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Wind Energy Based on Board Charging System for Electric Vehicles

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***Abstract*: Vehicles had become a part of our lives and their use has risen up to the sky in few years. The fuel combustion engines are now being replaced with electric motors that use batteries for propulsion. These vehicles have brought major advantages than the fuel driven vehicles to the environment and also the human race. The main idea of our project is to bring a power source that uses wind energy to recharge the battery in the vehicle. This can be done using a wind turbine mounted on the same vehicle's framework to minimize weight and not disturb the torque. The circuit used for charging the batteries grab the voltage from the rotating wind turbine. To prevent effects in discharge, this circuit is capable of recharging the batteries one by one. This recharging system can recharge the vehicle's batteries once they fall below the threshold level and keep us on the run instead of searching for a recharging station around us.**

***Keywords*: Turbine, Battery, Electric motor, Fuel combustion engines.**

1. Introduction

An electric vehicle (EV), also called electrics is a vehicle that uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels, fuel cells or an electric generator to convert fuel to electricity. EVs include, but are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft.

Government incentives to increase adoption were first introduced in the late-2000s, including in the United States and the European Union, leading to a growing market for the vehicles in the 2010s. And increasing consumer interest and awareness and structural incentives, such as those being built into the green recovery from the COVID-19 pandemic, is expected to greatly increase the electric vehicle market. A pre-COVID 2019 analysis, projected that Electric vehicles are expected to increase from 2% of global share in 2016 to 22% in 2 2030. A 2020 literature review, suggested that growth in use of electric vehicles, especially electric personal vehicles, currently appears economically unlikely in developing economies.

With all these concerns we are proposing a system to automatically recharge the battery of electric vehicles using wind energy which can have a better efficiency while travelling. Thus, reducing the cost of recharging the batteries throughout the journey also It do not increase the weight of the electric vehicle at greater extend.

Thinking of an efficient and eco-friendly mode of recharging with renewal energy is much more appreciable than comparing with that of the fuel vehicles. Bringing the eco-friendly vehicles is the main theme of Electric vehicles whereas giving the best renewable source of recharge method by harvesting wind energy while travelling is the ideology of the project.

2. LITERATURE SURVEY

[1] The paper describes the hybrid renewable sources, for instance, the wind generator and the photovoltaic modules utilized to produce power to recharge the electric vehicles (EVs) storage system automatically. The output voltage of the wind turbine is measured for three dissimilar speed scenarios. The performance of the solar photovoltaic had undergone different irradiance levels in the analysis. A series of studies have been carried out for the developed model of ACM under different load conditions. It uses both solar and wind energy for generation of electricity. Our proposed system is more effective and cost efficient.

[2] Mass adoption of electric vehicles (EVs) is contingent on the availability of charging infrastructure. An alternative approach is the dynamic re-deployment of drive train components for charging when the vehicle is stationary. This work proposes an on-board single-phase charger that re-uses the traction inverter and motor. Our proposed model is an on-board charging method which does not involve complex deployment and independent of charging stations.

[3] This paper proposes a voltage-source converter for an on-board Electric Vehicle (EV) charger which is compatible with both the single- and three-phase (1-ϕ and 3-ϕ) grids. The classic 3- ϕ active AC-DC rectifier circuit is used for both the 1-ϕ and 3-ϕ connection, but a new control scheme and LCL filter are designed to address the double-line frequency power pulsation issue caused by a 6 1-ϕ grid without using bulky DC capacitors. As it uses both single phase as well as double phase for energy conversion, it is a complex method and our proposed system is more effective and efficient.

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3. Block Diagram

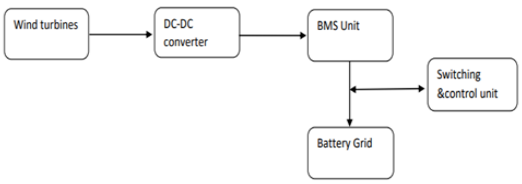

Fig. 1. Block diagram

(a) – Input: 3 Wind turbines generating 14.5V, 1.2A at 4000RPM each, (b), (c) – Control Area: Regulates DC and switches the circuit as required, (d) – Output: 13V, 3A to charge LiFePO4 battery grid of 12V, 18A capacity.

4. Working

The wind turbines are mounted in the vehicles at different parts to obtain maximum efficiency. The wind turbines produce current once the vehicle starts to travel over a certain speed, while the converter circuit is used to convert the current and voltage from wind turbines to supply the battery. The circuit helps boosting the current if required. Also it stabilizes the output range of voltage and current as required.

The Battery Management System is used to recharge and discharge the batteries efficiently. The input current is adjusted and supplied through BMS from the converter circuit. The BMS handles the recharging mechanisms with four stages of charging and the required voltage and current for each stage of charging is adjusted by BMS and the efficiency of recharging the batteries is maintained.

Steps involved are given as,

- Wind turbine to DC-DC Converter through rectifier circuit.
- Conversion of input voltage and current as per Battery grid parameters.
- Filtering the output from converter.
- Control unit (with PIC12f675) Switches the battery to be charged (based on battery level)
- After switching the battery to be charged the power is supplied to the battery through BMS.
- The BMS controls the current and voltage range for the battery.
- Once the battery is recharged or reaches the threshold level it alerts the microcontroller to switch the battery to be recharged.

5. Output and Graphs

Table 1
Output Power when air density ρ = 1.1839 kg/m^3 [the air density is considered at 30°C]

Speed in RPM	Power in Watts
4500	18
4000	17.4
3500	16.8
3000	16.2

Table 2
Output Power when air density ρ = 1.2041 kg/m^3 [the air density is considered at 20°C]

Speed in RPM	Power in Watts
4500	18.2
4000	17.6
3500	17
3000	16.4

Table 3
Output Power when air density ρ = 1.1644 kg/m^3 [the air density is considered at 30°C]

Speed in RPM	Power in Watts
4500	17.8
4000	17.2
3500	16.6
3000	16

6. Implementation of the Design in the Electric Vehicle

Fig. 1. Placement of designed circuit and battery

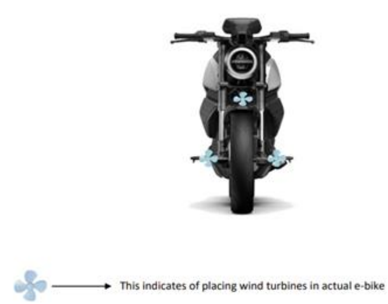

Fig. 2. Mounting wind turbines

7. Conclusion

Overall, the proposed system is eco-friendly and the most efficient way of producing electricity for the electric vehicles. Wind energy in particular is seen as an effective method of power generation and also renewable. Thus, reducing the cost of recharging the batteries throughout the journey also It do not increase the weight of the electric vehicle at greater extend. Home and office charging are dominant charging forms.

Also the needs of disabled people have to be considered when installing public charging points. Challenges here are, among other things, that several private and public actors are involved. Standardized and more user-friendly rules are required for parking and payment at public charging stations.

This means that electric vehicles are considered as part of the energy system. In this way, locally produced electricity (wind power) can be stored in the batteries of the electric cars and if demanded reinserted into the grid. This can balance irregular local production of electricity and also effect imbalances of the grid in general.

8. Future Scope

The coming decade is expected to be the decade of the fully electric vehicle. Countries around the world are waking up to the potential of emobility. While China is incentivising e-mobility with tax breaks, EV credit policies, research subsidies and more, countries like the UK, France, Norway and India are looking to adopt e-mobility at a larger scale, having expressed the desire to phase out petrol and diesel engines entirely in the coming decades.

India has a lot to gain from the widespread adoption of e-mobility. Under the Make in India programme, the manufacturing of e-vehicles and their associated components is expected to increase the share of manufacturing in India’s GDP to 25% by 2022. On the economic front, large-scale adoption of electric vehicles is projected to help save $60 billion on oil imports by 2030 - currently 82% of India’s oil demand is fulfilled by imports. Price of electricity as fuel could fall as low as Rs 1.1/km, helping an electric vehicle owner save up to Rs. 20,000 for every 5,000km traversed. Finally, electrification will help reduce vehicular emissions, a key contributor to air pollution which causes an average 3% GDP loss every year.

All these electric vehicles rely on the charging stations and electricity. India' power demand has been registering record highs in January and had touched 187.3 GW on 22 January and 185.82 GW on 20 January respectively. India had recorded a peak demand of 168.74GW in FY19. The proposed model will definitely aid the situation. As we rely on nether electricity or charging station. It can be seen as an independent vehicle.

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