CHAPTER 7

CONCLUSION AND SCOPE FOR FUTURE WORK

This chapter concludes the main contributions of this research work and also discusses the feasible future work.

7.1 CONCLUSION

Due to the growing demand on electricity, the limited stock and rising prices of conventional sources such as coal and petroleum, Photovoltaic energy becomes a promising alternative as it is universal, freely available, environment friendly and has less operational and maintenance costs. The Solar energy is a renewable, inexhaustible and ultimate source of energy. If it is used in a proper way, it has a capacity to fulfill numerous energy needs of the world. Moreover the need to depend less on fossil fuels and to reduce emissions of greenhouse gases, requires an increase of the electricity produced by RESs. This can be accomplished mainly by resorting to wind and photovoltaic generation, however introduces several problems in electric systems management due to the inherent nature of these kinds of RESs. Both are characterized by poorly predictable energy production profiles, together with highly variable rates. As a consequence, the electric system cannot manage these intermittent power sources beyond certain limits, resulting in RES generation reduction and hence the RES penetration levels are lower than expected levels. Here front-end DC-DC converter is required for conversion of energy from one stage to another and interfaced to grid/load through inverter topology.
The major contributions of the present research work are

- The present research work proposed a novel HHGI converter to control the battery mode of operation when integrated with the BLDC motor.

- Moreover, this work focused on reducing the number of semiconductor devices which would in turn reduce the Switching losses.

- The other contribution of the work is to minimize the rating of the surplus power storage battery.

- The proposed approach has been simulated in MATLAB. The proposed converter has been designed for efficient charging and discharging condition.

- For simulation of the proposed dynamic analysis of BLDC motor, PV panel is analyzed under different irradiation conditions such as 1000 Wb/m\(^2\) and 400 Wb/m\(^2\). The irradiation is varied from 1000 \(Wb/m^2\) to 400\(Wb/m^2\). The irradiation is maintained at 1000 \(Wb/m^2\) till 0.5 sec. Then irradiation is suddenly changed to 400 Wb/m\(^2\) at 0.5 sec to 1 sec and the corresponding waveforms of voltage, current and power are obtained.

- The result shows the PV Voltage till 0.5 second at 1000 Wb/m\(^2\) is observed to be 113 V where as at 0.5 sec, there is slight deviation and PV voltage is observed to be 150 V, but it suddenly settles constant from 0.6 second. It is observed that till 0.5 second at 1000 Wb/m\(^2\), PV current is maintained at
4.75 A whereas at 400 Wb/m$^2$, it is observed to decrease to 1.55 A from 0.5 sect to 1 sec. Thus the obtained PV power at 1000 Wb/m$^2$ is 540 W and 400 Wb/m$^2$ is 175 W respectively.

- Also the performance of the converter, battery response is analyzed under varying irradiation conditions.

- The result shows that the battery voltage maintained constant at 52 V as the proposed converter acts in the buck mode. At 1000 Wb/m$^2$ till 0.5 sec, the battery current is observed to be -3.2 A. Alternatively, at 400 Wb/m$^2$, from 0.5 sec to 1 sec, the battery current is observed to be +11 A. The battery effectively gets charged with 560 W from the excess input power.

- The response of the motor can be noted at the speed variation condition. From 0 to 0.5 second, the speed is maintained at 1500 rpm and after 0.5 sec, speed is decreased to 1000 rpm. The stator current is maintained constant 2.3 A till 0.5 second whereas the stator current is maintained at 2 A from 0.5 second to 1 second. The stator voltage is maintained at 60 V till 0.5 second at 1500 rpm where as at 1000 rpm the stator voltage is decreased to 40 V from 0.5 S to 1 second. For 1500 speed rpm, the $V_{dc}$ voltage is maintained at 200 V till 0.5 second, whereas at 1000 rpm, the voltage is decreased to 145 V.

- The simulation was done in order to evaluate the significance of the controllers (i.e. PI and Fuzzy), the results are evaluated for peak overshoot and undershoot response under varying conditions for PI and Fuzzy controllers. The Comparison of
the controller is mainly based on ST, POS and PUS respectively.

- The voltage response curve of the proposed converter is significant even with the variation in the irradiation condition. It can be noted that the reference voltage considered here is 200 V. It is observed from the simulation results that converter output voltage tuned by PI controller settles at 200 V with high POS and PUS with poor ST of 0.7 sec. However, converter output voltage tuned by FLC settles at 200 V with minimum POS, PUS and ST of 0.57 sec.

- The Motor Speed Response curve of the proposed converter can be noted that the reference speed of the motor is considered as 1500 RPM. The speed response of the motor is controlled by PI controller settles at 1500 RPM with high POS of about 1516 RPM and PUS of about 1480 RPM with poor ST of 0.7 sec. However speed response of the converter is tuned by FLC settles at 1500 rpm with minimum POS, PUS and ST. This is due to the fuzzy logic controller designed to apply the required control voltage that sent to the motor based on fuzzy rule base of motor speed error (e) and change of speed error (Ce).

- Also the torque response and the battery response of the converter are also evaluated. Hence the proposed system provides significant results in terms of settling time, peak overshoot and peak under shoot for the fuzzy controller.
7.2 FUTURE WORK

- The present research work can be additionally improvised through the implementation of various other intelligent controllers such as BELBIC, ANFIS, etc that help in minimizing peak overshoot, peak undershoot and settling time.

- Research work at present suggests that the novel HHGI converter analysis may be carried out with load side applications as in DFIG.

- The other future work would be to analyze sudden switching failures which can be compensated through auxiliary switches.