Design and Development of prototype for harnessing wind energy using moving traffic

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Abstract

The rapid transportation of heavy-duty vehicles on our highways all day is a clear proof of the hellish desire to consume society. This rapid transport of such heavy vehicles drags and creates the subsequent rapid wind on the surface of the highway. These fast winds generated on the highway may be trapped and then used in another possible form of energy, just as the kinetic energy of natural high-speed winds across high altitudes is captured by wind turbines and used for large-scale power generation. This study provides estimates and possibilities for this wind power generation.

Keywords: Energy harvesting, Wind Energy, Traffic movement

1. Introduction

Renewable energy is electricity supplied by wind, solar, geothermal energy, hydropower, and various forms of biomass. These sources were created because of their continuous supplies and availability from time to time. Due to the depletion of conventional power generation methods and the increasing adverse impact on the environment, the popularity of renewable energy sources has recently increased significantly. This popularity has been supported by cutting-edge research and breakthrough technologies that have been introduced so far to help make effective use of these natural resources. It is estimated that renewable energy sources may contribute about 20% to 50% of energy consumption in the latter part of the 21st century. The World Wind Energy Association estimates that by 2017, global energy is expected to exceed 5% from wind energy.

The energy market combines the recovery of the crisis and strong industry vitality. By 2040, energy consumption is expected to increase by more than 28%. The result of this strong growth is that, on the one hand, the energy needs of industrialized countries are increasing. The oil, gas, coal and electricity markets also follow the same trend. On the other hand, China and India have no signs of slowing down and continue to have strong demand for various forms of energy.

2.Scope

In view of this fact, we mainly rely on non-renewable resources, and they are depleting at a very rapid rate. In addition, the world lacks electricity. In addition, toxic waste from traditional sources such as coal and diesel is also a major crisis. For these reasons, we are trying to incorporate more renewable energy sources (such as solar energy, wind energy, etc.) into the grid to support the growing electricity demand. These renewable energy sources are long-term energy, and only the cost of capital is worth paying attention to.

Nowadays, vehicle density grows at a very fast rate, and due to the development of road transportation facilities, such as the development of highways and national highways, vehicles move at extremely fast speeds. It can generate large amounts of wind energy through moving vehicles on these highways.

3.Concept

The main goal is to use the maximum wind energy of cars driving on the road.

Unused and significant amounts of wind are used to drive vertical axis wind turbines, which will use the kinetic energy of the wind to generate electrical energy.

Incorporate more renewable energy into the power system.

Design a new method for generating electricity using wind energy generated by moving vehicles on freeways.

Develop an independent system to power the highway.

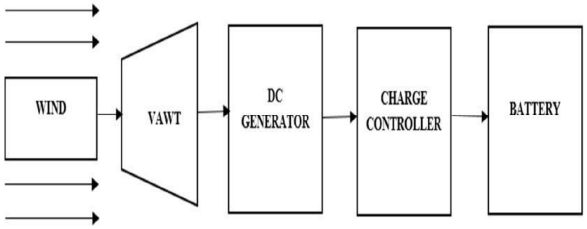
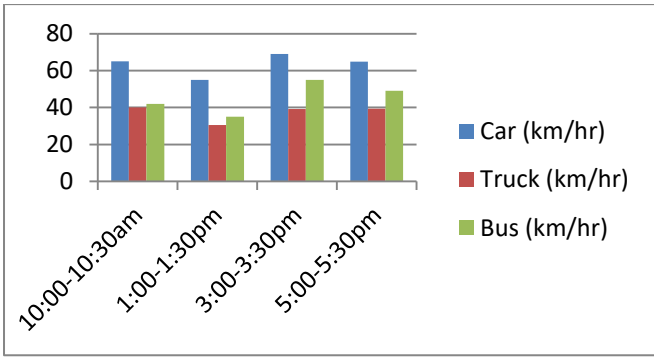


Fig. 1-Process Block Diagram.

Table 1- Chart Speed vs Time



4. Calculation

Velocity of wind turbine

$$Vw = \left[\frac{mv}{mw + dp\pi hR^2}\right]^{1/2} Vv$$

mv = 1200 kg , mw = $1.3 Kg/m^3$, dp = 0.01 Kg/m^3, R = $150 * 10^{-3}$ m , h = 0.450m

Vv = 80 Km/hr

Where,

mv = mass of vehicle

mw = mass of air

dp = pressure drop

R = radius of blade

h = length of blade

Vv = Avg velocity of vehicle

Vw = velocity of wind turbine

Vw = 6.6 m/s = 23.76 Km/hr

Power generated by turbine

$$P = \frac{1}{2} c_p \rho A V_w^3$$

P = $\frac{1}{2} * 1 * 1.33 * 0.135 * 6.60$

P_w = 0.54 KW

Table 2 Result Table for Different speed

(Km/h)	(Km/h)	Power (kW)	(Km/h)	Power (kW)	(Km/h)	Power (kW)
Value of K→ **K=0.1**			**K=0.01**	**K=0.001**		
0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	19.72	232.09	1.97	23.21	0.20	2.32
20.00	39.44	1856.69	3.94	185.67	0.39	18.57
30.00	59.17	6266.33	5.92	626.63	0.59	62.66
40.00	78.89	14853.53	7.89	1485.35	0.79	148.54
50.00	98.61	29010.81	9.86	2901.08	0.99	290.11
60.00	118.33	50130.67	11.83	5013.07	1.18	501.31
70.00	138.05	79605.65	13.81	7960.57	1.38	796.06
80.00	157.78	118828.26	15.78	11882.83	1.58	1188.28
90.00	177.50	169191.02	17.75	16919.10	1.77	1691.91
100.00	197.22	232086.45	19.72	23208.64	1.97	2320.86

5.Design & Analysis:

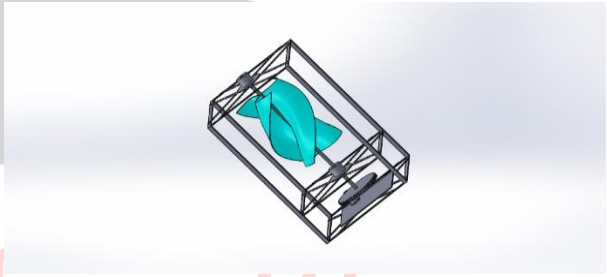
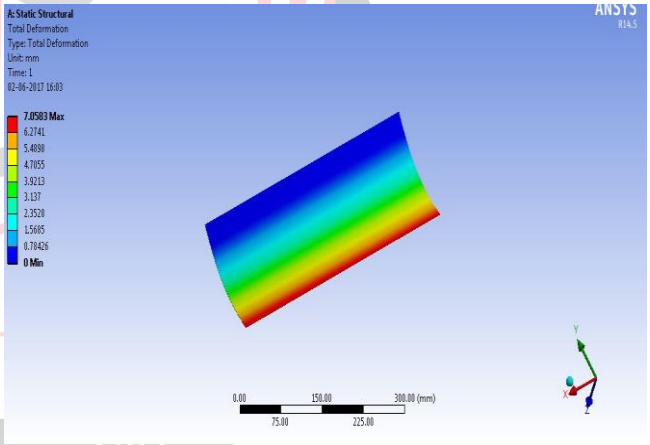


Fig. 2 Design of protype



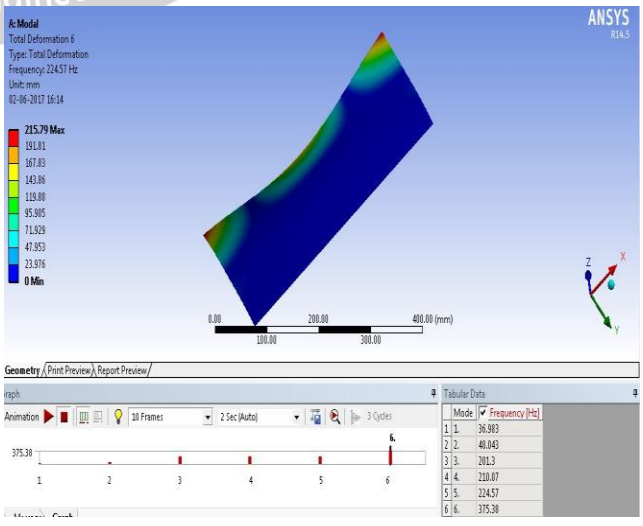


Fig. 3. Analysis of Prototype

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6.Conclusion

- The prototype will help in generation of sufficient power to run a street light
- Such prototype installed in series will be sufficient to generate a good amount of electricity
- The energy generated by this process is clean and no pollution is generated

7.Reference

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