Fuzzy Logic Mppt Method And Pi Control in Pv System as a Charge Controller

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ABSTRACT:
In this paper Fuzzy Logic MPPT (Maximum Power Point Tracking) method applied to photovoltaic panel sourced boost converter, under variable temperature (25–60 °C) and irradiance (700–1000 W/m2) after that the PI control was applied to buck converter to behave as a charge controller. Temperature and irradiance are the factors on which voltage and current of a PV system depend. Maximum available power of PV panels changes due to change in voltage and current by variable environmental conditions. PV panels are operated at maximum power point (MPP) to decrease payback period and increase efficiency of the system. By using FLC MPPT method in this system MPP changes from 94.6% to 99.5%. PI control is a simple technique which gives satisfactory results while constant voltage and current is maintained. The goal of this study is operating PV panel at maximum power point under variable environment conditions to increase efficiency and reduce cost and also provide appropriate current and voltage for charging battery to charge quickly, reduce losses and also increase life cycle of battery. This system was established and analyzed in MATLAB/Simulink.
Keywords: MATLAB, PV systems MPPT methods DC-DC converters PI control Charge controllers, SIMULINK

1. INTRODUCTION

This study offers a thorough analysis of the photovoltaic (PV) power system maximum power point tracking (MPPT) methods used up until January 2012. Numerous papers discuss various MPPT methods for a PV system, along with their implementation. However, choosing an MPPT might be confusing because each technique has advantages and disadvantages of its own. As a connection between the PV module and the load in solar generating systems, DC-DC converters are frequently utilised. When climatic circumstances vary and there are changes in the values of the resistive load, these converters must be selected so that they can match the maximum power point (MPP) of the PV module. In order to lower losses in the overall PV system, DC-DC converters must be utilised in conjunction with an MPPT controller. This article focuses on how three popular DC-DC converter topologies for PV systems affect the design of two components (inductance, capacitance). The boundary of the DC-DC converter's inductance and capacitance characteristics will shift when the climate changes. To get the best performance out of each converter, these two parameters need to be sized correctly.

2. PV (PHOTO VOLTAIC) CELLS: The use of solar cells that is relevant to science and technology is the photovoltaic (PV) system. Solar energy is the energy that a solar cell uses to convert sunlight and UV radiation directly into electricity. The purpose of this research is to boost the PV system's output of power and efficiency. Additionally, the load must get a consistent voltage regardless of changes in solar temperature and irradiance. Depending on the impacts of the environment, parallel and series combinations of PV arrays are employed to generate power.

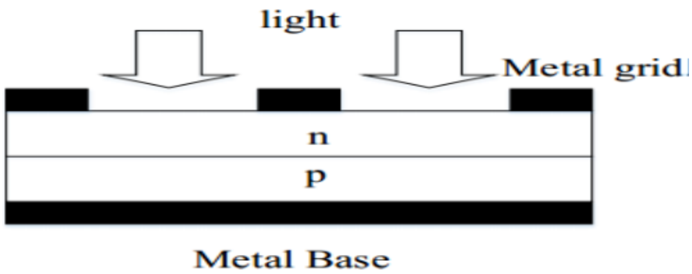


Fig2.1. Structure of PV cell

2.1. PV module:

When a greater voltage is required, PV cells are connected in series, and when a high current is required by the load, PV cells are connected in parallel. In most PV modules, there are 36 or 76 cells. We are utilising a module with 54 cells. The PV cell is encased, and the front side of the module is typically transparent and made of low-iron glass. A module's efficiency is lower than that of a PV cell because some of the incoming radiation is reflected by the glass cover and frame.

2.2. PV ARRAY:

A photovoltaic array is nothing more than the serial or parallel connecting of several PV modules. In order to satisfy the load need, the modules are secured in a grid form or as an array because the power provided by individual modules could not be enough to satisfy the needs of trading applications.

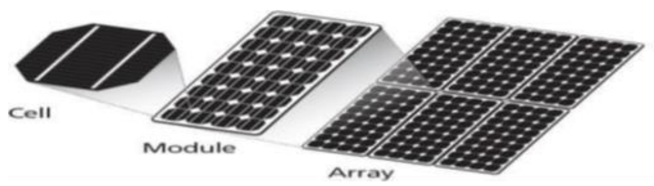


Fig2.2. Photovoltaic system

2.3. MAXIMUM POWER POINT TRACKING

Considering their interconnections to inverter systems, external grids, battery banks, or other electrical loads, PV solar systems can be set up in a variety of ways. The main issue addressed by MPPT, however, is that the efficiency of power transmission from the solar cell depends on both the amount of sunlight falling on the solar panels and the electrical characteristics of the load. This is true regardless of where the solar power will ultimately be used.

2.4. MPPT Implementation:

The solar panel's operating point is rarely at peak power when a load is connected directly to it. The operational point of the solar panel is determined by the impedance that the panel observes. Thus, the operating point can be shifted toward the peak power point by altering the impedance perceived by the panel. DC-DC converters must be used because panels are DC devices in order to transfer the impedance of one circuit (source) to the other circuit (load). As a result, fixing the duty ratio under such constantly shifting operating conditions is not practical. Algorithms used in MPPT implementations regularly sample panel voltages and currents before adjusting the duty ratio as necessary. The algorithms are implemented using microcontrollers. Most contemporary implementations make use of larger computers for analytics and load forecasting.

3. PROPOSED SYSTEM

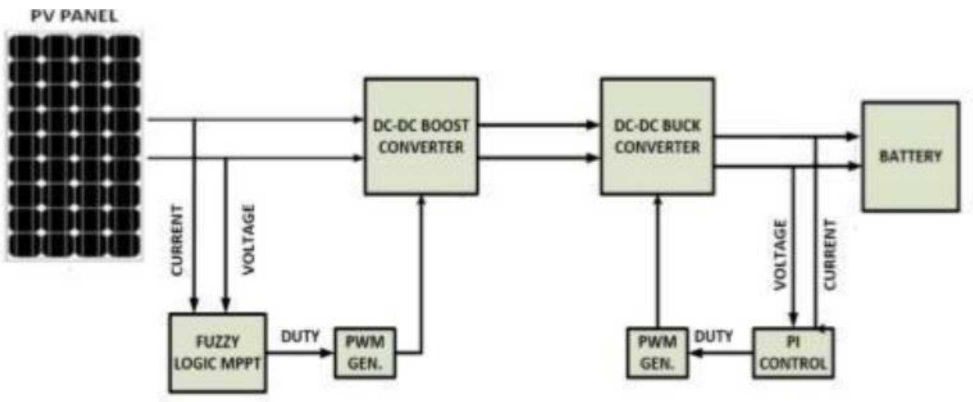
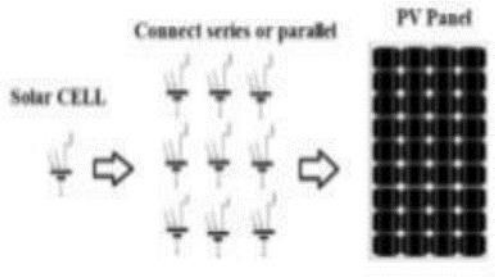
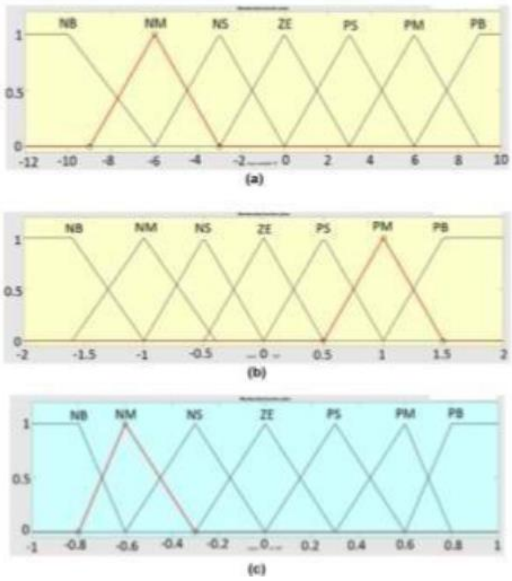


Fig3.1.PV system MPPT algorithm and PI control charge circuit

The proposed system is novel, and the FLC MPPT approach does not require knowledge of any system parameters. Additionally, because the boost converter is a DC-DC converter rather than a DC-DC converter, it has fewer circuit parts, which reduces losses and makes implementation easier. SEPIC, however, has the advantage of being able to function as both a boost converter and a buck converter. The PV panel's current and voltage are regulated using the Perturb & Observe MPPT method, a buck-boost converter, and the open circuit approach for controlling battery charge.



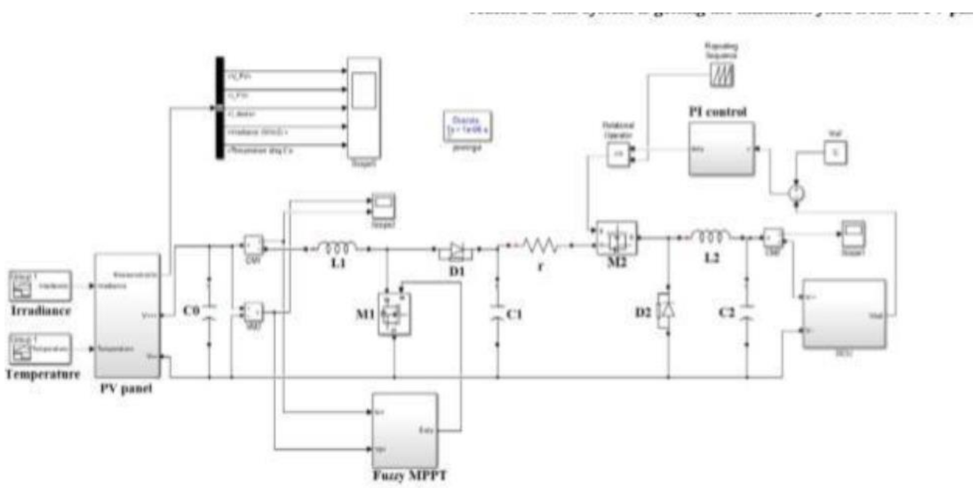


4. MATLAB/Simulink:

Simulink is a software extension for Mat Lab, a mathematical tool created by Natick-based The Math Works (http://www.mathworks.com). Large-scale numerical analysis capabilities underpin MatLab. Simulink is a tool for visually programming and analysing the outcomes of dynamic systems (those controlled by differential equations).

4.1. SIMULATION RESULTS

Fig.4.1The MPPT algorithm in Matlab/Simulink



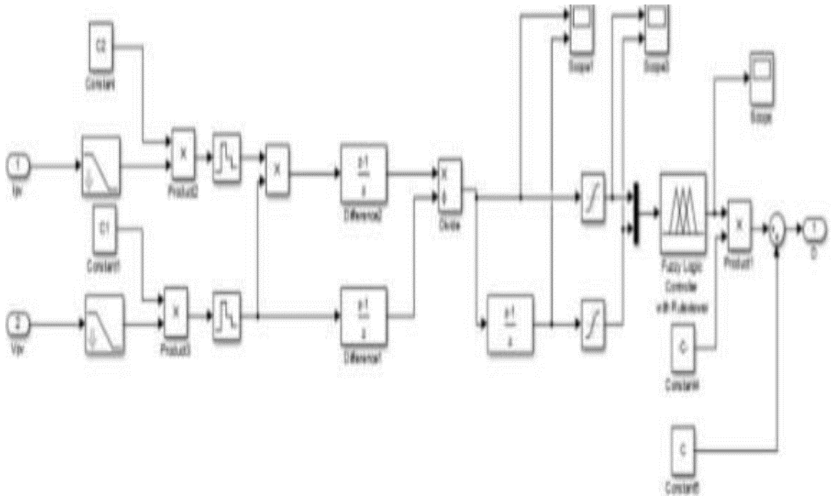
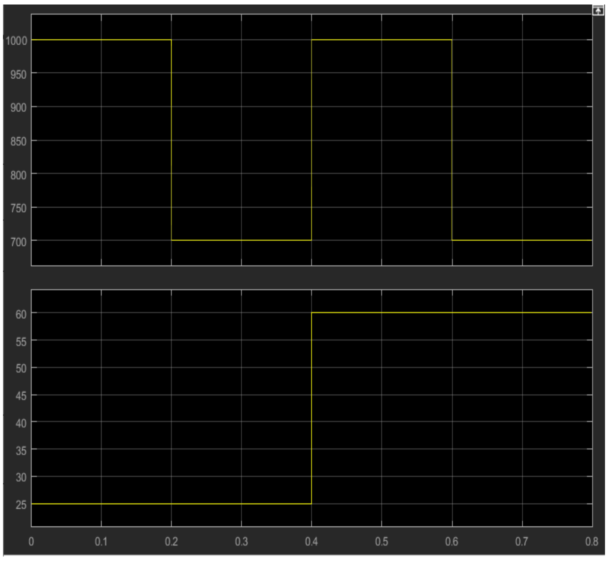


Fig 4.2. The System constructed in Matlab/Simulink.



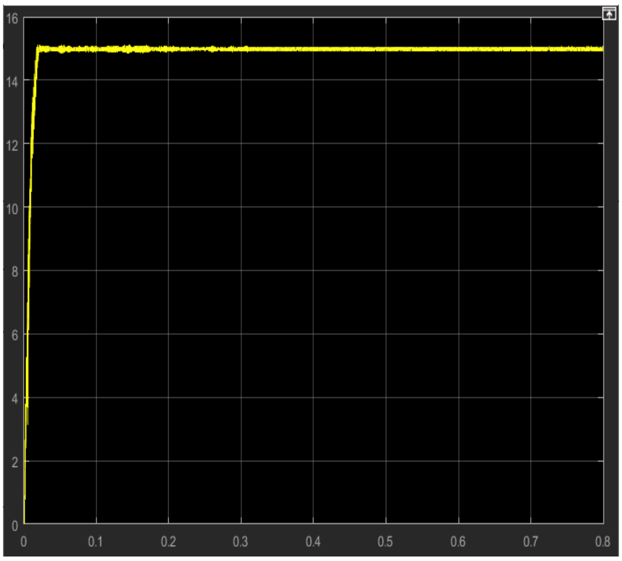
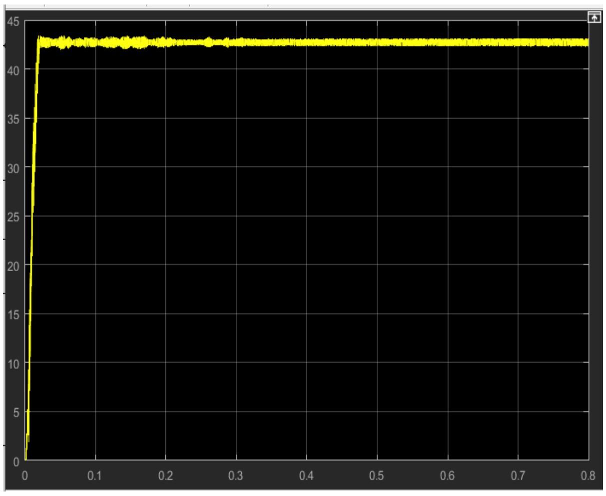


Fig. 4.3. Variable a. irradiance., b. Temperature Fig. 4.4. The load voltage of buck converter.



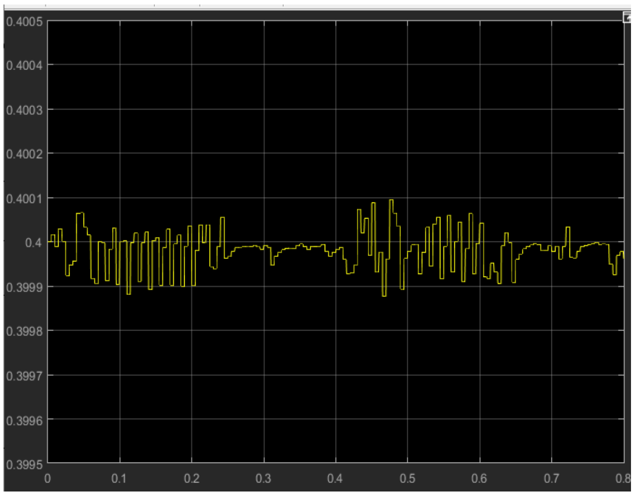


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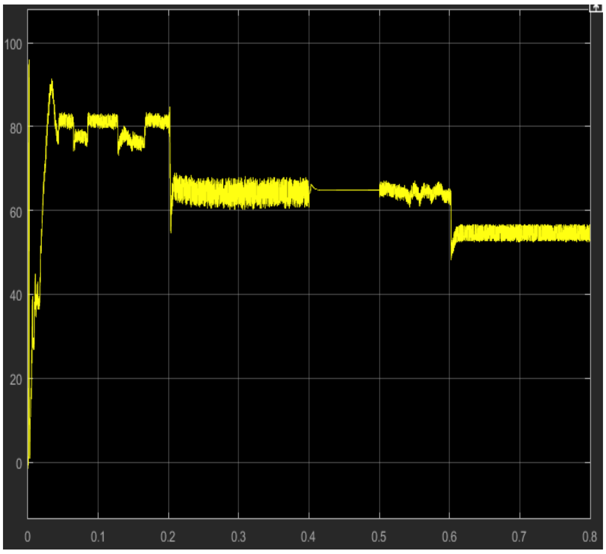
Fig. 4.5. The load current of buck converter MPPT

Fig. 4.6. The duty cycle regulated by FLC



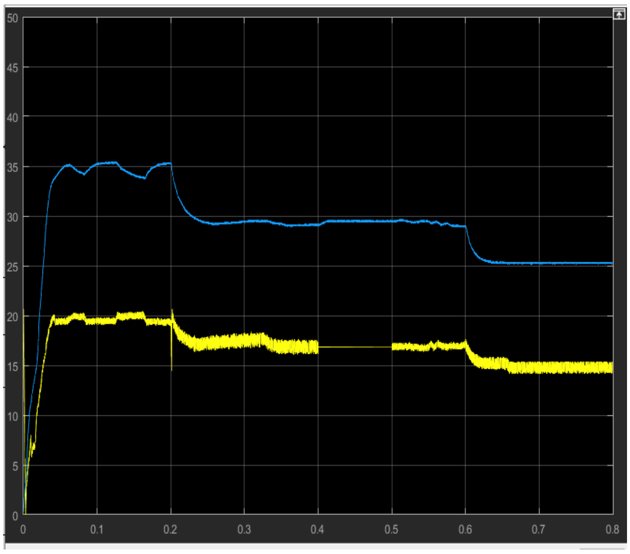
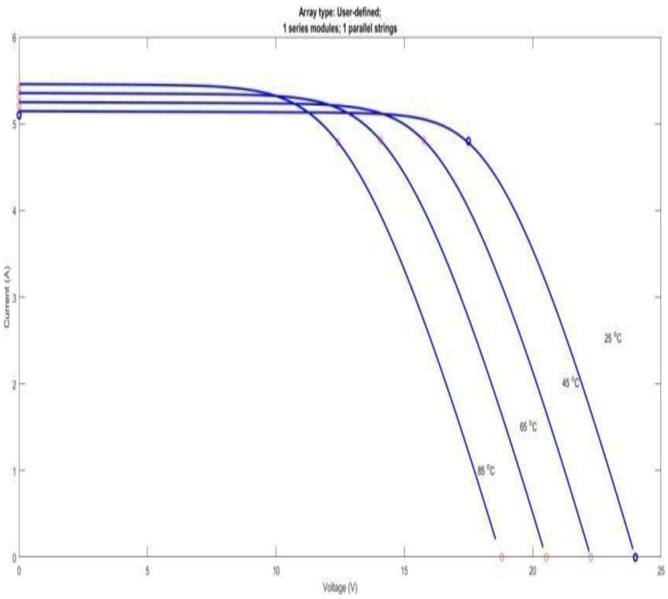
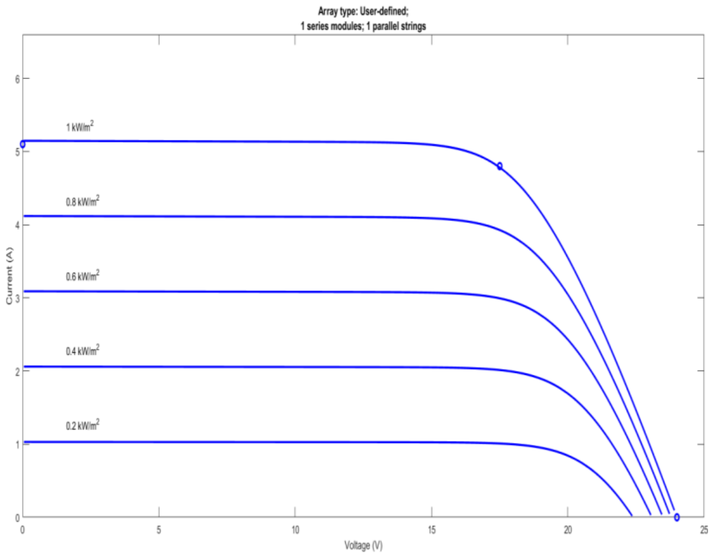


Fig 4.7. The Power of PV pane

Fig.4.8 The Voltage of PV panel and

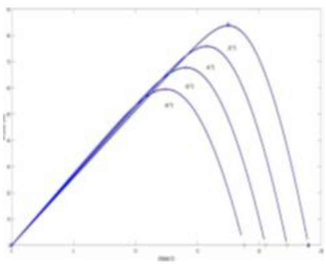




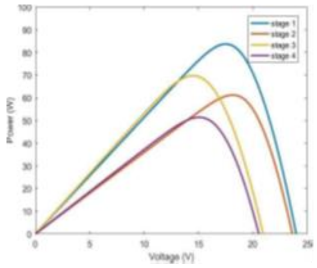
load of boost converter

I-V characteristic variable temperature.

(b) I-V characteristic variable irradiance,



P-V characteristic variable temperature



The P-V curves under variable irradiance

CONCLUSION

The proposed system has been investigated in four distinct scenarios. System responses to changing radiation and temperature were seen. The MPPT algorithm's MPP accuracy ranged from 94.8% to 99.4%. Up until the system's end, the buck converter's load current and voltage stayed constant (2.39 A, 15.03 V respectively). The system has largely delivered on our expectations of efficiency. In some circumstances, the buck converter's efficiency may be low, but the system's goal is to maximise PV panel output in order to save costs, charge the battery with a constant current and the proper voltage in order to reduce losses, quick charging, and increase life cycle of battery. If there is a meaningful support to the material, the system will be realized in real life.

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