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Wind Turbine Power Production Prediction Using Machine Learning

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Abstract: Proposing a model that uses machine learning and IoT to predict future energy production possibilities in particular locations that use windmills to produce electricity. Proposed model benefits the industries helping where to install windmills to produce the maximum possible energy by using live data analysis at the wind power stations. The above mentioned process is performed by installing our model in the location of inspection where the wind park is planned to bring. This is the efficient way of inspection or analysis as per our concerned proposal.

Keywords: IoT, Machine learning, inspecting windy locations

1. INTRODUCTION

Overuse of natural resources such as vital fossil fuel has led to the beginning of destruction in a sober staid. Thus air pollution is rampant. Thus improving the quality of the air we breathe, various measures are being taken by the government and other voluntary organizations which try to prevent air pollution and enhance the quality of air we breathe everyday[1],[2],[3]. Global warming is also a seriously growing problem. Large contributions of power production are from conventional methods leading to the emission of greenhouse gasses[4]. Instead of coal and oil-fired power plants utilizing renewable energy sources, have become a trend across the globe during the last few decades[5]. Our efforts are in a way that keeps in mind that wind energy is majorly available and also potential[6],[7]. Wind mill energy production is also being termed as the fastest growing across the world[8].

Despite all efforts, to this day it remains as an extraordinary challenge. It is very true that vehicles operated and factories running are not going to stop for the reason that the air is being polluted. It is a well-known fact that many aquatic organisms die in the process of producing electricity from hydroelectric power.

Fossil fuel power plants create ecological harms including water and soil use, thermal releases, air emissions, climatic and illustration impacts from cooling towers, ash disposal, solid waste disposal etc., So, in such a situation our machine learning model accurately predicts the amount of power that could be generated from windmills that are existing in our landscape[9]. Adding more, it also tells us where to install new wind turbines for satisfying future energy needs.

2. RELATED WORK

For future purposes we are in need of wind power, so we need to predict the wind speed, direction and power. Rather than regular power plants, the power produced from wind turbines relies generally upon meteorological conditions, specifically, the extent of the breeze speed, the atmospheric turbulence, and the control of the breeze turbine attributes. To sustain integration of wind power into the electricity grid, these methods are based on time-scale

- Long term forecasting,
- Medium term forecasting,
- Short term forecasting,
- Very short term forecasting.

To predict wind speed distribution machine learning has been widely used. The methods are classified into four types.

- Supervised machine learning,
- Unsupervised machine learning,
- Reinforcement learning,
- Evolutionary learning.

The prediction of wind power can be improved using machine learning algorithms. Using a multi-linear regression, wind power results can be shown.

In the following to solve errors in prediction of power, we can use a proposed method called SVM. Support vector machines are a kind of supervised learning and are second-hand to distinguish patterns and analyse data [10]. The other source to support vector regression is the method with which to carry out a support vector machine based on regression as this model can regard unpredictability as a support vector machine gives the high accuracy. Using a logistic regression model, we analyse the predicted accuracy of wind power arc at every wind speed and projected wind power forecasting using machine learning algorithms based on logistic regression models to resolve wind power forecasting errors[11]. To achieve this, we will use the value of the power curve at each wind speed and as additional using logistic regression the correctness of the power curvature was premeditated. If the forecasted wind speed input has ambiguity, these variables are capable of recompense. This was the reason which made promising to get better the fault origin by the abrupt alteration of output. In that workflow we can work on the regression methods, so we can get good accuracy and less loss.

WIND SPEED

The proportion of imperativeness in the breeze shifts with the strong state of the breeze speed, by the day's end, if the breeze speed repeats, there is multiple times greater essentialness in the breeze. Little assortments in wind speed generally influence the proportion of vitality available in the breeze[2].

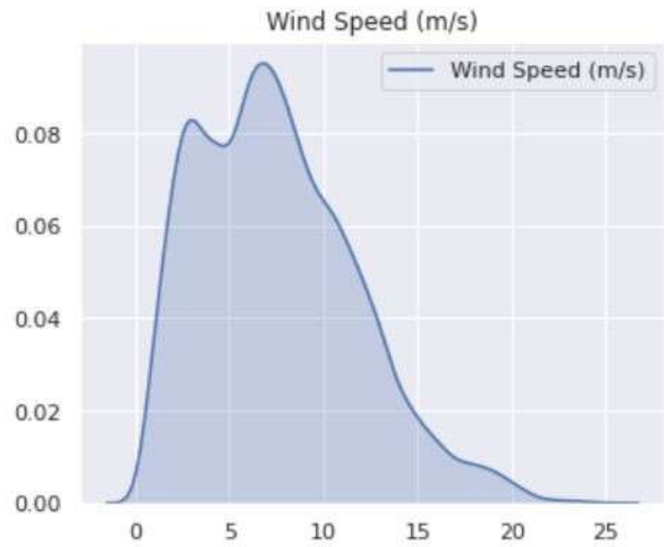

FIGURE-1. WIND DIRECTION

The direction of wind flow varies time to time, which has an effect on energy production. There are several examinations on the impact of wind flow direction on power production or potency of one turbine and wind turbines inside the wind energy facility. However, there are previous works that explore the effect of wind direction variation on loads on wind turbines within a wind farm. This figure shows the power generation in 360°.

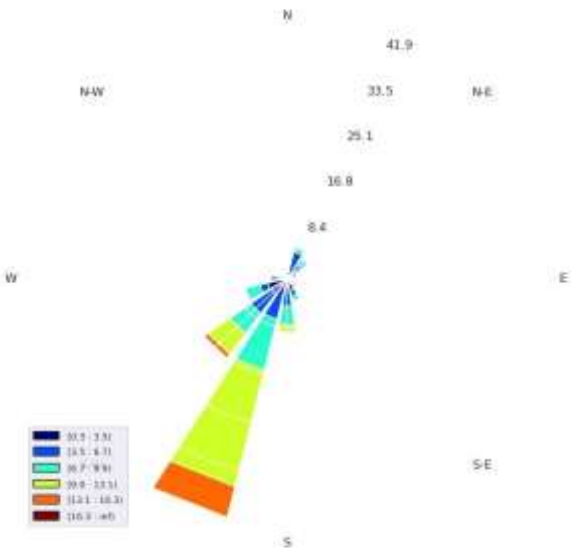

FIGURE-2. MEASUREMENT OF POWER

Subsequent analyses will take as a basis the following equation that describes the power generated by wind turbines: E-Av32 Where: v , wind speed Air density A , area described by turbine blades From the equation, A is the only fixed variable. In operation, the power will be based on the speed and density of the air, which vary throughout the year. Of these, speed is the most significant variable in energy production; in fact, the characteristic curve of a turbine is a graph of the power generated Vs wind speed. The figure sets out three zones based on the magnitude of the velocity: 1.0 - 3.5 m/s, turbines do not usually operate in this speed range because the power generated is low and the operation is not economically profitable. The minimum operation value is known as vcutin whose value is typically 3 - 3.5 m/s. 3.5 - 14 m/s, the turbine is in operation and the cubic dependence on wind speed is evident. For this turbine, approximately A 14.5 m/s is reached at a maximum in the power generated. 14 - 25 m/s, the maximum on the curve corresponds to the design speed of the turbine, once reached, the same power is still generated even if the speed increases. The increase in speed leads to an increase in mechanical loads that must withstand the structure so that at a certain magnitude a stop is made in the operation for safety. This value is known as V cutout and has a typical value of 25 m/s. In this proposed model we have combined wind speed & wind direction and get the total amount of power to be generated as MegaWatts (MW).The predicted output power can satisfy the company's need.In this prediction, we can use multilinear regression based statistical approach.

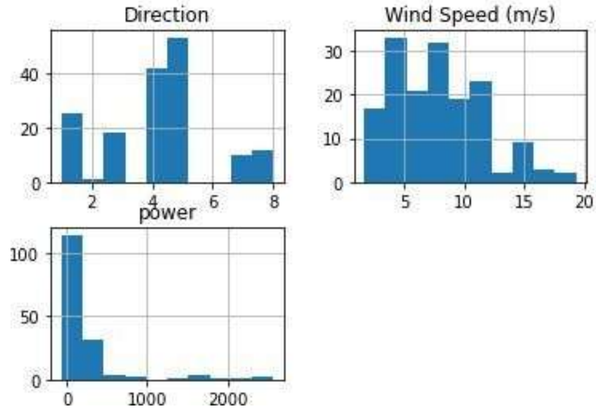

FIGURE-3. VARIATION OF WIND, POWER AND SPEED

The above figure shows the variation of the chosen parameters.

PROPOSED WORK

The proposed system requires the above dataset III.(a).The proposed system requires the area of the particular wind turbine to be selected. Then the date and time is chosen from the app. Depending upon the chosen time slot, the energy to be generated from the wind turbine is displayed as a prediction result. in the back end, according to the chosen time slot, the trained model is executed with the chosen test values, and the prediction result is displayed as an output . For prediction, multilinear regression based statistical approach and arima model is used. The model is designed in such a way to add the test results as training records for future training and execution. Thus the results are given as inputs as a feedback system in our proposed approach.

Date/Time	LV ActivePow...	Wind Speed (...	Theoretical_P...	Wind Direction (°)
01 01 2018 00:00	380.05	5.3113	416.33	259.995
01 01 2018 00:10	453.77	5.6722	519.92	268.641
01 01 2018 00:20	306.38	5.2160	390.90	272.565
01 01 2018 00:30	419.65	5.6597	516.13	271.258
01 01 2018 00:40	380.65	5.5779	491.70	265.674
01 01 2018 00:50	402.39	5.6041	499.44	264.579
01 01 2018 01:00	447.61	5.7930	557.37	266.164
01 01 2018 01:10	387.24	5.3060	414.90	257.949
01 01 2018 01:20	463.65	5.5846	493.68	253.481
01 01 2018 01:30	439.73	5.5232	475.71	258.724
01 01 2018 01:40	498.18	5.7241	535.84	251.851
01 01 2018 01:50	526.82	5.9342	603.01	265.505
01 01 2018 02:00	710.59	6.5474	824.66	274.233
01 01 2018 02:10	655.19	6.1997	693.47	274.233 [illegible]6.733
01 01 2018 02:20	754.76	6.5054	808.10	266.760
01 01 2018 02:30	790.17	6.6341	859.46	270.493

FIGURE-4. DATASET

REPRESENTATION

The scope of the proposed model lies in efficiently generating the power according to the availability. The prediction model helps in analyzing the weather condition while estimating the generation of power. This model is increasing the accuracy according to the actual generation of power with minimum loss. The proposed model is useful for correctly predicting the power generation. If the power generation is predicted accurately, then the power supply to the public is planned in advance.the proposed system helps to analyze the supply chain relationship. the cost of unnecessary operation of the turbine in poor weather conditions is reduced. This system is useful to the public electricity management board in analyzing wind power generation. It helps in reducing the power generation cost at an utmost level. The below figure III.
(b) shows the predicted result using the trained model.

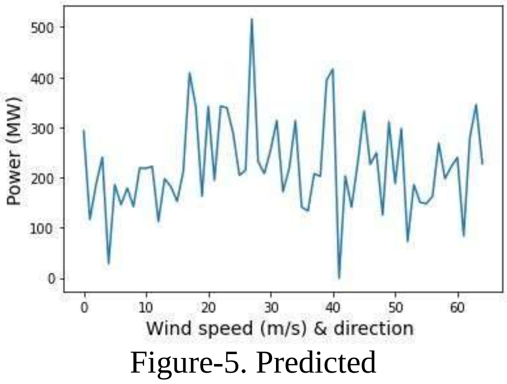

Figure-5. Predicted

OUTPUT

3. CONCLUSION

In this study, we have shown that power generation prediction can be done with utmost accuracy. Hence by using two factor wind speed and wind direction we can predict the power generation from a wind turbine can be predicted. Also, our model helps to suggest perfect

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locations for setting up windmills in a new region.The below figure shows the result of predicted outcome and says that whether the predicted power satisfies the company requirement.

FIGURE-6. WEBSITE USER INTERFACE

4. REFERENCES

[1] V. Ranganayaki and S. N. Deepa, https://www.hindawi.com/journals/tswj/2016/9293529
[2] Sathish Kumar G, Priyanka S, Aravindhraj N, Karthiga M Sentiment Analysis of Twitter Data using Machine Learning
[3] Goran Strbac , Mary Black "With wind penetration estimation of capability in giving adjusting administrations to power age frameworks", 2005.
[4] Atul Kumar, Muhammad Zafar Ullah Khan, Bishwajeet Pandey, Wind Energy: A Review Paper.
[5] Wind Power Forecasting Using Machine Learning: State of the Art, Trends and Challenges. Kathrine Lau Jørgensen Flexibility and Ancillary Services Energinet Fredericia, Denmark e-mail: klj@energinet.dk, Hamid Reza Shaker Center of Energy Informatics University of Southern Denmark Odense, Denmark e-mail: hrsh@mmmi.sdu.dk.
[6] Wind Power Prediction Using Ensemble Learning-Based Models JUNHO LEE, WU WANG, FOUZI HARROU , (Member, IEEE), AND YING SUN Statistics Program, Computer, Electrical and Mathematical Sciences and Engineering (CEMSE) Division, King Abdullah University of Science and Technology (KAUST), Thuwal 23955-6900, Saudi Arabia Corresponding author: Fouzi Harrou (fouzi.harrou@kaust.edu.sa).
[7] Greener RAN Operation Through Machine Learning Greta Vallero , Daniela Renga , Michela Meo , and Marco Ajmone Marsan.
[8] Ensemble Machine Learning-Based Wind Forecasting to Combine NWP Output With Data From Weather Station Pengwei Du , Senior Member, IEEE
[9] Wind Power Prediction Using Ensemble Learning-Based Models JUNHO LEE, WU WANG, FOUZI HARROU , (Member, IEEE), AND YING SUN Statistics Program, Computer, Electrical and Mathematical Sciences and Engineering (CEMSE) Division, King Abdullah University of Science and Technology (KAUST), Thuwal 23955-6900, Saudi Arabia.
[10] Kennedy E. Ehimwenma1, Sujatha krishnamoorthy,"Design and Analysis of a Multi-Agent E-Learning System Using Prometheus Design Tool.International Journal of

Artificial Intelligence”Volume8, No 1.May 2020.

[11] Yasoda, K., Ponmagal, R.S., Bhuvaneshwari, K.S. K Venkatachalam, “ Automatic detection and classification of EEG artifacts using fuzzy kernel SVM and wavelet ICA (WICA)” Soft Computing Journal (2020).