A REVIEW ON DESIGN AND SIMULATION OF STANDALONE PV SYSTEM

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Abstract: The aim of this review is design and simulation of standalone PV system. There are three types of solar system, grid connected solar system, off grid solar system and hybrid solar system, one of them is standalone PV system or off grid PV system. In this paper we are used perturb & observe (P & O) maximum power point tracking (MPPT) technique for extract the maximum power from the solar panel. Also used boost converter for MPPT and inverter for AC load.

Keywords: renewable energy, standalone PV system, MPPT, perturb & observe, boost converter, inverter**.**

I. INTRODUCTION

There are various source of energy are available like solar, wind, tides geothermal energy. Today, main source of energy is fossil fuels which stock are decreases slowly from the earth storage. Now a day renewable energy is take the place of non-renewable energy. According to the time changing people are find the nonconventional energy sources for their long time uses and pollution free sources. There for renewable energy sources fulfil this requirement, in which solar energy is the main source of energy in today. Standalone PV system or off grid PV system is important for the isolated region where there are no public grid or other utilities is available. Hence design of standalone PV system is important parameter, which is depending on the specific load requirement of the isolated area. Therefore, it is important to minimize the costs of the standalone PV system and to make the system competitive with the current energy sources and other renewable energy sources.

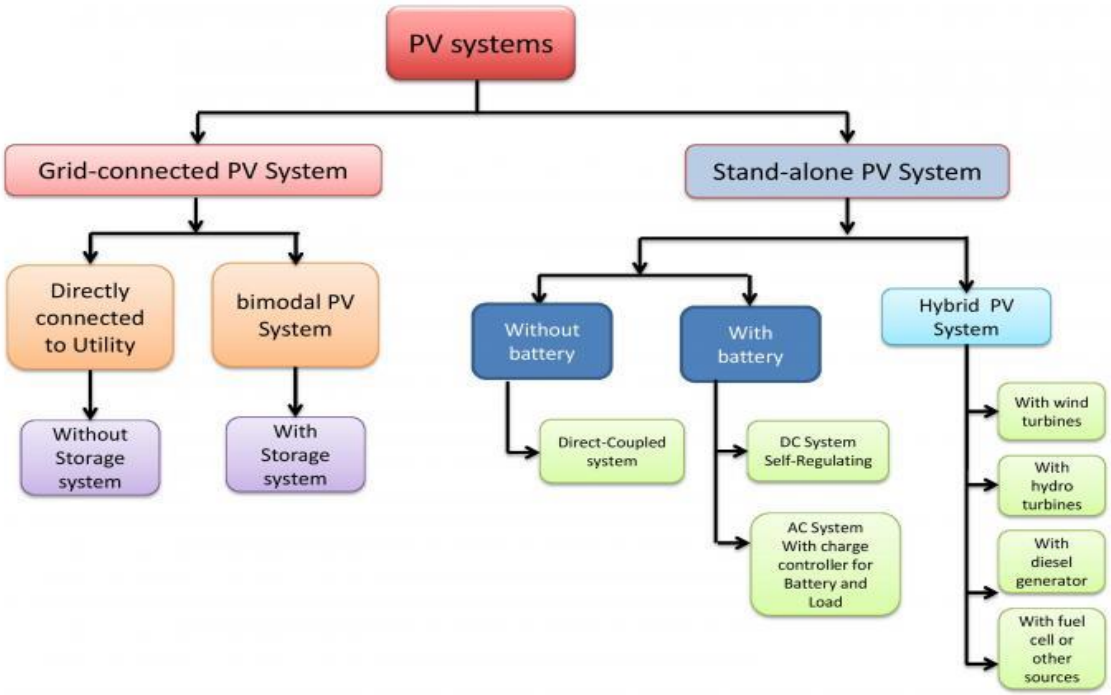

Figure -1: Types of PV system [9]

II. CLASSIFICATION OF STANDALONE PV SYSTEM

Standalone PV system or off-grid PV system is a system in which there is no connection of public grid or other utilities. There are different types of standalone PV system according to the load requirement, types of load, availability of resource.

a) Unregulated standalone PV system with DC load

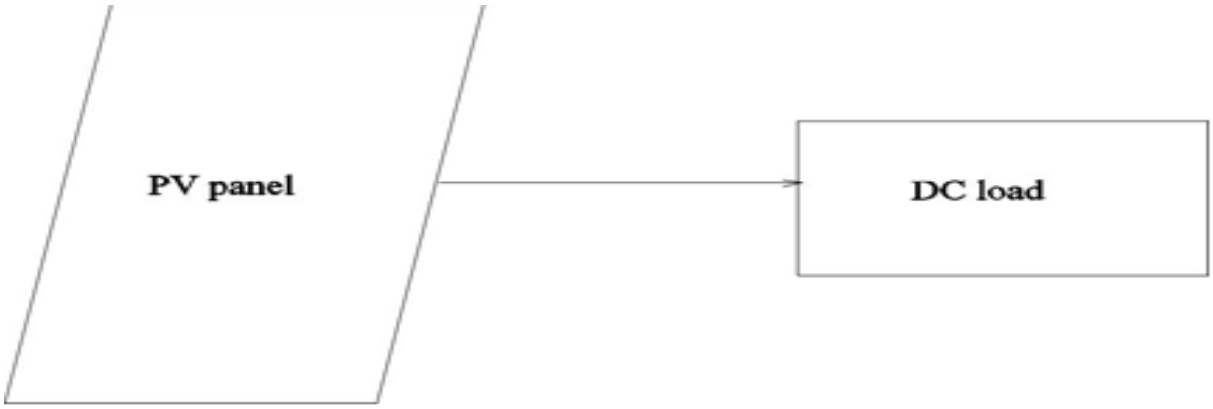

Figure-2: Unregulated standalone system with DC load

Generally, low power requirement is suitable for these types of system, there is no MPPT controller and battery is used. So, in night this system is not working.

b) Regulated standalone PV system with DC load

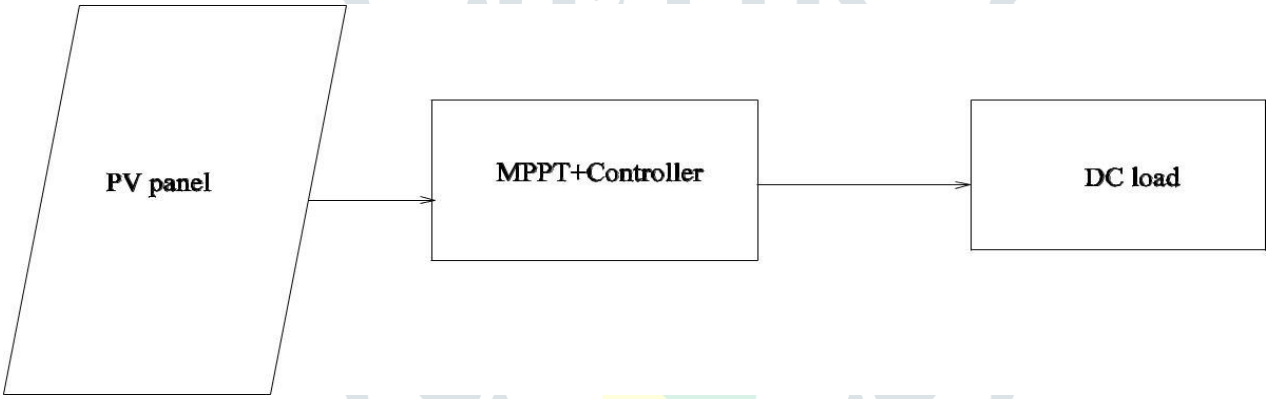

Figure-3: Regulated standalone system with DC load

This is the similar to the first system, but the different is MPPT controller is available in this case. MPPT controller is between the solar panel and load.

c) Regulated standalone PV system with battery storage and DC load

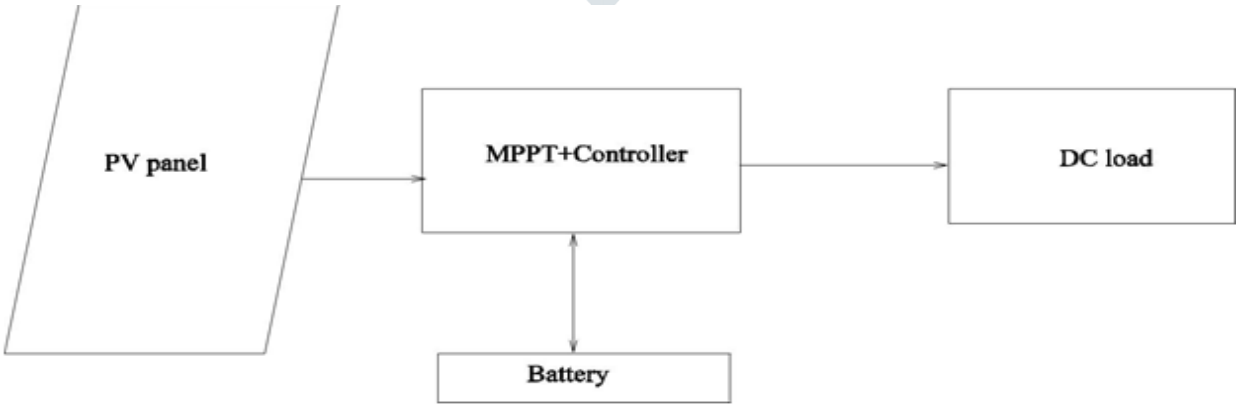

Figure-4: Regulated standalone system with battery and DC load

In these types of system there is battery storage is available which is increases the cost of the system due to the battery which has low life compared to the solar panel.

d) Regulated standalone PV system with battery storage, DC load and AC load

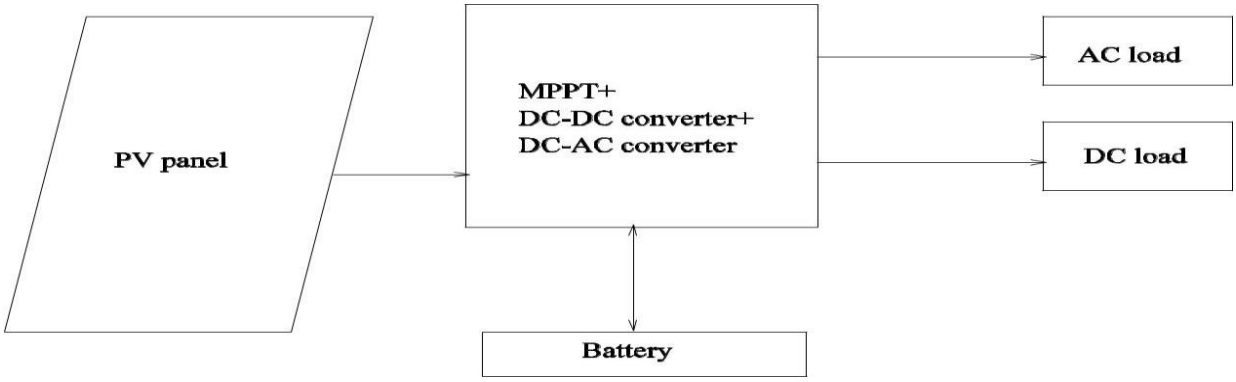

Figure-5: Regulated standalone system with battery, AC and DC loads

This system is similar to the previous system, but there is an inverter (DC-AC converter) is used for the AC load requirement. This system is widely used system but Cost of the system is also increases.

III. STANDALONE PV SYSTEM

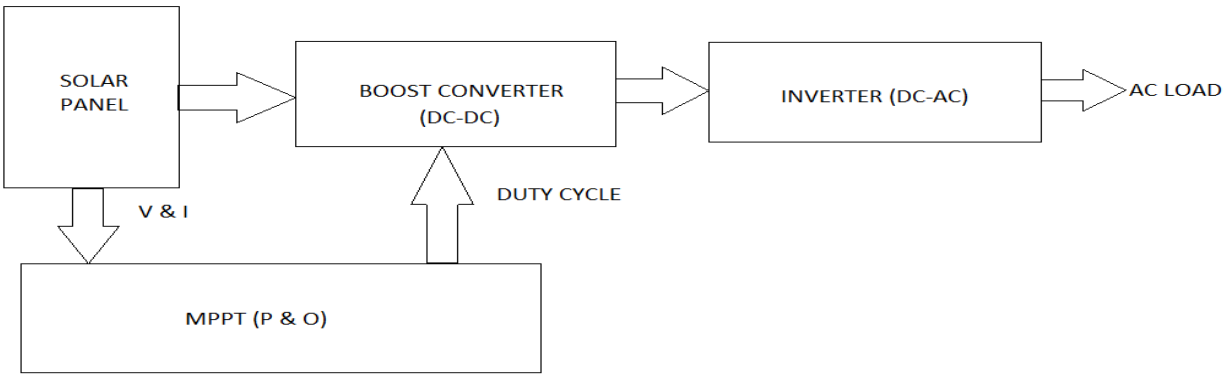

Figure-6: Block diagram of standalone PV system

Standalone PV system is an off grid PV system or also known remote area solar power system. Main component of standalone PV system are:

a) PV panel
b) DC-DC converter
c) Inverter
d) MPPT

a) PV panel:

There are many types of panel are available in market, according to the load demand solar panel are installed. Solar panels are connected to parallel and series, in series voltage is high and in parallel current is high.

b) DC-DC converter

It is a convert one DC voltage level to another DC voltage level. There are many types of converter.

1) boost converter
2) buck converter
3) buck-boost converter
4) cuk converter

In a boost converter input voltage is low and output voltage is high, According to its name it is boost the voltage. MPPT control the duty cycle of boost converter

c) Inverter

It is a DC-AC converter. There are many types of inverter available in market according to its VA rating.

d) MPPT

It is a maximum power tracking. It's used in solar generation system and wind generation system. It is used for extract the maximum power from the solar panel in various irradiations, various temperatures and various weather conditions. There are many types of MPPT available.

1) Perturb & observe (P & O)
2) Increment conduction (I C)
3) Constant voltage method
4) Fuzzy logic and neural network

In above methods P & O method is very efficient and widely used method because of its easy implementation and construction. In this method MPPT adjust the voltage of PV panel by small amount of power. If power is increase, then it will continue in same direction until the power is at its maximum value and same way in opposite decreases the panel voltage until the power is maximum.

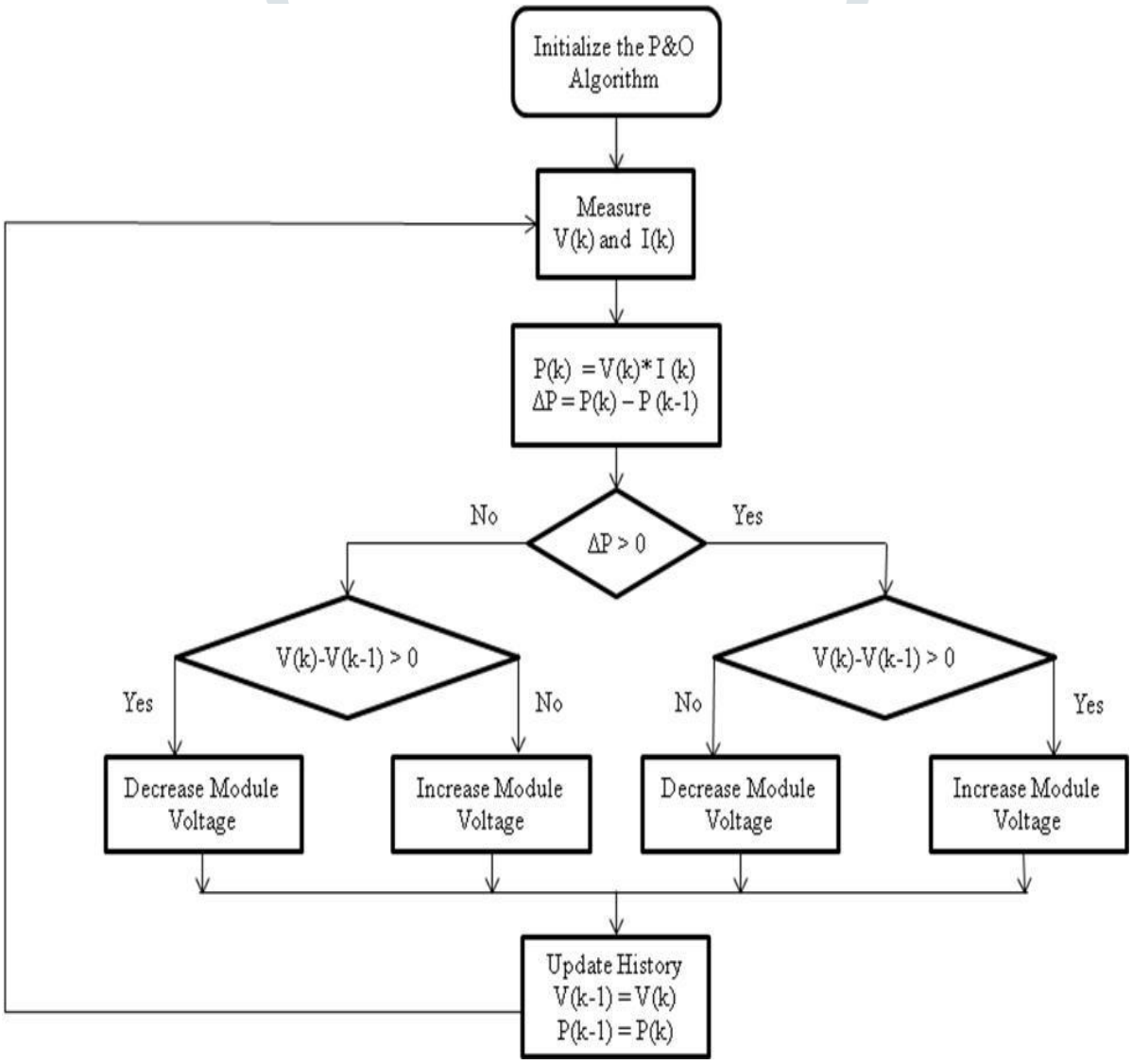

Figure-7: Flowchart of perturb & observe algorithm

IV. LITERATURE REVIEW

In the paper [1] Salima Kebaili and Achour Betka are present the design and simulation of standalone PV system. The main activity of their work purpose was establishing the library mathematical model of the different component of the standalone PV system. They have been also considered the how to get uninterrupted power supply to the system by using the battery storage system with MPPT charge controller. For this purpose, they used matlab/Simulink software.

In the paper [2] Himanshu Sharma, Nitai pal, Yaduvir Singh, Pradip Kumar Sadhu are present the implementation of a generalize model of PV system in matlab/Simulink software. Their proposed model is designed with a user-friendly icon and a dialog box like Simulink block libraries. By using their generalized PV model easily simulated and analysed in conjunction with power electronics. They are taking the effect of sunlight irradiance and cell temperature into consideration, the output current and power characteristics of PV model are simulated and optimized using the proposed model. Their model enables the dynamics of PV power system to be easily simulated, analysed and optimized.

In the paper [3] Kartika Dubey and M.T. Shah are present the current status of conventional energy sources. The main aim is simulation and development of solar system which are able to fulfil the power demand of isolated area where there is no availability of any public grid. They are used matlab/Simulink software for their purpose.

In the paper [4] Shikha Yadav and Rituraj Jalan present the design a solar off-grid PV system to supply the required electricity for a residential unit. Also presents a simple but efficient off-grid photovoltaic system for a residential unit that can meet the residential daily load demands of particular residencies. They have been used battery storage system during the night load requirement.

In the paper [5] B. Radha Krishna Varma and Dr. M. Gopichand Naik are present the cost-effective standalone PV system for the remote and/or off- utility grid power requirements. They design the Standalone PV systems which are operate independently of the electric utility grid, and designed and sized for the certain DC and/or AC electrical loads. Also used single phase to three phase converter for specified load.

In the paper [6] Ionel Laurentiu Alboteanu, sergiu Ivano and Gheorghe Manolea present the how to establish a library a simple mathematical models for individual component of a standalone PV system, like a solar cell, battery controller, inverter and load. Their work is done using the matlab/Simulink software.

V. CONCLUSIONS

Study and analysis of standalone PV system has been reviewed in this paper by introducing about types of standalone PV system component of standalone PV system as well as block diagram of standalone PV system, P & O MPPT method and flowchart of P & O algorithm.

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