Enhancing Efficiency of Hybrid Power Generation System Using Wind Energy and Solar Energy

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ABSTRACT: The hybrid energy system is the combination of two energy sources to give power to the load. For power to be used where it's generated so as to reduce transmission losses and costs. Reduced costs can be done by increasing the production of equipment. People should motivate the use of unconventional energy resources. It is very safe for the environment because it produces no emissions and noxious residual products, such as conventional energy resources. This proposed system has been integrated with the MPPT technique to achieve high efficiency in today's hybrid work. It is an efficient solution for generation. This proposed simulation will be done in MATLAB with care for all the parameters taken for this Simulink. This proposed system has been integrated with the MPPT technique to achieve high efficiency in today's hybrid work. It is an efficient solution for generation. This proposed simulation will be done in MATLAB with care for all the parameters taken for this Simulink.

Key Area: Solar Photovoltaic, Wind Turbine, Integration of Wind and Solar, Hybrid System, MATLAB etc.

I.INTRODUCTION

Electricity is most needed for everyday life. There are two ways to generate electricity, either through conventional energy resources or unconventional energy resources. The demand for electricity increases in terms both to meet the demand we have for generating electricity. Day-old electricity is generated by conventional energy resources such as coal, diesel, and nuclear. The main disadvantage of these sources is that it produces waste such as ash in coal-fired power plants, nuclear waste from nuclear power plants and to deal with this waste is very costly. And it also damages nature. Nuclear waste is also very damaging to the human being. Conventional energy resources are exhausted daily. It will soon disappear completely from the ground, so we have to find another way to generate electricity. The new source must be reliable, free of pollution and economic.

Unconventional energy resources should be good alternative energy sources for conventional energy resources.

1. Hybrid Energy System

The hybrid energy system is the combination of two energy sources to give power to the load. In other words, it can be defined as "The energy system that is manufactured or designed to extract energy by using two sources of energy is called the hybrid energy system." The hybrid energy system has good reliability, efficiency, low emissions and lower costs. In the previous system, solar and wind power is used to generate energy. The sun and the wind have good advantages over other non-conventional sources of energy. Both energy sources have greater availability in all areas. It takes a lower cost. There is no need to find a special location to install this system.

A. Solar Energy

Solar energy is that energy that gets through the sun's radiation. Solar energy is present on the earth continuously and abundantly. Solar energy is free. It does not produce gas to indicate that it is free of pollution. It is affordable. It has low maintenance costs. Only the problem with the solar system cannot produce energy in unfavorable weather conditions. But it has greater efficiency than other energy sources. It only needs initial investment. It has a long life and low emissions.

B. Wind Energy

Wind energy is the energy extracted from the wind. We use windmill for extraction. Its renewable energy sources. Wind energy needs lower costs for power generation. The cost of maintenance is even lower for the wind power system. Wind energy is present almost 24 hours a day. It has fewer emissions. The initial cost is also less of the system. Wind power generation depends on wind speed.

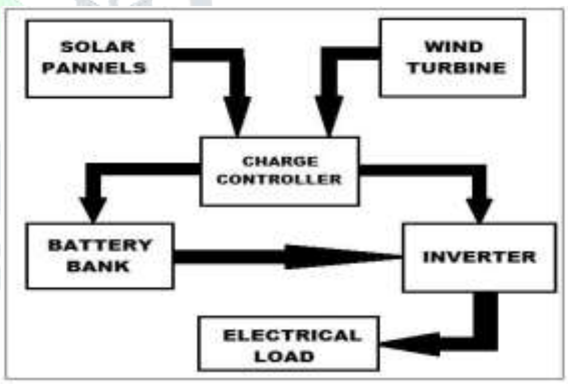

Fig.1: Block diagram of Hybrid energy generation system

Above figure shows the block diagram of the hybrid power generation system using wind and solar power. This block diagram includes following blocks.

- Solar panel
- Wind turbine
- Charge controller
- Battery bank
- Inverter

2. Perturb & Observe Algorithm

The Perturb & Observe algorithm states that when the operating voltage of the PV panel is perturbed by a small increment, if the resulting change in power P is positive, then we are going in the direction of MPP and we keep on perturbing in the same direction.

If P is negative, we are going away from the direction of MPP and the sign of perturbation supplied has to be changed.

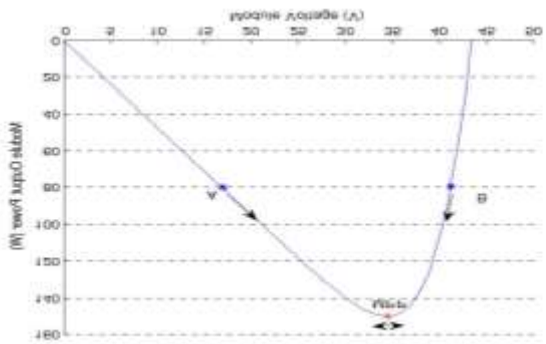

Figure 2: Solar panel characteristics showing MPP and operating points A and B

Figure: shows the plot of module output power versus module voltage for a solar panel at a given irradiation. The point marked as MPP is the Maximum Power Point, the theoretical maximum output obtainable from the PV panel. Consider A and B as two operating points. As shown in the figure above, the point A is on the left hand side of the MPP.

3. Implementation of MPPT using a boost converter

The system uses a boost converter to obtain more practical uses out of the solar panel. The initially low voltage output is stepped up to a higher level using the boost converter, though the use of the converter does tend to introduce switching losses. The block diagram shown in Figure 3.4 gives an overview of the required implementation.

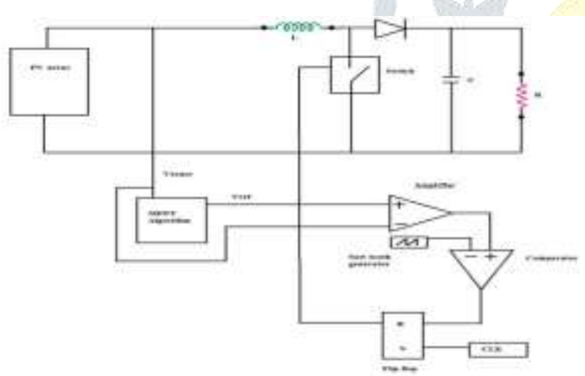

Fig 3.1 Simulation Work

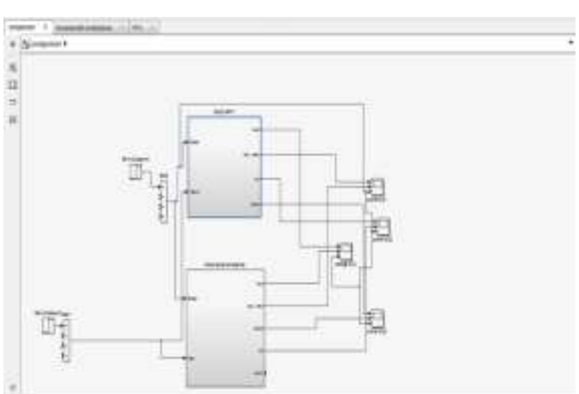

Fig 3.2: Comparison Model

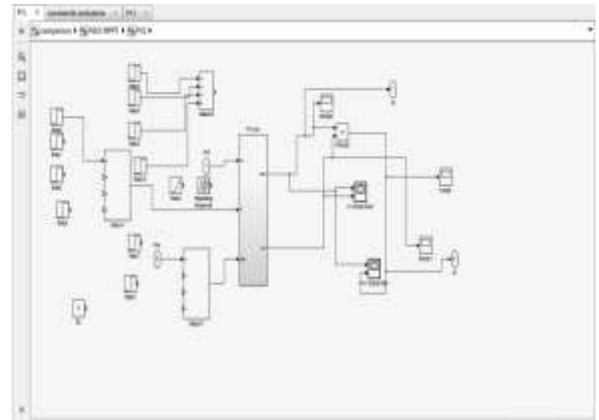

Fig 3.3: pv1

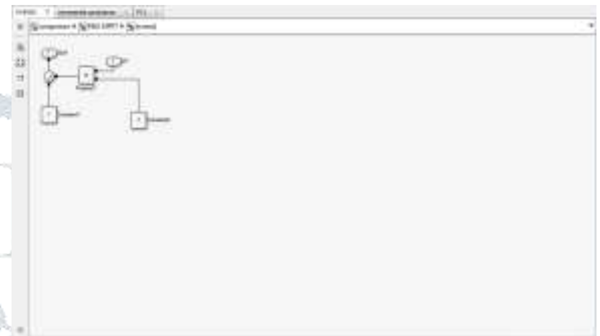

Fig 3.4: Inverse 1

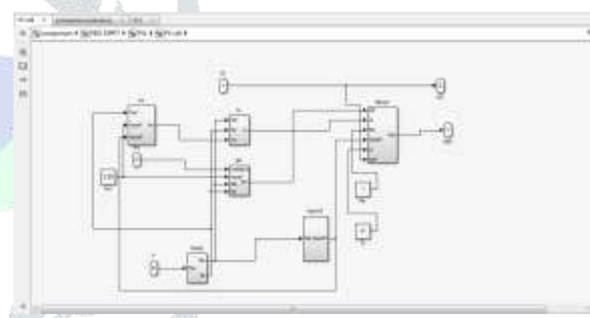

Fig 3.5: PV cell

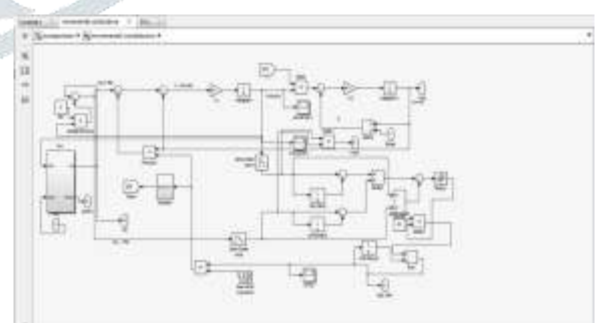

Fig 3.6: Proposed Incremental Conductance

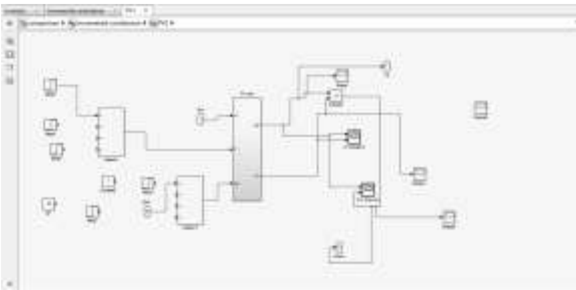

Fig 3.7: PV1

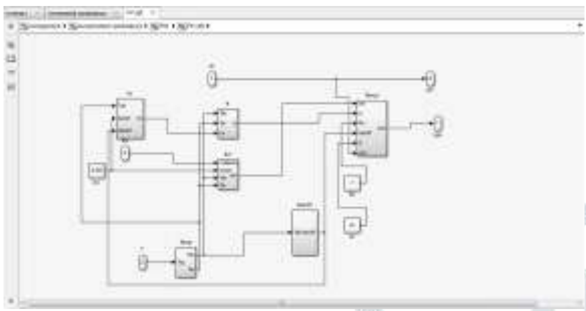

Fig 3.8: PV cell

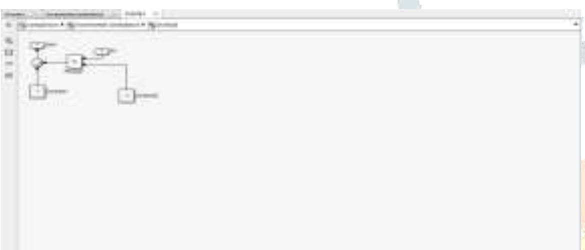

Fig 3.9: Inverse 1

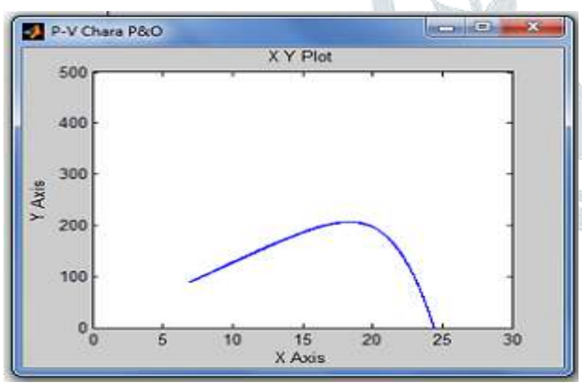

Fig 3.10: P-V Characteristics P& O

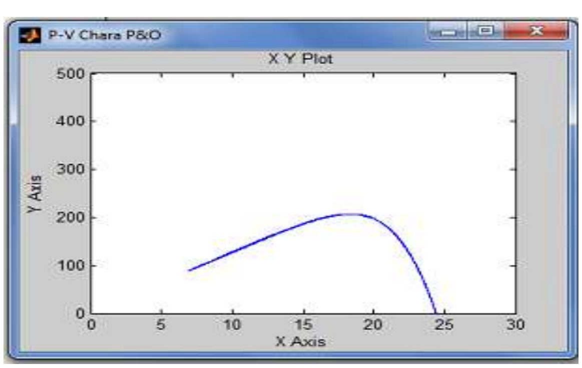

Fig 3.11: P-V Characteristics P& O

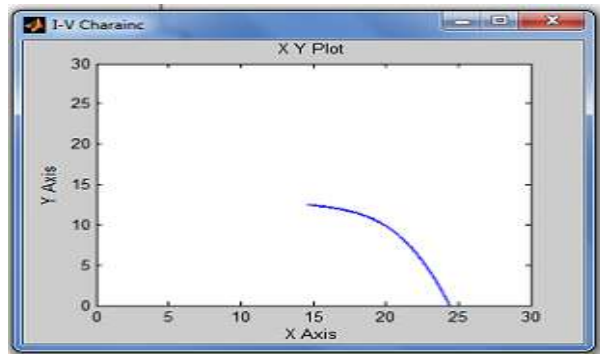

Fig 3.12 I-V Characteristics

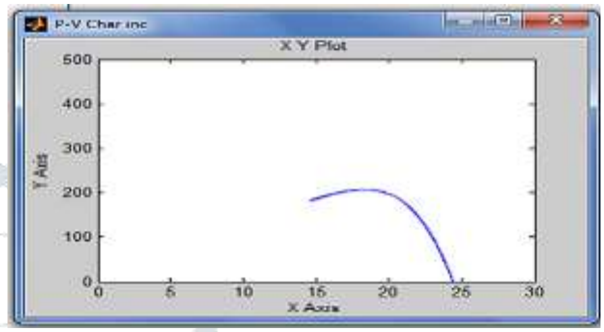

Fig 3.13: P-V Characteristics

Table 1: Comparison of different MPPT techniques

MPPT technique	Convergence speed	Implementation complexity	Periodic tuning	Sensed parameters
Perturb & Observe	Varies	Low	No	Voltage
Incremental Conductance	Varies	Medium	No	Voltage, current
Fractional Voc	Medium	Low	Yes	Voltage
Fractional I sc	Medium	Medium	Yes	Current
Fuzzy Logic Control	Fast	High	Yes	Varies
Neural Network	Fast	High	Yes	Varies

As shown in graph this research found very improve the efficiency of the solar panel as well eliminate the error due to change in irradiance. Here use of Perturb and Observe and Incremental Conductance method reduces the complexity and cost of implementation. As figure above shows the graphs come out after proposed simulation is so improved and the quotient point is very good.

4. Conclusion and Future Work

The model is simulated using SIMULINK MATLAB. p obtained in different fields were analyzed. The simulation was initially executed by switching to the MPPT mode, bypassing the MPPT block of algorithms in the circuit. It was observed that when we did not use an MPPT algorithm, the power gain in the load side was about 95 watts for a solar irradiation value of 87 watts per cm2. It should be noted that the photovoltaic panel generated a power of about 251 watts for this solar irradiation level. Conversion efficiency was therefore very low. The simulation was then run with the MPPT mode switch. This included the MPPT block in the circuit and the PI controller was powered by Vref calculated by the P & O algorithm. Under the same conditions of irradiation, the photovoltaic panel continued to generate a power of about 250 watts. In this case, however, the power obtained at the charging side was found to be approximately 219 Watt, thus increasing the conversion efficiency of the photovoltaic system as a whole. The power loss of the 251 available values generated by the photovoltaic panel can be explained by switching the losses to the high frequency PWM switching circuit and the inductive and capacitive losses in the intensity converter circuit. Therefore, it has been observed that the use of the Perturb & Observe MPPT technique has increased the efficiency of the photovoltaic system by approximately 127% from a previous output power of about 96 watts to an output power of about 216 watts.

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