International Journal of Scientific & Engineering Research Volume 11, Issue 9, September-2020
ISSN 2229-5518

A PID Controller using MPPT with PV System

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Abstract-The conventional energy sources such as coal, petroleum oil and natural gases take thousand of the year to form naturally. Renewable energy source are playing great role for today scenario of power providing but their intermediate nature makes less suitable for continuous delivery power here. Most of the research has work in the area to overcome from the random nature of the available power supply. In this paper solar irradiation is used. The different value of solar irrigation to adapt change the value of voltage current and power. In this paper to find the PV curve and IV curve. In this paper an attempt is made to summarize the work done on maximum energy technique.

Index Terms-MATLAB SIMULINK, PID CONTROLLER, PV SYSTEM, MPPT, PSIM software,Solar cell,PV Constant

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Introduction- Inspired by the recent development in technology there is a concern over the impact of conventional fuel usage. This leads to a rapid increase in pollution and its implication on the environment. Raises the concern for exploring viable renewable energy sources. Among, various renewal energy sources like thermal, solar, tidal, hydro, geothermal has gained a lot of attention around the world. It is found that solar energy has emerged as the most promising source of renewable energy. Since solar energy is derived from the sun it has numerous advantages like low maintenance, clean energy, ease of maintenance, unlimited energy from the sun makes it a practical solution over conventional fuel. The United Nation Development Programmer (UNDP) suggests that increase in usage of fossil fuels and coal-based power plants are the main contributor to the global greenhouse gas emission. Further, it is reported that the power supply deficit in various part of the world leads to the interest of various stakeholders on viable and clean energy solution like solar energy [1].

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The United Nation Climate Change (UNCC) raised their concern to combat climate change and emission of CO_2. With these objectives, the 21st Conference of Parties (COP21) of the United Nations

from a solar cell. MPPT methods are broadly classified as direct and indirect methods [5]. The Framework Convention on Climate Change (UNFCCC) was organized in Paris from November 30th to December 12th, 2015. The agreement is popularly known as the Paris Agreement (PA) was signed by 195 countries aiming to reduce the global temperature by 2 C [2]. Further, the agreement aims in strengthening developing countries to deal with the impact of climate change and reducing the increase in global temperature to 1.5 C. The International Energy Agency (IEA) in its world energy outlook, 2018 reported that global energy demand is set to grow by 25% to 2040. Since renewal energy sources are becoming the energy of choice will be adding two-thirds of global capacity by 2040 because of the falling cost of equipment and initiatives taken in PA [3]. With these sustainable global developments, the attention of the researchers in the field of solar energy has increased to overcome the effects of Photovoltaic (PV) system. The efficiency of a solar panel is its ability to convert sunlight into electricity given by the amount of electricity generated per unit of incident radiation i.e. W/m^2. It has been reported in [4], that crystalline silicon heterojunction structure used in PV module popularly known as Panasonic's HIT gives conversion efficiency of more than 25% and 25.6 % respectively. However, to achieve maximum efficiency it requires a robust control scheme to attain Maximum Power Point (MPP) which plays a vital role in the working of PV systems.

It is a well-known fact that the Maximum Power Point Tracking (MPPT) of a PV system depends on solar array and its isolation. Since MPP of a PV system is not constant it is required to continuously track the MPP. There are various

control algorithms to track MPP so as to draw maximum power indirect methods are popularly known as open-circuit and short-circuit methods [5-6] does not depend on climatic conditions rather it depends upon the mathematical.

Relationship of PV arrays. Hence, these methods cannot accurately track the MPP of the PV array in case of irradiation. The conventional direct methods tracking algorithm for the maximum power point are Perturbation & Observation (P&O) and Incremental Conductance (IC) method [6]. Out of the above-mentioned techniques, P&O and IC have gain attention from researchers because of their easy implementation, low cost, and simple structure. Moreover, these methods are also compatible with any PV systems as they don't require any information about PV systems [7]. The P&O tracking algorithm has inherently two disadvantages despite it

What is PID controller-?

PID Controller- It is a summation of P+I+D It means it is a summation of proportional integral derivative controller.

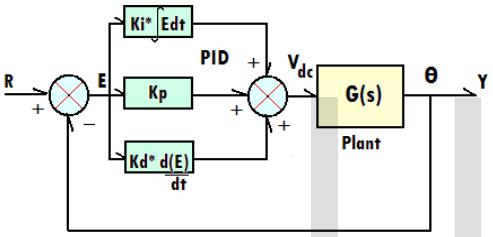


Figure 1. The relation between the characteristic I(v) of a cell and a load resistor(MOHAMED et al(2014)

- A closed loop (feedback) control system, generally with Single Input-Single Output (SISO)
- A portion of the signal being fed back is:

– Proportional to the signal (**P**)

– Proportional to integral of the signal (**I**)

– Proportional to the derivative of the signal (**D**)

– PID control works well on SISO systems of 2nd Order, where a desired Set Point can be supplied to the system control input

– PID control handles step changes to the Set Point especially well:

– Fast Rise Times

– Little or No Overshoot

– Fast settling Times

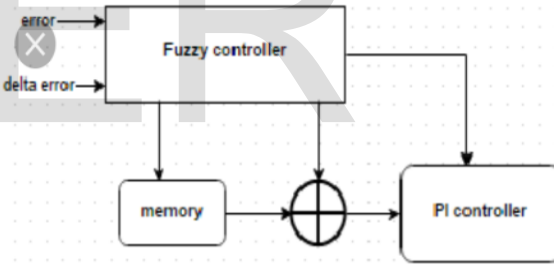
– Zero Steady State Error

– PID controllers are often fine tuned on-site, using established guidelines

– MOHAMED et al(2014)approach that PV system is one of the renewal energy sources. It is a technique which uses solar energy to produce electrical energy. Telbany approach that MPPT technique is used to match the load resistance to the source input resistance. Recently energy generated from clean renewable efficient and the enviourmental friendly sources have become one of the major research area. In this technique we have been used some MPPT control algorithm.

MPPT Technique- the maximum power point principle is based on circuit principle that when the photovoltaic cells output impedance and the load impedance are equal. The output power of photovoltaic cell is maximum. Some of the MPPT technique is given below-

INCREMENTAL CONDUCTANCE- it is a most commonly used technique because it can perform precise control under rapidly changing atmospheric condition without steady state oscillations

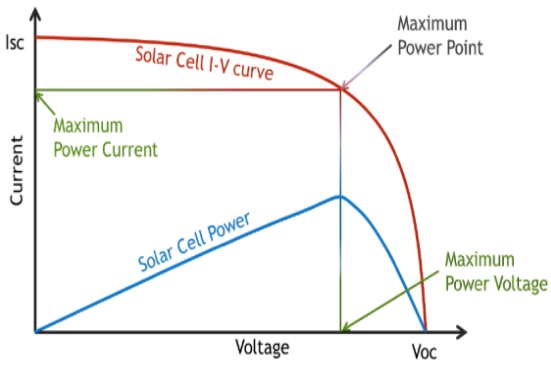


$$dIV/dv=I+V.di/dv$$

$$\frac{di}{dv} = -\frac{i}{v} at\ MPP$$

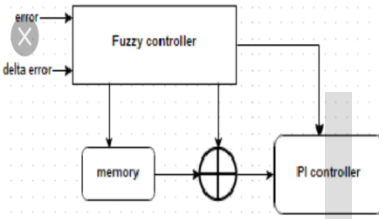
$$\frac{di}{dv} > -\frac{i}{v} left\ of\ MPP$$

$$-\frac{i}{v} right\ of\ MPP$$



PETURB AND OBSERVE TECHNIQUE-it is the simplest method of MPPT. The power output of the system is checked by varying the supply voltage. If the voltage is increase then power is also increase

Fuzzy logic-fuzzy logic was first introduced by a great mathematician Loftith A. This theory was not very popular at first and its applications were not clear. it uses human expert knowledge to make control decisions.



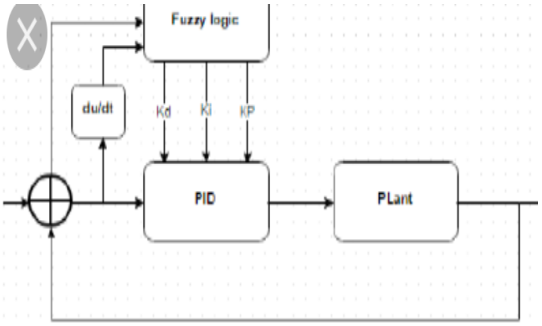
Figure(2) fuzzy controller using PI(MOHAMED et al(2014)

Artificial neural network- It is one of the machine learning techniques which have been developed as generalizations of mathematical models of biological nervous systems.

There are two methods for applied neural network controller in photovoltaic-

1. Using the neural network as a controller the duty cycle of the pulse with generator block.
2. Using the neural network as a reference for the maximum voltage and current.(MOHAMED et al(2014)

Fuzzy PID controller architecture-PID controller is a conventional controller that is used in many different controller application.PID controller output depends on three constant one for proportional term and one for integral term and last one for differential term.the most widely used method in tuning the PID controller is Ziegler-nichols tuning formula. Adaptive fuzzy pid controller for maximum power point tracking is introduced.



Other AI technique- The new algorithm used a neural network to enhance the performance of the increment conductance algorithm.

Fuzzy based MPPT algorithm- many control techniques has been proposed that use the fuzzy logic control for MPPT application either independently or along with other method. The main advantage of such controller is that controller parameters can be change very quickly in response to changes in the system dynamics without parameters estimation.(kalian chatterjee et al 2015)

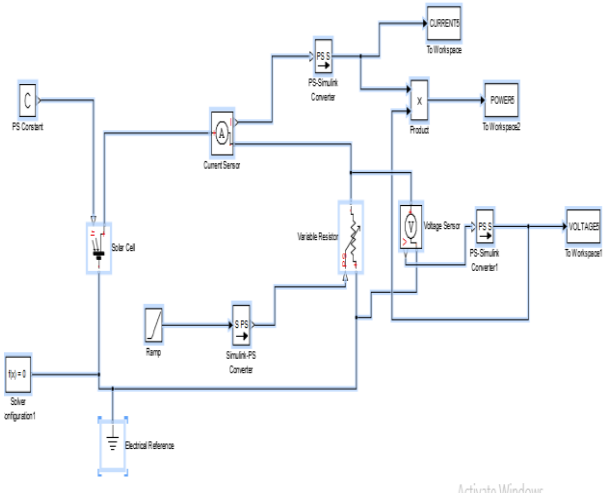
Comparisons among the MPPT techniques-This section offers an overview of the main characteristics of the MPPT controller techniques presented in a comparative way. However, the evaluation of control techniques is done along a set of evaluation criteria. These include *complexity*, *learnable*, *response time*, and *power consumption*. The results are summarized in Table I.

TABLE I. COMPARISON BETWEEN DIFFERENT MPPT TECHNSIQUES.

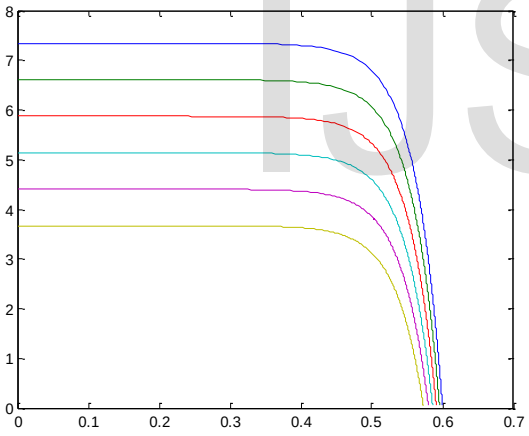
INCD	Complexity	Learnable	Response Time	Power consumption
P&O	Simple	No	Slow	Loss
Fuzzy	Simple	No	Slow	Loss
ANN	Complex	No	Fast	Efficient
FUZZY PID	Complex	Yes	Fast	Efficient
GA	Complex	Yes	Slow	Loss
AC FUZZY	Complex	No	Medium	Efficient
FUZZY NEURAL	Complex	No	Fast	Loss

Modal simulation-1

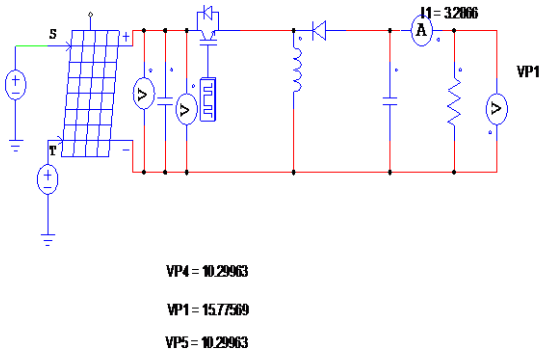
Fig(3) vi characteristics



FIG(2)TOUSE MATLABSIMULINK TO ANALYSIS THE VI CHARACTERISTICS



Fig(3) vi characteristics



This result shows the Dc-Dc boost converter shows the input voltage change according to the time but the output of the voltage is constant. This is a principle of Dc-Dc boost converter. But the result depends on this principle. In this result input voltage VP1, VP4 but output voltage is VP5.This circuit consists of an IGBT as a controlled switch, inductor, capacitor and resister. This switch is turn off or on the switching frequency Fs=1/T with a duty cycle D=ton/T. Where ton is a time interval when the switch is on.

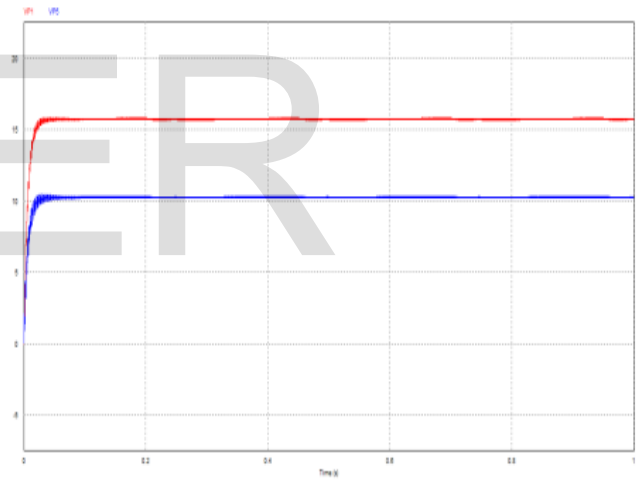


FIG 4 SIMULATION OF DC BOOST CONVERTER

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