WIND POWERED MOTOR SYSTEM FOR TWO WHEELER VEHICLE APPLICATION

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ABSTRACT

The project deals with a design of low speed micro wind turbine powered electric vehicle for low speed and back up applications.t contains a micro wind turbine fan connected to a permanent magnet dc generator, a dc - dc boost converter, and a single-phase full-bridge inverter charging circuit ,lead acid battery on the generator side There is high torque AC motor connected through a speed control system to the wheel axle of the vehicle.A study of efficiency and power losses was conducted in regard with fossil fuel efficiency and amount of fuel saved during slow driving. Objective is to reduce air pollution during slow speed driving of vehicles.

Keyword: *wind power generation, battery power backup, inverter circuit, AC motor.*

1.INTRODUCTION

ThisSMALL-SCALEwind energy conversion systems have become a rising trend due to increased demand for green and secure electricity supply, especially in remote areas. As a result, more than one

Million units have been installed worldwide. Nowadays, more than 250 producers are marketing small wind turbines (WTs) that are usually limited to 100 kW power according to different national and international regulations. Small WTs with rated power up to 40 kW dominate the market; however, the average power of a small WT installed is about 1 kW .There are special feed-in tariffs introduced by many countries for small WTs that make micro WTs with rated power up to 3 kW an attractive solution for residential buildings and small communities in those countries .

It is based on isolated full bridge dc–dc converters that may not be an optimal solution for sub-kW power levels, or based on a single-ended converter that requires four stages of energy conversion, which, in turn, could result in limitations of efficiency.

2.PROPOSED SYSTEM

The fuel consumption of any vehicle is maximum when it runs at a minimal speed mainly during high traffic. Due to this the efficiency of the vehicle is affected with 30% losses.In order to restrict the fuel consumption the vehicle is run on the electricity stored in battery. The power is generated using a micro wind turbine setup which uses a permanent magnet synchronous generator. The generated power is stored in battery through a power conditioning unitWhen the vehicle is traversing on low at about 5km/hr to 25 km/hr the battery is switched on and vehicle starts running by consuming the power from battery.When the vehicle cruises at speed higher than 25 km/hr it is switched back to fuel contact and runs normally during which the battery is simultaneously charged by the micro wind turbine setup using the onward velocity of the wind .This reduces the fuel consumption and pollution.

3. BLOCK DIAGRAM

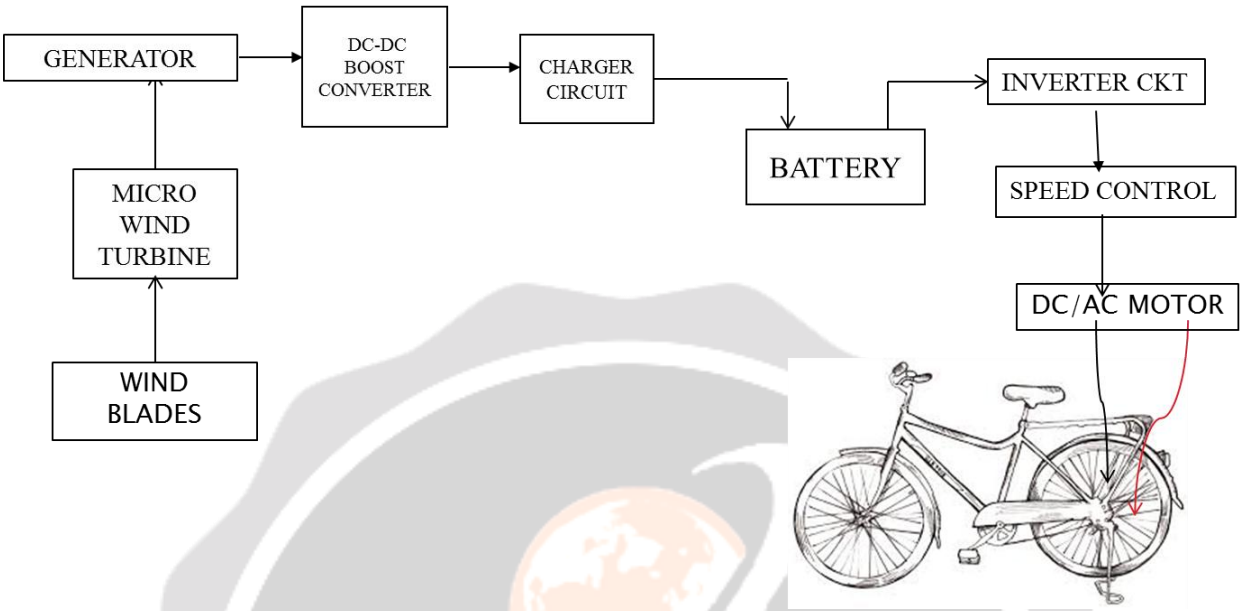

Fig-1 Block diagram of the proposed system

The figure 1 shows the block diagram of the basic design structure of the Wind power electric vehicle module .The power is generated through a micro wind turbine whose rotor is inturn connected to a PMSG generator. The generated voltage is which is of DC form is boosted through a DC-DC Booster circuit in order to increase the current, the boosted power is given to the charger circuit which has DC- AC inverter and a battery charging component. The DC-AC inverter converts the 12v dc voltage to a 220v dc supply and is fed to a motor with a rating of 0.1HP . The charging circuit limits the current and send a voltage of 12v and 1A current to the battery of rating 17AH for charging. The motor is connected through a chain sprocket gear system to the freewheel of the two wheeler.

4. HARDWARE COMPONENTS

The detailed description of the hardware design and the components used are as following

4.1 WIND TURBINE FINS

Fig -2wind blade fins

The figure 3 shows the typical wind turbine fins that are used for generation.The fins or blades of turbine is made up of thick plastic in order to reduce the weight. The fins have been selected corresponding to the force required to produce the required torque to rotate the rotor shaft of the dc generator. It is a known fact that the

rotational motion of the large fins in relation with the direction and velocity in accordance to the weight of the fin which acts as added momentum to the rotational force of the blades. These are designed to withstand very high speed and connected to the shaft of the generator. When the wind strikes the blades at required velocity, it rotates the rotor shaft connected through a rod which produces flux thus resulting in a rotational magnetic field producing electric power.

4.2 MICRO WIND TURBINE PMSG

Fig -3 . Steady State characteristics dependent of voltage

The micro-wind turbine used here is a Permanent Magnet dc generator. .The permanent magnet dc generator consists of rotating rotor connected to the wind blades. The stator is made up of permanent magnet the reason for use of permanent magnet type of stator is that it does not have to be excited externally through a source as it contains property of residual magnetism. The generator has aRating of output voltage range at 15v to 36v at a speed of 3000rpm to 9000rpm of the rotor shaft correspondingly. This can be obtained when the vehicle is moving at a velocity of 20km/hr to 60km/hr respectively depending on the velocity of the wind on to the fins.

***4.3* DC-DC Booster converter**

Fig-4 simple DC-DC Booster

A simple dc-dc boost converter is used in order to increase the voltage produced from the generator and is supplied to the battery. It is done in order to maintain the input voltage to the battery above 12v. The booster circuit consists of a combination of capacitor, inductor ,switches and diodes.A simple dc-dc boost converter is used in order to increase the voltage produced from the generator and is supplied to the battery. MOSFET switch is used to vary the duty cycle of the converter. Thus the booster has a rating as Input voltage of 3v-32v giving an Output voltage of 6v-50v correspondingly.

4.4. BATTERY

Fig-5 Lead-acid battery

The figure 5 shows a lead – acid battery .The lead acid battery used here is of rechargeable type .The purpose of this battery is to supply power to the motor through the inverter circuit and to store the power generated by the generator. The rating of the battery is 12v DC power supply with a battery backup of 17ah;.

4.5 INVERTER AND CHARGING CIRCUIT

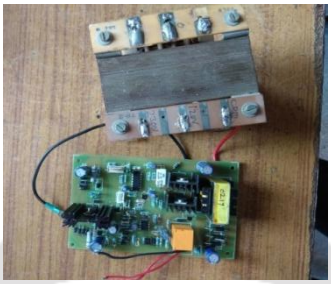

Fig -6 inverter and charging circuit

The above shown figure is the inverter circuit and charging circuit. This circuit is used to convert the 12v DC supply generated from the booster circuit to a 220v AC supply that will be given to the A inverter circuit is used to convert the potential stored in the battery to supply the motor. There is a charging circuit which limits the current supply given to the battery and keeps it constant to a particular value as per the battery capacity..It consists of :

- Voltage limiter
- Inverter circuit for DC- AC
- 12v -220v AC step up transformer

4.6. AC MOTOR

Fig -7 AC motor

The figure 7 shows the AC motor that is used to rotate the wheel axis of the vehicle.The motor is a series wound motor where the stator coils are conne00cted to the rotor windings through a commutator. This is being used in this is because of its high starting torque and high speed operations. The motor used here is both AC/DC motor it is a universal motor as it has a commutator but here the supply given to the rotor is 220v AC by means of an inverter circuit. The parameters of the motor is it requires 220v AC supply with a current of 0.75A , it has a rated speed of 6000rpm it requires an input power of 0.1HP.

4.7. HARDWARE SNAPSHOT

Fig-8 Hardware Snapshot

5. CIRCUIT DIAGRAM

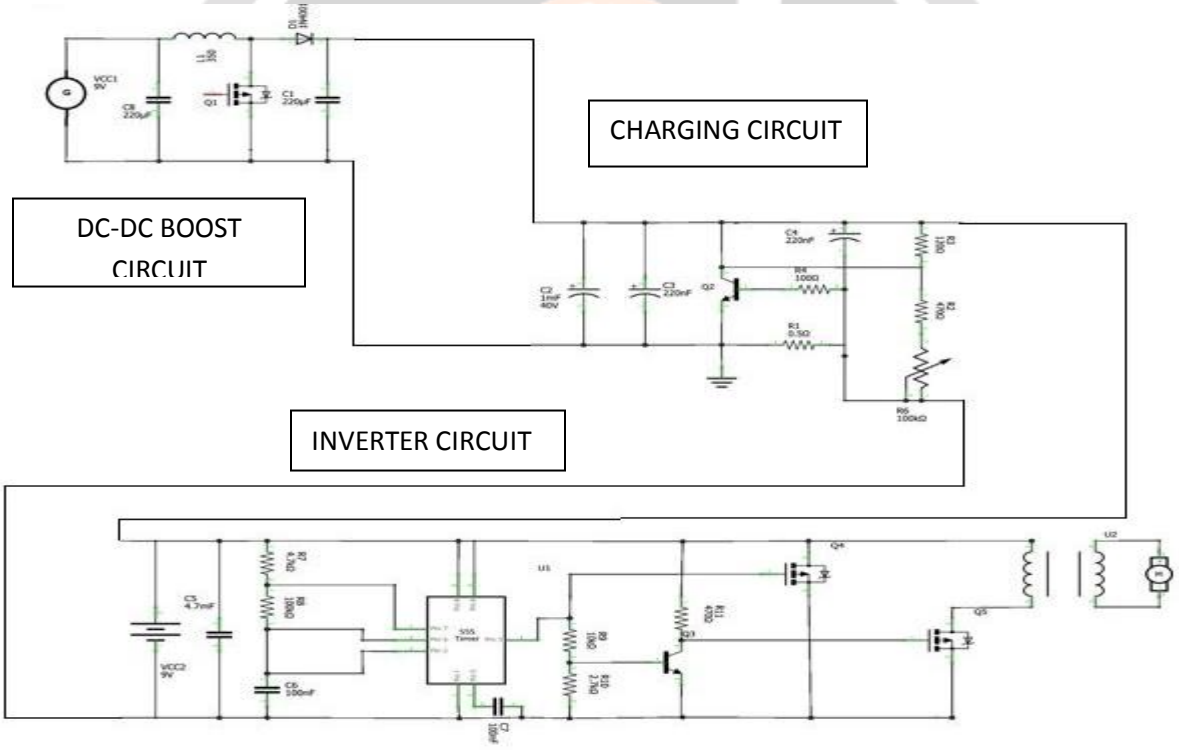

Fig-8 simple circuit diagram of the model

The figure 8 shows the simplified circuit diagram of the wind powered electric vehicle model .The model consists of three main circuit components .The DC-DC booster circuit, charging circuit and inverter circuit. Ina ll these circuits non- linear elements and linear elements are used.

6. CONCLUSION

Thus a wind powered vehicle was designed and developed to meet the requirements of energy field. The hardware was developed and calibrated to thecurrent needs. It is inferred that this system is more advantageous than the existing systems and there is a greater scope in the near future. This system is one of the best way to use renewable sources of energy in an efficient and reliable manner. The major advantages of this system are High

efficiency, Partially Eco-Friendly, Design is simple, it has High reliability. Although this system has various advantages the disadvantages should also be considered. Few of the major disadvantage is this system are cost is high, increased weight, requires regular maintenance.

The renewable energies are going to be the major source for power generation and utilization. This setup will be a great turning point in the field of renewable energy engineering and automobile engineering which provides more reliable and efficient vehicles to the future generation where fossil fuels will be under great demand. The future modifications that can be done according to our knowledge are the HP of the motor can be increased, low RPM, high battery backup capacity providing high initial torque in order for initial movement and to pull heavy weights

7. REFERENCE

1. Alexandros D. Alexandrou, Antonios G. Kladas, (2016) 'Integration of electric vehicles into the electricity grid for maximum utilization of wind energy', Power Generation, Transmission, Distribution and Energy Conversion MedPower.

2. Dixon, P.D. (2015) 'Design of a Micro-Wind Turbine for Implementation in Low Wind Speed Environments', James Madison University, Drumhedp, pp 125-130.

3. Haoran Fang, (2017) 'Lithium-ion battery charging strategy for electric vehicles based on particle swarm optimization method', Chinese Automation Congress (CAC).

4. Klaus Boettger, (1987) 'An Analytical Description of Lead Acid Battery Recharging Procedures', Darmstadt Germany (FRG), pp 103-107.

5. Nikhil Hatwar, (2013 'Design Approach for Electric Bikes Using Battery and Super Capacitor for Performance Improvement', International IEEE Annual Conference on Intelligent Transportation Systems, India, pp 1959-1964.

6. Pan Hua, Liang Zuo-fang, and XueQiang-zhong, (2017) 'Economic dispatch of power system including electric vehicle and wind farm' Energy Internet and Energy System Integration (EI2)
.
7. Pellitteri, F., (2013), 'E-bike battery charging: methods and circuits', Department of Energy, Information engineering and Mathematical models, 44 University of Palermo, vialedellescienze, building 9, 90128, Palermo, Italy, pp 107-114.

8. Pier Francesco Spagnol, (2013) 'Self-sustaining Strategy for a Hybrid Electric Bike', American Control Conference (ACC) Washington, DC, USA, pp 3479-3484.

9. Sanjay D. Nikhade, (2017) 'Design of an airfoil for low wind horizontal axis micro wind turbine', 2nd International Conference for Convergence in Technology (I2CT), India, pp 850-853.

10. Sarath Mohan, (2013) 'Economically Viable Conversion of a Pedal Powered Bicycle into an Electric Bike', International Conference on Electrical Machines and Systems, Busan, Korea, pp 450-453.

11. Su-Huei Chang, Qi-Hong Lim, and Kuo-Hsin Lin, (2014) 'Design of a Wind Energy Capturing Device for a Vehicle', Intelligent Systems, Modelling and Simulation (ISMS).

12. Zhou, X.Q, L.L. Ling, and J.M. Ma, (2015) 'The design and application of an unmanned surface vehicle powered by solar and wind energy', Power Electronics Systems and Applications (PESA).