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Fuzzy Logic Control (FLC) Scheme with Improved Stability for Hybrid Renewable System for Industrial Loads

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Abstract: *Renewable energy sources have gained popularity as a result of their reduced environmental impact and ability to meet increasing energy demands. The changeability and instability of renewable sources of energy are their defining characteristics.Hybrid power conditioners are designed to handle the various disadvantages of traditional energy sources. Through the use of storage and backup batteries, they can reduce their consumption and provide better reliability. The concept of this system is to use the fuzzy logic controller (FLC) to regulate the flow of power and keep the steady voltage at the point where common coupling occurs. The battery bank is also designed with an interface to the controller.*

Keywords: Sustainable Energy Resources, Energy management, Fuzzy Logic,modeling

1. INTRODUCTION

Over the last few decades, there seems to be an increased global effort to create renewable energy sources and the technology that support them, since energy has become a strategic sector. Multiple renewable energy sources, backup energy sources, and storage technologies have all been established [1]. Solar, wind, and other renewable energy technologies require continued research and development to enhance their efficiency. MPPT which is an important aspect of system performance and is one of the most important factors to consider MPPT techniques can be categorized into two groups in general. The first employs traditional algorithms. One of the main goals of this manuscript is to present two subsystems [2].The MPP of a PV exhibit is normally one of the main parts of a PV framework. Accordingly, a lot of MPPT techniques have been proposed and applied. The strategies contrast as far as intricacy, essential sensors, assembly speed, cost, viability range, execution equipment, notoriety, and different variables [3]. Wind, then again, is a spotless energy source that is dynamically assisting with limiting reliance on petroleum derivatives by exploiting a consistently diminishing expense of wind generator innovation in periods when the expense of conventional fills is rising. The Fuel Cell (FC) innovation is a proper alternative for repaying the brokenness of different sustainable power sources, for example, sun based light and wind due to its high productivity, fast burden reaction, seclusion, and wide fuel adaptability [4]. Also fuel cells are being explored as an electric power generating alternative for mobile and stationary applications. The battery can

be utilized to meet peak power demand, allowing the fuel cell stack to be as small as possible.Battery charge–discharge must be managed by the battery SOC, and the battery SOC must be maintained at an appropriate level. Therefore in the hybrid system, a proper load management approach is essential for improved system efficiency [5]. Hybrid renewable energy systems improve power quality and system reliability. In light of specific difficulties, for example, fiercely fluctuating inexhaustible wellsprings of energy like breeze speed, sunlight based radiation, and high introductory establishment cost, which causes changes in source and burden power, the requirement for incorporating diverse sustainable wellsprings of energy and sending suitable force the executive's methods is required [6]. For proficient force the executives FLC, SOC assessor, and battery charge regulator is required. The whole course of force the executives is overseen by a FLC, which depends on the force given by the sources and the heap interest. In this paper, an implanted regulator is utilized related to a network intelligent numerous info converter to perform MPPT for sun oriented PV boards and WTG, battery SOC assessment, charging/releasing of batteries dependent on prompt burden interest, and keeping a steady voltage at PCC and force stream control by directing the regulator's reference ebbs and flows [8].

2. PROPOSEDMETHODOLOGYANDDESCRIPTION

2.1 SOLAR PANEL

Sun-powered photovoltaic energy is perhaps the most important resource since it is free, endless, contamination-free, and effectively accessible all over the place [13].The everyday normal sunlight-based energy happening across India differs among 4–6 kWh per square meter each day dependent on the district, which can be utilized to produce power to satisfy the extending request [7]. PV power generators have also become a viable alternative in recent years due to a significant rise in research and development activity in the field of PV systems a source of energy that is used to supplement other sources of energy in system of hybrid energy.The goal of MPPT operation is usually achieved by integrating PV power sources with control algorithms [9].To solve the fanner problem, MPPT approach with quick response qualities and the ability to make good use of the electric power generated in all conditions is required.Many MPPT control algorithms have been presented that use the output power and voltage characteristics to find the best operating conditions differential approaches such as themethod of hill climbing or fuzzy rules[10].

Consider

$I = I\text{PV} - ID - I\text{SH},$

$I = I\text{PV} - \{\exp[q\,(V\text{PV} + IRS)/mkT] - 1\} - V\text{PV} + IRS/R\text{SH}\ldots$ (1)

2.2 WIND-ENERGY

Wind turbines change the mechanical energy created by the breeze into electrical energy. To use this electrical energy, you need voltage. The MPPT regulator relies upon the most extreme force move hypothesis[11]. The force differs from the breeze speed. Yield, voltage, and force created by wind turbines in the generator's impedance stay consistent, therefore. Then again, load impedance stays unaltered[14].To coordinate with the source and burden impedances, a force electronic converter with an MPPT regulator is associated straight forwardly with the heap. In the event that the source impedance differs, the converter's obligation cycle is changed to meet the heat.The torque=power generated by the generator at a given speed,

$Tm = (\lambda, \beta)\ \rho AV3\omega$(2)

Where,
ωm=Generator speed.
Cp=Coefficient of performance.
ρ=Density of air.
A=Area swept by turbine blade.
V=Velocity of wind.

2.3 FUEL CELL

Fuel cells are being considered as a source of electric power for transportation and stationary applications. High peak power needs and dynamic loads are insufficient for fuel cells [5]. To produce direct flow power, energy components utilize an electromechanical cycle like that of a battery. Subsequently, ignition and the related natural incidental effects are stayed away from. At the point when the power conveyed by sun based, WTG, and battery is not exactly the heap interest, an energy component is utilized to supply load[12]. The stream rate regulator of the energy unit is acclimated to control the hydrogen supply to the energy component dependent on the order from the force the executives regulator to create the important force dependent on request when the power device is conveying power, however issues, for example, chilly beginning issues are not thought about yet can be appropriately overseen utilizing the unique conduct of the battery [7].

2.4 BATTERY CELL

The purpose of battery testing is to determine the model's basic characteristics as well as to test control measures. The available capacity of the battery can differ from the rated value when the battery is depleted under different conditions. The available capacity can rapidly decrease when the temperature is low and the discharge current is high.In battery charge mode, fuel energy is employed as an input, and useful energy output is equal to AC energy output minus battery charge energy [5]. Lead-acid batteries are preferred because they are less expensive to purchase and maintain. A lead-acid battery exhibits exact voltage dynamics during current variations because it has a perfect voltage source in series with internal resistance [7].

For a 150Ah battery the charging current should not exceed 15A
IBattCh= 0.1 × 150 = 15A(3)
The boost converter being 95% (ηBoost-Conv = 0.95) will be
Calculated as:
$CB= Po/0.1 \times \eta$Boost-Conv× VBat-min

CB=1500/0.1 × 0.95 × 99

CB= 159.489 Ah(4)
Hence a 150Ah battery is selected.
The IBattDchat the output of the boost converter to deliver a power of 1.5 kW at thebattery voltage of VBat-min = 99V and ηBoost-Conv= 0.95 is$I$BattDch=$Po\eta$Boost-Conv× VBat-min$I$BattDch=1500/0.95 × 99= 15.94A(5)

3. SIMULATION RESULTS

FLC Based MPPT tracking is more reliable than other conventional control methods.

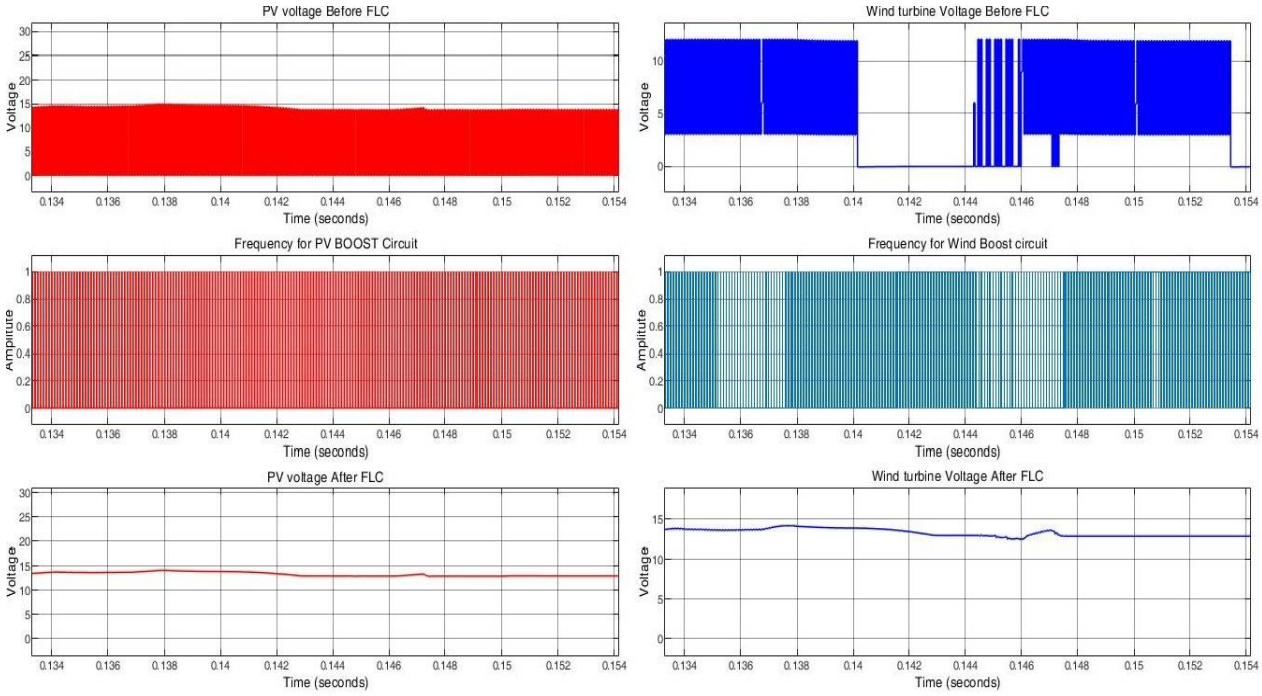

Figure 2:Before and after FLC Voltage of PV & Wind

CONCLUSION:

The plan of a force the boarding procedure for an independent half and half framework containing a WEG, a PVG, and an FC was proposed in this review utilizing a Fuzzy Logic strategy. We likewise utilized MATLAB/SIMULINK to build the cross breed framework in this paper. As a general rule, the most extreme force point of the breeze nearby the planet group has been cultivated utilizing essential squares: MATLAB/SIMULINK. To get the best framework unwavering quality, activity effectiveness, and cost decrease in coordinated energy from a sustainable source, energy the board arrangements are required. Neural organization, fluffy, and neuro fluffy-based control techniques are promising in the plan of cross-breed energy by inexhaustible frameworks, including framework measuring, execution control, and force the executives.

References:

[1] L. Olatomiwa, S. Mekhilef, M. S. Ismail, and M. Moghavvemi, "Energy management strategies in hybrid renewable energy systems: A review," *Renew. Sustain. Energy Rev.*, vol. 62, pp. 821–835, 2016.

[2] A. Jemaa, O. Zarrad, M. A. Hajjaji, and M. N. Mansouri, "Hardware implementation of a fuzzy logic controller for a hybrid wind-solar system in an isolated site," *Int. j. photoenergy*, vol. 2018, pp. 1–16, 2018.

[3] A. Yasin, G. Napoli, M. Ferraro, A. Testa, and V. Antonucci, "Fuzzy logic based management of a stand-alone hybrid generator," in *2011 International Conference on Clean Electrical Power (ICCEP)*, 2011.

[4] K.-S. Jeong, W.-Y. Lee, and C.-S. Kim, "Energy management strategies of a fuel cell/battery hybrid system using fuzzy logics," *J. Power Sources*, vol. 145, no. 2, pp. 319–326, 2005.

[5] S. Saravanan and S. Thangavel, "Fuzzy logic controller based power management for a standalone solar/wind/fuel cell fed hybrid system," *J. Renew. Sustain. Energy*, vol. 5, no. 5, p. 053147, 2013.

[6] K. W. E. Cheng, B. P. Divakar, H. Wu, K. Ding, and H. F. Ho, "Battery-management system (BMS) and SOC development for electrical vehicles," *IEEE Trans. Veh. Technol.*, vol. 60, no. 1, pp. 76–88, 2011.

[7] J. T. Bialasiewicz, "Renewable energy systems with photovoltaic power generators: Operation and modeling," *IEEE Trans. Ind. Electron.*, vol. 55, no. 7, pp. 2752–2758, 2008.

[8] N. Mutoh, M. Ohno, and T. Inoue, "A method for MPPT control while searching for parameters corresponding to weather conditions for PV generation systems," *IEEE Trans. Ind. Electron.*, vol. 53, no. 4, pp. 1055–1065, 2006.

[9] C. Laxmi, D. M.Narendra Kumar, and D. Sushant Kumar Mandal, "A comprehensive review on energy management strategies in hybrid renewable energy system," *Int. j. eng. technol.*, vol. 7, no. 2.23, p. 450, 2018.

[10] T. Esram and P. L. Chapman, "Comparison of photovoltaic array maximum power point tracking techniques," *IEEE trans. energy convers.*, vol. 22, no. 2, pp. 439–449, 2007.

[11] Kokare, S. Patil and L. Bacchav, "Implementation of a highly efficient MPPT technique for a PV system using sepic converter," *2017 International Conference on Information, Instrumentation and Control (ICICIC)*, 2017, pp. 1-5, doi: 10.1109/ICOMICON.2017.8279029.

[12] Patil and L. Waghmare, "ANN based Intelligent Energy Management for a Standalone Wind/Photovoltaic/Diesel Hybrid System with Battery Storage", *Majlesi Journal of Management*, vol. 8, no. 1, pp. 1-11, Mar. 2019.

[13] B. P. L. M. Waghmare, "Intelligent Control Strategy for Grid Connected PV/Wind/Battery/Fuel Cell Energy System", *IJCA*, vol. 12, no. 5, pp. 634 - 656, Jan. 2020.

[14] M. Waghmare, Sangita B. Patil, "Neural Network Based Energy Management Control for /Wind Hybrid System with Battery Storage", *IJAST*, vol. 29, no. 04, pp. 10322 -, Oct. 2020.