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Design And Development of Vertical Axis Turbine for Charging Moving Electrical Automobile using Wind Energy

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Abstract - *The electric vehicle is a storage of a battery unit includeds various chemical properties which is used to supply the strength to form a chemical energy that creates the electrical powered energy and makes easier to force the vehicle forward. In short the battery is a device which powers the electric vehicle to run at immense torque. Since the battery drains at higher speeds due to more power consumption and it affects the driving range of electric vehicle compared to IC Engine. As there is issue while charging which takes almost 1-2 hours using DC charger which is not affordable to the consumer. To overcome these issue the idea to introduce the turbine is used which can easily charge the moving electric motorvehicle with a simplistic design and cost effective manner. The main advantage will be the driving range will be increased by some amount than the existing electric motorvehicle and that will lead to renewable energy. To produce this renewable energy the VAWT turbine is used to convert wind energy to electrical energy.*

KeyWords: Electric Motor, VAWT, Battery, Renewable Energy

1. INTRODUCTION

The electric vehicles were introduced in around 1832 since then with there has been more advancement and ultramodern technology the electric motorvehicle has taken a major stand in the automobile market. The main focus of manufacturers was to reduce the emission and overcome the drastic climate change due to global warming. The pollutants like carbon monoxide, nitrogen has changed the environment which affected the living beings. The task for the automobile manufacturers was to arrest the pollutants present in the environment and produce clean and green energy. Since then there has been major changes made in the electric motorvehicle. There has been many research and advancement going on to increase the driving range of electric motorvehicle, also the electric motorvehicles which are mostly highly priced due to less availablity of parts and resources and however the consumer cannot afford the electric vehicle. Various government policies and incentives have been given to promote the electric vehicles and create a large market of electric motorvehicle which will lead to less noise pollution and air pollution compared to IC engine. There are various types of electric vehicles like available in the market like (BEV),Hybrid vehicle(HEV).Several aspects are considered for the electric vehicle like:

1.1 ENVIRONMENTAL EEFFECT

As IC engine generates more pollution than the electric vehicles several norms have been changed to overcome the drastic change in the climate. Electric vehicles are more effective with less air pollution and noise pollution and it generates clean energy.

1.2 PERFORMANCE

The electric vehicle has high power to weight ratio and can also create higher torque without any effort from zero. Due to fixed gear ratio the electric vehicle does not have clutch. the electric motorvehicles are lighter in weight which also have a good pickup than IC engine.

1.3 STABILITY

The electric vehicle have good stability and control which reduces the risk of accident which is caused due to loss of control.

2. PROBLEM STATEMENT

Design And Development Of Vertical Axis Turbine for Charging Moving Electrical Motorcar using Wind Energy.

3. PROBLEM DEFINITION

The automotive industry majority depends on Electric Vehicles due to the main factor of reducing the pollutants that are emitted from the IC Engine vehicles. The design is well defined on increasing the driving range using vertical axis wind turbine and giving maximun efficiency to electric vehicle.

4. OBJECTIVE

- To develop and design the Vertical Wind axis turbine for more power generation.
- To increase driving range of moving electric vehicle using wind energy.

5. CALCULATIONS

- **Selection of Airfoil:**

NACA 64XX

Length of Cord=125mm

Cl=1.4

Cd=0.08

- **Wind turbine design parameters :**

Swept Area:

Area=Diameter*Height

=0.125*0.15

=0.01875 m^2

Tip Speed Ratio:

Optimal Tip Speed Ratio= $\frac{4\pi}{n}$

$= \frac{4\pi}{5}$

=2.51

Power Coefficient(Cp):

power coefficient Cp=0.531

Slip or slide Number:

S= $\frac{C_L}{C_d}$

S=$\frac{1.4}{0.08}$

S=17.5

Profile efficiency:

$\eta_{profile} = 1 - \frac{\lambda}{s}$

=0.8571

=85.71%

Power Generated:

$Ps = \frac{1}{2} * Cp * \rho * A * V^3$

=0.369KW/Turbine

6. WORKING METHODOLOGY

- Turbine is a device which converts wind energy into mechanical energy and then to electrical energy.
- The application is to generate for power from the turbine to charge moving electric vehicle and extend range of EV's.
- The NACA 64XX profile was selected for design of turbine with thinner blades and slightly higher tip ratio.
- The bearings selected are as per ISO standards for wind turbine.
- As the turbine rotates at higher speed the power generation will be more which eventually charges the electric vehicle.
- In this way the VAWT was designed for charging moving electric vehicle.

7. DESIGN

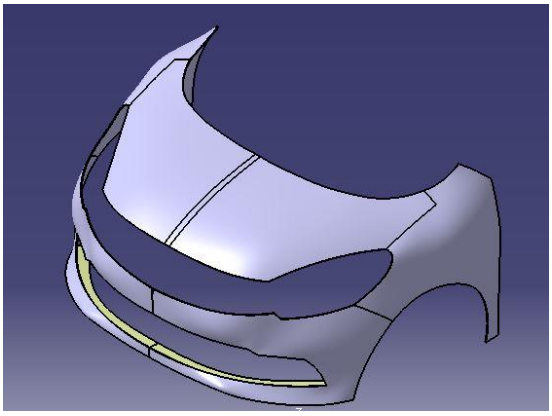

Fig-1: CAD model of Car body

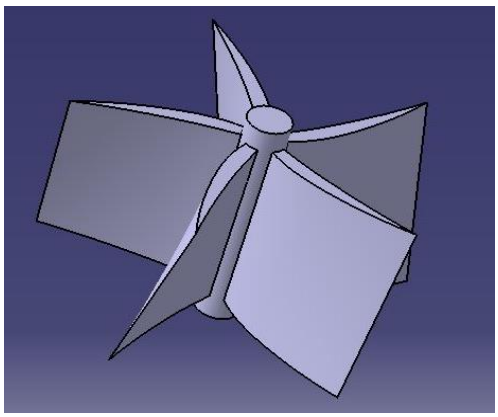

Fig-2: CAD model of VAWT

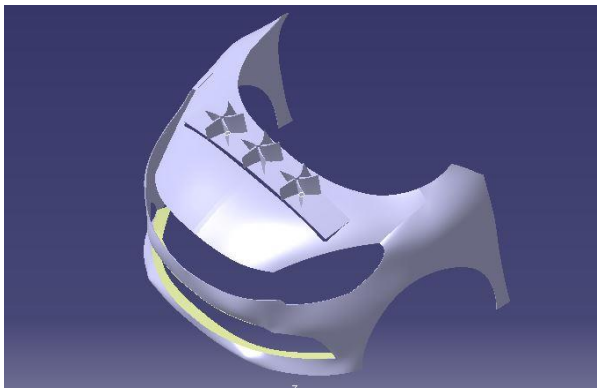

Fig-3: CAD model of Assembly

8. ADVANTAGES

- Maximum efficiency of turbine for charging electric vehicle.
- Smaller the no. of blades faster the turbine will rotate for more power generation.
- Easy maintanence and cost effective.
- The addition of Turbine may be effective for more power generation.
- Placement of turbine in the high flow area will effectively charge the battery.
- Increasing the driving range of moving EV's

9. DISADVANTAGES

- The turbine at higher speed can lead to catastrophic failure.
- Less no. of turbine will give minimun power generation.
- There will be no power generation in tight moving traffic situation.

10. FUTURE SCOPE

- The selection of the material for VAWT will be required for maximum efficiency.
- Analysis of turbine at higher speed should be done to calculate actual energy generated.
- Analysis of VAWT to avoid catastrophic failure to be done using analysis software.

11. CONCLUSION

The proposed design of the battery charging system is able of producing the needed power affair that's needed for charging the batteries that's being used in the Electric Vehicles in an effective manner. Indeed though this system depends substantially on the vehicle speed that varies all the time, the system is suitable to produce constant power continuously so that the battery charging is continued.

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