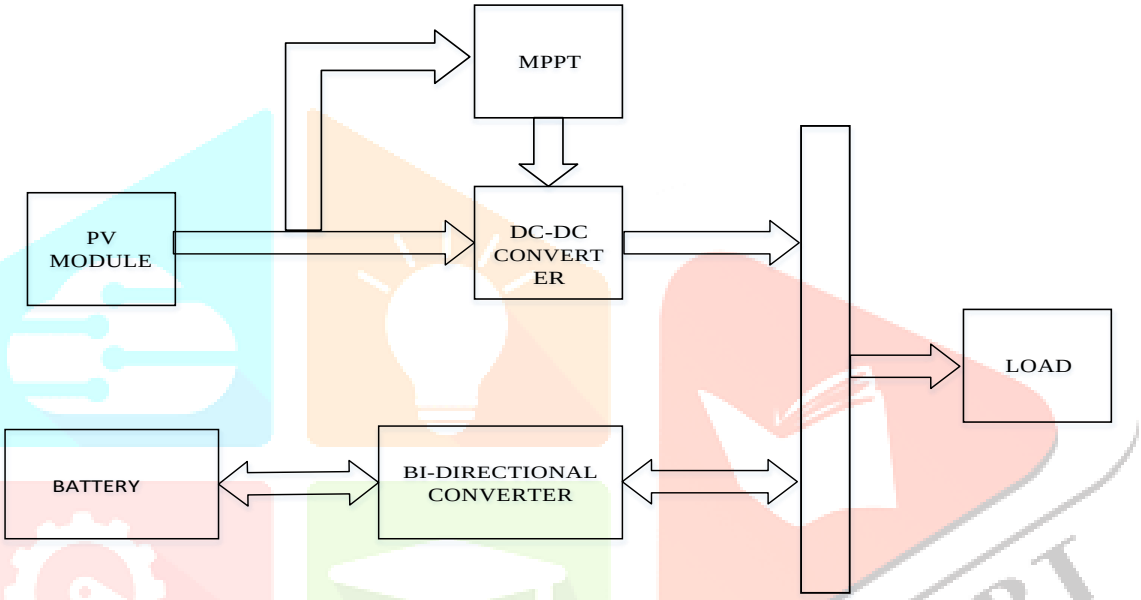

Fig.2.1 Overall block diagram of PV energy system

It contains PV modules or clusters, which convert sun based energy as sun oriented illumination into electric energy. The dc-dc converter changes the level of the voltage to coordinate with it with the electrical machines that are provided by this framework. This DC-DC converter might be either buck or lift or buck-help dependent upon the required and accessible voltage levels. The greatest force point following framework pressures the most extreme force from the PV modules. A bi-directional converter which can supply the current in both the ways is utilized to charge the battery when there is a force excess and the energy put away by the battery is released into the heap when there is a force deficiency.

BATTERY CHARGING

INTRODUCTION:

Battery is a capacity gadget which is stores the abundance power created and utilizes it to supply the heap notwithstanding the generators when force is required. Both PV and wind energy frameworks (depicted in the past parts) are coordinated for example associated with a typical DC transport of consistent voltage and the battery bank is additionally associated with the DC transport. Any force move whether from generator to battery bank or generator to stack or from the battery bank to the heap happens by means of this steady voltage DC transport. As the force stream related with the battery isn't uni-directional, a bidirectional converter is expected to charge or potentially release the battery if there should arise an occurrence of abundance as well as shortfall of force individually

BI-DIRECTIONAL DC-DC CONVERTERS:

Bi-directional DC-DC converters are called so because of their capacity of permitting the force stream in both the ways, contingent upon the prerequisite. There are numerous applications for the bidirectional converter like Hybrid Vehicles, Uninterruptable Power Supplies (UPS) and furthermore stockpiling frameworks controlled by Fuel cells and furthermore environmentally friendly power frameworks.

CLASSIFICATION:

In light of the disengagement between the information and yield side, the bidirectional converters are grouped into two kinds. They are:

1. Non Isolated type
2. Isolated type

NON-ISOLATED BI-DIRECTIONAL DC-DC CONVERTERS:

An essential non-isolated bidirectional converter can be gotten from the unidirectional converters by utilizing bi-directional switches. Essential buck and lift converters don't permit the bidirectional force stream because of the presence of the diodes that are unidirectional gadgets. This issue can be tackled by utilizing a MOSFET or IGBT with an enemy of equal diode which permits stream of current in both the ways [18].

The different non-isolated sort bidirectional DC-DC converters are:

1. Multilevel converter
1 Switched capacitor converter
2 Cuk/Cuk type
3 Sepic/Zeta type
4 Buck-Boost converter
5 Coupled inductor converter
7 Three-level converter

ISOLATED BIDIRECTIONAL DC-DC CONVERTERS:

The segregated kind converters can work in wide force ranges. The electrical confinement is accomplished by utilizing a force transformer in the circuit. However, the transformer works just for AC supply. Presenting AC interface in the circuit expands the intricacy of the circuit In light of the setup, the separated bidirectional DC-DC converters can be sorted into two kinds:

a) A current took care of secluded bidirectional DC-DC converter.

b) Voltage took care of disconnected bidirectional DC-DC converter.

The different segregated sort bidirectional converters are:

1. Fly-back converter
2. Forward fly-back converter
3. Half bridge converter
4. Full bridge converter

RESULTS AND DISCUSSIONS

6.1 RESULTS

Simulation results of PV module:

Fig. 6.1 V-I curve of PV module

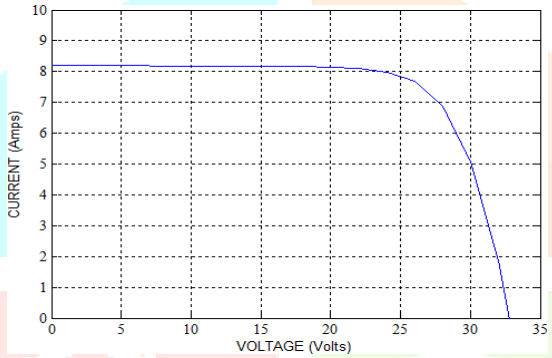

Fig. 6.2 P-V curve of PV module

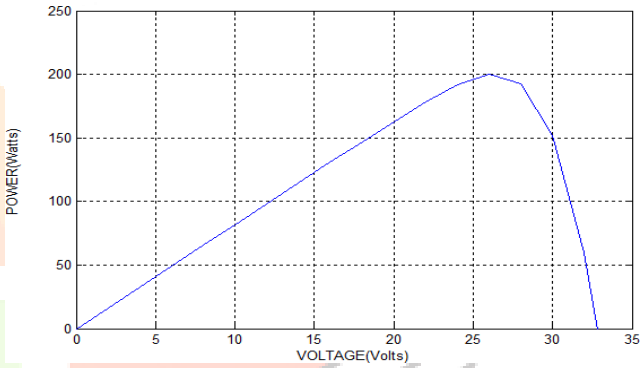

Fig 6.1, 6.2 represent the I-V and P-V characteristics of a PV module. From fig 6.1 We can see that hamper (Isc) of PV module is roughly 8.2A and open circuit voltage (Voc) is around 32.9 volts. From fig 6.2 we can see that greatest force is roughly 200W and it happens at a current of 7.61A and voltage at 26.3V around.

Effect of variation of irradiation:

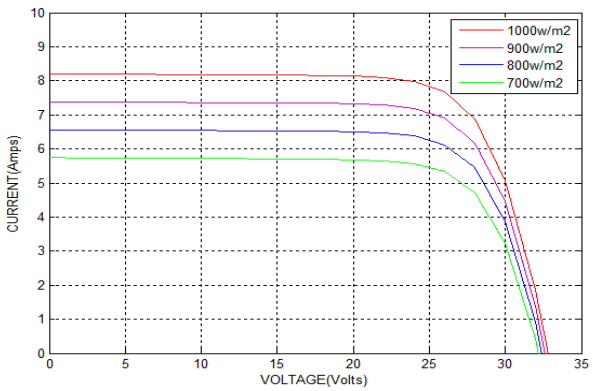

Fig. 6.3 Effect of variation of irradiation on I-V characteristics

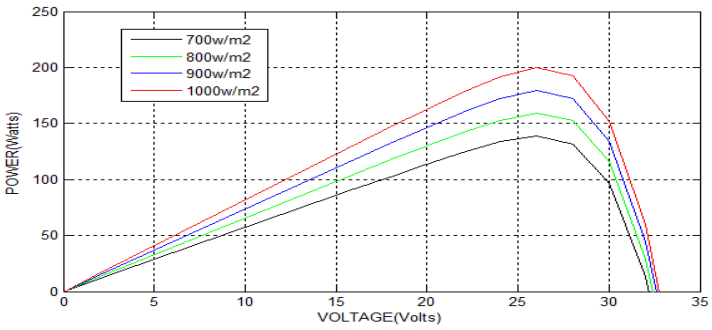

Fig. 6.4 Effect of variation of irradiation on P-V characteristics.

In fig 6.3, 6.4 we can see the impact of progress in sun oriented illumination on PV qualities. From fig 6.3 we see that as we increment the sun powered light short out current increments. Variety in Solar illumination impacts for the most part on current, as we can see from fig 6.3 as we increment sun powered light from 700 w/m2 to 1000 w/m2 current increments from 5.7A to 8.2A around however impact of variety of sun oriented illumination on voltage is exceptionally less. Fig 6.4 shows the impact of variety of sun oriented illumination on P-V qualities. As sunlight based illumination builds, power produced likewise increments. Expansion in power is principally because of augmentation in current.

Effect of variation of temperature:

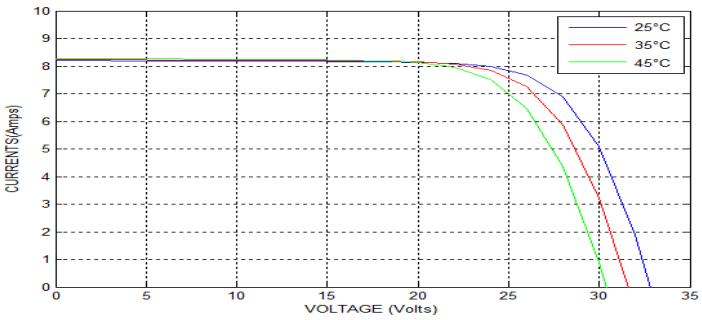

Fig. 6.5 Effect of variation of temperature on I-V characteristics.

The result of variety of temperature on I-V qualities is appeared in the fig 6.5. From the fig 6.5 we can see the variety of temperature for the most part impacts voltage, as we increment the temperature voltage diminishes however current remaining parts practically unaltered. Fig 6.6 shows impact of temperature minor departure from the P-V qualities. As temperature expands power produced diminishes, in light of the fact that on augmentation of temperature voltage diminishes.

CONCLUSIONS:

i) PV cell, module and exhibit are reproduced and impact of natural conditions on their qualities is considered.

ii) Wind energy framework has been examined and reproduced.

iii) Maximum power point of activity is followed for both the frameworks utilizing P&O calculation.

iv) Both the frameworks are coordinated and the cross breed framework is utilized for battery charging and releasing.

FUTURE SCOPE:

i) MPP can be followed utilizing various calculations.

ii) Battery charge regulator can be intended for more dependable activity and better battery life.

REFERENCES:

[1] T. Salmi, M. Bouzguenda, A. Gagtli, "MATLAB/Simulink based modeling of solar photovoltaic cell ," *International journal of renewable energy research*, vol.2, no.2, 2012.

[2] S. Meenakshi, K.Rajambal, S. Elangovan "Intelligent controller for stand-alone hybrid generation system," *IEEE*, May. 2006.

[3] Nabil A. Ahmed, Masafumi Miyatake, "A stand-alone hybrid generation system combining solar photovoltaic and wind turbine with simple maximum power point tracking control," *IPEMC* 2006, *IEEE*, 2006.

[4] M. G. Villalva, J. R. Gazoli, "Modeling and circuit based simulation of photovoltaic arrays," *Brazilian power electronics conference (COBEP),* 2009.

[5] Marcelo Gradella Villalva, Jonas Rafel Gazoli, "Comprehensive approach to modeling and simulation of photovoltaic arrays," *IEEE transaction on power electronics*, vol.24, no.5, May 2009.

[6] Hiren Patel and Vivek Agarwal, "Matlab based modeling to study the effect of partial shading on PV array characteristics," *IEEE transaction on energy conversion*, vol.23, no.1, March 2008.

[7] Mohammed Abdulazeez, Ires Iskender, "Simulation and experimental study of shading effect on series and parallel connected PV modules," *IEEE transaction on energy conversion*, vol.27, no.2, March 2008.

[8] SiyuGuo, Timothly Michael Walsh, "Analyzing partial shading of PV module by circuit modeling," *IEEE* 2011.