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Artificial Wind Power Prediction on Moving Vehicle

Mr. Shailesh K. Kokate[1], Prof.Mr.N.N.Shinde[2], Miss.Madhuri B.Mulik[3]
[1]Asst.Professor, SIT College of Engineering, Yadrav, Maharastra, India.
[2]Professor, Department Of Technology Shivaji University, Kolhapur, Maharastra, India.
[3]Asst. Professor, SIT College of Engineering, Yadrav,Maharastra,India.

Abstract:- Wind energy is clean & inexhaustible source of energy. Wind turbines used to extract power from wind. This paper considered small size of rotor diameter of wind machine. The device mounted on the two wheeler .Firstly vehicle's speed considered as the speed of wind. The available power in wind calculated using the speed of vehicle. Then wind speed recorded on moving vehicle using analog anemometer. For the corresponding wind, generated power calculated. Author also examined percentage of change in speed of wind using two wheeler. It also examined the actual power available in the wind and expected power from artificial wind generation.

Keywords:- Artificial Wind, Vehicle Speed, Small Size Rotor, Two Wheeler, Wind Energy.

I. INTRODUCTION

As a clean, inexhaustible source of energy, wind energy is a steadily growing source of electric power and has received considerable amount of attention in many countries of the world. Energy is available in two different alternatives, nonrenewable (coal, fuel, and natural gas) and renewable (solar, wind, hydro, and wave) sources. Especially, after the industrial revolution in the nineteenth century, first coal and then fuel oil are used as primary energy sources for the needs of modern communities. As it is known, fossil fuels have limited potential, and at the current rates exploitations they are expected to be depleted within the next centuries. This is one of the reasons why clean, sustainable, and environmentally friendly alternative energy resources are currently sought.

With increasing significance of environmental problems, clean energy generation becomes essential in every aspect of energy consumption. Wind energy is very clean, but not persistent for long periods of time. In addition to this, ability of a wind turbine to extract power from varying wind is a function of three main factors, namely, the wind power availability, the power curve of the machine, and the ability of the machine to respond to wind fluctuations. In contrast to conventional power generation where input energy can be scheduled and regulated, wind energy is not a controllable resource, due to its intermittent and stochastic nature.**[1]**

Wind energy is a source of renewable power which comes from air current flowing across the earth's surface. Wind turbines harvest this kinetic energy and convert it into power. The electricity is sent through transmission and distribution lines to customers. Wind generation is one of the fastest growing sources of electricity and one of the fastest growing markets in the world today. With an average annual growth rate of more than 25% over the past decade, wind is the fastest growing sector of the energy industry all over the world. The advantages of wind energy are numerous and clear, and the technology itself has taken a leap forward in recent years.[2]

Wind power is the most mature and cost-effective renewable energy technologies available today, costing between 3 and 5 cents/(kW · h), depending upon the wind resource and financing of a particular project. It is competitive with traditional power plants. Unlike the electricity from fossil-fuel-powered sources, which depends on fuels whose prices are costly and may vary considerably, the cost of wind power is relatively stable. Wind is a converted form of solar energy. Wind power is inexhaustible and requires no "fuel." Wind turbines do not produce greenhouse gasses that may cause global warming. Wind turbines can be erected on farms or ranches, thus benefiting the economy in rural areas. Farmers and ranchers can continue to work on the land because the wind turbines use only a fraction of the land.

The percentage of wind energy in electric power systems is growing rapidly due to enhance public concerns environment impacts and escalation in energy cost associated with the use of conventional energy sources. **[3][4]**It is estimated that by 2020, about 12% of the worlds electricity will be supplied by wind generation **[5].**Electric power from wind energy is quite different from that of conventional resources. Unpredictability and variability of wind power generation is one of the fundamental difficulties faced by power system operators. Good forecasting and modelling tools are urgently needed forth efficient integration of wind energy into the power system. **[6][7]** Especially for forecasting of the power generating by wind farms **[8][9].**

II. METHODOLOGY

The method adopted for artificial wind power prediction is first artificial wind data generated using anemometer mounted on vehicle and readings noted for wind speed. The purpose of this research is to find out available power in wind when riding a vehicle. For this purpose a 100 c.c. vehicle used and chosen suburban area where obstructions to flowing wind are minimum. The speed of vehicle increased by decimal digits and readings noted for generated wind speed. The generated wind velocity noted in table 1. This gives the vehicle speed and actual speed generated. The readings of speed are in m/s and power is in watts. From the data generated, we predicted the available and actual power in wind. In order to determine power estimation, it is necessary to simultaneously consider the frequency of wind velocities and the power curves of the wind turbines **[10][11]** Generating electricity from the wind is environmentally friendly, socially acceptable, and economically competitive **[12].** Wind power has become the dominant source of alternative energy **[13]** and experienced a dynamic growth in recent years **[14].** The fact that wind energy is considered as the most preferred alternative energy source by many researches **[15]** has motivated further growth of wind farms and research in wind energy. The power extracted from the wind is expressed by **[16]**

Power, $P = ½ \rho A V^3$ (1)

Where, ρ = Air Density,
A= Swept Area of Blades,
V= Velocity of flowing wind.

For testing purpose following equipments were used

1) Bajaj Discover 100cc two wheeler.
2) Analog anemometer

Specification
Range 0-100,000m
Possible measuring wind speed 1-15m/s.
Made by- OTA KEINI SEISAKUSHO, Japan.

III. EXPERMENTAL RESULTS

For experimentation purpose we choose a suburban road where we run vehicle. The starting speed of vehicle is taken as 2.77m/s then we increased the speed of vehicle each time by 10kmph the successive speed of vehicle noted .We examined the speed of wind by actual wind speed and available wind speed. Table 1 gives information about the vehicle speed which is measured at suburban road.

Table 1. Vehicle Speed & Actual Generated Speed

Sr.No.	1	2	3	4	5	6	7
Vehicle Speed in m/s.	2.77	5.55	8.33	11.11	13.88	16.67	18.05
Actual Generated speed in m/s.	3.89	12.46	12.46	14.71	33.87	51.37	88.88

In this proposed work author used moving two wheeler to generate actual wind speed data. The actual generated wind speed is noted in table1. We noticed that the actual generated wind speed increased from 3.89 m/s to maximum 88.88m/s.

Fig.1 Graph of Vehicle Speed Vs Actual Generated Speed

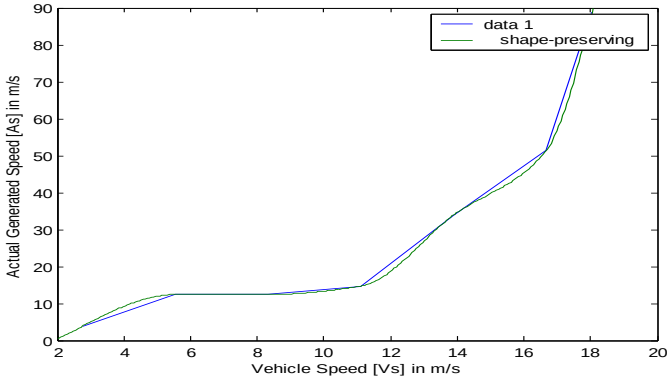


Table 2. Percentage of change in wind speed

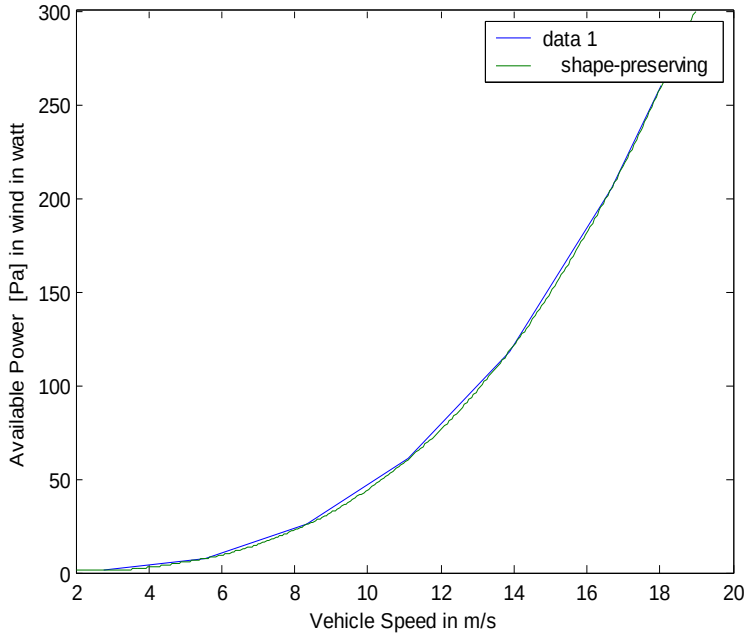
Sr.No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
% Change	71	44	66	75	40	32	20

From table 2 we noticed that for reading first, third, & fourth we noticed maximum percentage of change in wind speed measurement. Reading fourth gives maximum percentage of change i.e.75%.

Table 3. For Vehicle Wind Speed and Available Power in Wind

SR.NO.	**Vehicle Speed[Vs] in m/s.**	**Available Power in Wind [P_a) in Watt.**
01	2.77	0.94
02	5.55	7.569
03	8.33	25.59
04	11.11	60.71
05	13.88	118.39
06	16.67	205.103
07	18.05	260.37

Fig.2 Graph of Vehicle Speed Vs. Actual Power in Wind



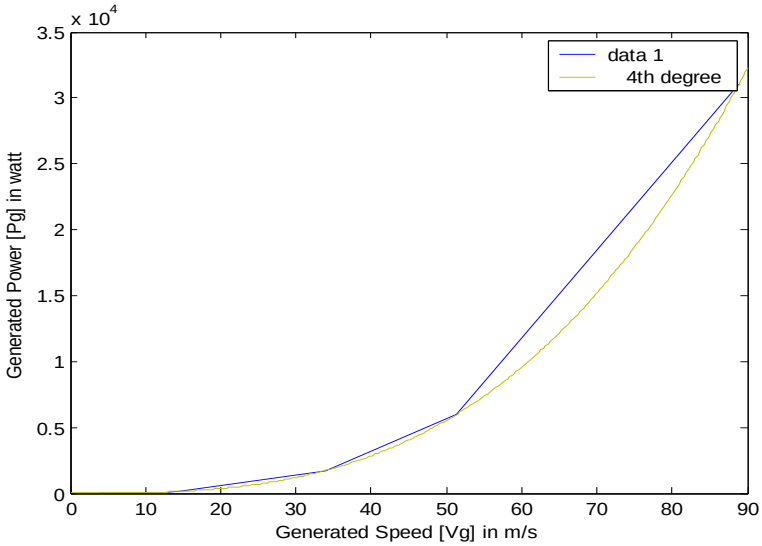
From Figure 1 we noticed that the vehicle speed is less than actual generated speed of wind. The speed of wind is more because the flow velocity of wind added with speed of vehicle. Here we do not take in to consider the effects of obstructions offered by trees, buildings. The maximum speed of vehicle is 18.05m/s and the corresponding value of actual generated wind speed is 88.88m/s which is so large. The other readings give us opportunity to produce wind power and that speed should be sustained by the system. Here system includes the small wind mill having small rotor diameter and vehicle.

Artificial wind speed measured on vehicle and available power in the measured artificial wind speed. given below.

Table 4. Artificial Wind Speed Generated & Generated power

SR.NO.	Generated Speed[Vg] in m/s	Generated Power (P_g) in Watt.
01	3.89	2.606
02	12.46	85.64
03	12.46	85.64
04	14.71	140.93
05	33.87	1720.33
06	51.37	6001.20
07	88.88	31082.9

Fig. 3 Graph of Generated speed Vs. Generated Power



From above figure 3 we again noticed that wind velocities of 14.71 m/s, 33.87 m/s, 51.37 m/s,& 88.88 m/s produced maximum power viz. 140.93 watt,1720.33 watt, 6001.20 watt, 31082.9 watt respectively. The sudden increase in power after 50 m/s.

Table 5. Percent Change In Power

Available Power in Wind [P_a] in Watt.	Generated Power (P_g) in Watt.	% Increase in Power (Pi)
0.94	2.606	2.2×10^2
7.569	85.64	11.31×10^2
25.59	85.64	3.34×10^2
60.71	140.93	2.32×10^2
118.39	1720.33	14.53×10^2
205.103	6001.20	29.25×10^2
260.37	31082.9	119.37×10^2

IV. CONCLUSION

We noticed from above experiment that wind velocities increased along with speed of vehicle. The generated wind velocities increased between 0.71-0.20 times of actual wind velocities. The percentage of increase in generated power from available power in wind range between 2.2×10^2 to 119.37×10^2.

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REFERENCES

[1]. Milborrow, D., 2002. Wind energy technology—the state of the art. J. Power Energy 216, 23–30.

[2]. Ming-Shun Lu, Chung-Liang Chang, Senior Member, IEEE,Wei-Jen Lee, Fellow, IEEE, and Li Wang, Senior Member, IEEE] Combining the Wind Power Generation System With Energy Storage Equipment.IEEE Transactions On Industry Applications, Vol. 45, No. 6, November/December 2009 2109.

[3]. Iglin´ ski, B.,Kujawski,W.,Buczkowski,R.,Cichosz,M.,2010.Renewableenergyin the Kujawsko–Pomorskievoivodeship.Renewable and Sustainable Energy Reviews 14,1336–1341.

[4]. Paska, J.,Sa"ek, M.,Surma,T.,2009.Currentstatusandperspectivesofrenewable energy sourcesinPoland.RenewableandSustainableEnergyReviews13, 142–154.

[5]. Fan, S., Liao, J.R., Yokoyama, R., Chen, R., Lee, W.J., 2009. Forecasting the wind generation using a two-stage network based on meteorological information. IEEE Transactions on Energy Conversion 24, 474–482.

[6]. Lei, M., Shiyan, L., Chuanwen, J., Hongling, L., Yan, Z., 2009. A review on the forecasting of wind speed and generated power. Renewable and Sustainable Energy Reviews 13, 915–920.

[7]. Soleimanzadeh, M., Wisniewski, R., Kanev, S., 2012. An optimization framework for load and power distribution in wind farms. Journal of Wind Engineering and Industrial Aerodynamics 107–108, 256–262.

[8]. Callaway, D.S., 2010. Sequential reliability forecasting for wind energy: tempera- ture dependence and probability distributions. IEEE Transactions on Energy Conversion 25, 577–585.

[9]. Kusiak, A., Zhang, Z., 2010. Short-horizon prediction of wind farm power: a data driven approach. IEEE Transactions on Energy Conversion 25, 1112–1122.

[10]. S en, Z., 1997. Statistical investigation of wind energy reliability and its application. Renewable Energy 10, 71–79.

[11]. S en, Z., S- ahin, A.D., 1998. Regional wind energy evaluation in some parts of Turkey. J. Wind Eng. Ind. Aerodyn.37 (7), 740–741.

[12]. Monfared, M., Rastegar, H., Kojabadi, H.M., 2009. A new strategy for wind speed forecasting using artificial intelligent methods. Renewable Energy 34 (7), 845–848.

[13]. Mabel, M.C., Fernandez, E., 2008. Analysis of wind power generation and prediction using ANN: a case study. Renewable Energy 33 (5), 986–992.

[14]. (http://www.awea.org).

[15]. Burton, T., Sharpe, D., Jenkins, N., Bossanyi, E., 2001. Wind Energy Handbook, 5–7.

[16]. Bianchi, F., Battista, H., Mantz, R., 2006. Wind Turbine Control System: Principles, Modeling and Gain Scheduling Design''. Springer pp.8–28.