Simulation of fuzzy based MPPT control scheme with a hybrid of power generation system

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Abstract : In the traditional mechanisms the PO paradigm is utilized to track the power need adaptation as several enhanced mechanisms have been established which offers efficient outcomes. Furthermore, for the power the traditional mechanism do not utilize nay storage mechanism as the residual power after accomplishing the need can be restored for next constraint. To track the maximum power point effectively several paradigms are generated. It is demonstrated that the conventional mechanism of MPPT suffers from several problems. Therefore to enhance the presentation of the method the present work offers an improved method. The conventional MPPT scheme with Fuzzy technique is updated in the present work to achieve the useful and reliable outcomes. In case if the solar system is failed to generate the power due to the sun light is not available so in that case the Battery Energy Storage System was utilized in the solar system. Also in other case if the BESS along with the solar system both failed and the working is stopped. Then to tackle this problem the Diesel Generator is used in the present work to enhance the capacity of the power generation of the mechanism.

IndexTerms - Battery Energy Storage System, MPPT, Diesel Generator.

I. INTRODUCTION

To attain the current requirement of power resources offered through the nature are on the edge of exhaustion that's why the power sector now-a-days are looking for novel resources. Through utilizing renewable sources of energy the major aspect for global warming is the carbon content in the environment that can be decreased to a large amount. Solar PV technology uses the sunlight as a majorly significant renewable resource. For the cause of cheap accessibility of sunlight and solar PV's panels simplified structure this mechanism is much desired. To enhance the design mechanism of PV panels the discussion of several formations in the PV panels has been illustrated with the work requirement in the previous work. The photovoltaic modules operate at optimum rate and extort maximum energy out of it by the Maximum Power Point Tracking Controller (MPPT). In the power point to attain the high effectiveness the several paradigms are deliberated. Even though the MPPT paradigms are efficient but also many of them have a serious demerit that is they are very slow.

From the time as introduced to the mankind the requirement of the energy has been enhanced exponentially. To achieve social and economical development and also to advance the living situations of the human among the improvisation of energy has also been monitored in the heath care sector this is the way by which mainly the energy is used. To serve the productive procedures and enhance the human living and assure the daily basic requirements of the human life such as lightning, food processing, comfort ability and communication has also been met properly so the energy has most significant contribution. Since 1850 the utilization of the fossil fuels has also been enhanced. From the earlier time there is dominant position of fossil fuels such as gas, oil etc that directs to the fast development in carbon dioxide emission. For the human welfare productivity and comfort the energy transformation had considered. As human has became quite dependent on energy in human prosperity the continuous supply of energy has major role.

The distribution of the energy is accomplished as follows. In the cooking water, heating space, heating and drying the 45% of the energy is used. The ten percent of the energy is utilized for the maximum temperature industrial procedures. In order to operate the electric motors the 15% of the energy is used and for transport the 30% of the energy is utilized. Because of the fossil fuels 80% of the Global emission of CO_2 is happened. Through the population of the world among the advent of the economic growth there is a need of several sorts of energies. Side by side the demand and economic progress of the energy occurs. In the previous years the countries that were in growing stage demanded the more energy by which the cost of the energy is increased and in future the enhancement in the price will be monitored. In order to achieve the domestic energy requirements after the oil crises in 1973/74 and 1979/80 the non oil generating countries centered on electricity creation. The chance of energy supply disruptions is still there as the oil prices are steady. The 80 percent of fossil fuel that is a contradiction to use a low carbon emitting modern energy mechanism as the 80 % of the fossil fuel world's energy supply is acquiescent. The enhancement in energy effectiveness will be an element of GHG-emission decrease.

II. BATTERY ENERGY STORAGE SYSTEM

The photovoltaic or wind power based energy creation has got widespread attention in the worldwide overdue time. The State Grid Corporation of China (SGCC) is constructing the National Wind/PV/battery vitality stockpiling station with the

Transmission Joint showing job. It is situated at Zhangbei, Hebei China. The power generation capacity of Zhangbei is up to 10 Million kW from wind power.

Through the energy storage scheme the power quality of the renewable energy hybrid power generation scheme is enhanced. The several control mechanisms like a superconducting magnetic energy scheme, battery energy storage scheme, a flywheel energy scheme and an energy capacitor scheme with entire cell/electrolyzer hybrid method have been suggested arrangement for the hybrid storage energy scheme.

In several applications that are frequency regulation, grid stabilization, transmission loss decrease, diminished congestion, enhanced flexibility etc. the battery energy storage scheme have been utilized. Now-a-days the normalization of the power alteration issues in PV and wind power production is enhancing wide focus. The battery power or the degree of effectiveness has to be sacrifice as using the BESS to control the alterations in the wind power and the PV.

III. PROBLEM FORMULATION

To extort the highest capable power of the PV modules regarding solar irradiance and temperature at specific instant of time through Maximum Power Point Tracking Controller the Maximum power point tracking control mechanism is utilized. In order to track the maximum power point effectively several paradigms are generated. Because of the usage of the effectiveness is decreased the nearly all MPPT paradigms suffer from the demerit of being slow tracking. In the traditional mechanisms the PO paradigm is utilized to track the power need adaptation as several enhanced mechanisms have been established which offers efficient outcomes. Furthermore, for the power the traditional mechanism do not utilize any storage mechanism as the residual power after accomplishing the need can be restored for next constraint.

IV. PROPOSED WORK

Earlier it is demonstrated that the conventional mechanism of MPPT suffers from several problems. Therefore the projected work generates an improved method to enhance the presentation of the scheme. The projected scheme upgrades the traditional MPPT mechanism among fuzzy scheme so that the helpful or flexible outcome can be attained. Sometimes it is probable that the solar system fails to produce the power mechanism because of the inaccessibility of the sun light therefore Battery Energy Storage System was utilized in the solar system. But it was also observed that there were some of the cases when the sunlight, battery and power fails and stops working. Thus in proposed work, the diesel generator is also applied with the BESS to increase the capability of power generation of the system.

V. RESULTS

The Figure 1 depicts the simulation model of PV array. In this model the Fuzzy MPPT is utilized for the Maximum Power Point Tracking (MPPT). In this model the irradiance that is 1000 and temperature that is 25 is fed to the Photovoltaic array. The m output that is used to define the voltage, current and power of the PV array is fed to the Fuzzy MPPT after measuring the current and voltage that is the change in voltage and change is power.

The output of the PV array is given to the Fuzzy MPPT controller. In this controller the previous voltage values and power values are compared with the present voltage values and the power values. There are some errors are generated while comparing the values. The Fuzzy MPPT offered the voltage reference that is fed to the Boost converter. As the pulse is generated from the boost converter it is also used to fetch the maximum power that is applied after the Fuzzy MPPT controller. The output of the boost converter is fed to the 3-level bridge and the other input of the 3-level bridge comes from PWM. The three level bridge is used to convert the power from DC to AC. Afterward the output of the 3-level bridge is given to the panel. Inductor is used to balance the power and after that load is also applied in the circuit. After running the model it has to be checked that how much output is offered by the PV array or the PV array provides the exact output. To measure the output characteristics like voltage, current and power a panel is connected. Three outputs are obtained from this that is converter output, Panel Output and 2 outputs.

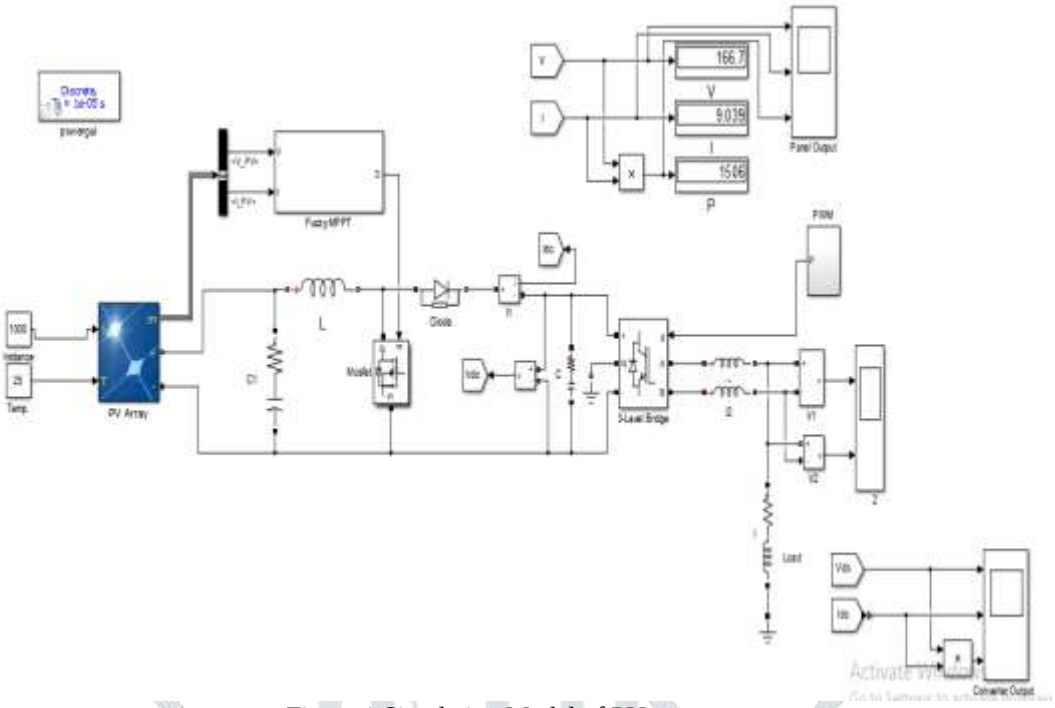

Figure 1 Simulation Model of PV array

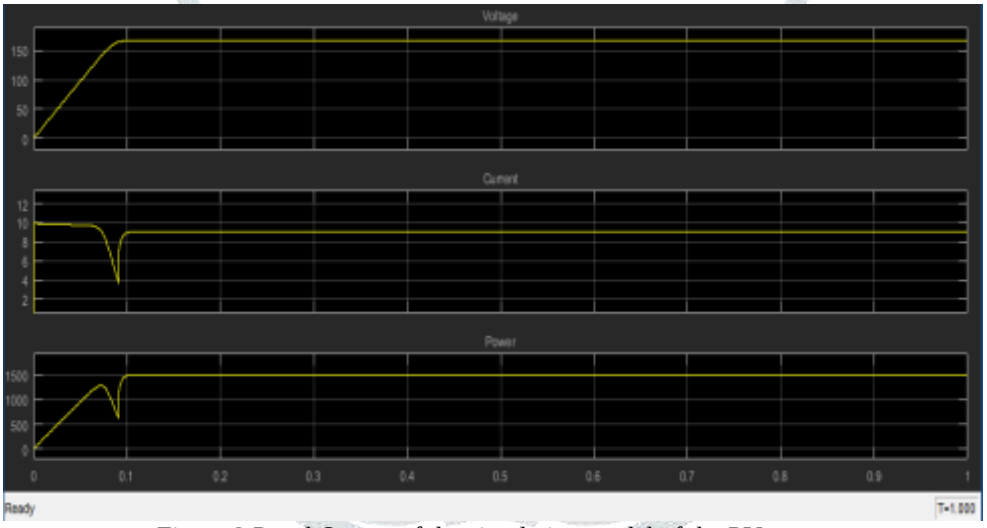

Figure 2 Panel Output of the simulation model of the PV array

The graph of Figure 2 Shows the Panel Output of the Simulation Model of PV array. This graph illustrates the P-V and I-V characteristic curves. When the irradiance is 1000 the voltage, current and power of the system that is shown in the graph is 166.7 V, 9.039 A and 1506 W.

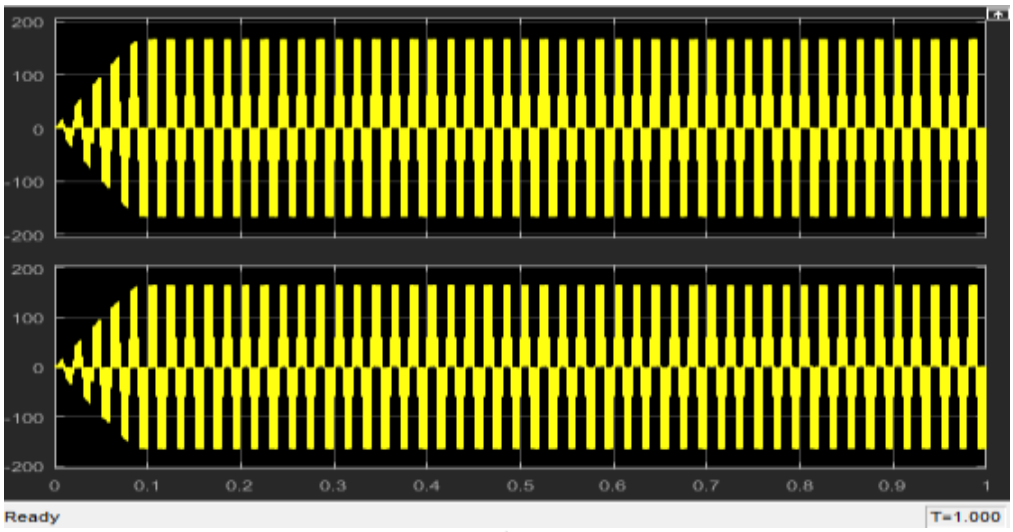

Figure 3 Main Output of the simulation model of the PV array

The graph of Figure 5.3 depicts the Main Output. This output is attained at the main panel of the simulation model of the PV array. Here the graph shows the amplitude of the current and the voltage with respect to time when the irradiance is 1000.

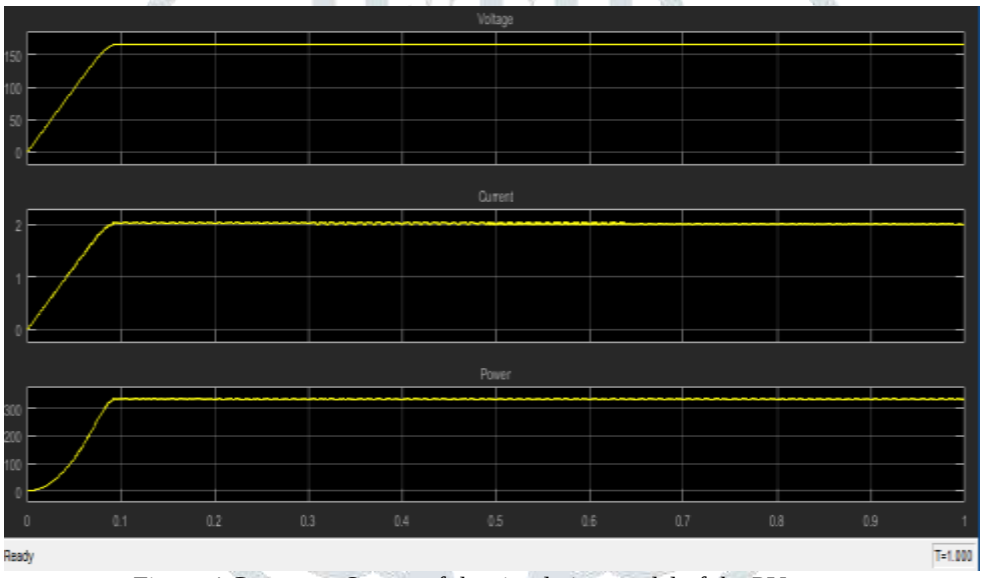

Figure 4 Converter Output of the simulation model of the PV array

The graph of Figure 4 illustrates the Converter output when the irradiance is 1000. The P-V and I-V characteristics are shown here in the graph in which the voltage is 175 V, Current is 2 A, and the Power is approximately 340 W.

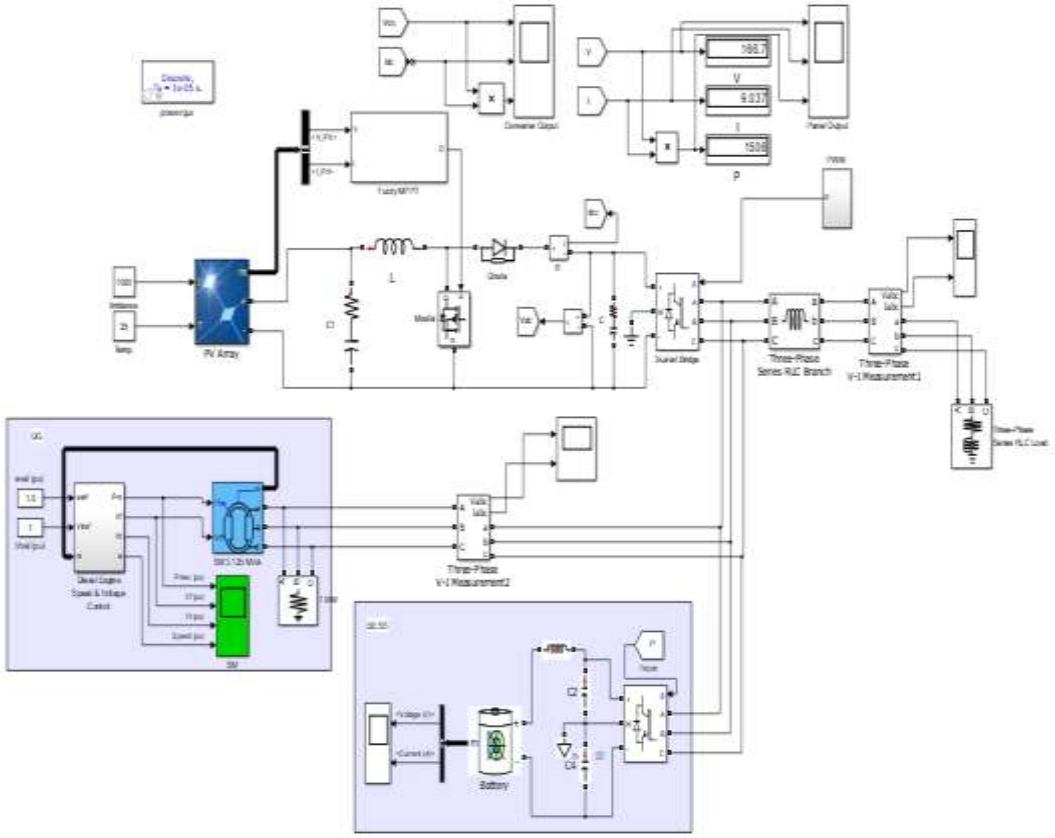

Figure 5 Simulation model of PV array using Diesel Generator and BESS.

The Figure 5 shows the simulation model of PV array using Diesel Generator and BESS. Through utilizing an alternator and a diesel generator generates the electricity. In this diesel generator the diesel fuel is used by the engine to operate. The power quality of the system is enhanced by the battery energy storage system. In several applications that are frequency regulation, grid stabilization, transmission loss decrease, diminished congestion, enhanced flexibility etc. the battery energy storage scheme have been utilized.

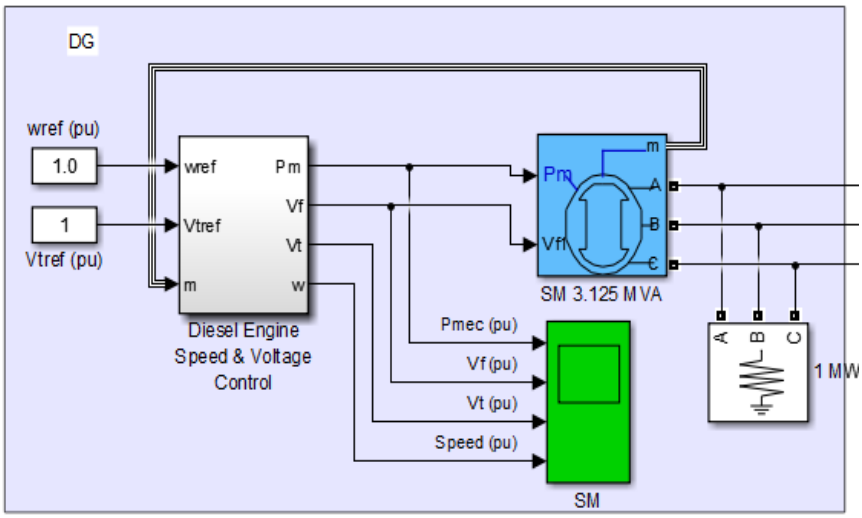

Figure 6 Diesel Generator Model

The Figure 6 illustrates the Diesel Generator Model. In this model the three inputs are given to the Diesel Engine Speed and Control that are Wref, vref and m. The output of the Diesel Engine Speed and Control is given to the SM and also to the SM 3.125 MVA.

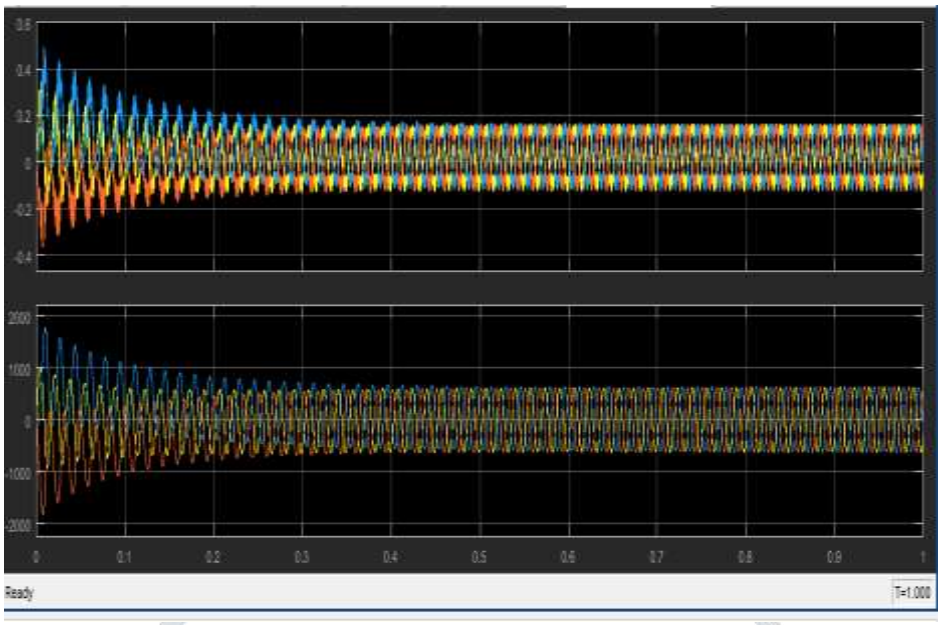

Figure 7 DG output

The graph of Figure 7 illustrates the Diesel Generator Output. This graph shows the output of the Diesel generator in which the Voltage and current varies with respect to time in phase 1 and phase 2.

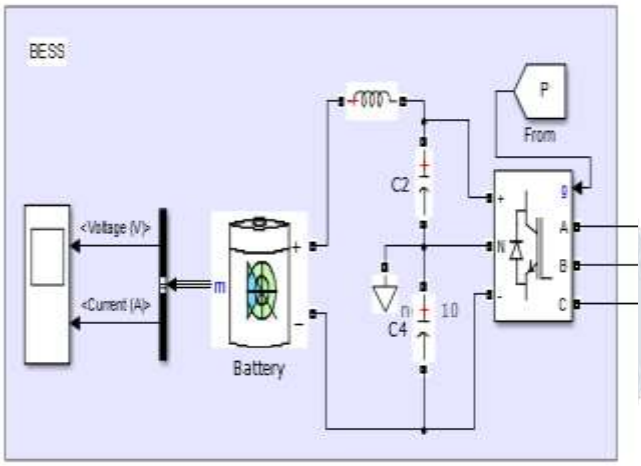

Figure 8 Battery Energy Storage System

The Figure 8 illustrates the Battery Energy Storage System. In this system three phase input is given to the three level bridge that is used to convert the signal from DC to AC. Afterward two capacitors are used and a inductor is also used in the circuit. A battery is also connected to the system. The voltage and current is measured that is produced by the battery and a panel is used. The power quality of the system is enhanced by the battery energy storage system. In several applications that are frequency regulation, grid stabilization, transmission loss decrease, diminished congestion, enhanced flexibility etc. the battery energy storage scheme have been utilized.

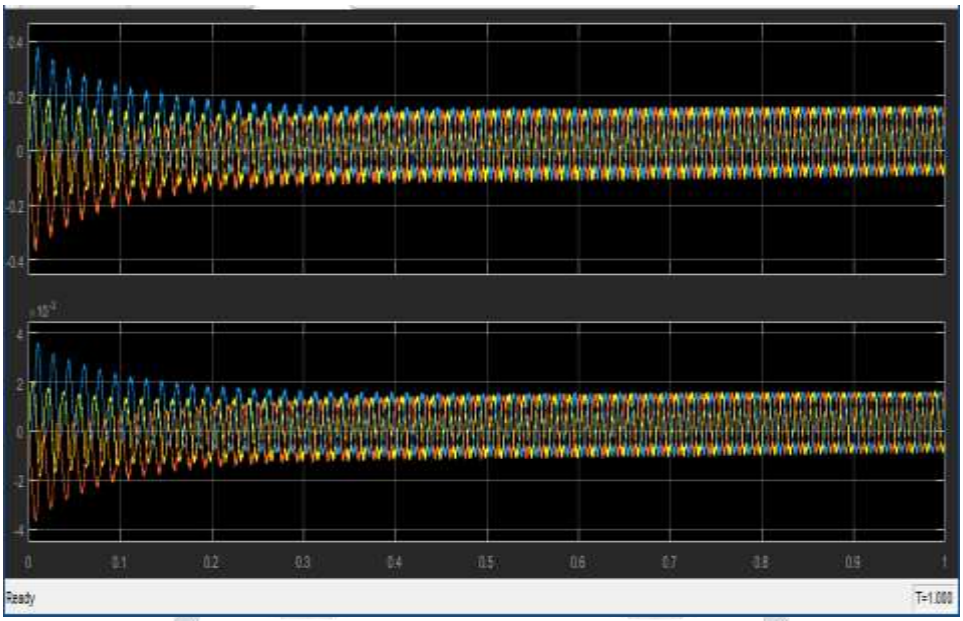

Figure 9 Panel Output of the Simulation Model of PV array using DG model

The graph of Figure 9 Shows the Panel Output of the Simulation Model of PV array using DG model. This graph illustrates the P-V and I-V characteristic curves. When the irradiance is 1000 the voltage, current and power of the system that is shown in the graph is 166.7 V, 9.037 A and 1506 W.

VI. CONCLUSION

By applying the MPPT mechanisms the maximum power is extorted of the PV module. The MPPT controller extorts values of the irradiance and temperature at a specific instant of time that is taken into an account. The efficient power is tracked through utilizing the various proposed mechanisms. The major demerit of the nearly all paradigms of MPPT is the slow tracking which concludes to decrease the effectiveness usage. In the conventional mechanisms the PO paradigm is utilized to track the power which needs adaptation as several improved mechanisms that can offer efficient outcomes. In this paper by utilizing the BESS and Diesel generator the problem of failing the solar system is conquered as well as the issue that the battery is failed is also conquered in this work. The capacity of the Power system is increased by using the Diesel generator. Hence, the efficient results are obtained comparative to the conventional mechanisms so the proposed mechanism is the better mechanism.

The Diesel Generator and the BESS are utilized for the generation of the energy in the projected work. They are used to enhance the operation of the mechanism. In Future Switching of the BESS and the Diesel generator can be done in order that the energy can be utilized when it is required. So in this way the energy can be saved.

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